Digitization of Mushrooms and Lichens collections from Nepal: Bringing Underrepresented Taxonomic Groups into the Global Biodiversity Database

Programme: BIFA  
Project ID: BIFA5_023  
Project lead organization: Global Institute for Interdisciplinary Studies  
Project implementation period: 1/7/2020 - 31/7/2021  
Report approved: 11/11/2021

Narrative Final report

Executive Summary

Fungi are complex, biotic resources and constitute the most diverse group of eukaryotic organisms on earth. Despite their myriad roles within the world's ecosystems and also being an integral part of human well-being, they have received limited attention in biodiversity studies. This project aims to transfer digitalized data of lichens and mushrooms specimens in two herbarium centres (National Herbarium and Plant Laboratories - KATH and Tribhuvan University Central Herbarium- TUCH) and a museum (Natural History Museum - NHM) of Nepal, with proper management (sorting, curating, labelling) into the GBIF platform and provide an immense opportunity to maximise their visibility fulfilling taxonomic and geographical gaps in the global database.

We digitized 2462 specimens of lichens (TUCH:1123; KATH: 1207; NHM: 132) and 3971 specimens of mushrooms (TUCH:707; KATH: 1620; NHM: 1644) The occurrence data (totalling 6433) obtained from this digitization have been managed in six datasets (two lichens and mushrooms) for each of TUCH, KATH and NHM) and published on the GBIF Portal. Before the project started, it was difficult to quantify the number of fungal specimens at working institutions because most of them did not have the registered individual catalogue number. Here, we explored barcode applications as unique identifiers to complement specimen digitization.

During the project implementation, we realized/learned, how important is to bring proper field-level data, preserve specimens and the importance of digitization for the global audiences. Despite the Covid-19 pandemic and its consequences on the implementation of targeted activities, we have brought most of our major deliverables within the designed time frame with slight adjustments on the working modalities.

Progress against milestones

Has your project completed all planned activities?: Yes

Has your project produced all deliverables?: No  
Rationale: We are not able to publish checklists of lichens and mushrooms as we decided to incorporate a comprehensive list of the collections with their taxonomic details from recent collections and revisions. It is worthwhile to mention that we decided to submit checklists for quality journals with considerably good impact factors.

Report on Activities

Activity implementation summary

Despite the ongoing COVID-19 pandemic, we implemented most of the planned activities and succeeded to meet targets/deliverables. Training young minds (Research Asistantants and
Volunteers) and inception of digitization programme on the understudied mycological group are of
great achievement. Securing co-funding from the ForestAction Nepal and, Himalayan Climate and
Science Institute, USA (HCSI) to bring additional datasets and for other complimentary supports was
also a remarkable success. Nevertheless, the remaining parts of the project (though not the major
ones) like checklists and technical data papers are in progress and will be published within the next
couple of months (tentatively within the next six months). We have also realized that we made
excessive ambition of the proposal to bring so many deliverables within this short time frame.

Completed activities

**Activity name: Literature Review**

**Description:** During this period, an intensive review on available literature based on lichens and
mushrooms collections from Nepal were made. Team members were asked to share the bibliographic
databases that they have found useful in working with Nepalese lichens and mushrooms. Some of the
noteworthy databases found include Web of Science, Scopus, GoogleScholar, Digital Library of
Commons(https://dlc.dlib.indiana.edu/dlc/); Regional database for Hindu Kush Himalayan
region(http://rds.icimod.org/Home/Data?group=17), National Herbarium and Plant Laboratories(KATH)
website etc. To access grey literature, publications on Nepalese language, local bulletins, proceedings,
books and similar grey literature were compiled. For a moment and also for a long run this compilation
is helpful to bring mycological knowledge from Nepal in different local, regional and global assessment
processes. Dr. Devkota (main applicant of this project) is also contributing as a research fellow, for the
IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services)
Sustainable use of wild species assessment (2018 - 2022). IPBES is an independent
intergovernmental body, having 133 member countries, provides policymakers with objective scientific
assessments about the state of knowledge regarding planet's biodiversity, ecosystems and the
contribution they make o the people. Research process and progress on this planned project on
mushrooms and lichens are already helpful to share and discussed the primary findings among the
participants of the assessment during Chapters meetings and workshops. This kind of sharing and
learning will definitely help to deliver the project's aims to the wider audiences in such a global forum.
Simultaneously, having strong knowledge of such underrepresented taxa, it will be really good to bring
noble information and knowledge on IPBES assessment process itself.

