



National Biodiversity Centre

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Status Report 2023-25



Status Report
(2023-2025)



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Royal Government of Bhutan
Serbithang, Thimphu

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MESSAGE FROM THE PROGRAM DIRECTOR

Bhutan's unwavering commitment to biodiversity conservation continues to be a defining pillar of its national development philosophy. Since the ratification of the United Nations Convention on Biological Diversity (CBD) in 1995 and the establishment of the National Biodiversity Centre (NBC) in 1998, the country has pursued a balanced approach toward sustainable utilization, conservation, and equitable benefit-sharing of biological resources. The enactment of the Biodiversity Act of Bhutan 2022 and the adoption of the Biodiversity Rules and Regulations 2023 further affirm Bhutan's determination to regulate access to genetic resources and safeguard associated Traditional Knowledge, ensuring lasting benefits for both people and ecosystems.

The 2023-2025 Status Report highlights the collective achievements of the six core programs under NBC, showcasing continued advancements in genetic resource conservation, biodiversity research, sustainable use, and public engagement. The period saw significant progress across the board, and the key milestones include the National Animal Gene Bank surpassing 27,000 cryopreserved samples, seed accessions in the Plant Gene Bank expanded through nationwide fieldwork, and community-based conservation initiatives gained traction for native livestock and crop species alike. Meanwhile, bioprospecting initiatives developed nine value-added products and forged new ABS agreements, while the National Herbarium documented over 140 new plant records, including species new to science and Bhutan. The Royal Botanical Garden flourished as both a conservation and educational landscape, and the Biodiversity Information Management Program led the national coordination of Bhutan's Fifth National Biodiversity Strategies and Action Plans (5th NBSAP), serving as Secretariat for NBSAP and representation at the 16th meeting of the Conference of Parties (COP 16) of the CBD.

Amid escalating pressures from climate change, land-use change, and biodiversity loss, these achievements reflect Bhutan's commitment to science-based and community-centered biodiversity management. They also underscore the importance of sustained partnerships with national institutions, local communities, and international organizations in ensuring conservation that is inclusive, resilient, and forward-looking.

On behalf of NBC, I extend our sincere appreciation to all our stakeholders, collaborators, and donors who continue to support our mission. This report is not only a record of accomplishments but also an invitation for continued dialogue, cooperation, and collective action to safeguard Bhutan's rich biological heritage for generations to come.



Dr. Karma Dema Dorji
Program Director
National Biodiversity Centre
Ministry of Agriculture and Livestock

EXECUTIVE SUMMARY

Bhutan's unwavering commitment to biodiversity conservation is exemplified by its early ratification of the CBD and the establishment of the NBC in 1998. Guided by its mandate to ensure the conservation and sustainable use of biological resources and the fair and equitable sharing of benefits arising from their use, the NBC continues to spearhead biodiversity management initiatives through its six core programs and also as the Secretariat for the NBSAP, a guiding document for the country in biodiversity planning, implementation, and reporting under the Kunming-Montreal Global Biodiversity Framework (KMGBF).

The Animal Genetic Resources (AnGR) Program continued to advance both in-situ and ex-situ conservation of Bhutan's native livestock breeds. These included the establishment and expansion of *Saphag* pig breeding units across multiple sites, evaluation of *Nublang* cattle population status, conservation potential, and challenges in Sombeykha (considered the home track of the breed), initiation of new conservation efforts for *Belochem* poultry and *Yubja* chicken, native livestock inventory in Tsirang and Dagana *Dzongkhag*, tissue cryopreservation of endangered species, and improved germplasm conservation with the installation of a new liquid nitrogen plant. The National Animal Gene Bank now houses over 27,000 doses of genetic material, supporting long-term livestock conservation.

The Plant Genetic Resources (PGR) Program continued to enhance national seed security and agro-biodiversity conservation through extensive community engagement and scientific collection efforts. Between 2023 and

2025, over 560 seed samples of traditional crop varieties were collected from 42 *gewogs* and deposited in the National Plant GeneBank, with 300 accessions backed up in the reporting year with a cumulative collection of 3,836 accessions for long-term storage. The program advanced crop diversity monitoring, characterization, and farmer seed system studies under the Biodiversity for Opportunities, Livelihoods, and Development (BOLD) project, the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) supported Neglected and Underutilized Species (NUS), and the Bhutan Trust Fund for Environmental Conservation (BT FEC) supported projects, while also documenting traditional agricultural knowledge across communities. These efforts supported targeted capacity-building initiatives, helping secure Bhutan's plant genetic heritage for food and agriculture for food and nutrition security.

The Bioprospecting and Access and Benefit Sharing (ABS) Program made key strides in strengthening Bhutan's biodiversity-based innovation and equitable benefit-sharing frameworks. With support from an Australian volunteer under the Australian Volunteer Program (AVP), the program enhanced laboratory capabilities, including hands-on High Performance Liquid Chromatography (HPLC) training. Local product development saw enhanced success with *Zhinor* and *Pangtse Makhu*, exemplifying community engagement in biodiscovery. Awareness campaigns on biodiversity and biopiracy were conducted across sectors, including tourism and health. In support of access and benefit-sharing protocols, nine ABS products were developed with the

support of the International Centre for Integrated Mountain Development (ICIMOD), and eight new ABS agreements were signed with local communities for a secure and ethical supply chain and benefit sharing. In addition, one scoping agreement was signed for scoping research of three potential medicinal plants of Bhutan. An ABS logo was also developed to enhance the product's identity and convey its value as an officially recognized ABS product. The year saw an increasing awareness and interest among the public for bioprospecting and ABS. These achievements reflect Bhutan's growing capacity in linking biodiversity conservation with sustainable use and national development goals.

The National Herbarium (NH) strengthened its role as Bhutan's premier botanical repository, housing over 21,500 preserved plant specimens representing 3,986 species. Between 2023 and 2025, the herbarium added 144 species that were either previously absent or underrepresented in its collection, including specimens of taxa new to science and several notable rediscoveries. Key highlights include the discovery of 21 new species records for Bhutan and two taxa newly described from the country. The herbarium also led the flora and vegetation assessment of the Danashey Model Rehabilitation Project site in Tsirang.

The Royal Botanical Garden Serbithang (RBGS) strengthened its dual mandate of ex-situ conservation and environmental education through infrastructure upgrades, species conservation, and public outreach. Major milestones include the construction of a botanical café and souvenir shop, improved fencing, and renovation of the Biodiversity Interpretation Centre. The garden

collected more than 250 live plant accessions and nearly 100 seed accessions, successfully propagating 11 native species. Orchid micropropagation efforts also expanded, with over 1,650 plantlets currently maintained. The RBGS also contributed to key national events, including the National Day celebrations and the Royal Visit from Thailand. In addition, it generated a total revenue of Nu. 3.48 million, comprising entry fees, flower sales, and facility rentals.

The Biodiversity Information Management Services Program, also serving as the NBSAP Secretariat, played a central role in the formulation of the Fifth NBSAP. The program facilitated over six national and regional consultations to ensure alignment with global biodiversity targets and national development priorities. Bhutan's active engagement at COP 16 in Colombia, particularly in ABS and gender-inclusive biodiversity planning, was recognized internationally. The program also continued to manage the Bhutan Biodiversity Portal as the country's primary platform for biodiversity data while leading BioBlitz activities and public awareness initiatives. In addition, the program coordinated the baseline biodiversity assessment for the Danashey Model Rehabilitation Program in Tsirang, a flagship initiative under MoAL, to ensure ecological integrity is safeguarded in the restoration of over 1,165 acres of fallow land.

TABLE OF CONTENTS

1	INTRODUCTION
5	ANIMAL GENETIC RESOURCES
37	PLANT GENETIC RESOURCES
45	BIORPOSPECTING AND ABS
59	NATIONAL HERBARIUM
66	ROYAL BOTANICAL GARDEN
81	BIODIVERSITY INFORMATION MANAGEMENT
91	ARTICLES
151	JOURNAL ABSTRACTS
157	ANNEXURE



INTRODUCTION

Corydalis ecristata
© Phuentsho

BIODIVERSITY OF BHUTAN



Blue Sheep (*Pseudois nayaur*)
© Kezang Tobgay

Biological diversity is fundamental to all life-supporting processes on Earth. The diverse groups of animals, plants, and microorganisms play a crucial role in maintaining a healthy and balanced ecosystem on which humans rely. From the food we eat to the air we breathe, biodiversity underpins our survival. Additionally, it provides essential products and services such as clean water, timber, medicine, soil formation, organic waste disposal, and resilience against climate change, among many others.

In Bhutan, biodiversity conservation is deeply rooted in traditional beliefs, socio-cultural values, and the philosophy of Gross National Happiness, all of which have contributed to the country's

exceptional biodiversity richness in the twenty-first century.

With 69.71% of its land as forest area (FMID, 2023) and 52% as protected area network, Bhutan is home to 11,248 species of flora and fauna, including 4,978 species of flowering plants, 3,511 insects, 129 mammals, 736 birds, 125 fish, and 158 amphibians and reptiles (BSB, 2017).

More than 300 species of medicinal plants have been documented so far at elevations ranging from 200 to 7,800 meters above sea level (masl). While over 150 crop species are known to occur in Bhutan, the country's key agricultural biodiversity comprises more than 55 priority crop species.

NATIONAL BIODIVERSITY CENTRE

In recognition of the critical role of biodiversity in sustainable development and guided by committed environmental leadership, Bhutan ratified the CBD in 1995 during the 73rd session of the National Assembly. The CBD underscores the importance of conserving and sustainably utilizing biological resources while ensuring fair and equitable benefit-sharing. Subsequent to the ratification, Bhutan developed its first Biodiversity Action Plan in 1997.

Recognizing the fragmented responsibilities for biodiversity management in the country, the plan recommended an institutionalized and integrated biodiversity management framework. This led to the establishment of the National Biodiversity Program in 1998, which was upgraded to the status of a non-departmental agency in 2001 and renamed as the National Biodiversity Centre (NBC). Currently, as enshrined in the Biodiversity Act of Bhutan 2022, the Centre serves as the National Repository for plant and animal germplasms and as the Secretariat for the country's National Biodiversity Strategies and Action Plan (NBSAP). It also serves as the National Focal Point for the Nagoya Protocol on Access and Benefit Sharing, the Commission on Genetic Resources for Food and Agriculture (CGRFA), and the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA).





VISION: Effective conservation, sustainable utilization and equitable sharing of benefits arising from access and use of biological resources.

GOAL: To become a premier institute on biodiversity in the country resulting in the effective management of biodiversity and maximizing the benefits from it as well as contributing to international efforts toward conserving biodiversity.

MISSION: Biological resources effectively conserved, sustainably used and benefits equitably shared for enhancement of livelihood, food security and environmental well-being of the country.

Rufous Sibia
(*Heterophasia capistrata*)
© Phuentsho



Sipsoo Type sheep
©AnGR

Animal Genetic Resources



Beylaaitey
© AnGR

BACKGROUND

The Animal Genetic Resources (AnGR) Program, established in 2005, is dedicated to the conservation and sustainable utilization of AnGR in Bhutan, through both in-situ and ex-situ approaches. Its foundation was laid with the Type Three project, supported by the SDS fund in 2005, followed by the Integrated Livestock and Crop Conservation Project (ILCCP) during the 10th Five-Year Plan (FYP). The ILCCP played a pivotal role in upgrading the National Animal Genebank into a fully operational facility while bolstering on-farm conservation initiatives. Over the past decade, the program has significantly strengthened its capabilities in animal gene banking, coordination of in-situ conservation efforts, and promotion of sustainable use of prioritized AnGR.

In recent years, the program has benefited from additional key projects, including the High-Altitude Northern Areas of Bhutan (HANAS) project, supported by the World Bank-BTFEC, which focused on on-farm conservation of Jakar sheep, and the Asian Food and Agriculture Cooperation Initiative (AFACI) project, aimed at enhancing the value and improving AnGR in Bhutan. A significant milestone was achieved in 2011 when the cryopreservation protocol for semen at the National Animal Genebank was validated with technical assistance from UNDP and FAO. The program also contributed to global efforts by submitting State of Animal Genetic Resources for Food and Agriculture reports to FAO in 2009, 2010, and 2024, aiding the development of the Global Plan of Action for animal genetic resources. Additionally, it manages and collects AnGR data for the Domestic Animal Diversity Information System (DAD-IS) and provides regular updates on Bhutan's AnGR status to FAO. The program is further equipped with a fully functional DNA laboratory for basic molecular research.

KEY ACHIEVEMENTS (IN-SITU CONSERVATION)



Yuta (Native horse)
© AnGR

The in-situ conservation of AnGR was initiated in 2008 with funding from the GEF-UNDP Integrated Livestock and Crop Conservation Project, focusing on capacity building and enhancing local diversity by adding value to these resources. Ongoing initiatives are directed toward securing resources to implement interventions that reinforce in-situ conservation while addressing emerging threats to traditional livestock genetic resources. The program is also working with various stakeholders to establish conservation communities for other indigenous livestock species and actively seeking funding to develop robust conservation strategies and implementation plans. More importantly, the program is also continuing to work on breed purification of the native livestock breed.



A Nublang herd in Sombeykha, Haa

© AnGR



Harachu Breeding Unit
© AnGR



Samthang Breeding Unit
© AnGR

Establishment and Operationalization of Saphag Pig Breeding Units

In August 2023, the Animal Genetic Resources Program successfully oversaw the establishment of a nucleus *Saphag* breeding farm at Harachu. With construction completed and 20 piglets sourced from Dagana region, the unit became fully operational. In October 2023, feasibility studies were carried out in Samthang *Chiwog* for a proposed nucleus breeding unit, followed by close monitoring of construction progress. The monitoring ensured compliance with infrastructure standards, identified areas for improvement, and involved the local community to promote sustainable conservation of indigenous pig genetic resources. In February 2024, 24 high quality *Saphag* piglets were sourced from Udzorong Gewog, Trashigang, and distributed to the newly constructed Samthang unit. To strengthen the gene pool and prevent inbreeding, breeding boars were also distributed to existing units in Rukha and Harachu.



Rukha Breeding Unit
© AnGR

*Nublang Bull (Bos Indicus)*

© AnGR

Breed Evaluation and Conservation of Nublang Cattle in Haa

In January 2024, the program evaluated the indigenous *Nublang* cattle population in Sangbaykha and Gakiling Gewogs, Haa Dzongkhag. Field assessments and consultations with farmers revealed a shift toward *Jersey* cattle in Sangbaykha, while Gakiling and Yaba-Shema still maintained valuable purebred *Nublang* populations. These areas were identified as potential in-situ conservation sites, owing to strong farmers' commitment, the cultural significance of the breed, and its proven adaptability to highland conditions. Despite key challenges such as labor shortages, decreasing grazing areas, and breed competition, farmers in Gakiling expressed willingness to expand their herds if adequate support is provided.



Saphag Pig in Samthang, Wangdue Phodrang
© AnGR

Community-Led Conservation in Zhemgang and Chhukha

In October 2024, the AnGR Program successfully identified community-led in-situ conservation opportunities for native animal genetic resources in Zhemgang *Dzongkhag*. This included collaboration with youth cooperatives, local farmers, and extension agents. In March 2025, the operationalization of breeding units in Rukha, Samthang, and Harachu was monitored, with plans to scale up *Saphag* pig production for market integration while preserving genetic purity. During the same month, Loggchina *Gewog* in Chhukha was assessed as a feasible site for a new in-situ pig unit, mirroring the successful model established in Athang *Gewog*.

Feasibility for Native Poultry Conservation in Punakha

A feasibility study was initiated for a native poultry layer farm in Tserina, Kabjisa Gewog, Punakha Dzongkhag in May 2025. Proposed by a local farmer via the Dzongkhag Livestock Sector, the initiative focuses on conserving the *Belochem* poultry strain and producing organic eggs. The site was found suitable, with available water, electricity, and adequate biosecurity measures. The farm is expected to begin operations in the next fiscal year with 200–300 birds and the use of organic feed, contributing to conservation and rural livelihood enhancement.



Yubjha Naap (Native Black)
© AnGR



© AnGR



Naked Neck



Seim

Livestock Inventory and Breed Documentation in Tsirang and Dagana

Between April and May 2025, livestock inventories and stakeholder consultation meetings were held in Tsirang (Sergithang, Semjong, Mendrelgang, Patshaling) and Dagana (Drujeygang, Khebisa, Goshi). These activities aimed to validate population data, assess the sustainability of ILCCP programs, and identify native livestock hotspots. The findings will guide strategic interventions to improve genetic purity and promote value-added native livestock products in target communities.



Seim



**Site Assessment for
Youth-Led Conservation
Initiatives in Zhemgang
and Chukha**



© AnGR

In April 2025, a second site assessment was conducted in Ngangla Gewog, Zhemgang, in collaboration with the Pangbang Youth Cooperative, local farmers, and extension services. The team laid the foundation for *Saphag* pig and *Yubja* chicken conservation initiatives and developed a work plan with infrastructure needs for implementation in 2025–2026. In June 2025, a follow-up trip to Loggchina was conducted to source *Saphag* pigs and coordinate the relocation of exotic stock from the proposed conservation site to make way for the new breeding facility.

KEY ACHIEVEMENTS (EX-SITU CONSERVATION)



Bhutan's traditional animal genetic resources are of exceptional value, playing a pivotal role in the livelihoods of rural communities while holding profound socio-cultural and economic significance. Established in 2005 in collaboration with the Centre for Genetic Resources of the Netherlands, the National Animal Gene Bank was created with the primary objective of preserving the genetic diversity of Bhutan's unique indigenous livestock breeds. Currently, the gene bank safeguards **27,292** doses of semen and DNA samples from various native breeds, serving as a vital resource for research, long-term conservation, and potential breed reconstruction in the face of extinction risks. Since 2018, a collaborative effort with the National Dairy Research and Development Center has advanced embryo cryopreservation programs, successfully collecting and preserving approximately 20 viable *Nublang* embryos to date. Ongoing initiatives include detailed studies to characterize production parameters and economically significant traits through selective breeding and DNA mapping, ensuring this conserved germplasm acts as a critical genetic reservoir to enhance national food security amid challenges posed by climate change and related threats.

