Global Biodiversity Information Facility

FINAL NARRATIVE REPORT

Guidelines on how to complete this report are included in italics.

Use the information included in your BIFA Full Proposal (reproduced in Annex 1 of your BIFA contract) as a baseline from which to complete this report.

Remember that this report will be made available on your project page on the GBIF website and therefore should not include any contact information, unless you have permission from all mentioned in the report that their contact information can be published.

Contents

Project information

Main contact person and role:	Prof. Dr. Mushtaq Ahmad/ Project Lead
Institution/network/agency affiliation:	Plant Systematics and Biodiversity Lab., Department of Plant Sciences Quaid-i-Azam University Islamabad
BIFA Project ID:	BIFA4_046
Project title:	Expanding the value and reach of plant data mobilization in Pakistan
Start date and end date of the reporting period:	01/05/19 - 30/04/20
Country in which the activities take place:	Pakistan

Executive summary

Please provide a brief summary of your project's objective(s), its implementation and achievements. You should also describe the context and the approach taken for the final evaluation of your project, and also the key best practices and lessons learnt identified. Remember to include any additional objectives that were defined during the implementation of the project and explain why they were added to the project's initial objectives. In the event of unexpected challenges which have prevented you to reach a planned project objective, please provide explanations and indicate if and how you plan to reach these objectives post project.

(Max. 350 words.)

The project had three components: increasing Pakistan herbaria and herbarium records contributing to GBIF;dexpanding use of mobilized data;; and developing resources to help persuade Pakistan's government to join GBIF. Specific targets were set for each component; none were met. The covid pandemic closed all Pakistani universities from April until mid September. This stopped digization and email contact with most most Pakistani botanists. The impact was severe because the last two components were envisioned as outgrowths of the first. Georeferencing was affected more than databasing (31% vs 83% of targets) because it was to be started in March. Project participants suggested that ISL staff travel to their herbaria to provide training. Covid prevented this, but it is a recommended strategy for future efforts.

Five unfunded herbaria added 100 or more records to OpenHerbarium during the project period. Three are GBIF providers; others are not. RAW, a federal herbarium, will ask for approval to apply in November 2020. Two herbaria joined OpenHerbarium during the project; four others are expected to join and/or increase their activity. Barkworth had planned to visit several herbaria around Peshawar, including two federal herbaria that had interested in digitization but was not given travel permission. To reach these herbaria, she will holding and recording Zoom meetings on digitization in 2021. All herbaria actively contributing to OpenHerbarium will be encouraged to become GBIF providers.

The mobilized data are not being used in research and teaching. The interim report suggested that the March workshop include student presentations and discussion relating to this topic. Barkworth gave three talks on such usage in Pakistan and is following up on them now. She also, when reviewing papers,comments on the need to consult GBIF and OpenHerbarium when discussing the distribution of taxa. She continues to work with Pakistani herbaria and faculty who have expressed interest in data mobilization. She will place greater emphasis on data use in doing so. She is also working with Dr. Amir Sultan (RAW) to persuade the National Agricultural Research Council of the importance of developing an online botanical infrastructure for Pakistan, including supporting a Pakistani portal for OpenHerbarium.

Progress against expected milestones

Please indicate the status of the expected milestones as outlined in Annex 3 of the contract, at the time of final reporting.
Please provide links in the sources of verification.

In the event of unexpected delay(s), please provide detailed explanatory notes.Expected milestones	Completed? Yes/No	Explanatory notes	Sources of verification
Gain certification at BIFA Capacity Enhancement Workshop (Mid-term report milestone)	No	The person who attended the workshop has left the project. He was contacted. According to him, he submitted the assignment which he could complete to Laura Russel because IPT is not working in Pakistan.	
At least one dataset has been published to GBIF.org (Mid-term report milestone)	Yes	AKASH: https://www.gbif.org/dataset/0c4eacef-79ba-4b22-8822-291b2ce69f21	GBIF
All deliverables have been produced (Final report milestone)	No		