- Though major portion of this activity was carried between aforementioned period, still this is an
ongoing process until we bring out checklists of lichens and mushrooms. So far, collected information
is used to bring a scientific publication - which is published in a journal "Diversity".

**Start Date - End Date:** 1/7/2020 - 31/7/2020

**Verification Sources:**
https://ipbes.net/sustainable-use-wild-species
assessment
https://www.mdpi.com/1424-2818/13/7/330

**Activity name: Attendance of BIFA Capacity Enhancement Workshop followed by
Inception workshop**

**Description:** Shiva Devkota, PI of BIFA5_023 has participated on the 2020 virtual Data Mobilization
Workshop for Asia (21-24 July) and completed a course successfully. It was an instrumental training to
learn about project planning, data capture, data management and data publishing tools.
https://www.gbif.org/event/BoAe3g7KjGeJUzC3oxs9v/data-mobilization-workshop-for-asia-2020

- Inception workshop was cancelled because of the COVID-19 situation, but in-person meetings in
small clusters were carried out at each institutions.

**Start Date - End Date:** 21/7/2020 - 24/7/2020

**Verification Sources:** The basic badge obtained by Shiva Devkota
https://openbadgepassport.com/app/badge/info/307289

**Activity name: Data Additions/ Fieldwork (Co-funding)**

**Description:** A week long field trip was conducted in Jalthal area, Jhapa to collect post-monsoon
mushroom species and to document local ethnomyiological knowledge. It was kindly supported by the
ForestAction (Forest Resources Studies and Action Team) Nepal under the ongoing project framework
"Uprating Community Forest management in Nepal: enhancing biodiversity and livelihoods" supported
by Darwin Initiative, UK. Jalthal forest is a biodiversity rich fragmented remnant forest in the densely
populated region of eastern lowland of Nepal. The forest is used by around 100,000 people living
around it. The surrounding forest is inhabited by ethnic minority Meche people. Meche people have
their own language and culture are found only in Jhapa district of Nepal especially around the Jalthal
forest. There are several other groups of indigenous people Santhal, Rajbanshi, Rai, Limbu, Tamang
and other ethnic groups like Bahun and Kshetri. The forest is an important resource for many people living around the forest and there has not been a proper documentation of natural history and traditional knowledge of the area.

**Start Date - End Date:** 12/12/2020 - 18/12/2020

**Verification Sources:** https://www.darwininitiative.org.uk/project/DAR26022/

https://www.forestaction.org/programs/index/14


**Activity name:** Digitization of herbarium at KATH, TUCH and NHM

**Description:** We digitized 2462 specimens of lichens (TUCH:1123; KATH: 1207; NHM: 132) and 3971 specimens of mushrooms (TUCH:707; KATH: 1620; NHM: 1644)

**Start Date - End Date:** 1/9/2020 - 31/7/2021

**Verification Sources:**
https://www.gbif.org/project/1oof3bltISyNanpvIWQYwz/digitization-of-mycological-collections-in-nepal # Appendix 1- "Some glimpse of project activities - BIFA5_023-Updated Version"

**Activity name:** Database management and submission to GBIF

**Description:** The occurrence data obtained from this digitization have been managed in six datasets. All data have been cleaned and formatted following DwC, checked by experts for the taxonomy and georeferenced, and then published to GBIF. All datasets have been published using Integrated Publishing Toolkit (IPT) of the hosted by International Center for Integrated Mountain Development (ICIMOD), Kathmandu, Nepal.

**Start Date - End Date:** 1/9/2020 - 31/7/2021

**Verification Sources:**
Mushrooms Flora of Nepal at National Herbarium and Plant Laboratories (KATH)
https://www.gbif.org/dataset/c92e9439-601d-47d4-8727-ff16ef69952f

Lichens Flora of Nepal at National Herbarium and Plant Laboratories (KATH)
https://www.gbif.org/dataset/37742167-d38a-4a4e-8b7d-76f75c2baed8

Mushrooms Flora of Nepal at National History Museum
https://www.gbif.org/dataset/bbd4efafa-9796-4e0c-8c1a-0b92f6a95907

Lichens Flora of Nepal at National History Museum, Tribhuvan University, Nepal
https://www.gbif.org/dataset/841c97b3-a5e1-428f-aa78-5953bdf01328