Domestic Buffalo (*Bubalus Bubalis*)

© AnGR



Goat and Sheep Germplasm Collection

In August 2023, 17 native goats and 17 sheep (16 bucks and 1 doe) were sourced from four *gewogs* in Chukha *Dzongkhag* (Dungna, Loggchina, Darla, and Samphelling) to diversify semen collections and preserve pure native lines. Between February and March 2024, 13 *Sipsoo*-type sheep were procured from unexplored flocks in Norgaygang, Tendu, and Pemaling *Gewogs* under Samtse *Dzongkhag*. These sheep were transferred to the National Small Ruminants Research and Development Centre (NSRRDC) in Bumthang for breeding and germplasm conservation purposes.





Capacity Building in Cryopreservation Techniques

In March 2024, NBC conducted hands-on training on tissue collection, cryopreservation, and culture techniques for endangered species. The sessions included biopsy procedures, post-mortem tissue sampling, and cryopreservation methods, enhancing the technical capacity of staff and researchers engaged in long-term genetic resource conservation.





Wild Water Buffalo
© AnGR

Germplasm Gap Analysis and Prioritized Collection Plan

During FY 2024–2025, a comprehensive gap analysis was conducted using the AnGR database to assess germplasm representation of native livestock species. The analysis identified critical shortages in several breeds, prompting the development of a targeted collection work plan. The plan prioritizes underrepresented species in the gene bank and guides future field missions to close genetic resource gaps over the next five years.



White-Bellied Heron Egg in Incubator

Avian Genetic Conservation: White-Bellied Heron

In May 2025, NBC collaborated with RSPN to collect and analyze three non-viable White-Bellied Heron eggs from Changchey, Tsirang, to understand the causes of embryonic developmental arrest. Tissue samples from a deceased chick were successfully cryopreserved, marking a significant milestone in avian genetic conservation and contributing to the long-term preservation strategy for this critically endangered species.





Procurement of a New Liquid Nitrogen Plant (LN2)

One of the most critical achievements in FY 2024–2025 was the procurement of a new LN2 plant to support germplasm conservation. Funded by the European Union’s “Promoting Inclusive, Sustainable, and Resilient Agri-Food Systems in Bhutan” project, the new plant, capable of producing 5–6 litres per hour, replaces the previous unit, which has been non-functional since 2023. Interim LN2 requirements were met through monthly procurement from SD Cryogenics, based in Samdrup Jongkhar. Operational training was also provided to ensure the sustainable use and management of the new plant.

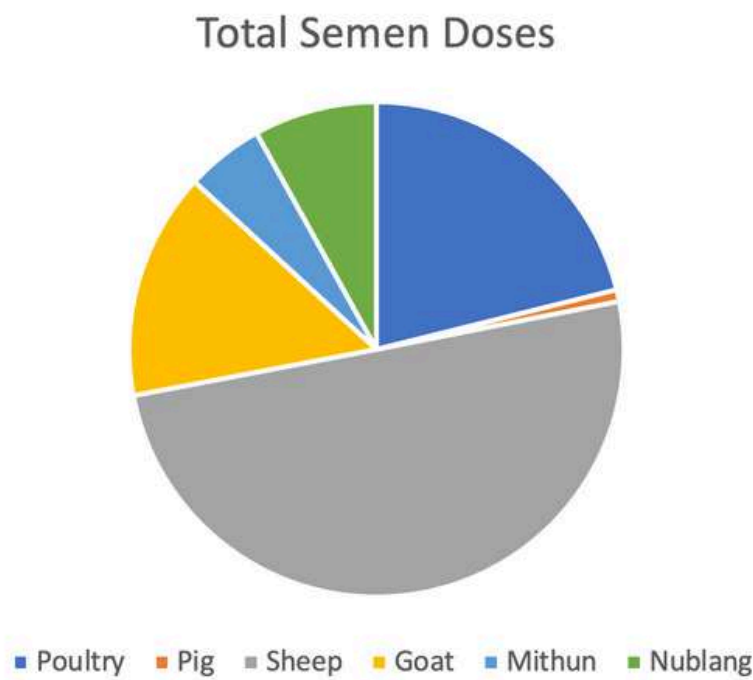


Current Status of Germplasm Collection

The National Animal Gene Bank, also referred to as the National Animal Repository, safeguards 27,292 doses of semen collected from various traditional animal breeds. A concise visual representation of the gene bank's extensive collections is presented below.

Table 1: Collections at the gene bank

Donor Animals	Total Semen Doses
Poultry	5,764
Pig	209
Sheep	13,678
Goat	4,051
Mithun	1,390
<i>Nublang</i>	2,200
Total	27,292





CENTRE FOR NUBLANG CONSERVATION AND DEVELOPMENT (CNCD)



BACKGROUND

The Centre for Nublang Conservation and Development (CNCD), formerly the National Nublang Breeding Centre, was established in 1978 as a Sheep Breeding Unit in Bidung, Trashigang. Relocated to its current site in Tashiyangphu, approximately 8 km from Wamrong Dungkhag in Trashigang *Dzongkhag*. Following the transfer of all sheep stocks to Bumthang, the farm was repurposed as a Mithun Calf Rearing Centre under the Regional Mithun Breeding Farm, Arong. In 1994–1995, following a Royal Command, it was again repurposed to focus only on conserving the Siri (*Nublang*) cattle breed, a native Bhutanese breed valued for its adaptability to harsh conditions, disease resistance, milk quality, draught power, and crossbreeding.

Situated at an elevation of 2,050–2,550 meters above sea level, CNCD began with an initial breeding stock of 40 *Thrabum* heifers, four breeding bulls, and two Mithun-cross bullocks from Somboeykha (Haa) and Doban (Sarpang). Since 1996, the Centre has developed a sustainable elite herd through selective breeding. In 2022, the CNCD was transferred to the NBC as part of departmental reforms aimed at enhancing efficiency and aligning with the NBC's mandate for genetic resource conservation. Renamed to CNCD, the Centre continues to operate under NBC's technical and administrative guidance.

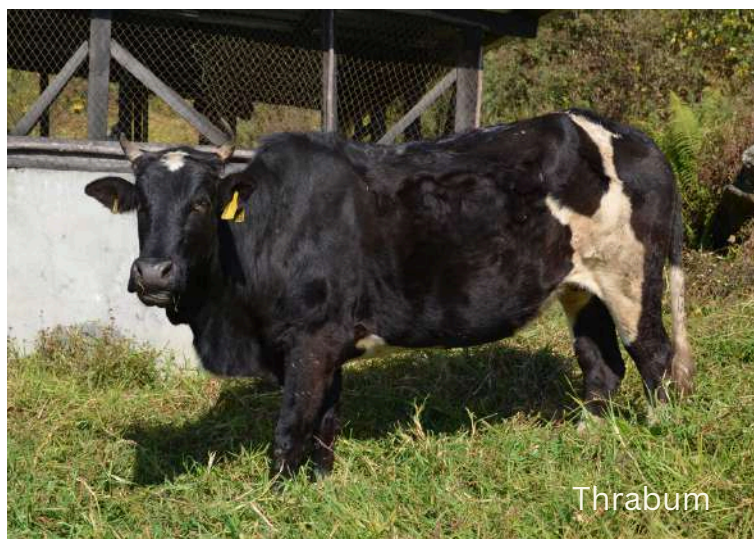
MAJOR ACCOMPLISHMENTS OF 2024-2025

In FY2024-2025, CNCD achieved significant progress in herd management, production, infrastructure development, and conservation efforts, reinforcing its role in preserving Bhutan's indigenous cattle breed.

Nublang Herd Management

- **Population:** The Centre maintained an average of 186 heads of cattle (110 Livestock Units), exceeding the recommended carrying capacity of 140 heads (80 LU) due to regular births and replacement stock purchases. A total of 35 calves were born (18 female, 17 male), supporting herd growth.
- **Production:** Annual milk production reached 37,295 liters, with 20,974 liters sold and 16,321 liters fed to calves. The average milk yield per cow was 3 liters per day, with a lactation yield of 925 liters over a 308-day lactation period. Manual milking was preferred due to the ineffectiveness of milking machines for the *Nublang* breed.
- **Bull Supply:** High-quality *Nublang* bulls were supplied to farmers for crossbreeding, generating Nu. 100,000 in revenue and supporting in-situ conservation by promoting improved purebred progeny.

- **Health Management:** The herd mortality rate was 4.68% (8 deaths), primarily due to accidents and sudden deaths linked to the farm's sloped terrain. Routine deworming, vaccinations (FMD, BQ/HS, LSD), and biosecurity measures, including biological pits, minimized disease risks. Regular sampling with RLDC, Kanglung, ensured early detection of health issues.
- **Nutrition:** The Centre conserved 57 metric tons of Kikuyu hay and 34 metric tons of maize silage, supplemented by fresh banana trunks, oats for calves, and concentrate feeds (dairy ration, cattle concentrate, and calf starter pellets). Napier plantations were expanded to address winter fodder shortages.
- **Replacement Stock:** Four breeding bulls and five heifers were purchased (Nu. 0.485 million) from Sangbaykha, Haa, to enhance genetic diversity.



Thrabum



Nublang

Infrastructure Development

CNCD completed several infrastructure projects to enhance operational efficiency and biosecurity, funded primarily by the European Union's "Promoting Inclusive, Sustainable, and Resilient Agri-Food Systems in Bhutan" project:

- **Administrative Block:** A new office building (Nu. 4.17 million) was constructed, providing space for staff meetings, visitor accommodation, and future veterinary storage and cryopreservation facilities.



© CNCD

- **Feed Store:** A new feed store (Nu. 2.5 million) with improved ventilation and capacity for 36 metric tons of feed addressed storage challenges.



- **Milk Processing Unit (MPU):** A modern MPU (Nu. 2.44 million) improved dairy product hygiene and processing efficiency.





- **Biological Pits:** Three biological pits (Nu. 0.212 million) were built for safe carcass disposal, enhancing biosecurity per BFDA regulations.
- **Farm Machinery:** A power tiller (Nu. 0.407 million) was procured to expand maize cultivation to 2 acres, increasing silage production.

Revenue Generation

CNCD generated Nu. 1,102,436 in revenue during FY2024-2025, as reflected below:

- **Milk Sales:** Nu. 846,936 from 20,974 liters sold, driven by consistent demand for *Nublang* milk.
- **Culled animals:** Nu. 39,000 from culled animals.
- **Animal Disposal:** Nu. 116,500 from the sale of non-breeding stock.
- **Breeding Bull Supply:** Nu. 100,000 from supplying bulls to farmers for crossbreeding.

Current Status

CNCD operates as a leading ex-situ conservation hub for *Nublang* cattle, maintaining an average herd of 186 heads despite exceeding the farm's carrying capacity of 140 heads. The Centre's rugged terrain (220 acres of 276.06 acres developed) supports Kikuyu grass pastures and fodder trees, supplemented by conserved silage and concentrate feeds. The reproductive performance is strong, with an average age at first service of 32.9 months, first calving at 43.4 months, and a calving interval of 13.39 months, an improvement from the previous year's 14.1 months.

The Centre's 27 staff members, including a Senior Biodiversity Supervisor, animal attendants, and pasture attendants, manage operations despite two vacant positions (Biodiversity Officer and Supervisor). High-profile visits during the year, including those from the Hon'ble Minister (MoAL), Director (DoL), Secretary (MoAL), and Program Director (NBC), provided guidance to enhance operations. A new Toyota Vigo Hilux (BG-1-A1797) and Scorpio Bolero (BG-1-A1617) support mobility, easing staff and produce transport.

CENTRE FOR YUBJA CONSERVATION AND DEVELOPMENT (CYCD)



© CYCD

BACKGROUND

The Centre for *Yubja* Conservation and Development (CYCD), located in Sertsam under Jarey Gewog, Lhuentse Dzongkhag, was established on February 5, 2017, coinciding with the Birth Anniversary of Gyalsay. Situated at an altitude of 986 meters above sea level, the Centre occupies 95.5 acres adjacent to the Gorgan highway towards Maedtsho Gewog. CYCD was initially set up with 63 heads of Nublang cattle and later received an additional 26 heads from the National Dairy Research Centre (NDRC) in Yusipang. The Centre's significance was underscored by a visit from His Majesty on May 13, 2018, during which he emphasized the importance of strengthening conservation efforts for *Nublang* cattle and indigenous *Yubja* poultry.

On November 14, 2022, CYCD was transferred to the NBC as part of Bhutan's civil service reforms aimed at enhancing efficiency, effectiveness, and service delivery. This strategic move aligned CYCD's operations with NBC's mandate to streamline interventions, optimize resource utilization, and foster synergy in biodiversity conservation. CYCD's vision is to ensure the effective conservation, sustainable utilization, and equitable sharing of benefits arising from Bhutan's biological resources. Its mission focuses on conserving these resources to enhance livelihoods, ensure food security, and promote environmental well-being.

MAJOR ACCOMPLISHMENTS OF 2024-2025

In the fiscal year 2024-2025, CYCD achieved significant milestones across its *Nublang* and *Yubja* units, alongside substantial infrastructure and operational advancements.

Nublang Unit

The *Nublang* Unit, focused on conserving Bhutan's native cattle breed, maintained a stable population of 140 heads despite stock transfers, sales, and culls. Key achievements include:

- **Population and Reproduction:** The unit recorded 46 births (32 female and 14 male calves), demonstrating robust reproductive performance. The average age at first service was 36.5 months (1095 days), with first calving at 46.5 months (1396 days). The calving interval averaged 479.43 days (15.98 months), influenced by factors like feed availability and seasonal variations.

- **Production:** Annual milk production reached 19.8 metric tons, with 11.8 metric tons from milking and 7.3 metric tons for calf suckling. The average lactation yield was 2.1 liters per cow per day over a 305-day lactation period, with an average of 27 milking cows contributing 1.59 metric tons monthly.
- **Livestock Supply:** The Centre supplied 15 bulls to farmers in Lhuentse and Mongar Dzongkhags for breeding and rearing, and replaced 12 pregnant heifers to maintain herd quality.
- **Animal Health:** A comprehensive health management system resulted in a low herd mortality rate of 3.57% (5 deaths), primarily due to accidents, predator attacks, and old age. Routine vaccinations (FMD, BQ/HS, LSD) and quarterly deworming were implemented, with only 19 clinical cases reported, mainly digestive issues in calves and musculoskeletal injuries.
- **Nutrition:** The unit developed 11.61 acres of sub-tropical improved pastures, including Napier grass, and renovated over 10 acres of existing fields. To address winter feed shortages, 116.99 metric tons of winter fodder (Napier/maize silage, straw, hay) were conserved, ensuring year-round nutrition.

Yubja Unit

The Yubja Unit, dedicated to conserving native poultry breeds (*Seim*, Native Black, and *Belochem*), managed a flock of 1,699 birds, with 72.6% comprising layers, cockerels, and growers/pullets. Key accomplishments include:

- **Egg Production:** The unit produced 26,443 eggs annually, a significant increase from the previous year, averaging 2,204 eggs per month. Of these, 91.6% were settable for hatching, with the remaining 8.4% classified as second-class eggs.
- **Reproduction:** The artificial hatchery achieved a hatchability rate of 60.62% from 3,575 set eggs, producing 2,350 chicks (1,609 female, 741 male, and 178 second-class). The fertility rate was 87.06%, supported by a 10:2 male-to-female breeding ratio. The average age at first laying was 21 weeks.
- **Poultry Supply:** The Centre supplied 700 pullets to Pema Gatshel (400) and Lhuentse (300), meeting rising demand from local *Gewogs* and *Dzongkhags*. An additional 200 birds for the Royal Farm are being reared for delivery in July 2025.
- **Production Metrics:** Hen Day Egg Production (HDEP) averaged 12.57%, and Hen Housed Egg Production (HHEP) averaged 12.41%, influenced by environmental factors, feed type, and bird age.



Yubjha Naap (Native Black)
© AnGR

Infrastructure and Development

CYCD completed several critical infrastructure projects through the European Union's "Promoting Inclusive, Sustainable, and Resilient Agri-Food Systems in Bhutan" project to enhance operational efficiency and sustainability:

- **Cattle Passing Bridge:** A Nu. 3.6 million suspension bridge over Oongarchu facilitated safe cattle movement.