In the event of unexpected delay(s), please provide detailed explanatory notes.Expected milestones	Completed? Yes/No	Explanatory notes	Sources of verification
Sustainability and next steps have been documented 1.Integrate data mobilization into research & teaching. 2. Prepare white paper for persuading Pakistan to become a GBIF member.	No	Integration There seems little appreciation of the value of mobilized data, even by those involved in the process. Barkworth spoke on the matter at a Symposium in Karachi ti celebrate completion of the Flora of Pakistan, but it requires understanding and commitment by faculty. Barkwortworth also, In reviewing papers and advising students asking for language help with their papers, Barkworth draws attention to OpenHerbarium and GBIF whenever appropriate, but this reaches few people. She suggested that there be a round table discussion on how developing data resources could be integrated into ongoing research while she was in Islamabad, but there was too little time. Barkworth needs to spend more time developing online resources that will support the activity. White paper Barkworth met with the chair of the Pakistan Agricultural Research Council on the Sunday she was in Islamabad, but he was had time only for discussing the progress made with the botanic garden at RAW. She (Barkworth) has failed to follow up with a letter asking that PARC support data mobilization. She should have.	
(Final report milestone)	No		

Activities

Please indicate the status of the activities as outlined in the BIFA Full Proposal (section 4.4), at the time of final reporting.

*The table below should be completed in the same way as in the BIFA Full Proposal, but should include information and updates on the status of each activity. Please indicate relevant source(s) of verification and **provide links, or a copy of the source of verification** mentioned if no links are available. Attachments should be provided in the Annex.*

In the event of unexpected delay(s), please provide detailed explanatory notes and indicate new planned completion date(s).

Please include any additional activities completed during the implementation of the project that were not originally outlined in the BIFA Full Proposal.

Add rows as required.

Activity name	Expected deliverable	Contribution to goals listed in table 4.3 of the BIFA Full Proposal	Status of activity at final reporting: Completed? Yes / No (inc. % complete)	Explanatory notes, including new planned completion date if necessary	Source(s) of verification
Data capture workshop	20 additional individuals with the ability to capture data from herbarium specimens in a manner and with the accuracy required for effective data sharing. Impact: Required to ensure achievement of data goals.	Goal 1: Data capture	Yes	ISL: All the collaborators attended the planned workshop at ISL. KUH: 4 individuals were shown how to barcode and enter data. All were experienced taxonomists. BGH: About 60 people present, many students in plant taxonomy.	ISL: See attached attendance record and evaluation (Annex 1 & 2) KUH, BGH (University of Malakand): no formal attendance record or evaluation. KUH: at the end of the workshop, they were able to use OpenHerbarium. BGH: Request to limit workshop size and ask participants to complete some activities before the workshop had been overlooked (Annex: Workshop organization). Probably no one capable of following up, particularly since about 2 days later, universities were closed.

Activity name	Expected deliverable	Contribution to goals listed in table 4.3 of the BIFA Full Proposal	Status of activity at final reporting: Completed? Yes / No (inc. % complete)	Explanatory notes, including new planned completion date if necessary	Source(s) of verification
Datacapture	15,500 new occurrence records in OpenHerbarium and GBIF.		12,075 added; 77% complete	There was a slow start but the biggest problem was covid closure of all universities in March	Data in GBIF
District file acquisition and incorporation	Public Domain geographic file for Pakistan's districts.	Goal 2: Georeferencing	0%	Unsuccessful. Barkworth wrote to the Surveyor General and received no response. She followed up with individuals who thought they knew how to obtain one but the leads were not for geographic files. Eventually gave up. It is not at all clear that there are geographic files for Districts, let alone Tehsils, the two admin levels that often appear on labels.	

Activity name	Expected deliverable	Contribution to goals listed in table 4.3 of the BIFA Full Proposal	Status of activity at final reporting: Completed? Yes / No (inc. % complete)	Explanatory notes, including new planned completion date if necessary	Source(s) of verification
Georeferencing workshop	20 additional individuals learn how to georeference specimens using Geolocate. Required to ensure achievement of data goals.	Goal 2: Georeferencing	Yes	Direct batch Georeferencing was practiced at the workshop.	See attached attendance record and evaluation (Annex 3 & 4)
Georeference 15,500 records.	Value added to 15,500 records contributed to GBIF.	Goal 2: Georeferencing	12,094 records georeferenced, 78%	The georeferencing workshop was held about 3 days before universities were closed and after India's actions in Kashmir increased travel restrictions and costs.	Data in GBIF