Mushrooms Flora of Nepal at Central Department of Botany, Tribhuvan University, Nepal
https://www.gbif.org/dataset/3968921a-e2e4-4d2c-a190-ef6655b8c0a5

Lichens Flora of Nepal at Central Department of Botany, Tribhuvan University, Nepal
https://www.gbif.org/dataset/cb28169b-df56-44d5-994a-b35cdaa81fa6

**Activity name:** Submission of data papers

**Description:** A part of information from this project is used to review useful lichens from the Nepal Himalayas - which in turn helps to collaborate with lichenologists from China and Switzerland to bring a collective review paper entitled "Ethnolichenology—The Use of Lichens in the Himalayas and Southwestern Parts of China" - published in a well circulated scientific journal "Diversity"

Other data-papers on lichens and mushrooms are being prepared and will be submitted after bringing few more missing information.

**Start Date - End Date:** 1/1/2021 - 31/7/2021

**Verification Sources:**
https://doi.org/10.3390/d13070330

**Activity name:** Result sharing workshop and final report submission

**Description:** Due ongoing pandemic we've only made in-persons meetings in small clusters. A
Webinar will be concluded with all the partner organizations and stakeholders once we are ready with our data papers and, checklists of lichens and mushrooms. Discussion has been already established with Dr. Bandana Shakya, Node Manager HKH-BF at ICIMOD Kathmandu and she is also supportive with this plan. It is likely that ICIMOD could facilitate this webinar bringing other stakeholders from working countries in the Hindu Kush Himalayan region.

**Start Date - End Date:** 15/7/2021 - 31/7/2021

**Verification Sources:**
- Final Report
- Dr. Bandana Shakya, Node Manager HKH-BIF (Email: bandana.shakya@icimod.org)

https://www.icimod.org/ecosystem-services/hkh-bif/

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### Report on Deliverables

#### Production of Deliverables - Summary

The main long term objective of this project is to contribute to bringing recent information on much-underestimated taxa like lichens and wild mushrooms in Nepal and to mobilize/deliver the species occurrence data based on information of the collection at the museum and major herbariums centres of Nepal onto GBIF for the wider scientific community. Having a set target of publishing at least six datasets, we have published all datasets as planned. In spite of having these unprecedented times,

We managed to bring additional occurrences records/data paper on fungi from a very new collection site Jalthal, Jhapa (before our study, not a single fungal species were collected from there).

Additionally, we've also brought a data paper and published in a scientific journal and almost 75% done with checklists of lichens and mushrooms.

Furthermore, we are also planning to bring (within the next 4 months) two technical papers (each on lichens and mushrooms) mainly describing methodology and lessons learned on digitization and publication procedures.