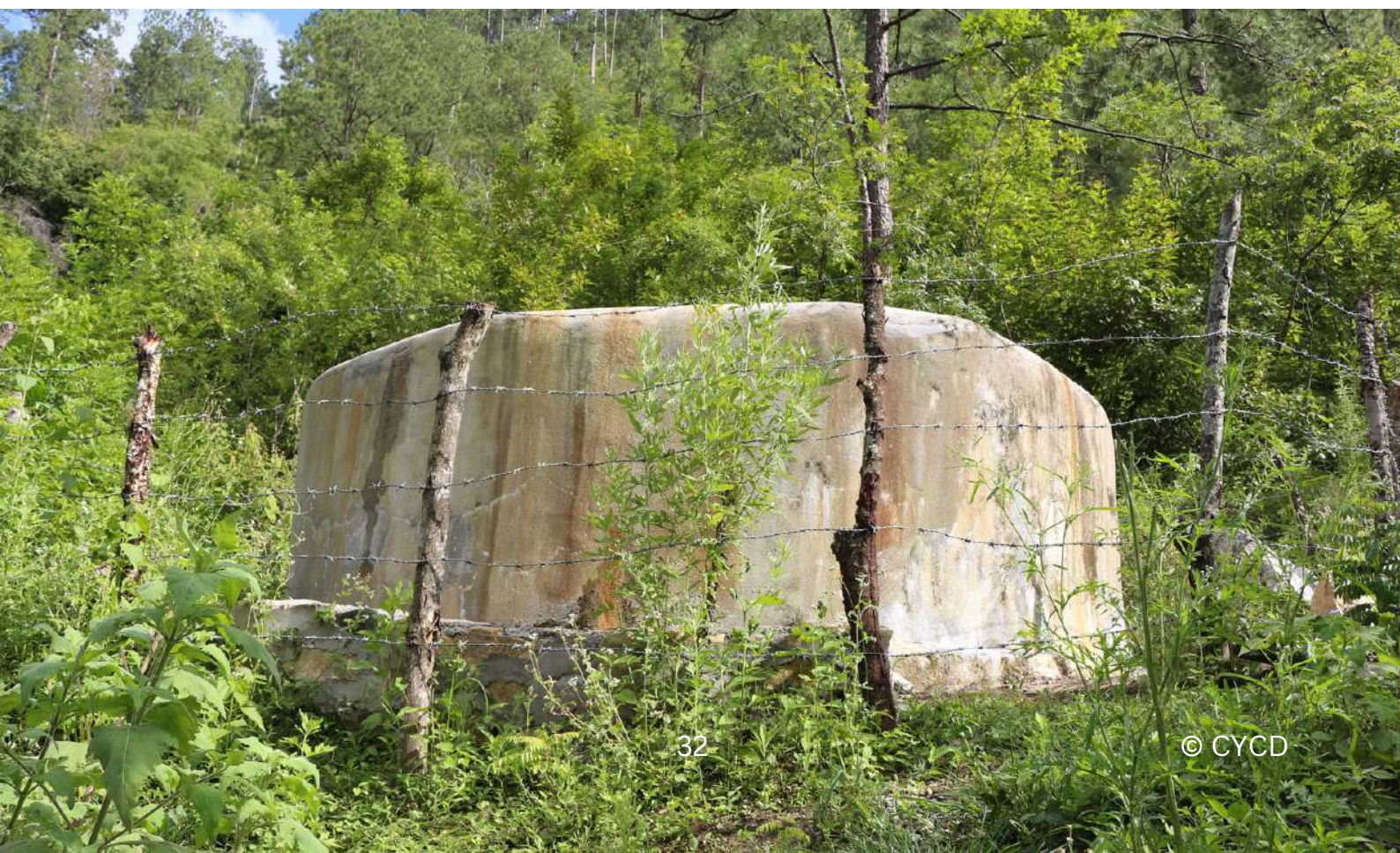


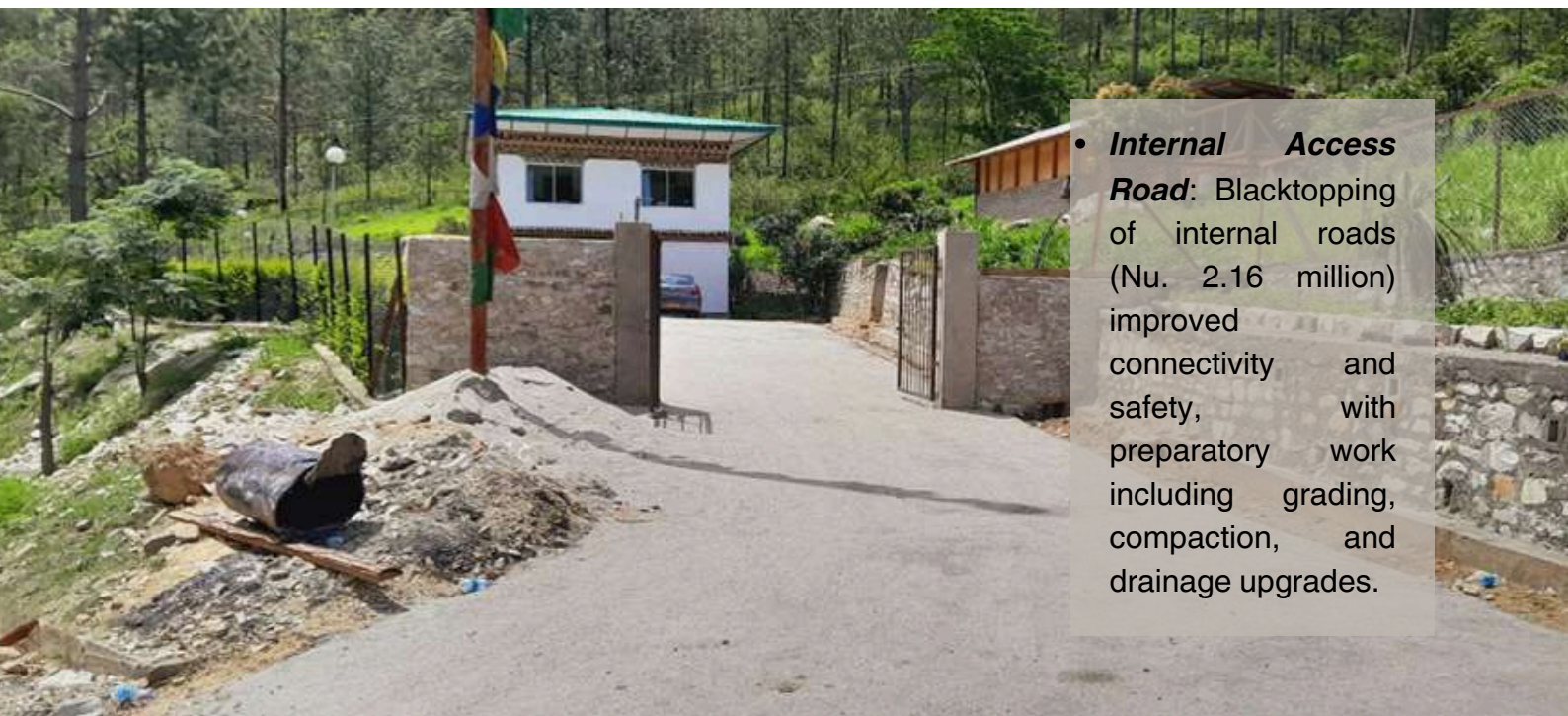
New cattle pass bridge
© CYCD

- **Biosecurity Facilities:** Facilities costing Nu. 1.3 million, including dress-changing rooms, chain-link fencing, biological pits, gates, and foot dips, were constructed to strengthen disease prevention.



- **Water Supply Maintenance:** Preventive maintenance, including pipeline replacement and reservoir tank construction, was completed at Nu. 0.635 million, ensuring reliable water access.

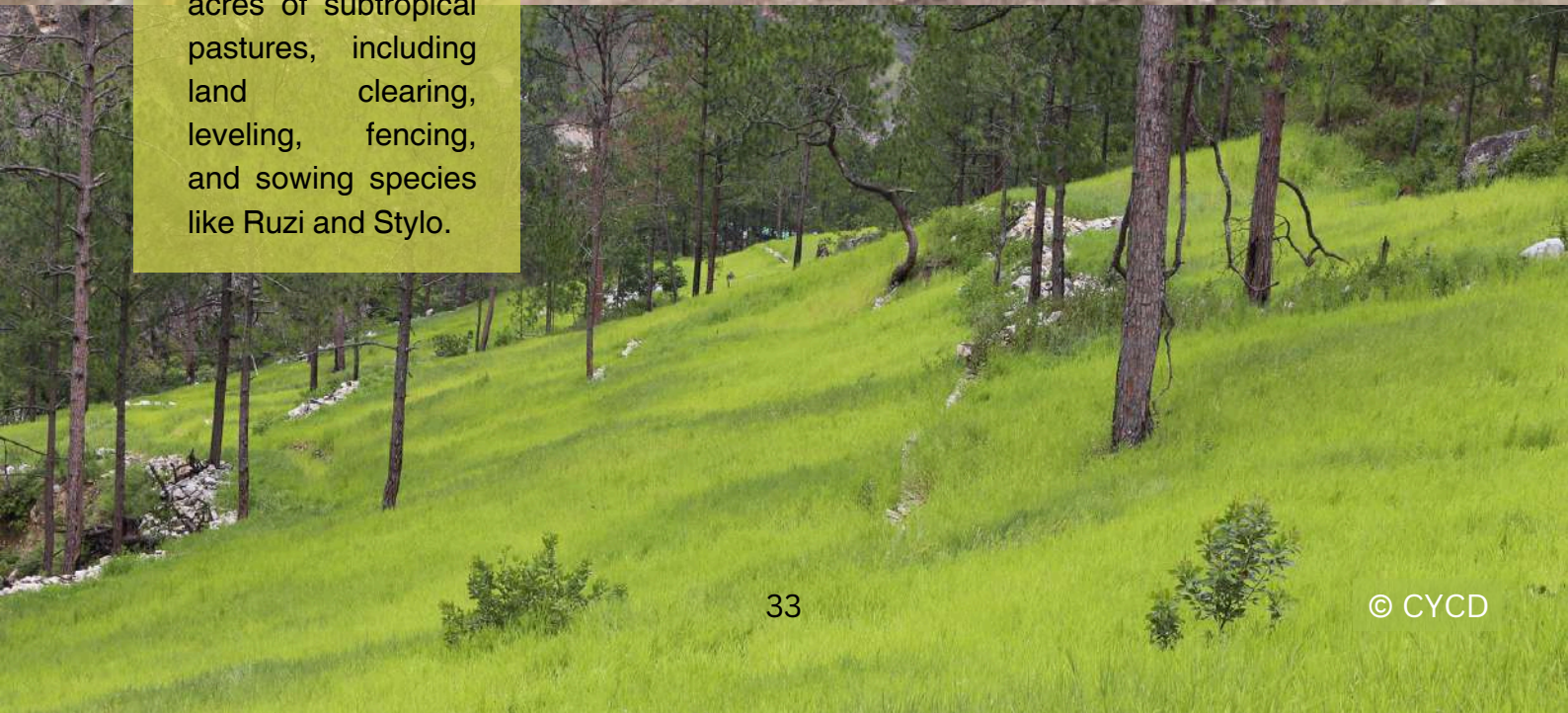




- **Internal Access Road:** Blacktopping of internal roads (Nu. 2.16 million) improved connectivity and safety, with preparatory work including grading, compaction, and drainage upgrades.



- **Pasture Development:** Nu. 0.8 million was invested in developing 11.61 acres of subtropical pastures, including land clearing, leveling, fencing, and sowing species like Ruzi and Stylo.





Equipment Procurement

Essential equipment, such as feed mixers, butter churners, cream separators, chaff cutters, anti-slip cow mats, hydroponic trays, poultry crates, and brooder heaters, was procured to enhance production and animal welfare.





- **Replacement Stock:** The Centre acquired 90 native poultry (Native Black, *Balaitey*, *Seim*, and *Frizzal*) from Tsirang, 28 cattle from the CNCD in Trashiyangphu, and 15 native pigs for a nucleus herd in Zhemgang.



Revenue Generation

CYCD generated over Nu. 0.85 million in revenue during FY2024-2025 through the sale of milk, dairy products (butter and cheese), eggs, and live animals and birds. This income highlights the commercial viability of the centre's operations and the market demand for its products. Key revenue sources include:

- **Milk and Dairy Products:** Sales from 11.8 metric tons of milk, along with butter and cheese, contributed significantly to revenue.
- **Egg Sales:** The *Yubja* Unit's 26,443 eggs supported local markets, with 91.6% being high-quality settable eggs.
- **Live Animal and Bird Sales:** The supply of 15 bulls, 700 pullets, and other livestock generated additional income, meeting regional demand.

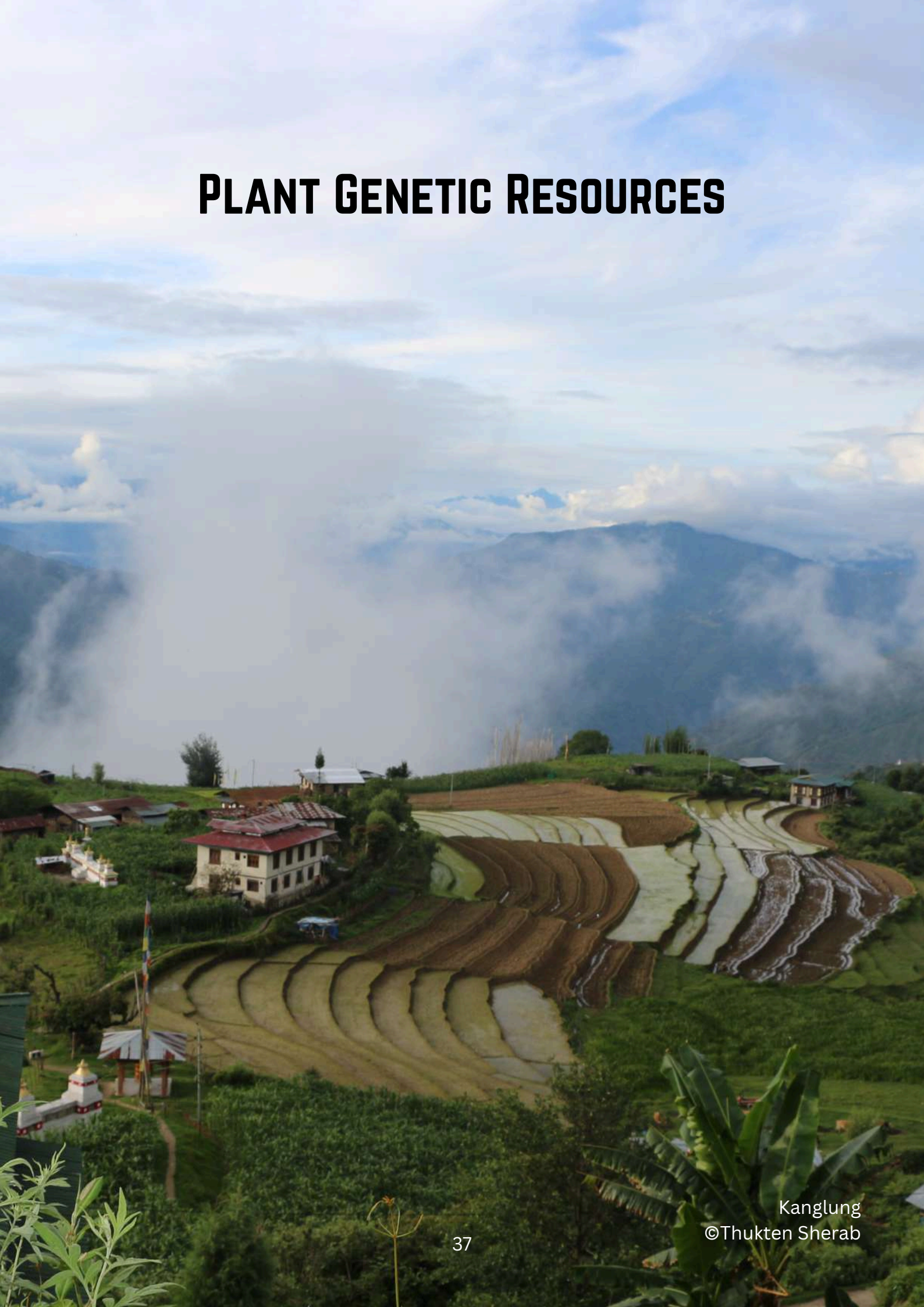
Current Status

CYCD continues to operate as a vital hub for conserving Bhutan's native livestock under the NBC's oversight. The *Nublang* Unit maintains a stable cattle population with effective health, nutrition, and reproductive management, ensuring the genetic preservation of the *Nublang* breed. The *Yubja* Unit supports a diverse poultry flock, meeting local demand for native pullets while advancing breeding programs. Infrastructure upgrades have significantly improved farm functionality, biosecurity, and accessibility, positioning CYCD for sustainable growth.

The Centre's workforce, led by a Senior Biodiversity Officer and supported by unit in-charges, drivers, animal attendants, and pasture attendants, remains dedicated despite challenges, including five staff resignations in FY2024-2025. Collaboration with the *Dzongkhag* Administration, Lhuentse, and the Ministry of Agriculture and Livestock ensures continued support for CYCD's initiatives. The Centre adheres to Bhutan's biosecurity policies, achieving compliance in farm premise practices, herd health, and record-keeping, as verified by the Bhutan Food and Drug Authority (BFDA).

CYCD's ongoing efforts focus on enhancing productivity, expanding outreach to local farmers, and maintaining its role as a leader in ex-situ conservation and research. The Centre's strategic alignment with national biodiversity goals and its ability to adapt to challenges, such as feed shortages and environmental factors, underscore its resilience and commitment to Bhutan's agricultural heritage.

PLANT GENETIC RESOURCES



BACKGROUND

As a part of the Eastern Himalayan biodiversity hotspot, Bhutan is ranked 12th in terms of biodiversity per unit land area (Tamang, 2003). Agrobiodiversity, specifically known as Plant Genetic Resources for Food and Agriculture (PGRFA), forms a significant subset of this biodiversity. The PGRFA is further categorized into four subcomponents: domesticated crops (DC), semi-domesticated crops (SDC), crop wild relatives (CWR), and wild edible plants (WEP). Each of these subcomponents showcases a range of diversity levels, including agroecosystem, species, varietal, ecotype, genetic, and allelic. This rich diversity is distributed across various altitudes throughout Bhutan, reflecting the country's diverse ecological range.

Bhutan's agroecological zones, which include the Humid Subtropics, Wet Subtropics, Dry Subtropics, Warm Temperate, Cool Temperate, and Alpine zones, are recognized for their importance in maintaining the diversity of PGRFA. This diversity is crucial for the country's food and nutrition security, both for the current and future generations. Since 2001 and 2005, respectively, two strategies have been implemented in a complementary manner to conserve this diversity:

- 1) In-situ on-farm conservation (2001)
- 2) Ex-situ conservation (2005).