Activity name	Expected deliverable	Contribution to goals listed in table 4.3 of the BIFA Full Proposal	Status of activity at final reporting: Completed? Yes / No (inc. % complete)	Explanatory notes, including new planned completion date if necessary	Source(s) of verification
Data cleaning tool development	Set of 3 easily run routines for cleaning data, one each for geographic, name, and time data. They will run on csv files before submission or on downloaded data that will be cleaned and then resubmitted. They will enable amendment of two fields based on errors in one and will benefit all who provide data to Symbiota networks.	Goal 4: Data cleaning and thereby improve quality of data provided, goals 1 and 2.	No Tools have not been developed but significant data cleaning has been completed.	Not created; the files received by Barkworth were so small, it was easy to clean them before upload. What she failed to check until after the covid closure were GBIF's comments. Many errors have been corrected, others require access to the specimens and/or someone who knows Pakistan's geography (correcting 85 mismatch of lat/lon data with country). Some of the taxon errors GBIF reflect errors in GBIF's backbone. A file listing these will be provided. "Insertae sedis" is a term added by GBIF (despite telling people at a work shop that fields for which there is no information should be left empty). Some date "errors" reflect lack of available information for month and/or day..	List of nomenclatural errors in GBIF's backbone. ISL: https://www.gbif.org/dataset/6f40c8ec-2b95-47d5-9064-eda6a8ddf3fb/metrics AKASH: https://www.gbif.org/dataset/0c4eacef-79ba-4b22-8822-291b2ce69f21/metrics

Activity name	Expected deliverable	Contribution to goals listed in table 4.3 of the BIFA Full Proposal	Status of activity at final reporting: Completed? Yes / No (inc. % complete)	Explanatory notes, including new planned completion date if necessary	Source(s) of verification
Registration	Addition of herbaria to OpenHerbarium; submission of applications as data publishers to GBIF (and their approval).	Goal 5. Essential to becoming GBIF data providers.	50%	Four herbaria (CHIT KUH, PMAS, QARSHI) were added to OpenHerbarium. KUH and PMAS were given barcodes. but workshops involving them were held shortly before the covid shutdown. They have contributed almost no records as yet so becoming GBIF providers is not yet appropriate. Barcodes for CHIT and PMAS will be shipped Aug. 1. Barcodes for QARSHI have been ordered.	KUH https://openherbarium.org/collections/misc/collprofiles.php?collid=71 See Annex-Entering data QARSHI https://openherbarium.org/collections/misc/collprofiles.php?collid=70 Images of CHIT and PMAS barcodes. Will be sent to Pakistan on August 1, 2020 (copy of receipt will be sent). QARSHI (Copy of order receipt will be sent).

Activity name	Expected deliverable	Contribution to goals listed in table 4.3 of the BIFA Full Proposal	Status of activity at final reporting: Completed? Yes / No (inc. % complete)	Explanatory notes, including new planned completion date if necessary	Source(s) of verification
Collection metadata	Five more Pakistani herbaria registered and with current information in Index herbariorum.	Goal 6. Expand knowledge of herbaria in Pakistan.	40%	Barkworth trip had to be shortened so fewer herbaria were visited than planned. Two herbaria, QARSHI and CHIT were added to Index herbariorum. Barkworth had received barcodes for CHIT and some are on order for QARSHI. Pakistan blocked all but essential mail in April. She has made contact with a Pakistani student in the UK who has agreed to take them to Pakistan when she returns, possibly not until October.	Registration in Index herbariorum CHIT http://sweetgum.nybg.org/science/ih/herbarium-details/?irn=258595 QARSHI http://sweetgum.nybg.org/science/ih/herbarium-details/?irn=257742 .