#### Production of deliverables

**Title:** Mushrooms Flora of Nepal at National Herbarium and Plant Laboratories (KATH)

**Type:** Dataset

**Status update:** PUBLISHED

**Dataset scope:** For the wider audiences.

**Expected number of records:** 1620

**Data holder:** National Herbarium and Plant Laboratories (KATH) / Department of Plant Resources (DPR)

**Data host institution:** International Centre for Integrated Mountain Development (ICIMOD)

**Sampling method:** Based on the herbariums deposited at KATH

**% complete:** 100

**DOI:** https://doi.org/10.15468/485yak

**Expected date of publication:**

**Title:** Lichens Flora of Nepal at National Herbarium and Plant Laboratories (KATH)

**Type:** Dataset

**Status update:** PUBLISHED

**Dataset scope:** For the wider audiences.

**Expected number of records:** 1207

**Data holder:** National Herbarium and Plant Laboratories (KATH) / Department of Plant Resources (DPR)

**Data host institution:** International Centre for Integrated Mountain Development

**Sampling method:** Based on the herbariums deposited at KATH

**% complete:** 100

**DOI:** https://doi.org/10.15468/v4bntu

**Expected date of publication:**

**Title:** Mushrooms Flora of Nepal at Central Department of Botany, Tribhuvan University, Nepal

**Type:** Dataset
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<thead>
<tr>
<th>Title: Lichens Flora of Nepal at Central Department of Botany, Tribhuvan University, Nepal</th>
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<tbody>
<tr>
<td>Type: Dataset</td>
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<tr>
<td>Status update: PUBLISHED</td>
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<tr>
<td>Dataset scope: For the wider audiences</td>
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<td>Expected number of records: 707</td>
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<tr>
<td>Data holder: Tribhuvan University Central Herbarium (TUCH) / Central Department of Botany, Tribhuvan University</td>
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<tr>
<td>Data host institution: International Centre for Integrated Mountain Development (ICIMOD)</td>
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<tr>
<td>Sampling method: Based on the herbariums deposited at TUCH</td>
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<td>DOI: <a href="https://doi.org/10.15468/9dyswy">https://doi.org/10.15468/9dyswy</a></td>
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<table>
<thead>
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<table>
<thead>
<tr>
<th>Title: Lichens Flora of Nepal at Natural History Museum, Tribhuvan University, Nepal</th>
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<tr>
<td>Type: Dataset</td>
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<tr>
<td>Status update: PUBLISHED</td>
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<td>Dataset scope: For the wider audiences</td>
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<td>Expected number of records: 1644</td>
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<tr>
<td>Data holder: Natural History Museum, Tribhuvan University (NHM/TU)</td>
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<td>Data host institution: International Centre for Integrated Mountain Development (ICIMOD)</td>
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<td>Sampling method: Based on the herbariums deposited at NHM</td>
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<tr>
<th>Title: Ethnolichenology—The Use of Lichens in the Himalayas and Southwestern Parts of China</th>
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<tbody>
<tr>
<td>Type: Data Papers</td>
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<tr>
<td>Description: Chinese samples are available in the Lichen Herbarium of the Kunming Institute of Botany (KUN-L) and we reviewed useful lichen collections housed at different herbaria (KATH, TUCH) and at the Natural History Museum, Tribhuvan University, Nepal, for their additional notes.</td>
</tr>
<tr>
<td>Sources of verification:</td>
</tr>
<tr>
<td>DOI: <a href="https://www.mdpi.com/1424-2818/13/7/330/htm">https://www.mdpi.com/1424-2818/13/7/330/htm</a></td>
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<table>
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<tr>
<th>Title: Mushroom flora of Jalthal forest, Jhapa, Eastern Nepal</th>
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Impact of COVID-19 pandemic on project implementation

Amidst this pandemic, we had tried our best to implement BIFA5_023 activities taking every care and precaution. Having this stringently hard time, some of the plans have been changed and the following working strategies were adapted to bring the best.

# As the mass gathering was strictly prohibited, we simply organized informal meetings (avoiding mass gatherings for inception and closing workshops) in small clusters each with a single collaborating institution. The remaining meetings cost and surplus money from internet service are used to purchase covid preventive health items and pre-cautions.

# To maximise our output and to undertake desktop work, we had rented a room for six months period in Kupandole, height Lalitpur utilizing the pending travel budget (travel restrictions in the public vehicle).

# Additional occurrence records of mushrooms (co-funding) for these pre and monsoon periods have been postponed due to the ongoing pandemics. This has hindered the publication of a scientific paper on their taxonomy and ecology. We are planning to bring complete checklists after bringing additional species details.

Events

GIIS Monday #webniar series-13. "Wild Mushrooms in Nepal: Plate to Poison"

Dates: 2020-08-04 - 2020-08-24
Organizing institution: Global Institute for Interdisciplinary Studies (GIIS)
Country: Nepal
Number of participants: 100
Comments: This webinar series was mainly focused on wild mushrooms of Nepal, its present status and future prospects. Here, Shiva Devkota also highlighted about ongoing digitization project under GBIF/BIFA framework and also highlighted the importance for the data documentation and visualization.
Website or sources of verification: https://www.youtube.com/watch?v=1INGi6LBA3s&t=1544s

Events

A talk programme by Mycological Association of Washington DC, USA
Events

A talk programme: 23rd Annual San Diego Fungus Fair of the San Diego Mycological Society

Dates: 2021-02-21 - 2021-08-21
Organizing institution: San Diego Mycological Society
Country: USA
Number of participants: 300
Comments: Shiva Devkota has also presented the research of the digitization project and the designed mycological expedition in Nepal in another live talk, this time during the 23rd Annual San Diego Fungus Fair of the San Diego Mycological Society, held in February 2021. [Video Link]

Website or sources of verification: http://sdmyco.org/fungus-fair/

Communications and visibility

The Global Institute for Interdisciplinary Studies (GIIS) has provided BIFA5_023 details on its website: https://www.thegiis.org/project-details/digitization-of-mushrooms-and-lichens-collections-from-nepal:-bringing-underrepresented-taxonomic-groups-into-the-global-biodiversity-database.html