The Plant Genetic Resources (PGR) Program was established in Bhutan in response to BAP I (1997), while BAP I was formulated in response to Bhutan's ratification of CBD in 1995. The BAP I on "Plant Genetic Resources" states that 'where such facilities do not exist in the country, they should be developed, where desired.' Therefore, in view of the paramount importance of PGRFA, the PGR Program was established under the National Biodiversity Centre for the Conservation and Sustainable Use of PGRFA in the country, considering the decline of traditional crop diversity in the country due to many complex factors, namely urbanization, displacement of crop varieties, change in cropping system, etc. The developmental activities in the country have led to the introduction of improved and hybrid varieties with increased yield, which were a systemic effort of agriculture research centres, of which some parental lines are exotic and foreign in origin. The agriculture extension service and distribution of improved cultivars to the farmers have led to the rapid replacement of native traditional crop varieties with improved ones. And the rapid urbanization activities have caused a loss of agricultural land, which is used for building industries and other man-made structures. Climate change has caused turmoil with the factors of production of crops with a rise in average mean temperature, rainfall patterns, and incidence of pests and diseases. All these factors have contributed to the loss of our native traditional PGRFA. In the face of climate change, the native traditional PGRFA plays a role in serving as a gene pool for producing climate-resilient varieties, adaptation to the local environment, and pest and disease resistance through systemic plant breeding programs. In view of this, the PGR program conducts an annual germplasm inventory at a *gewog* or block level in the country by meetings with the farmers, analyses of risk/threat to local crop diversity, and the current trend and status of local crop agrobiodiversity. This is followed by the identification of donor farmers and the germplasm collection mission of the prioritized crops.

KEY ACHIVEMENTS (ON-FARM CONSERVATION AND EX-SITU CONSERVATION



Crop Germplasm Inventorying and Collection

On-farm crop diversity inventory, exploration, and germplasm collection were conducted in 4 *Dzongkhags* of Sarpang, Samdrup Jongkhar, Tsirang, and Chukha. This activity was carried out during the financial year 2023-2025. The program collected germplasm samples from 12 *gewogs* in Sarpang (Shompangkha, Gakiling, Gelegphu, Samtenling, Dekidling, Chhudzom, Senggye, Tareythang, Umling, Chhuzangang, Serzhong, and Jigme Choeling); 4 *gewogs* of Samdrup Jongkhar (Gomdar, Wangphu, Orong, and Phuntshothang); and Bongo *gewog* under Chhukha *Dzongkhag*. A total of 391 germplasm samples were collected from Sarpang *Dzongkhag*, 220 from Samdrup Jongkhar, and 24 samples from Chukha *Dzongkhag*. The collections comprise cereals, legumes, oil seeds, and vegetables. The samples are being processed and conserved in both the base (long-term) and active (medium-term) collections at the National Plant Genebank. A total of 3,836 accessions are currently conserved in the genebank. The details are presented in Table 5.

Additionally, the collection team replenished germplasm in the Community Seed Banks (CSB) of Gomdar and Phuntshothang with the fresh seeds. A total of 14 crop varieties in Gomdar and 39 crop varieties in Phuntshothang CSB were replenished. This activity was clubbed with the germplasm inventory, exploration, and collection missions. The details are presented in Table 2 and Table 3.

Table 2: List of varieties conserved at community Seed Bank in Khoyar/Gomdar

Sl. No.	Crop	Varieties	Remarks
1.	Paddy	7	Conserved since 2018
2.	Barley	3	Conserved since 2022
3.	Sweet Buckwheat	3	Conserved since 2023
4.	Bitter Buckwheat	2	Conserved since 2023
6.	Foxtail millet	5	Conserved since 2018
7.	Little millet	3	Conserved since 2018
8.	Beans	8	Conserved since 2019
9.	Maize	8	Conserved since 2022
10.	Pea	4	Conserved since 2022
11.	Sunflower	1	Conserved since 2020
12.	Perilla	1	Conserved since 2020
13.	Mustard	1	Conserved since 2020
14.	Pumpkin	1	Conserved since 2020
15.	Sorghum	1	Conserved since 2020

Table 3: List of varieties replaced at Community Seed Bank in Khoyar/Gomdar

Sl. No.	Crop	Varieties
1	Maize	2
2	Beans	8
3	Sorghum	1
4	Finger millet	1
5	Sweet buckwheat	1
6	Rice bean	1
	Total	14

Two new bean varieties of economic value, cultivated by farmers in Narphung Chiwog, have been added to the community seed bank collection. The cultivation of paddy has been reduced due to water scarcity in Gomdar.

Table 4: List of varieties conserved at Community Seed Bank in Phuntshothang

Sl. No.	Crop	Varieties
1	Paddy	13
2	Maize	2
3	Pop corn	1
4	Beans	4
5	Ricebean	7
6	Lablab bean	1
7	Cowpea	4
8	Horsegram	2
9	Seasame	1
10	Soyabean	3
11	Niger	1
Total		39 Varieties

Table 5: Number of Accession & crops conserved in the National Plant Genebank

Sl. No.	Crop Name	Accession
1	Paddy	1245
2	Maize	599
3	Bean	297
4	Finger millet	230
5	sweet buckwheat	193
6	Vigna	104
7	Mustard	122
8	Bitter buckwheat	155
9	Barley	93
10	Soya bean	95
11	Foxtail Millet	120
12	Wheat	90
13	Amaranth	60
14	Little Millet	97
15	Perilla	98
16	Niger	9
17	Pea	30
18	Turnip	9
19	Sesame	25
20	Sag	5
21	Sorghum	27
22	Chilli	92
23	Water melon	2
24	Mungbean	10
25	Radish	10
26	Fodder	15
27	Tomato	2
28	lettuce	2
Grand total		3836

Rehabilitation and promotion of Neglected and Underutilized Species (NUS Project)

The on-farm conservation of Neglected and Underutilized Crop Species (NUS) activities were implemented in seven *gewogs* under four *Dzongkhags*, namely, Wangphu and Orong in Samdrup Jongkhar; Yalang and Bumdeling in Tashiyangtse; Tading and Dophuchen in Samtse; and Bongo in Chhukha. The activities were implemented in collaboration with the ARDCs of Wengkhar and Samtenling, NCOA, and with the *Dzongkhag* Agriculture Sector of the sites. The activities focused on reviving and promoting the NUS crops (millets) that are on the decline in all the sites. Four finger millet accessions and four foxtail millet accessions from the National Plant Genebank were evaluated, selected, and promoted in all the sites. Additionally, during the Financial Year 2024-2025, as part of this collaborative activity and with the primary aim to build capacity of the farmers, the ARDC Wengkhar, in collaboration with NBC and *gewog* agriculture sectors, conducted awareness programs and demonstrations on product development and millet value addition, benefiting 145 farmers of Bumdeling, Yalang, Orong, and Wangphu *gewogs*. Millet-based products such as cookies, noodles, flour, and spicy snacks were produced and packaged to increase shelf life and marketability. Similar activities were carried out by the ARDC Samtenling in Tading and Dophuchen *gewogs* and NCOA in Bogo *gewog*, benefiting a total of 60 farmers. These activities were funded through the ITPGRFA supported project on Participatory Conservation, Sustainable Use, and Management of NUS crops for adaptation to Climate Change and Livelihood.

10th Biodiversity Fair

Coinciding with the 117th National Day, the 10th Biodiversity Fair was organized in collaboration with the Tsirang *Dzongkhag* Administration under the theme “Preserving our past, securing our future: safeguarding our agrobiodiversity.” A total of 90 participants from 30 *Gewogs* representing 10 *Dzongkhags* showcased nearly 1,000 different seed and crop varieties. Notable recognitions included the exhibition of 149 varieties by farmers from Doonglagang and rare varieties such as “*Dangpo Ashom*” from Trashiyangtse. The fair was organized to create wider awareness on the importance of conservation and sustainable use of PGRFA for resilient and sustainable food systems.

Integrated Cropping Trials and Farm Mechanization Support

A mixed cropping trial of millet and quinoa was established in Zamsa, Bongo *Gewog*, Chhukha, in partnership with NCOA during the financial year 2024-2025. It was part of the NUS crops revival and promotion program supported by ITPGRFA. The initiative aimed to diversify and enhance food and nutrition security at the household level. To reduce crude traditional methods of processing millet products, the ITPGRFA project converged with other project sources, and farmers were supported with a Japanese multi-mill, power tillers, and a multi-crop thresher funded by the Food and Agriculture Organization (FAO) and FSAPP. Additionally, the project site was also supported with fencing materials to mitigate human-wildlife conflict and encourage farmers to continue cultivating these crops. Farmers already started to market the millet products at the farmers’ sales outlet located at Gedu. Strengthening such market access and improved post-harvest handling serves as a promising example of traditional-modern integration in sustainable farming.

Capacity Building and Training

To sustain the project activities and empower project stakeholders, including farmers, a key capacity development activity on millet value addition and product development was organized at the National Food Research Centre, NARC (Nepal), from 16 to 21 April 2025. A total of 11 participants from ARDC, *Dzongkhag*, NCOA, NSC, DAMC, NBC and farmers took part in the training. It was also a part of the project exit strategy.

Project Monitoring and Technical Reporting

Field monitoring of the NUS project was carried out across all project sites. The progress of the activities was assessed and documented both in images and clips for reporting and records during the monitoring missions. Such documentation was required as evidence for the donors as well as for our own record for future references.

Participatory On-Farm Conservation and Sustainable Use of Native Horticulture Crop Diversity

The PGR program launched a new BTFEC-supported project in FY 2024–25. An inception and planning workshop was held in September 2024 with 24 participants from five *Dzongkhags* and national research centers to align stakeholders on roles, activities, and timelines. Following this, a baseline survey was conducted from November to December 2024 across Bongo, Mendrelgang, Bjoka, Lumang, and Langthel *gewogs*. The survey documented 198 native horticultural crop species, both wild and cultivated, and captured data on local use, conservation status, traditional knowledge, and product development potential. A total of 133 community members (73 male, 60 female) participated in the survey.

Strengthening Genebank Operations and Facilities

Risk Management and Operational Improvements

With technical support from the Global Crop Trust, NBC completed a comprehensive risk assessment and developed mitigation and management plans for gene banking operations. SOPs for key activities, including conservation, regeneration, safety duplication, and distribution were developed and audited. The Red Book of Risk has also been audited and approved. This strengthens the program's preparedness against environmental, financial, and technical risks.

Capacity of the program on Quality Management System (QMS) has also been enhanced with engagement in a series of virtual and in-person meetings and workshops.

Red Book of Risk

Version 1.0-001

April 2025

Equipment and Accessioning

To safeguard long-term seed viability and improve operations, the following critical equipment were procured:

- Heat sealer machine
- Seed Aspirator
- Data logger
- Laminar flow chambers
- Water distillation purification system
- Pro Breeze dehumidifier
- PPM mixture
- Accession display board
- Aluminum foil sealer
- A nondestructive rotronic moisture meter (received directly from the Crop Trust)
- Aluminum foil bags have been received directly from the Crop Trust
- The Germination Cabinet (procured from EPB project)
- Electronic balance procured from other projects
- 3 tablets were received directly from the Crop Trust, which has been reported to the management and recorded in the official document.
- Data loggers for temperature and humidity.
- LCD display board for display of accessions

With support from the BOLD (Biodiversity for Opportunities, Livelihood and Development) Project WP1, 262 new germplasm samples were collected from 11 *gewogs* in Sarpang during the Crop Diversity Inventory, and 150 accessions were processed and added to the National Genebank, increasing the cumulative collection of 3,800 accessions conserved in the national plant genebank for long-term conservation.

GBIS (Genebank Information system) System Upgrade

A major milestone was the migration of the GBIS system to a secure, scalable server hosted by the Government Data Centre, coordinated by the GovTech Agency. The new system includes features such as data backups, in vitro/cryo data handling, characterization tools, and improved user access, replacing the unstable and outdated infrastructure at NBC.

Staff Development and Technical Capacity Enhancement

- Five major international training programs were attended by Genebank staff and collaborators to build technical expertise in gene banking, cryopreservation, and data management:
- Genebank Data Management, GGCE, GeneSys – Delhi, March 2024 (2 staff)
- International training course at World Vegetable Center HQ – April 2024 (1 staff)
- Asia-Pacific Workshop on Genebank Operations (ICRISAT) – September 2024 (1 staff)
- Knowledge Exchange Visit to IRRI – October 2024 (4 participants)
- Cryopreservation & Tissue Culture (KU Leuven, Belgium) – Jan–Feb 2024 (1 staff)



BIOPROSPECTING AND ACCESS AND BENEFIT SHARING (ABS) PROGRAM





BACKGROUND

Bhutan ratified the Nagoya Protocol in 2012, which sets out core obligations to regulate access to genetic resources, benefit-sharing, and compliance. Established in 2009, the Bioprospecting and ABS Program focuses on recognizing the value of Bhutan's biological resources and associated Traditional Knowledge (TK). Serving as the national focal point for the Nagoya Protocol on ABS, the program conducts biodiversity research within the ABS framework. The program operates a bioprospecting laboratory and oil distillation facility, conducting phytochemical analysis and maintaining a collection of over 1200 plant extracts. Additionally, the program oversees the Bhutan ABS Fund, which was created as a reinvestment mechanism, receiving financial benefits generated from accessing genetic resources or associated TK and directing these funds toward supporting initiatives aimed at conserving biodiversity. In one and half decades, close to 20 ABS products have been developed in partnership with national and international companies, with a strong emphasis on community engagement and benefit sharing.



**ACCESS
BENEFIT
SHARING**



KEY ACHIEVEMENTS



Competent National Authority (CNA) Meeting

Three CNA meetings were convened, on 25th October 2023, 17th February 2025, and 25th June 2025, respectively, in accordance with the Biodiversity Rules and Regulations 2023. The meetings served as a formal platform to review ongoing ABS-related projects, facilitate cross-agency coordination, and endorse the signing of new scoping agreements. The 4th CNA meeting held on 25th June 2025 endorsed Bhutan's fifth NBSAP. The event reaffirmed NBC's mandate as the coordinating agency for ABS implementation in Bhutan and provided critical policy direction for advancing legal and technical frameworks.

Scoping Agreement with Bhutan Agro Industries Limited (BAIL)

To explore the nutraceutical potential of *Citrus reticulata*, the NBC signed a formal scoping agreement with Bhutan Agro Industries Limited (BAIL) on 7th March 2024. The agreement marked a key milestone in initiating collaborative research on native citrus varieties with potential health benefits. This partnership signifies NBC's growing role in promoting scientific research that connects biodiversity with product innovation and value addition.

Scoping Agreement with TERRA Himalaya Pvt. Ltd.

NBC signed a scoping agreement with TERRA Himalaya Pvt. Ltd on 29th May 2025 to conduct research and development on *Swertia chirayita*, *Inula racemosa*, and *Rhodiola crenulata*. The agreement outlines the responsibilities and research expectations for the company and strengthens private-sector involvement in the ethical exploration of Bhutan's biodiversity under the ABS framework.

Negotiation of ABS Agreement with Silent Pool Distillers

NBC and Silent Pool Distillers, a UK-based craft spirits company, are in discussions for an ABS agreement for the use of Bhutanese juniper berries in premium gin production. The agreement represents a landmark model for ethical use of Bhutan's native plant resources in international luxury spirits markets under the ABS framework.

Potential Collaboration with Jägermeister on Herbal Liquor

NBC is in discussions with the Germany-based liquor company Jägermeister to explore the formulation of a new herbal liquor product infused with *Swertia chirayita*. This partnership aims to commercialize the species while promoting sustainable sourcing, community benefit, and ethical trade under the ABS framework.



Traditional Knowledge Documentation in Protected Areas

In collaboration with Bhutan for Life (BFL) and local stakeholders, NBC completed the documentation of traditional ecological knowledge related to conservation and climate resilience in 15 *gewogs* within protected areas. These included Laya and Lunana (Gasa), Nichula (Dagana), Ngangla (Zhemgang), Chhudzom and Senggye (Sarpang), and nine *gewogs* in Samdrup Jongkhar and Thimphu. The findings are being integrated into biodiversity planning and cultural conservation efforts.





Stakeholder Workshop on Bioprospecting as a Nature-Based Solution (NbS)

NBC, in collaboration with ICIMOD, organized a two-day stakeholder workshop from 22nd to 23rd April 2024 in Paro. The workshop aimed to identify synergies in bioprospecting and ABS efforts, particularly concerning key medicinal plants such as Rhododendron and wild ginger. The event brought together multiple stakeholders to deliberate on advancing bioprospecting as NbS to enhance sustainable livelihoods. The dialogue fostered strategic alignment between conservation, community benefits, and scientific innovation.





Showcasing Bioprospecting at the Bhutan Agrifood Trade and Investment Forum (BATIF)

From 15th to 19th May 2024, NBC, ICIMOD, and the CSI Market participated in the BATIF in Thimphu. The event served as a platform to promote bioprospecting as a nature-based solution (NbS) approach and to generate interest among donors, investors, and stakeholders. By focusing on establishing efficient raw material supply chains that connect communities and industries, NBC emphasized its commitment to sustainable use of genetic resources and fair and equitable sharing of benefits.





Capacity Building in Phytochemical Research with Chanel PB and AVP Expert

In a significant capacity-building effort, NBC partnered with Chanel Parfums Beaute (Chanel PB) to train staff in basic plant extraction methods, analytical HPLC for phytochemical profiling, and preparatory HPLC for compound purification. The two-week training, held from 18th to 29th March 2024, was led by Chanel PB's chemist, Ms. Meava Gillet. The program included lectures, demonstrations, and hands-on exercises and was attended by officials from NBC, BAIL, and MSPCL. It contributed substantially to building in-house technical capabilities for biodiscovery research.