Activity name	Expected deliverable	Contribution to goals listed in table 4.3 of the BIFA Full Proposal	Status of activity at final reporting: Completed? Yes / No (inc. % complete)	Explanatory notes, including new planned completion date if necessary	Source(s) of verification
Research use – presentations on value of data mobilization	Engagement of the participating herbaria in data sharing. Current participants resulted from such talks.	Goal 7. Research use	10% -	No session or round table discussion held. Barkworth included topic in talk on updating the Flora of Pakistan. She also routinely checks papers on new distribution records for evidence that OpenHerbarium and GBIF have been consulted.	PowerPoint of presentation.

Activity name	Expected deliverable	Contribution to goals listed in table 4.3 of the BIFA Full Proposal	Status of activity at final reporting: Completed? Yes / No (inc. % complete)	Explanatory notes, including new planned completion date if necessary	Source(s) of verification
Research use – products	Completion of data paper from current project and submission of one research paper that draws on information in GBIF plus OpenHerbarium. Its focus will be on using mobilized data to create regional floristic resources for different parts of Pakistan.	Goal 7. Research use	No	Barkworth started but needs to complete/	

Activity name	Expected deliverable	Contribution to goals listed in table 4.3 of the BIFA Full Proposal	Status of activity at final reporting: Completed? Yes / No (inc. % complete)	Explanatory notes, including new planned completion date if necessary	Source(s) of verification
Preparing high-quality specimens	Provision of high-quality specimens to several herbaria, including those not included in this project. Ideally, this will lead additional institutions to start sharing data.	Goal 8. Preparation of high-quality specimens.	No	Barkworth simply forgot. Will prepare specimens in July 2020 and send as a gift to all registered herbaria in Pakistan. Complete Sept 15, 2020. Whether this will result in their becoming interested in data sharing is not clear.	
Sustainability	Goal 7. Research use Develop roadmap for persuading the Federal Government of Pakistan to become a full member of GBIF.	Goal 9. Sustainability and Goals 1 and 2, adding more data providers (federal collections) and georeferenced records to GBIF.	No	Shortening of planned trip resulted in fewer personal contacts, including contact with the federal herbaria. In the past, such contacts have been essential for persuading herbaria to become involve. Regretfully, it is not sufficient to keep them engaged. Will follow up more after sending specimens.	

Deliverables

This section should summarize the project deliverables as outlined in the BIFA Full Proposal (section 4,5), at the time of final reporting. Please highlight any changes from the original plans.

If no result has been achieved on a specific point, or in the event of unexpected delay(s), please provide detailed explanatory notes and indicate new planned completion date(s).

Please include any additional deliverables completed during the implementation of the project, that were not originally outlined in the BIFA Full Proposal.

Add rows as required.

a. Data

*Details of datasets published and/or pending publication as an outcome of the project. The table below should be completed in the same way as in the BIFA Full Proposal but should include information and updates on the status of each dataset. **Please provide links in sources of verification.***

If the dataset is not yet published, please indicate this as "not published" and provide a detailed explanation, % of digitization and expected date of publication.

Add rows as required.

Title of dataset	Data type (checklist/occurrences/sampling event) [1]	Estimated number of records (specimens)	Status of dataset: Published / not published and % of digitization and expected date of publication	Data holding institution agreed to publish its data via GBIF.org (Yes/No)	Explanatory notes	Source(s) of verification: DOI or URL

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[1] Dataset classes: http://www.gbif.org/publishing-data/summary#datasetclasses

Title of dataset	Data type (checklist/occurrences/sampling event) [1]	Estimated number of records (specimens)	Status of dataset: Published / not published and % of digitization and expected date of publication	Data holding institution agreed to publish its data via GBIF.org (Yes/No)	Explanatory notes	Source(s) of verification: DOI or URL
ISL	12000	36, 175 total, 10762 added, an additional 7359 georeferenced.	*Examples: Published or Not published, 90% digitized, expected date of publication September 2020*	Yes	Covid closure stopped work	https://doi.org/10.15468/bp6jy3
AKASH	1500	1367, 109 georeferenced; all added as part of project	yes	Yes	Covid closure stopped work	https://doi.org/10.15468/t4lkyc
Sargodha University Herbarium (SARGU)	500	8, 5 georeferenced; all added as part of project	Unknown	Yes	See earlier comments	https://www.gbif.org/publisher/35bfbdb4-e2b5-4163-af66-4d835ebdb940 https://openherbarium.org/collections/misc/collprofiles.php?collid=
Government College University Lahore (GCUSAH)	500	14, 7 georeferenced; all added as part of project	Unknown	Yes	See earlier comments	https://www.gbif.org/publisher/d5e9316e-8600-45b4-9eb3-f6ba38460ed1 https://openherbarium.org/collections/misc/collprofiles.php?collid=