Shiva Devkota has discussed and presented (n = 5: in five provincial states in Nepal) about ongoing digitization project while serving as a resource person for a project "Strengthening capacities for implementation of the Nagoya Protocol in Nepal" by IUCN Nepal in close collaboration with the Ministry of Forest and Environment, Nepal Government. # Pictures attached. Presentations were made for the provincial government officials mainly from the forestry, agrobiodiversity, plant resources, veterinary offices, universities and related stakeholders. # Appendix 1

BIFA5_023 updates are also regularly being provided and available on the page: https://www.gbif.org/project/10of3b3ltSyNanpvlWQYwz/digitization-of-mycological-collections-in-nepal

ICIMOD/HKH-BIF (Hindu Kush Himalayan Biodiversity Information Facility) has just uploaded two of Shiva Devkota's mushrooms pictures into its newly designed webpage. ICIMOD is an associate member of the Global Biodiversity Information Facility (GBIF), and HKHBIF is the GBIF-mediated publishing platform that is hosted by ICIMOD. It is a regional node of GBIF. [Website Link]

Monitoring and evaluation

Final Evaluation

From the inception of the project, we were committed to the accountability, learning and dissemination through which our mutual work with GBIF/BIFA "translated" into more effective, efficient and sustainable programme interventions.

Earlier a mid-term evaluation and thereafter close observation help to bind the experience made so far. It was found that the collaborating government and academic institutions (GIIS, KATH, TUCH and NHM) are in a single framework (though there are several limitations with this COVID) to implement this project and are delivering their activities effectively amidst this pandemic time.

Some of the changes which we introduced than mentioned in a proposal are as below and such
changes turned out to be important decisions.
-working from a rented room to overcome the COVID fear;
-the focused work on digitization bringing contributions of five research assistants (Mycologist, Lichenologists, and Digitization Expert)
- Bring additional scientific publications for peer-reviewed journals (data papers) on digitization techniques and lessons learned.

Furthermore, all partner organizations are agreed to work further on the citizen science approach to bring occurrence records of lichens and mushrooms.

The GBIF logo was used in PowerPoint slides and GBIF/BIFA and Ministry of the Environment, Government of Japan were greatly highlighted and acknowledged in scientific publications. As this digitization project is focused on the less-studied group of biodiversity, the GBIF could use this work and publications (datasets and data papers) for the further reinforcement of similar works in other countries. # Appendix 1- "Some glimpse of project activities - BIFA5_023-Updated Version"

Best Practices and Lessons Learned

We realized that there were some areas, which could be addressed to make this kind of digitization programme more friendly (in terms of capital and physical assets). Proper curation and labelling of the herbarium are necessary not only for future uses but equally essential to gear up the digitization process.

Post Project Activity(ies)

As stated earlier, we'll finalize checklists of lichens and mushrooms and manuscripts will be submitted to ISI journals. Simultaneously, will be working to prepare data papers on digitization technology and lesson learning. We'll be happy to share our publications with the GBIF/BIFA coordination team, once papers are published.

Nepal which is located in the Central Himalayan region is the centre of origin, adaptation, growth and dominance of different biotypes. Many interesting species are present within narrow elevational gradients starting from the lower belt to the higher landscapes. Among the studies species, wild mushrooms and lichens are very poorly explored and described irrespective of the higher plants and flagship animals. So, the next priority should be to foresee mycological surveys in many virgin lands, seeking their diversity, genetic variation and ecology and bring such information to the widely shared/available GBIF Portal.

Sustainability plans

This initiation should not be stopped and it is of utmost necessity that we must continue working on lichens and wild mushrooms in the next season too. Our team is the first to start digitization of these understudied taxa in Nepal and we are committed to bringing/add more occurrences data in the days to come.

Having these sorts of evidence-based datasets, help to understand the existing fungal scenario/gap analyses in Nepal and will play an instrumental role to design further explorations/collections trips finding much underexplored areas/taxonomic groups. Involved institutions are fully convinced with these data and planning to arrange further field trips accordingly.

The effectiveness of the further explorations will be measured based on finding understudied taxonomic groups from less explored areas of Nepal.

With this project, all the partner institutions will continue to promote open science to benefit the development of biodiversity data mobilization.

GBIF leads the Biodiversity Information Fund for Asia (BIFA), a programme funded by the Ministry of the Environment, Government of Japan. The programme provides supplementary support for activities addressing the needs of regional researchers and policymakers through mobilization and use of biodiversity data.