Swertia Cultivation Site Visit and Market Linkages

Representatives from Jägermeister, Chanel PB, and Bio Bhutan visited *Swertia* farming communities in Lauri from 21st to 24th October 2024. The visit assessed the community's capacity to supply *Swertia chirayita*, which has already surpassed Chanel PB's demand. The team explored new market opportunities and potential partnerships while laying the groundwork for a sustainable raw material supply chain. In 2025, 2,000 kilograms of *Swertia chirayita* were procured, generating Nu. 3 million in revenue, of which Nu. 1.5 million was directly received by the Lauri community group and the other half was deposited into the Bhutan ABS Fund.

Facilitation of Material Transfer Agreements (MTA) and Letters of Undertaking (LoU)

To ensure legal compliance in the transfer and use of Bhutanese genetic resources, NBC facilitated the execution of 43 MTAs and 12 LoUs during FY 2023–2024, followed by 39 MTAs and 8 LoUs in FY 2024–2025. These instruments regulate access for both research and commercial purposes, safeguarding against biopiracy and misappropriation. The implementation of MTAs and LoUs underscores NBC's role as a national authority in ensuring ethical and regulated use of the genetic resources.

Distribution of Legal Documents and Operational Guidelines

NBC printed and distributed the Biodiversity Act of Bhutan 2022, the Biodiversity Rules and Regulations 2023, and Version I of the Standard Operating Procedures (SOPs) to enforcement officers and key agencies. Recipients included the Royal Bhutan Police, Department of Forests and Park Services, Department of Revenue and Customs, and others. This effort supported the operationalization of the legal framework and enhanced institutional capacity to enforce access and benefit-sharing laws.



Hosting of Australian Volunteer for Biodiscovery Support

From May 2023 to May 2024 and March 2025 to June 2025, NBC hosted an Australian volunteer under the Australian Volunteer Program (AVP) to support the Bioprospecting and ABS Program. Throughout her tenure, she contributed to the enhancement of NBC's biodiscovery research and development initiatives. Even after completing her assignment, she continues to support the program remotely, providing technical expertise and mentorship. Her continued involvement exemplifies the valuable role of international partnerships in building national research capacity, significantly enhancing in-house laboratory research capacity.

Hands-On Capacity Building on HPLC Techniques

To strengthen laboratory-based research and compound profiling, NBC conducted intensive practical training on HPLC for its officials at the Bioprospecting Laboratory. The training was supported by a service engineer from Nepal and Dr. Barbara Meurer (AVP). Staff received hands-on guidance in using analytical and preparatory HPLC systems, significantly enhancing the centre's technical ability to conduct phytochemical analysis and bioactive compound screening.

Phytochemical Analysis of Medicinal Plants

As part of the HPLC training and research activities, NBC completed phytochemical profiling of ten potential medicinal plant species: *Symplocos paniculata*, *Acorus calamus*, *Terminalia chebula*, *Terminalia bellirica*, *Juniperus recurva*, *Phyllanthus emblica*, *Picrorhiza scrophulariflora*, *Cannabis sativa*, *Rheum australe*, and *Plukenetia volubilis*. These analyses contribute critical baseline data for understanding bioactive constituents, supporting product development, and identifying commercial potential.



Nature-Based Product Development and Branding

As part of the project funded by the Federal and Commonwealth Development Office of the United Kingdom, NBC, in collaboration with ICIMOD and the S.C. Design Studio, supported the development and market readiness of nine nature-based products produced by eight different start-ups and scale-ups. These efforts included laboratory testing, formulation enhancement, rebranding, packaging design, and business plan development. The official launch was held on 10th July 2025 which was graced by the H.E. Lyonpo Younten Phuntsho, Minister, Ministry of Agriculture and Livestock. The products ranged from herbal tea and massage balm to hand wash and tinctures, each developed in partnership with local community groups under ABS agreements.





Launch of Access and Benefit Sharing (ABS) Logo

To promote ethical and sustainable bioprospecting practices, NBC designed and launched an official ABS logo. The logo with three variants will be granted to business entities and entrepreneurs that comply fully with Bhutan's ABS legal framework. More than just a visual identifier, the logo represents a commitment to responsible use of biological resources, fair and equitable sharing of benefits, and community well-being. It also serves as a market assurance tool for consumers and stakeholders interested in supporting biodiversity-based enterprises.



Primary Logo



Secondary Logo



Icon



Formalization of Community-Based Natural Resource Management (CBNRM) Groups

Seven Community-Based Natural Resource Management (CBNRM) groups were established with bylaws to enhance community governance, sustainable use, and benefit-sharing mechanisms. These groups were formed to ensure a secure and sustainable supply chain and fair and equitable sharing of benefits. The groups are *Tshaluna Ngomen Shomda Dulen Tshogpa* (Thimphu), *Goenshari Zhelngosa Ganoderma Detshen* (Punakha), *Kuenthuen Phendey* (Pemagatshel), *Ruechhedkha Khempa Mengi Detshen* (Wangduephodrang), *Kaba Nagtshel Rangzhin Menrig Detshen* (Trongsa), *Dzedokha Phacheng Detshen* (Chhukha), and *Jom Dagam Ngomen Tshogpa* (Thimphu). They are directly involved in supplying genetic resources for the nature-based products, and their establishment reinforces grassroots participation in biodiversity conservation and the benefit-sharing mechanism.

Signing of Eight ABS Agreements with Community Groups

Eight ABS agreements were signed between start-ups and scale-ups and CBNRM groups to ensure sustainable sourcing of raw materials and fair and equitable sharing of benefits. They are Bio Bhutan Pvt. Ltd., Menjong Sorig Pharmaceutical Corp. Ltd., Pure Bhutan, KDY Production, Jinlab Agro Products, Mugwort Solution, Kingdom Essences Pvt. Ltd., and the operator of the Zhinor Facility. These agreements are a testament to the public-private partnerships in the biodiversity-based businesses and aim to strengthen community-company partnerships.

Spatholigotia jetsuniae
Credit: Phuentsho

NATIONAL HERBARIUM





The National Herbarium (NH) was established in 1998 with financial support from the Danish International Development Agency (DANIDA) and became operational in 2003. It is the only herbarium in the country (Herbarium code THIM) listed in the Index Herbariorum (<https://sweetgum.nybg.org/science/ih/>) - a guide to the world's herbaria, where only those collections that are permanent scientific repositories are included.

The main functions of the National Herbarium are to serve as the national repository of type (a preserved specimen designated as a permanent reference for a new species, new genus, or some other taxon) and voucher specimens of botanical collections; lead and coordinate plant systematics and taxonomy-related studies, including national floristic works; and identify conservation priority species in the country. The ancillary functions include providing taxonomic services to other agencies and stakeholders and programs of the centre.

Over the past 20 years, the National Herbarium focused on building its collections through routine collections programs, international collaborations, and national thematic projects, including (i) the Bhutan fern project, (ii) the pilot project on invasive plant species of Bhutan, (iii) the comprehensive assessment of climate change impacts on endemic plant diversity, (iv) the impact assessment of invasive plants in Bhutan, (v) Red listing of Bhutan's endemic plant species, and (vi) biodiversity conservation and sustainable use in HANAS and the botanical survey of the Danashey Model Rehabilitation program. Currently, the NH houses more than 21,300 accessions of angiosperms, gymnosperms, pteridophytes, and bryophytes specimens (Table 5).



KEY ACHIEVEMENTS

Additional Species Added to the National Herbarium

During fiscal year 2023-2024, the National Herbarium program successfully collected and added approximately 52 additional plant species that were either previously absent or underrepresented at the National Herbarium. In the subsequent fiscal year, 2024-2025, an additional 92 species were added, further enriching the herbarium collections.

Sipraea bella
© Phub Gyeltshen





Discovery of New Records

The National Herbarium either led or was instrumental in the discovery of five species new to Bhutan, namely, *Paphiopedilum* × *pradhanii* Pradhan, *Impatiens pseudolaevigata* Gogoi, B. B. T. Tham & Lidén, *Podocarpus neriifolius* D.Don, *Zeuxine drukyulensis* P. Gyeltshen, K. Rabgay & Kumar and *Musa balbisiana* var. *bhutanensis* P. Gyeltshen, described in the fiscal year 2023-2025.

In addition, 29 species were new records added to the Flora of Bhutan:

- *Achimenes longiflora* DC.
- *Biophytum reinwardtii* (Zucc.) Klotzsch,
- *Breynia macrantha* (Hassk.) Chakrab. & N.P.Balakr., *Bridelia assamica* Hook.f.
- *Bulbophyllum crabro* (C.S.P. Parish & Rchb.f.) J.J. Verm., Schuit. & de Vogel
- *Bulbophyllum rigidum* King & Pantl.
- *Burmanna nepalensis* (Miers) Hook.f.
- *Ceropegia khasiana* Murug.
- *Cymbidium tortisepalum* var. *longibracteatum* (Y.S.Wu & S.C.Chen) S.C.Chen & Z.J.Liu
- *Diospyros lanceifolia* Roxb.
- *Galeola cathcartii* Hook.f.
- *Goniothalamus sesquipetalis* (Colebr.) Hook.f. & Thomson

- *Grewia serrulata* DC.
- *Gymnocladus assamicus* Kanj. ex P.C. Kanj.
- *Hemiorchis pantlingii* King
- *Hypericum podocarpoides* N.Robson
- *Impatiens falcifera* Hook.f.
- *Impatiens gamblei* Hook.f.
- *Ipomoea triloba* L.
- *Lippia alba* (Mill.) N.E. Br. ex Britton & P.Wilson
- *Liparis kumokiri* F. Maek.
- *Melastoma malabathricum* L.,
- *Ormosia robusta* (Wight) Voigt
- *Peliosanthes maheswariana* D. Borah, N.Tanaka & Taram
- *Phlogacanthus curviflorus* (Wall.) Nees
- *Sterculia lanceolata* Cav.
- *Vincetoxicum belostemma* (Benth.) Kuntze.



Agapetes serpens
© Phuentsho

Cotoneaster thimphuensis
© Phuentsho

Current Status

A cumulative total of 21,388 specimens representing 3,993 species of seed plants (angiosperms & gymnosperms), pteridophytes (ferns & allies), and bryophytes (mosses) are currently documented in the Bhutan Biodiversity Specimen Portal (see Table 5) and through publication of journal articles and books. The genera and species for pteridophytes (Ferns & allies) were based on Fraser-Jenkins et al. (2023), and bryophytes (mosses) were retrieved from the portal checklist and Long (1994).

Table 5: Cumulative summary of taxa and specimens till June 2025

Taxa	Genus	Species	Specimens
Seed plants (angiosperms & gymnosperms)	1,298	3,141	17,931
Pteridophytes (Ferns & allies)	93	563	2,395
Bryophytes (mosses)	213	282	1,193
Grand Total	1,604	3,986	21,519

A photograph of Paphiopedilum fairrianae flowers in a garden. The flowers are pink and white with dark purple stripes. They are growing from a pot with green leaves. In the background, there are other plants and a building.

ROYAL BOTANICAL GARDEN SERBITHANG

BACKGROUND

The Royal Botanical Garden, Serbithang (RBGS), was established in 1999 to commemorate the silver jubilee of His Majesty the Fourth Druk Gyalpo's golden reign. It is the only botanical garden in the country with its core mandate to serve as a living repository for ex-situ conservation of native flora.

The initial establishment of the garden was facilitated through the funding support of BTFEC. Other donors that provided either technical or financial support to date include the Darwin Initiative project (2004-2006), Mangdechhu Hydro Power Authority (MHPA 2012-13), Tangsibji Hydro Power Project Authority (2014-17), Garfield Weston Foundation through Millennium Seed Bank, Royal Botanical Gardens, Kew (2016-2024), European Union (EU-SSP, EU-RDCCRP, EU-PISRAFS), GEF-UNDP, Australian Volunteers Program, and Botanic Gardens Conservation International.

Besides being an ex-situ conservation area, the garden also serves as a biodiversity educational resource and a rescue centre for rare and threatened plant species of native flora. It is also a popular public recreational site. Since 2016, in collaboration with the Royal Botanic Garden, Kew, UK, the garden has initiated seed banking of tree seeds for ex-situ conservation. The other repurposed initiatives of the garden include exploring and researching the potential of the native plant species in ornamental horticulture and plant-based enterprises, including micropropagation of native orchid species. Since 2015, the garden has significantly contributed to the Royal Bhutan Flower Exhibitions and other national events like the annual National Day celebration.



KEY ACHIEVEMENTS

IMPROVING THE GARDEN FACILITIES

Construction of Botanical Café and Souvenir Shop at the Royal Botanical Garden, Serbithang

A botanical café and a souvenir shop were constructed at the Royal Botanical Garden. The initiative aims to enhance the garden's infrastructure and overall visitor experience. It was supported through the GEF/LDCF/NAPA-3 project "Enhancing Sustainability and Climate Resilience of Forest and Agriculture Landscape and Community Livelihoods in Bhutan" with a total funding of Nu. 3.409M. The construction began in March 2023 and was completed in October 2023, including the addition of a retaining wall to support the site's structural integrity.

The café offers a unique space for nature enthusiasts to relax and connect with nature while enjoying their favourite beverage. The souvenir shop, a retail area for Bhutanese products, provides a platform for local artisans and a memorable experience for visitors.





Refurbishment of the Biodiversity Interpretation Centre's flooring

The damaged wooden flooring of the Biodiversity Interpretation Centre was replaced with more durable tiled flooring, significantly improving the facility's functionality and appearance. The activity was completed in June 2024.

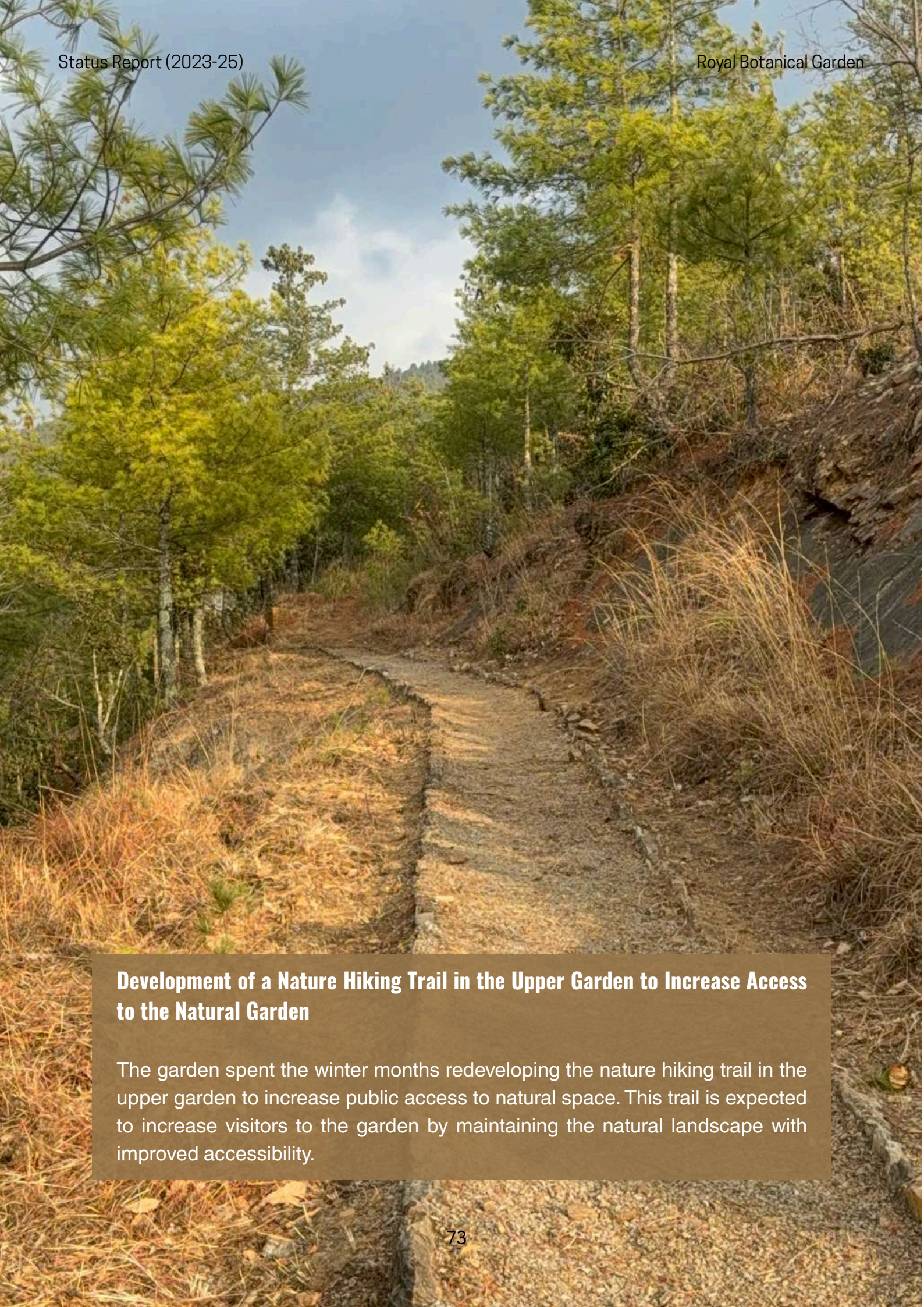
The refurbished facility now offers a more accessible and welcoming environment for visitors of all age groups. It continues to serve as a valuable educational resource for all age groups, especially school and college students, and underscores our commitment to fostering biodiversity awareness and ensuring the garden serves as both a place of natural beauty and a hub of learning.



Chain-Link Fencing to Combat the Issue of Wild Boars

The Royal Botanical Garden has been dealing with the constant invasion by the wild boars, damaging the flowers and living collection in the garden. To address this issue, the garden constructed the first phase of chain-link fencing along the boundary between the NBC head office and the garden. This phase of construction is expected to lower the invasion by wild boars in the garden and also intrusion by unauthorized private individuals. The construction of the fencing was supported by the European Union with a total budget of Nu. 1.95 million.