b. Other deliverables

Describe other deliverables (e.g. publication of data papers, analysis, reports etc.) produced by the project. In the event of unexpected delay(s), please provide detailed explanatory notes and indicate if the deliverable(s) are to be produced post-project, and if so, indicate expected completion date(s).

Please provide links in the sources of verification. Attachments should be provided in the Annex.

Name and type of deliverable	Status of deliverable: Completed? Yes / No (inc. % complete)	Explanatory notes	Source(s) of verification
Online resources concerning preparation of high-quality specimens, label generation, and data capture	Not completed.	Barkworth's responsibility. Web site initiated but proved difficult to use. Redesign was time consuming. Will be adding resources starting August 15	https://biodiversitysharing.org/
National, provincial, and district checklists derived from publications and mobilized specimen data.	13 have been posted.	There are other checklists that could be posted but the difficulty is persuading authors to do so. The hope is that putting suitable instructions online will persuade additional authors to do so but, because posting a checklist on line is probably not seen as contributing to hiring or promotion decisions, uptake will be slow.	https://openherbarium.org/projects/index.php?pid=7
Addition or significant updating of metadata for at least five more herbaria in Index herbariorum.	Yes	CHIT, POONCH, and QARSHI added to Index herbariorum. KUH and HUP updated their information.	CHIT http://sweetgum.nybg.org/science/ih/herbarium-details/?irn=258595 POONCH http://sweetgum.nybg.org/science/ih/herbarium-details/?irn=257033 QARSHI
Lectures and training classes at colleges to demonstrate several ways how to access the published records and other procedures involved and how this online data can be useful and handy for them.	Yes and no	Barkworth worked with KUH staff while in Karachi, but the university had closed the day before for Covid. She also gave a presentation on the University of Malakand but, instead of having a set of 3 sessions restricted to 20 participants, as she requested, the workshop included about 60 participants and one session. No evaluations were conducted.	

Name and type of deliverable	Status of deliverable: Completed? Yes / No (inc. % complete)	Explanatory notes	Source(s) of verification
Data paper highlighting resources becoming available for Pakistan (intended for Taxon)	No	It was started in December but the planned discussion meeting could not be scheduled and then it fell by the wayside. It will be restarted in August.	Will inform GBIF when submitted.
Paper demonstrating increased value of checklists when shared via OpenHerbarium (Possibly Pakistan Journal of Botany).	No	It has been started. Submission date planned for August 31. It will be more general, not just Pakistan.	Will inform GBIF when submitted.

Events organized as part of the project

Please indicate the status of the events as outlined in the BIFA Full Proposal (section 4.6), at the time of final reporting.

*The table below should be completed in the same way as in the BIFA Full Proposal, but should include information and updates on the status of each event. **Please provide links to any documents or web pages documenting the event(s) in the sources of verification. Attachments should be provided in the Annex.***

In the event of unexpected delay(s), please provide detailed explanatory notes and indicate new planned completion date(s).

Please include any additional events organized as part of the project that were not originally outlined in the BIFA Full Proposal.

Add rows as required.

Event title	Organizing institution	Date held / expected dates	Number of participants	Explanatory notes	Source(s) of verification

Event title	Organizing institution	Date held / expected dates	Number of participants	Explanatory notes	Source(s) of verification
Data Capture Workshop	ISL	13th-14th November, 2019	20-25	Delayed from August to November due to collaborators schedule.	Attendance record and participant's feedback (Annex 1 & 2)
Georeferencing training workshop	ISL	9th-10th March 2020	20-25	Delayed to get maximum data captured so as to take advantage of batch georeferencing.	Annex 3 & 4

Calendar of activities

The calendar should be completed in the same way as in the BIFA Full Proposal (section 4.7) but should also clearly indicate and include any changes (e.g. use of colour-coding to indicate expected changes and/or delays). Please provide explanations for any changes in the "Notes" column. Please provide general comments on the calendar of your activities in the 'General comments on project implementation' section.