A photograph of a dirt hiking trail winding through a forest of tall pine trees on a hillside. The trail is made of dirt and small stones, and the surrounding vegetation includes dry grass and pine needles. The sky is blue with some clouds.

Development of a Nature Hiking Trail in the Upper Garden to Increase Access to the Natural Garden

The garden spent the winter months redeveloping the nature hiking trail in the upper garden to increase public access to natural space. This trail is expected to increase visitors to the garden by maintaining the natural landscape with improved accessibility.



ENHANCING CONSERVATION INITIATIVES

Collection of native plant species for conservation and sustainable use

In line with the main objective of the Royal Botanical Garden Serbithang, **to serve as a living repository for ex-situ conservation of native flora**, the garden carried out several collection expeditions across the country. The collection expeditions increased the species and genetic diversity of the collections and enhanced the opportunity to showcase the country's floral diversity.

2023-2024 Collection List

- Collected and genebanked 52 accessions of seeds in 2023-24 ~ Annexure 7
- Collected 153 accessions of live plants in 2023-24 ~Annexure 8

2024-2025 Collection List

- Collected 46 accessions of seeds of wild plants ~Annexure 9
- Collected 104 accessions of live plants ~Annexure 10



Propagation of native species through seeds

The garden implemented propagation trials for 23 native species through seeds, and 11 species resulted in successful germination and establishment. The seeds were collected from October to November and sown in November after thorough cleaning and a proper seed treatment method. The seeds were provided with mechanical scarification (removing the outer shell) and stratification (soaking). The media used for the seed germination was a combination of leaf mould, sand, and vermicompost (3:1:1). Environmental conditions of the seed beds had a temperature range from 2 to 18 degree Celsius, humidity of 59-61%, and photo period of 6-8 hrs, and the seeds were watered once a week by spraying with a watering to avoid seed displacement. The high germination percentage of the seeds indicates the potential for mass propagation of native species through seeds, and the seeds that did not germinate were mainly due to damaged and immature seeds, proving the importance of the timing for seed collection and seed storage.



Orchid Conservation through Innovative Technology

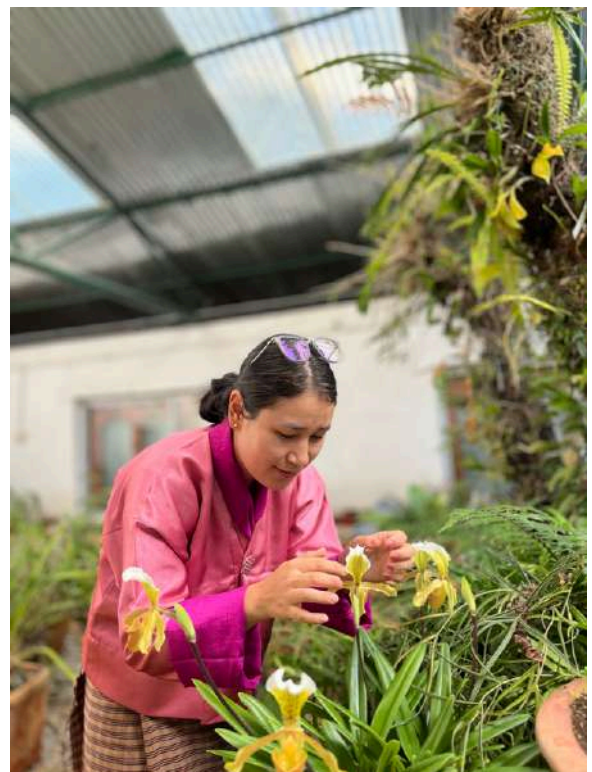
The garden has been putting considerable effort into the conservation, research, and sustainable utilization of Bhutan's native orchids. A major achievement has been the successful micropropagation of *Chiloschista gelephuense*, a rare and endemic orchid species found near the Gelephu Tshachu. Despite initial challenges, healthy plantlets were successfully propagated through sterile lab conditions, marking a significant breakthrough in ex-situ orchid conservation.

To further strengthen these efforts, a modern micropropagation laboratory was constructed and became operational in 2022. The facility has greatly enhanced the garden's capacity to implement climate-smart and science-based conservation techniques. Building on this success, the garden has now expanded propagation trials to include other native orchids such as *Cymbidium hookerianum*, *C. erythraeum*, and the critically endangered slipper orchids *Paphiopedilum fairrieianum*, *P. venustum*, and *P. insigne*.

Currently, the laboratory maintains a total of 1,652 individual orchid plantlets in culture, contributing to species recovery, biodiversity conservation, education, and the potential for sustainable livelihood options linked to native orchid resources.



Orchid seed sowing under sterile conditions



Orchid hand pollination at the Orchidarium at RBGS



Micropropagated orchid in the Orchid Micropropagation laboratory



Micropropagated *Paphiopedilum fairrieianum* orchid seedlings at the Orchid Conservatory

CONTRIBUTION TO NATIONALLY SIGNIFICANT EVENTS

116th (2023) and 117th (2024) National Day celebration in Thimphu, Changlimithang

The garden team played a significant role in enhancing the aesthetics of Changlingmithnag Stadium for the annual celebration of the national day on December 17, 2023, and 2024. The garden contributed over five thousand annual flowers and potted perennial plants.

In collaboration with the Royal Project Coordination Office and the Department of Agriculture, the garden was actively involved in the meticulous arrangement of the plants, transforming the venue into a vibrant and welcoming space, aptly reflecting the significance of the National Day. This joint initiative not only showcased the garden's horticultural skills but also highlighted the seamless coordination between different agencies.



Tendrelthang Flower Display



Venue beautification during the State Visit by Their Majesties the King and Queen of Thailand to Bhutan

The garden team led the beautification of Tendrelthang and Buddha Dordema areas during the state visit by Their Majesties the King and Queen of Thailand. The beautification task was carried out between the 18th and 25th of April 2025, and the dismantling and transportation of plants were done from 26 to the 27th of April 2025.

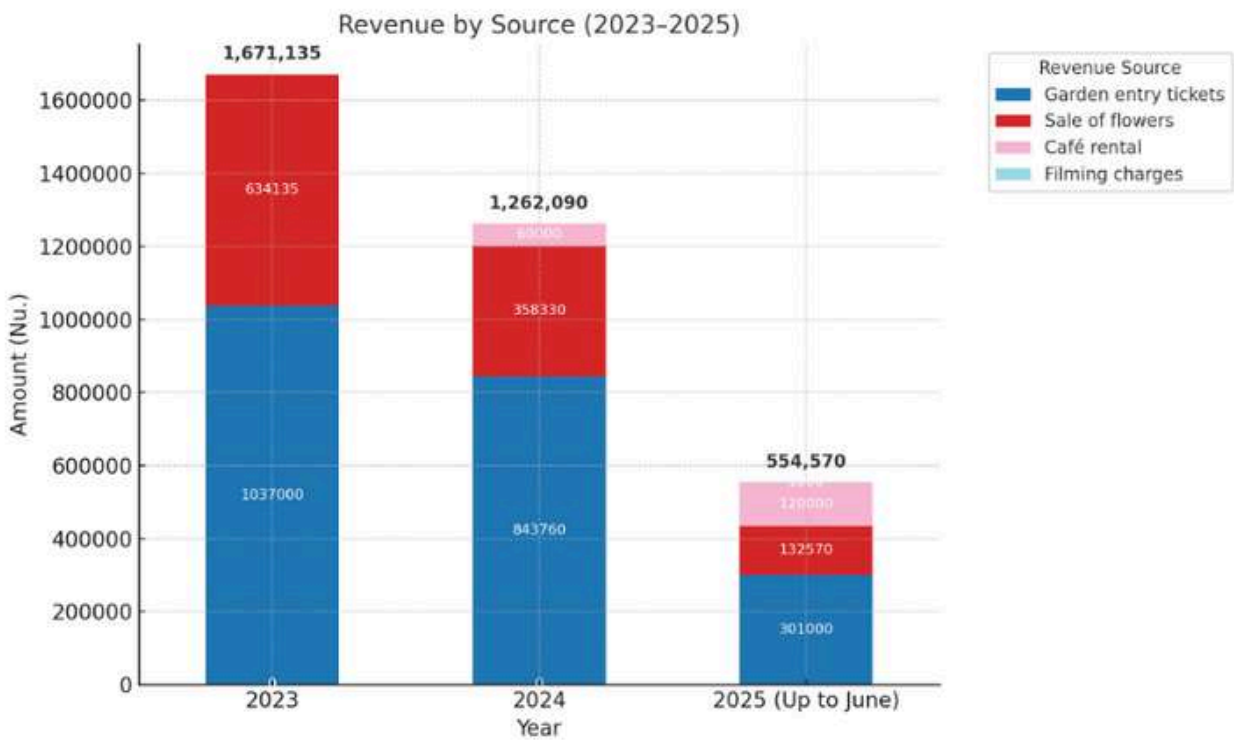


REVENUE GENERATION INITIATIVES

While the primary objective of the garden is ex-situ conservation of floral resources, the garden also aims to derive economic benefits from the maintenance of the botanical garden. Thus, the garden has ventured into generating revenue from different services of the botanical garden, such as the sales of flowers and native ornamental plants, charging fees for professional filming, entry fees, and the monthly rental charges of the cafeteria.

Table 6: An overview of the revenue generated and deposited into the government coffers

Year	Types of Servicves	Amount	Total
2023	Garden Entry Tickets	10,37,000	16,71,135
	Sale of flowers	6,34,135	
2024	Garden entry tickets	8,43,760	12,62,090
	Sale of flowers	3,58,330	
	Café rental (Oct to Dec 24)	60,000	
2025 (As of June 2025)	Garden entry tickets	301,000	554,570
	Cafe rental	120,000	
	Sale of flowers	132,570	
	Filming charges	1000	



Revenue generated by the Royal Botanical Garden through different revenue sources

BIODIVERSITY INFORMATION MANAGEMENT PROGRAM





BACKGROUND

The Biodiversity Information Management Program (BIMS) was initiated in 2003 to oversee and coordinate the documentation and dissemination of biodiversity information across the country. The program also coordinates the development and implementation of the NBSAP, contributing towards the Post-2020 Global Biodiversity Framework. Additionally, the program serves as a Biodiversity Data Publisher on GBIF.

In 2008, under the framework of South-South Cooperation between Bhutan, Benin, and Costa Rica, funded through the government of the Netherlands, NBC developed the biodiversity portal. Subsequently, in 2010, the portal was upgraded to become the national portal on biodiversity, known as the Bhutan Biodiversity Portal (www.biodiversity.bt), officially launched on 17th December 2013. Since then, the portal has received funding support from various organizations, including WWF Bhutan, National Geographic Society, GBIF, and GEF-LDCG/NAPA III project. Technical assistance for the portal is provided by Strand Life Sciences in India, Ashoka Trust for Research in Ecology and the Environment, Indian Biodiversity Portal, and GovTech, Bhutan. This citizen-science-based portal currently holds information on both wild and domestic biodiversity of Bhutan. Currently, there are more than 2,700 registered users on the Bhutan Biodiversity Portal, with over 107,217 observations. The portal has more than 307 documents and over 45 datasets related to the country's biodiversity.

The first ever Biodiversity Statistics of Bhutan was published in 2019, which reported more than 11,000 species in the country. Plans are underway to publish subsequent statistics on biodiversity in the future.

Representation at the COP16 on Biological Diversity in Cali, Colombia



As the NBSAP Secretariat, the Centre successfully coordinated the participation of Bhutan's official delegation to COP 16 in Cali, Colombia. The delegation included representatives from NBC and Technical Working Group (TWG) members from the Department of Agriculture, Department of Livestock, Department of Forests and Park Services, Department of Macro-Fiscal and Development, Secretariat to National Commission for Women and Children (NCWC), and BT FEC.

The delegation actively participated in various thematic discussions, presenting Bhutan's experiences in:

- Access and Benefit Sharing (ABS)
- NBSAP development
- Gender mainstreaming in biodiversity policy

In addition to official sessions, strategic networking meetings were conducted with key stakeholders, including:

- CEO of the Global Environment Facility (GEF)
- President of COP
- Officials from the German Ministry of Environment
- Satoyama Initiative representatives
- Advanced Satellite Technology G-Zero Coalition

Key Takeaways:

- **Biodiversity Leadership:** Bhutan's progress in NBSAP implementation and maintaining ecological connectivity was recognized as a global example.
- **ABS Recognition:** Bhutan's success in ABS highlighted the value of equitable natural resource governance.
- **Gender Integration:** The country's approach to gender inclusivity in environmental planning was commended.
- **International Collaboration:** Bhutan's active engagement helped foster global partnerships and knowledge exchange.

NATIONAL BIODIVERSITY STRATEGIES AND ACTION PLAN



BHUTAN 2025

As a party to the CBD, Bhutan is mandated to update its National Biodiversity Strategies and Action Plans periodically. This plan serves as the national guiding framework for conserving biodiversity and promoting the sustainable use of biological resources. As the NBSAP Secretariat, the NBC successfully coordinated the development of the Fifth NBSAP in collaboration with the Department of Climate Change (DECC) under the Ministry of Energy and Natural Resources (MoENR) and the United Nations Development Program (UNDP).

This included the development of the NBSAP's targets, strategies, and actions that are aligned with the global biodiversity targets as well as national priorities. Following this, a nationwide consultation was conducted between 15 January and 5 March 2025 to validate and mainstream the proposed strategies.

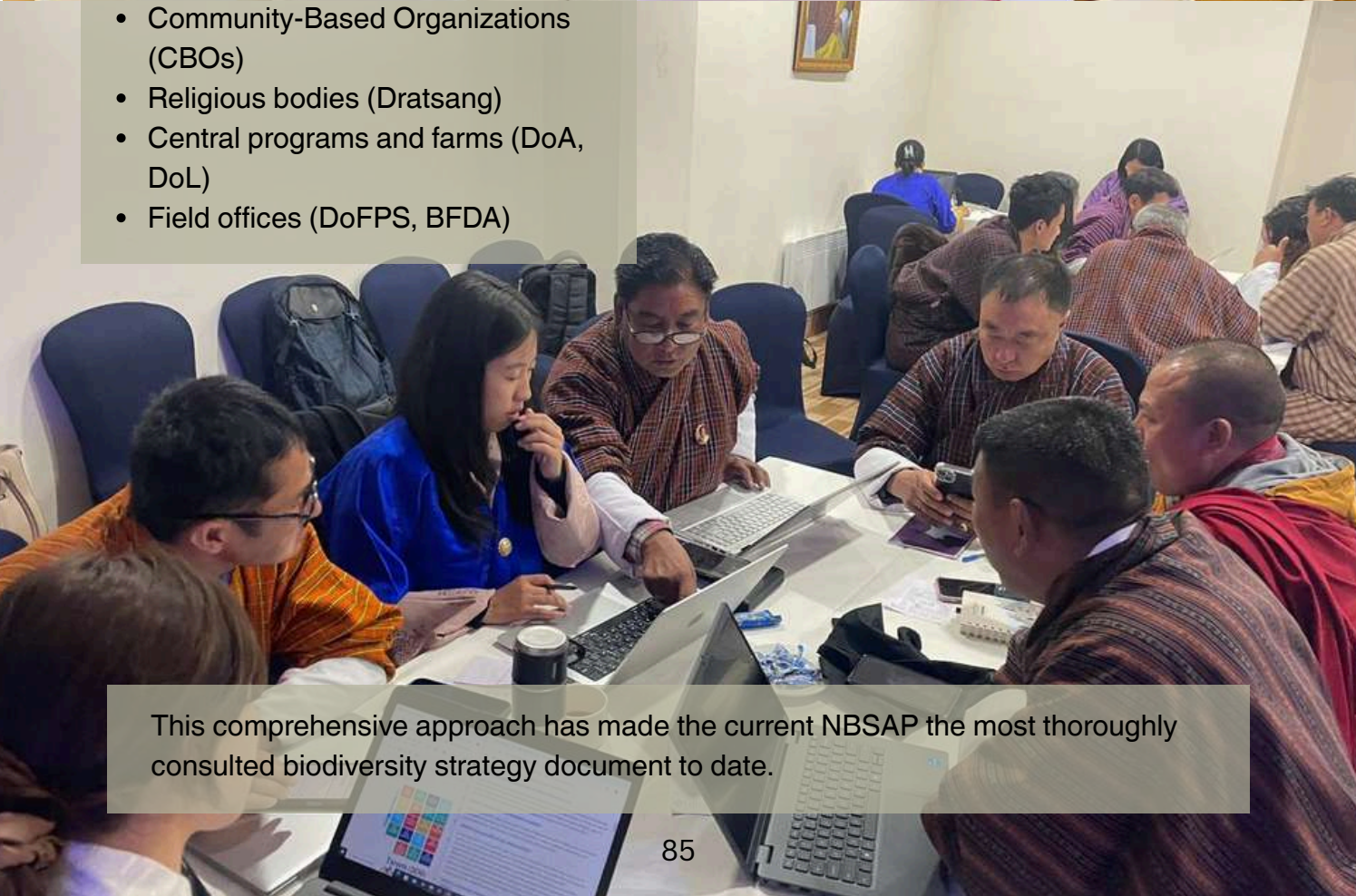


Consultation Summary:

- One national consultation workshop was held in Thimphu.
- Four regional workshops were held in Tashigang, Trongsa, Punakha, and Paro.
- One private sector workshop was held in Phuentsholing.

Stakeholder Representation:

- Sector officers (finance, agriculture, livestock, education, planning, environment)
- Land Record Officers
- Engineers
- Local government and thromde representatives
- Community-Based Organizations (CBOs)
- Religious bodies (Dratsang)
- Central programs and farms (DoA, DoL)
- Field offices (DoFPS, BFDA)



This comprehensive approach has made the current NBSAP the most thoroughly consulted biodiversity strategy document to date.

**REGIONAL CONSULTATION MEETING ON
THE NATIONAL BIODIVERSITY STRATEGIES AND ACTION PLAN
TRASHIGANG, 15-17 JANUARY, 2025**



**REGIONAL CONSULTATION MEETING ON
THE NATIONAL BIODIVERSITY STRATEGIES AND ACTION PLAN
TRONGSA, 21-23 JANUARY 2025**



International Day for Biological Diversity (IDB) — 22 May 2025





To commemorate the IDB 2025, NBC organized a bioblitz in collaboration with students from the Royal Thimphu College at the Royal Botanical Garden. The event included:

- Field documentation of local biodiversity
- Awareness on biodiversity conservation
- Orientation on the Bhutan Biodiversity Portal

This outreach initiative helped increase youth engagement and awareness around biodiversity issues.

Biodiversity Assessment for the Danashey Model Rehabilitation Program (MRP)

The Danashey Model Rehabilitation Program (MRP) is a flagship initiative under the Ministry of Agriculture and Livestock (MoAL), aligned with Bhutan's 13th Five-Year Plan. Designed to restore over 1,165 acres of fallow land in Tsirang *Dzongkhag*, the program seeks to enhance food and nutrition security while promoting sustainable land management. As part of the program's commitment to environmental safeguards, NBC was assigned to lead the coordination of a baseline biodiversity assessment.

NBC successfully conducted the first round of preliminary surveys (April–May 2025) in collaboration with:

- Department of Forests and Park Services
- Department of Livestock
- Department of Agriculture

The assessment covered a wide range of taxonomic groups, including vegetation, aquatic macroinvertebrates, mycodiversity, fishes, birds, herpetofauna, mammals, butterflies and moths, and bees. These baseline findings are critical in ensuring that ecological integrity is maintained and considered before the implementation of any developmental activities within the rehabilitation site.

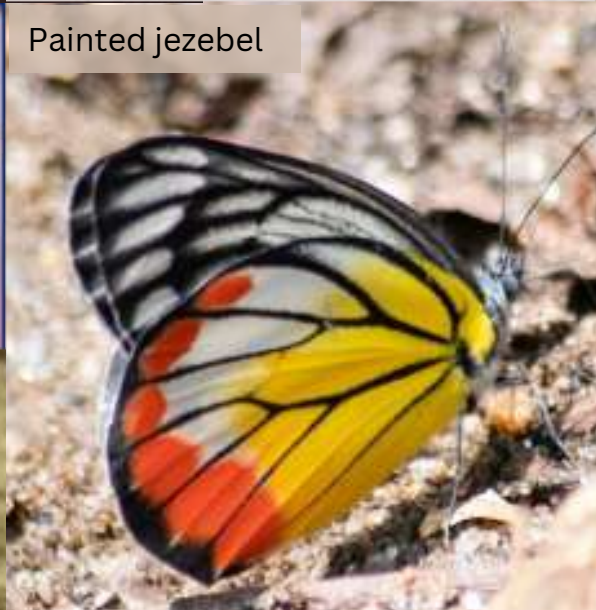


Bee assesment group during the survey



Devario aequipinnatus

Painted jezebel



Buff-striped keelback

Polypedates leucomystax



Hornbill



Dark Archduke

Articles



National Biodiversity Centre's participation in the Rhododendron Week 2025 in Merak, Trashigang

~Reported by Botanical Diversity Collection Services



A team of nine officials from the Botanical Collections Program participated in the inaugural Rhododendron Week, held from 3rd to 9th April 2025 in Sheytemi, Merak, Trashigang. The participation was partially supported by the Department of Tourism.



The primary objective was to promote education and awareness on Bhutan's rich floral biodiversity, with a focus on Rhododendron diversity, agrobiodiversity, and the sustainable use of biological resources through the ABS framework.

The team conducted a range of educational and outreach activities, including the establishment of an information stall showcasing Bhutan's domestic agrobiodiversity and products developed through bioprospecting. The exhibit also featured vivid photographic displays and live samples of various *Rhododendron* species, aimed at enhancing public understanding and appreciation of Bhutan's botanical heritage.



The display stall with the photos of various species of *Rhododendrons* from Bhutan displayed for public viewing.



Interactive engagements such as a BioBlitz and biodiversity-themed quizzes were organized, attracting active participation from local students and community members. Prizes for these activities were generously sponsored by the Department of Tourism. A workshop focusing on basic plant identification and herbarium preparation techniques was also conducted to strengthen the skills of local forestry staff and students.



Additionally, the team designed a biodiversity route map integrated with QR codes that link directly to species information on the Bhutan Biodiversity Portal. These codes were installed along key points of the Mindrula–Jigmeling trail, providing visitors with accessible, real-time insights into Bhutan’s ecological diversity.



QR code installed near the Lhasey Kuntu Lekpa stupa along Mindrula to Jigmeling trail.

The NBC’s involvement significantly enriched Rhododendron Week 2025 by contributing an educational and conservation-focused perspective, thereby fostering increased public engagement and support for biodiversity conservation and sustainable resource use.

The team was deeply honoured by the visit of His Majesty the King and His Royal Highness the Gyaltshab, whose gracious presence served as a profound source of inspiration for all participants.

Spring Blooms of Talung: A Glimpse into a High-Altitude Floral Refuge

~Reported by Phuentsho



The beautiful hamlet of Talung in Haa (©Phuentsho)

During a brief stop above Talung village in Haa, Bhutan—on our return from a botanical collection tour to Tergola—we encountered a small area teeming with floral diversity. Though the original purpose of the visit was to observe *Primula kingii* in bloom (which was not yet flowering), the detour revealed a surprising highlight of the spring season: a concentrated burst of rhododendron diversity across less than 30,000 square meters of landscape.

At around 3,000 meters above sea level, the mountain slopes were ablaze with the orange blooms of *Rhododendron cinnabarinum*. Below these slopes, marshy ground glowed white with profuse clusters of *Rhododendron ciliatum*, forming a soft, floral blanket over the wetland that also serves as the village's primary water source. Scattered nearby were *Rhododendron anthopogon* and *Rhododendron setosum*, typically found higher in the alpine zone, now flourishing here in a lower transitional habitat.



The beautiful blossoms of *Rhododendron cinnabarinum* (©Phuentsho)



Rhododendron setosum
©Phuentsho



Delicate white flowers of *Rhododendron anthopogon*

©Phuentsho



Bushes of *Rhododendron ciliatum* with beautiful white flowers dominating the marshy area (©Phuentsho)

The *Rhododendron baileyi* is a species that looks like a larger form of *Rhododendron lepidoptum* (©Phuentsho)



Equally notable were the small, graceful patches of *Rhododendron baileyi* and *Rhododendron wallichii* in the saturated ground. As anticipated, *Rhododendron arboreum* var. *roseum* was observed flowering near stands of blue pine (*Pinus wallichiana*), adding to the mix of colour and form.



Beautiful purple flowers of *Rhododendron wallichii* which is now considered a synonym of *Rhododendron campanulatum* (©Phuentsho)

One of the most striking features of the visit was the flowering of *Cassiope fastigiata*, a species generally found above 3,600 meters. Yet here it was, blooming vibrantly among rhododendrons at 3,000 meters—a reminder of nature's surprises. *Cassiope fastigiata* is one of the two species of *Cassiope* found in the country, with the other being *Cassiope selaginoides*.



Beautiful bell-shaped flowers of *Cassiope fastigiata* (©Phuentsho)

The cultural landscape added further beauty. Talung's houses, large and built from rammed mud, stood separated by tall drystone walls. In the heart of the village bloomed a large *Prunus cornuta* tree, its white fragrant flowers perfuming the air with a soft sweetness that lingered even as we moved on.

Though *Primula kingii* eluded us this time, the visit left us deeply fulfilled—thanks in part to two dear colleagues from the Department of Forests and Park Services, whose knowledge and companionship led us to this floral gem nestled in Bhutan's highlands.

AnGR Overview Articles



Reviving Poultry Heritage in Tserina, Punakha

In Bhutan, native poultry breeds are not just a source of food; they are woven into the fabric of rural livelihoods, cultural identity, and agricultural resilience. With populations of these indigenous breeds steadily declining due to modernization and crossbreeding, urgent conservation efforts are needed. One such initiative is now taking shape in Tserina, Kabjisa Gewog, Punakha Dzongkhag.

From May 23 to 25, 2025, a team from NBC conducted a feasibility assessment for establishing a native poultry layer farm proposed by Mr. Pema Dorji, a certified organic farmer. The project, aligned with NBC's Animal Genetic Resources (AnGR) conservation strategy, focuses on reviving the *Belochem* poultry strain, historically significant in the Punakha region, while promoting sustainable livelihoods through organic egg production.

A Vision Rooted in Conservation and Rural Prosperity

The proposed farm aims to conserve the *Belochem* strain through in-situ breeding, producing organic eggs and day-old chicks (DoCs) to meet the rising demand from local and high-end markets. The initiative not only aligns with Bhutan's biodiversity goals but also supports economic diversification in rural areas.

Mr. Pema Dorji, known for his progressive farming methods, currently cultivates certified organic strawberries, soybeans, kiwis, and hazelnuts. He supplies produce to premium outlets like River Lodge and Bhutan Blossom and has plans to initiate organic paddy cultivation. Though his poultry experience is limited, having reared only 20 *Yubjha* birds previously, his strong foundation in organic agriculture and established market linkages make him a promising partner for this conservation venture.

Field Assessment: Challenges and Opportunities

The NBC team traveled to Tserina, a remote village 17 km from Khuruthang, navigating 7 km of muddy farm road that required a 4x4 Bolero and, at times, pushing the vehicle through difficult patches. This underscored the area's infrastructure challenges, particularly during monsoons, but an upcoming blacktop road promises improved access, vital for market connectivity.



Mr. Pema Dorji and the site identified for poultry shed construction and free-range farming

A detailed inspection of the proposed 0.62-acre farm site (Thram No. 110) revealed key strengths:

- Reliable utilities: Access to spring water and electricity
- Existing electric fencing: Protects against wildlife threats
- Site isolation: Enhances biosecurity and disease prevention

Mr. Dorji's existing infrastructure and commitment to organic farming provided a strong foundation for the poultry venture. A more conservative plan was developed: starting with 200–300 birds, with Mr. Dorji growing or sourcing organic feed locally to maintain certification and control costs. The *Belochem* strain was selected for its historic prevalence in Punakha and adaptability to local environments. To support this, NBC committed to providing technical assistance in shed design, sourcing of breeding stock, and organic poultry management.

Strategic Support and Next Steps

To ensure long-term success, NBC and collaborating stakeholders have agreed on the following support measures:

- **Capacity Building:** Targeted training on poultry management, biosecurity, and organic feed preparation by August 2025.
- **Infrastructure Support:** NBC will provide materials such as wire mesh and CGI sheets for poultry shed construction, to be completed by October 2025.
- **Breeding Stock:** 200–300 *Belochem* pullets will be sourced with support from the Centre for CYCD, Sertsham.
- **Monitoring and Partnership Facilitation:** Regular monitoring will begin in 2026 to ensure sustainability, with NBC facilitating premium contracts with River Lodge, where Mr. Dorji already supplies strawberries, and exploring partnerships with Bhutan Blossom and Aman Resorts.

Mr. Dorji has committed to a five-year engagement with the project and will cover labor costs for infrastructure development. Egg production is projected to begin in early 2026, with the farm expected to generate approximately 15,000–18,000 eggs per cycle (60–80 eggs per bird) at Nu. 25 per egg, generating approximately Nu. 375,000 per cycle, supplemented by manure and spent bird sales.

Conservation and Socioeconomic Impact

The conservation impact of the project is significant. By focusing on the *Belochem* strain, one of Bhutan's 10 native poultry breeds, the farm will serve as a genetic reservoir, helping preserve resilience traits vital for adapting to environmental stresses. Further, by distributing DoCs to neighboring farmers, the project supports broader regional conservation and livelihood efforts.

Economically, the farm stands to benefit not just Mr. Dorji's household but also the wider community. His two sons are expected to contribute to operations, with potential for youth employment as the farm expands to 500 birds by 2027.

Remaining Challenges

While promising, the project must address several key challenges:

- **Experience Gap:** Mr. Dorji's limited poultry background requires ongoing training and support.
- **Market Volatility:** Price fluctuations necessitate efficient operations and premium buyer contracts.
- **Disease Risk:** Strict biosecurity protocols are essential to prevent outbreaks.
- **Financial Strain:** High infrastructure costs will be mitigated through cost-optimized shed design and phased investment.

Conclusion

The Tserina Native Poultry Farm presents a compelling model of community-driven conservation integrated with organic agribusiness. With strategic technical and material support from NBC and a realistic, phased implementation plan, the project is well-positioned to make meaningful contributions to Bhutan's biodiversity conservation and rural development goals.

By preserving the *Belochem* strain and demonstrating the viability of native breed-based agribusiness, this initiative sets a precedent for sustainable livestock development in Bhutan, where tradition, innovation, and environmental stewardship go hand in hand.

BTfEC Supported the “Participatory On-farm Conservation and Sustainable Use of Native Horticulture Crop Diversity” Project

~Asta M. Tamang, Rinchen Dorji, and Thukten Sherab

Project Goal

“The overarching goal of this project is to strengthen the conservation of on-farm native horticulture crop diversity in the target area, safeguarding and revitalizing invaluable genetic resources to ensure the resilience and sustainability of local agricultural systems through active collaboration with farmers, researchers, and stakeholders, the project seeks to preserve and enhance the diversity of native horticulture crops, enabling communities to thrive in the face of changing climatic conditions, pests, and diseases.”

The project aims to enhance the participatory on-farm conservation, management, and sustainable utilization of local horticulture crop diversity in Zhemgang: Bjoka (South Central region), Trashigang-Lumang (Eastern region), Trongsa-Langthel (Monpa community) (Central region), Tsirang-Mendrelgang (Southern region), and Chhukha-Bongo (Western region), an ecologically diverse region known for its rich agricultural heritage, with collaboration with ARDCs. The primary beneficiaries of this project will include local farmers, indigenous communities, and agricultural practitioners who rely on diverse horticultural crops for their livelihoods and food security. By leveraging a community-driven approach, the project seeks to promote the conservation of traditional and locally adapted horticulture varieties while concurrently fostering sustainable agricultural practices that ensure the long-term vitality of the region’s agricultural ecosystems. The project’s strategy revolves around a participatory approach that involves close collaboration between local farmers, agricultural experts, researchers, and relevant governmental agencies. This strategy will be implemented through several key activities:

1. Baseline Assessment and Data Collection: A thorough baseline assessment will be conducted to understand the existing horticulture crop diversity, identify local varieties, and assess the current practices and challenges faced by farmers.

2. Capacity Building and Knowledge Sharing: Workshops, training sessions, and farmer field schools will be organized to empower local farmers with knowledge about sustainable agricultural practices, seed selection, crop rotation, and organic pest management. Traditional knowledge will be integrated with modern techniques to enhance the overall understanding of horticultural crop diversity.

3. On-Farm Demonstrations and Trials: Model demonstration plots will be established to showcase various horticultural crop varieties and cultivation techniques. These plots will serve as living classrooms where farmers can learn by doing, gaining practical insights into maintaining diverse crops and adapting to changing climate conditions.

4. Regional Field Gene Bank/Local Germplasm Repositories: Regional Field Gene Banks/germplasm repositories will be established to collect, store, and distribute locally adapted seed varieties. This will safeguard against the loss of valuable plant genetic resources and promote the use of native seeds.

Project outcome

- **Native Horticulture Crop Genetic Diversity Enhanced:** The project endeavors to increase the number and variety of native horticulture crop species cultivated within the target area. Through systematic documentation and active engagement with farmers, the project will contribute to the revitalization of rare, indigenous, and underutilized native horticulture crop diversity. This outcome will safeguard against genetic erosion and promote the conservation of diverse genetic resources, enabling ecosystems to better adapt to changing environmental conditions.
- **Germplasm Repositories/Field Gene Banks Established:** The project's efforts to establish Central and Regional Field Gene banks and germplasm repositories will provide a tangible mechanism for conserving native horticulture crop diversity. These repositories will serve as reservoirs of native seeds, ensuring their availability for future generations. By institutionalizing seed-saving practices and establishing a reliable source of diverse seeds, the project will play a pivotal role in safeguarding valuable genetic resources and reinforcing on-farm conservation efforts.
- **Value Addition and Product Development and Diversification and Enhanced Livelihood of the Farming Communities:** The project will emphasize value addition, product development, packaging, and marketing of native and nutrient-rich native horticulture crops, thereby contributing to employment and income generation of the farming community in the target area.
- **Crop Diversity Conservation and Sustainable Utilization Efforts Expanded to Horticulture Crops:** Strengthen in-vitro conservation and cryopreservation of horticultural crop diversity in vitro.

- **Strengthened Community Ownership and Resilience:** Through active community participation and engagement, the project aims to foster a sense of ownership and responsibility for the conservation of local horticultural crop diversity. This heightened involvement will not only contribute to the long-term preservation of crop diversity but also enhance the resilience of local communities against external threats, as they develop a deeper understanding of the significance of diverse crops and their role in sustainable food systems.
- **Nutritional Profiling Analyzed for Potential Native Horticulture Crops:** As of now no studies on the native horticulture crops have been done on nutritional values, and limited knowledge on the health benefits from consuming these native crops. This analysis involves assessing the nutrient content of these crops, including macronutrients (such as carbohydrates, proteins, and fats) and micronutrients (such as vitamins and minerals). The purpose of this analysis is to highlight the nutritional benefits of these native crops, which are often overlooked in favor of high-yielding or exotic varieties. The results of this analysis can provide valuable information for farmers, consumers, and policymakers, promoting the cultivation and consumption of these nutritionally rich native crops. By understanding the nutritional profile of these crops, we can better appreciate their value in our diets and their potential contribution to food and nutritional security and health.