Activity	2019								2020				Notes
	M	J	J	A	S	O	N	D	J	F	M	A	
Data capture workshop							X						
Submit data paper to Taxon													
Data capture at all participating institutions		X	X	X	X	X	X	X	X	X	X	X	
Mandatory attendance of a project team member to the BIFA Capacity Enhancement Workshop (expenses for attending the workshop are covered by the BIFA programme)			X										
Deadline for mid-term report – 31 October 2019 Mandatory milestones attached to the mid-term report: - Gain certification at BIFA Capacity Enhancement Workshop - At least one dataset has been published to GBIF.org							X						
Presentation at TDWG (Barkworth; separately funded					x								Developing digital botanical resources in and for Pakistan.pptx
Presentation at University of Karachi, followed by small workshop										x			Flora of Pakistan

Activity	2019								2020				Notes
	M	J	J	A	S	O	N	D	J	F	M	A	
Workshop at University of Malakand											X		Workshop organization
Activity: Georeferencing workshop											X		Presentation followed by discussion; importance of accurately recording of locality in field notes emphasized.
Deadline for final reporting – 30 April 2020 CHANGED TO JULY 31 Mandatory milestones attached to the final report: - All deliverables have been produced - Sustainability and next steps have been documented												X	Universities were expected to be open in June 2020, the extension was requested to complete the activities.

a. **General comments on project implementation**
   (Max. 200 words)

The project encountered several obstacles. Two events with significant impact were India's scrapping of the agreement covering administration of Kashmir and the pandemic. The former led to travel restrictions and tightened security in adjacent parts of Pakistan, the latter to closure of all Pakistani universities in early March. The impact was particularly serious because many of those working on the project do not have reliable internet access in their homes. An additional, unrelated, problem was that Barkworth had to curtail her travel plans, cancelling the August 2019 visit and limiting her March visit to about 10 days. This precluded her meeting with the four federal laboratories. This was considered a critical step in reviving Pakistan's interest in rejoining GBIF. The reduced travel did not have a direct impact on the development of effective online resources and the two data papers.

Project communications and visibility

Describe the way the results of your project have been and will continue to be communicated and shared with the project stakeholders and broader GBIF community.

Please also review the page describing your project available from http://www.gbif.org/programme/bifa and highlight any additional documents, events, news items or links that you would like to add to your page and provide links/attachments in the Annex.

The results of the project have been continously discussed with taxonomists in Pakistan and visitors from other Universities to persuade them to take part in sharing data. This will be continued in future. ISL is planning to get local funding (HEC-Pak, Pakistan Science foundation etc.) to digitize further.

Barkworth sent emails to many botanists in Pakistan about working being done (see Annex – Sample) and, before the pandemic, promised to develop online resources. Once the universities closed, the value of doing so dropped drastically because many of those interested returned to their home town or villages where there is little or no access. She was unaware that they were re-opened in June. She plans to start developing the kind of online resources envisioned in this proposal in August. She also drew attention to the importance of GBIF and OpenHerbarium to anyone interested in updating the Flora of Pakistan at a meeting in Karachi.

Monitoring, evaluation and lessons learned

Please indicate the results of the monitoring and evaluation plans, as outlined in your BIFA Full Proposal (section 4.9), at the time of final reporting.

Ideally this section should also include the following:

- *An evaluation of the project activities and their outputs/deliverables*
- *An assessment of the overall outcomes, impacts of the project and how it contributes to the overall objective of the BIFA programme*
- *Comments on the project implementation and completion, and its efficiency and effectiveness, strength and weaknesses etc.*
- *Any feedback on the project's relevance from the partners and stakeholders*
- *Indications and reasons for any changes which have been made to the project's original plans, and actions to follow-up*
- *Areas of success to build on, after the project's implementation period and best practices that could be useful for the community*
- *Main lessons from the project experience that could be applied in other contexts*
- *Conclusions from your experience during the implementation of the project and recommentations for the GBIF Secretariat or the community to reinforce the success of the project*

(Max. 400 words)

- Evaluation of the project activities and their outputs/deliverables: The simplest goals, adding ocurrence records, georeferencing, adding herbaria to *Index herbariorum* and OpenHerbarium, were met reasonably well given the shortened time frame resulting from the covid closure. The higher level goals, such as the preparation of data papers and online resources, were not completed. Attempts were made to engage Pakistani botanists in the preparation of a data paper, but no constructive responses were received. The project would have benefitted from active engagement of the Project Leader.
- Assessment of the overall outcomes, impact, and contribution to BIFA programme. Data moblization has started and there is intrest. The difficulty is persuading those in charge of herbaria that they themselves must be committed to data mobilization and make use of the opportunities it opens. Too often it is regarded as something to tell students about, not to engage with. Having said that, there is more information on Pakistan's plants becoming available and the amount will grow, but future efforts must focus on involving faculty at multiple institutions. A side effect of covid is to make everyone more attuned to the use of online learning resources.
- Comments on the project implementation and completion:
- Feedback: There is definite interest in online resources, These must start with consideration of the purpose of herbarium specimens. All too often, a herbarium exists but its specimens are poorly documented and repetitive.
- Planned follow up actions: Ship barcodes to CHIT and order them for QARSHI (USPS is now accepting mail for Pakistan). Develop a series on presentations on preparing and documenting herbarium collections and then mobilizing the information efficiently via OpenHerbarium. Find a way to persuade those publishing checklists to share them via

OpenHerbarium and for teachers to enage with their students. The problem is that, at many university's, class size in taxonomy classes is very large and the faculty member teaching them may have little background in the subjet.

- Areas of success to build on: Build online teaching resources because there is interest.
- Lessons: It is imperative that those hosting workshops restrict attendance. People attending the project workshops benefitted because there were relatively few individuals and there were follow up activities at their institutions. When there are 50 or more people in attendance and no follow up engagement, there is little benefit.
- Conclusions and recommendations: A commitment to *disseminating* knowledge of how to mobilize data and then use the mobilized data is essential.

Sustainability plans

Please provide a description of how the partners involved will build on the results of this project in their future work. This could include future collaborative activities, such as plans to complete any unfinished project activities and how the future impact of the project could be monitored and/or measured.

Barkworth is committed to continuing to help Pakistani herbaria and botanists become active participants in providing and using mobilize specimen data but primarily by developing online resources, engaging in virtual meetings and, if appropriate drawing attention to how doing so would benefit a planned project or manuscript.

Annex – Additional sources of verification

Sources of verification are for example links to relevant digital documents, news/newsletters, brochures, workshop related documents, pictures, etc.

Barkworth

Developing digital botanical resources in and for Pakistan

Synopsis March 2020; sample of information sent out to Pakistani herbaria and botanists as an email attachment

Using the Flora of Pakistan to strengthen and widen Pakistan's botanical infrastructure. Talk presented at the University of Karachi at celebration of the completion of the Flora of Pakistan. Also used at Qarshi Industries and Pir Mehr Ali Shah Arid Agriculture University.

Entering data into Symbiota. Used during workshops at University of Karachi and Malakand..

Malakand presentation – introduction to workshop at university of Malakand, About 60 people in attendance; expected 20.

Workshop organization – Individuals and OH Exploring. Sent for use by University of Malakand. A list of simple pre-workshops activities. It had not been given to any of the participants before the workshop.

Exploring OH-Introduction, OH exploring - searching

Georeferencing, Used at Quaid-i-Azam workshop.

From GBIF messages – problematic names. Investigation showed that GBIF's backbone has names that are not in accordance with the International Code of Botanical Nomenclature for algae, fungi and plants. I consulted Dr. Kanchi N. Gandhi, a member of the standing committee for nomenclature of vascular plants before deciding the form of the name used by GBIF was incorrect. It was usually some minor difference that was a problem. Some of the problems came from people entering records of specimens that had not yet been identified. The records come in with empty fields.

CHIT barcodes. Will be shipped Aug 1 (Barkworth is tied up with a meeting until then).

PMAS barcodes. Will be shipped Aug 1 (Barkworth is tied up with a meeting until then).