Project Beneficiaries

Direct Beneficiaries:

- **Farmers:** Farmers are the primary beneficiaries. They would benefit from the training programs on sustainable farming practices, conservation of native horticultural crops, and value addition and product derivation. This could lead to increased crop yields, improved soil health, and enhanced resilience to climate change. The project could also help farmers access new markets, increase their income, and add to nutritional and food security.
- **Local Communities:** Local communities would benefit from the increased awareness and education about the importance of biodiversity and the role of native crops in sustainable agriculture. The project could also lead to improved food security and dietary diversity in the community.

Indirect Beneficiaries:

- **Women:** The project caters to the needs of women by involving them in all stages of the project, from the conservation activities to the product development process. Women often play a crucial role in agriculture and biodiversity conservation, and their participation could lead to more sustainable and effective conservation strategies. Additionally, the project could provide women with new income-generating opportunities, contributing to gender equality and women's empowerment.
- **Men:** Men would also benefit from the project through the training programs and the potential for increased income from farming and product sales. They would also play a crucial role in the conservation activities and the decision-making processes related to the project.
- **Youth:** The project could have a positive impact on girls and boys by improving food security and nutrition in the community. The educational programs could also increase their awareness about the importance of biodiversity and sustainable agriculture, shaping the future stewards of the environment. The project could also lead to new employment opportunities in an eco-friendly manner.

The landscape chosen is significant due to its rich biodiversity, particularly in terms of native horticultural crops. These crops not only contribute to the local ecosystem's health but also play a crucial role in the livelihoods of the surrounding human population. The sustainable use and conservation of these crops are therefore of utmost importance. The landscape's resources, including the native horticultural crops, contribute to the ecosystem's balance. They provide habitat for various species, contribute to soil health, and play a role in nutrient cycling. For the human population, these crops are a source of food, income, and sometimes medicine. They are part of the community's cultural heritage and contribute to food security and dietary diversity.

This project aligns with several national plans and priorities. It contributes to the goals of biodiversity conservation and sustainable utilization. By promoting the use and conservation of native horticultural crops, the project supports the conservation of genetic diversity, which is crucial for food security and adapting to climate change. Moreover, the project's participatory approach ensures the involvement of local communities in conservation efforts. This not only empowers these communities but also ensures the long-term sustainability of these efforts, as the locals have a vested interest in the conservation of these resources.

In conclusion, this project is necessary, as it addresses the critical issues of biodiversity loss, food security, and climate change adaptation. It also promotes sustainable agricultural practices and community involvement in conservation efforts, aligning with national priorities. The project can bring about a significant positive change in the conservation and sustainable use of native horticultural crop diversity.

Achievement

Baseline survey documentation of native horticulture crop diversity



Base-line documentation at Bjoka Gewog

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The baseline documentation of native horticulture crop diversity was done through conducting meetings with the farmers of different chiwogs under one *gewog*. The farmers and local government leaders were briefed on the mandates and activities carried out by the National Biodiversity Centre (NBC). The crop diversity documentation was recorded with the use of MS-Excel and Epicollect software with a pre-designed template capturing different data about the crop diversity available in the *gewog*. The handheld portable GPS tracker device was used for recording geographic information. The consent form was used for outlining the research project and an agreement for the participant to take part in the documentation.

Table 7: Participants from 5 *gewogs*

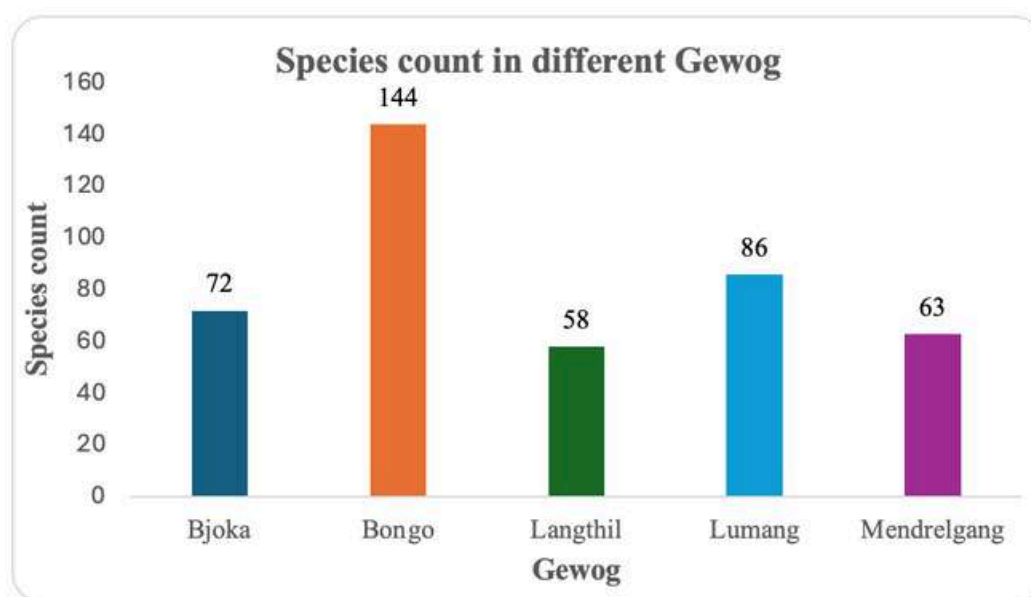
Sl. No.	<i>Gewog</i>	Number of participants	Male	Female
1	Bongo	41	19	22
2	Mendrelgang	18	12	6
3	Bjoka	25	20	5
4	Lumang	22	11	11
5	Langthel	27	11	16
Total		133	73	60

The baseline line survey gathered the cultivated as well as wild edible crop list, local use, socio-economic parameters, traditional knowledge systems related to native horticulture crops, basic botanical details, and status of conservation and explored potential crops for product development, engaging 133 local participants.

Result

Species Composition and Diversity Across *Gewogs*

A total of 423 plant diversity was documented across five *Gewogs*: Bjoka, Bongo, , Lumang, and Mendrelgang. Among these, Bongo *Gewog* reported the highest species richness, with 144 unique botanical species, followed by Lumang (86), Bjoka (72), Mendrelgang (63), and (58). This variation reflects both ecological heterogeneity and possibly different levels of ethnobotanical knowledge or survey intensity.



Graph showing species count in 5 *gewogs*

Habit-wise Classification of Documented Species

The species were classified into eight broad habit types. The dominant growth habit was trees (145 species), constituting over one-third of the total flora recorded. Herbs (121) and climbers (78) followed as the next most abundant groups. Shrubs accounted for 54 entries, while less common forms included ferns (8), bamboos (6), orchids (5), and subshrubs (5).

This diverse range of habits indicates a complex and rich plant structure across the surveyed *Gewogs*, possibly driven by varying microclimatic conditions and altitudinal gradients. The dominance of trees and herbs further suggests the prominence of forested and semi-natural ecosystems with understory herbaceous layers.

Family-Level Taxonomic Representation

Species were distributed across numerous plant families, with several exhibiting notable representations:

- **Cucurbitaceae** (33 species): Indicates the prevalence of vine crops, both cultivated and wild, often used in traditional food and medicine.

- **Rutaceae** (26 species): A family known for aromatic shrubs and trees, used for culinary and medicinal purposes.
- **Dioscoreaceae** and **Rosaceae** (22 species each): Signify the presence of tuberous crops (like yams) and temperate fruiting trees and shrubs.
- **Solanaceae** (21 species): A key food and medicinal plant family, including crops like chili and eggplant.

The top ten families collectively account for a significant portion of the total species diversity, underlining their ecological and socio-economic importance. Notably, the presence of Moraceae, Anacardiaceae, Zingiberaceae, and others further demonstrates the mixture of tropical and subtropical floral components.

Ethnobotanical and Conservation Implications

This richness, especially in under-documented *Gewogs* such as Bongo and Lumang, represents not just biological diversity but also cultural and livelihood relevance. Many species from Cucurbitaceae, Zingiberaceae, and Dioscoreaceae are traditionally used for food, spices, and medicine, indicating strong potential for conservation through sustainable utilization.

Safeguarding Our Diversity: The Role of On-Station Field Genebank in Ex-Situ Conservation

~Cheki Wangmo

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Introduction

The on-station field gene bank annually undertakes a series of activities such as seed multiplication, phenotypic characterization, and maintenance of vegetative propagated crops. The quantity of samples cultivated each year for seed multiplication is determined by the demand and the seeds gathered during annual germplasm exploration and collection expeditions across the country.

Insufficient seed samples consisting of different types of legumes, cucurbits and chillies, collected from Orong, Gomdar, and Wangphu *gewogs* under Samdrup Jongkhar *Dzongkhag*, were cultivated for multiplication, harvested, and processed for packaging. The collection of these smaller varieties ensures the conservation of the diverse range of local seeds maintained by farmers. Wherever possible, these varieties are multiplied and conserved within the gene bank, contributing to the rich biodiversity of our agricultural heritage.

Cultivation and multiplication of the repatriated crop, wheat (repatriated in 2008) from John Innes Research Institute, UK, and beans repatriated from CIAT Colombia, is a significant achievement.

Wheat (56 accessions) was repatriated in 2008 and has been conserved in a gene bank at a temperature of minus 20 degrees Celsius. Multiplication of these repatriated small samples was done where the germination % was low; however, multiplication for 10 accessions was successful, exhibiting diverse phenotypic variations among these accessions, but it needs to carry out a second cycle of multiplication. Moreover, these crops have demonstrated a robust adaptability to the prevailing environmental conditions of the temperate region where they are currently grown. This successful regeneration underscores the potential of these crops in contributing to agricultural diversity and food security.

The conservation of recalcitrant crops in the field forms an integral part of our annual activities. This is particularly crucial as the in vitro lab is in the nascent stages of formulating precise protocols for each crop variety. Currently, seven species, each comprising multiple varieties, are maintained as seasonal crops in the small field genebank.

A diverse collection of vegetatively propagated crop germplasm, including potatoes, has been collected from Lhuntse, Trashiyangtse, and Lingzhi in Thimphu *Dzongkhag*. Accessions of bulbs, rhizomes, and perennial crops such as chives and chayote, sourced from Lhuentse, Trashiyangtse, Samdrup Jongkhar, and Mongar *Dzongkhags*, are currently being maintained as a living collection.

This diverse collection not only represents our commitment to conserving agricultural biodiversity but also serves as a valuable resource for future crop improvement efforts. In our pursuit of comprehensive crop understanding, we strive to collect phenotypic data whenever feasible. This encompasses data for multiple crop types, including beans, bitter gourd, and cucurbit species.

Our methodology involves using the Bioversity International Descriptor list as a reference guide. This globally recognized list provides a structured framework for capturing key phenotypic traits, thereby ensuring the consistency and comparability of our data.

The collected data is stored in the Genebank Information System (GBIS), where it functions as preliminary crop information, offering valuable insights into their characteristics and growth patterns.

To enhance understanding, we also include pictorial descriptions where possible. These visual aids offer a more tangible perspective of the crops, complementing the textual data and providing a more holistic view of each crop's phenotype.

Through these efforts, we aim to contribute to the global knowledge base of crop diversity, supporting research and innovation in agriculture.

Objective

- Initial seed increase for small samples for conservation
- Phenotypic information data collection.
- Seed multiplication of repatriated Samples
- Maintain vegetatively propagated crops in the field gene bank.

Methodology

i) Selection of seed materials

The number of samples to be grown annually is based on the quantity of small seed samples collected during the germplasm exploration collection trip that is carried out annually. For repatriated accessions only half of the seed quantities are used for multiplication, leaving the rest of the quantity as safety backup. For the vegetatively propagated crops maintained on-station, only small quantities like 2Kg each for potatoes and 250g each for *Allium* sp., are selected to maintain annually.

ii) Field Design

The plot design for small sample multiplication is based on the quantity of seeds that are available; only plant spacing is maintained that is required for different crop varieties. For vegetatively propagated crops maintained annually, single plot sizes of 1.5x3 sq m are maintained for different potato samples. For garlic, onion, and bulbing leeks, a single plot of 1x1.5 sq m is maintained. Repatriated seeds are grown in individual pots/polythene bags, as the quantity of seed sample size is very small, i.e., 10 to 15 seeds only for one accession.

Type and Number of Crops

These crops are all grown at the On-Station field genebank for one cropping season, i.e., from January till December.

Table 8: List of Small Sample Multiplication

Crops	Quantity/Sample/Accessions	Remarks
Maize (Pop Corn type)	2 samples	- Collected from Haa and Sarpang Dzongkhag - Harvested adequate quantity for conservation
Maize (Pop Corn type)	2 samples	- Collected from Haa and Sarbhang Dzongkhag - Harvested and enough for packing for conservation

Cucumber	2 sample	- Collected from Gomdar Gewog/Samdrup Jongkhar <i>Dzongkhag</i> - Harvested and enough for packing for conservation
Beans	7 Samples	Collected from Haa and Sarbhang <i>Dzongkhags</i>. Harvested and enough for packing for conservation
Chilli	2 Samples	Collected from Pemathang Gewog, Samdrup Jongkhar <i>Dzongkhag</i>
Bitter gourd	1 Sample	Collected from Gomdar Gewog, Samdrup Jongkhar <i>Dzongkhag</i>
Pumkin	3 Samples	Collected from Orong & Phuntshothang Gewogs.
Total	16 Samples	

Table 9: List of Repatriated Crops

Crop	Species	No. of Accessions	Remarks
Wheat	<i>Triticum aestivum</i>	50	
Bean	<i>Phaseolus vulgaris</i>	5	Second cycle of multiplication
		Total: 55	

Table 10: List of Vegetatively Propagated Crops

Crop	Species	No. of Samples	Remarks
Potato	<i>Solanum tuberosum</i>	21	
Garlic	<i>Allium sativum</i>	7	
Onion	<i>Allium cepa</i>	4	
Chives	<i>Allium tuberosum</i>	2	
Bulbing Leek	<i>Allium ampeloprasum</i>	2	Single clove at initial growth but develops multiple cloves in subsequent years
Chayote	<i>Sechium edule</i>	4	
Yam	<i>Dioscorea</i> sp.	3	
Taro	<i>Colocasia esculenta</i>	3	
Ginger	<i>Zingiber officinale</i>	2	
Turmeric	<i>Curcuma longa</i>	1	
	Total	49	

Results:

i) Small sample multiplication:

Some of the multiplied Crops.



Winged Bean



Bitter gourd



Cucumber

All bean accessions, except for winged bean, were successfully multiplied to quantities sufficient for packaging and long-term conservation in the genebank. The winged bean, being a subtropical crop, was initially multiplied in pots; however, the harvested quantity was insufficient. Consequently, it has been sown in the field for a second multiplication cycle. The remaining bean samples have been successfully multiplied and conserved.

Bitter gourd, sourced from a subtropical region, was cultivated in pots within the greenhouse for multiplication and has been conserved. The remaining crop samples listed above were successfully multiplied and are now conserved.

ii) Repatriated Accessions



Wheat diversity in Repatriated Accessions



Phaseolus coccineus (Scarlet runner bean)

Wheat accessions exhibited diverse phenotypic variations in terms of ear colour, ear length, size, and presence of awns; however, they need second cycle of multiplication to fulfill the required quantity of seed for packaging for conservation.

Three varieties of scarlet beans were harvested and conserved.

iii) Vegetatively Propagated Crops:

The annual cultivation of these crops is carried out according to the specific growth seasons of each crop. Currently, *Dioscorea* spp., rhizomes, and *Colocasia* are being grown in the greenhouse. Bulb and tuber crops have been harvested and are in storage for the next seasonal planting cycle, after which they will be maintained in the field genebank. Chives and chayote continue to be maintained in the field.



Colocassia/Taro



Bulbing leeks

Conclusion

This is an annual activity, being implemented yearly by following the seasonal cropping calendar for different crops. The yearly germplasm collection activity adds to the number of vegetatively propagated samples maintained.

ITPGRFA Benefit Sharing Fund (BSF) Project Fourth Cycle – NUS Project

~Asta M. Tamang, Rinchen Dorji and Thukten Sherab

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Bhutan is one of the beneficiary countries of the Fourth Cycle of the Benefit-Sharing Fund (BSF) of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA). Through this funding support, Bhutan implemented an on-farm plant genetic resources conservation and sustainable use project titled “Participatory On-farm Conservation, Sustainable Use and Management of Neglected and Underutilized Crop Species (NUS) for Livelihood and Adaptation to Climate Change” (PR-80). The project focused on conservation and sustainable use of three neglected and underutilized crops species, which are finger millet (*Eleusine coracana*), foxtail millet (*Setaria italica*), and little millet (*Panicum miliaceum*), through a participatory approach.

These crops were selected due to their declining cultivation status in the project sites and their potential to enhance food security, nutritional diversity, and climate resilience in local farming systems. The project was implemented in seven locations across four *Dzongkhags*, which are Samtse, Chhukha, Trashiyangtse, and Samdrup Jongkhar, and primarily targeted marginalized farming communities residing in remote and topographically challenging areas. Beneficiaries included the Lhop communities in Tading and Dophuchen (Samtse), the villages of Phasuma and Zamsa (Chhukha), Yalang and Bumdeling (Trashiyangtse), and Wangphu and Orong (Samdrup Jongkhar), directly benefiting over 1,517 farmers and approximately 1,500 others indirectly.

The project implementation was executed nationally by mainstreaming in the annual work plan and budget of the MoAL. The NBC led overall coordination, in collaboration with key technical partners, including the NCOA in the western region, ARDCs of Samtenling (South) and Wengkhar (East), and the *Dzongkhag* agriculture sectors of Chhukha, Samtse, Samdrup Jongkhar, and Trashiyangtse. These collaborators played vital roles in delivering technical and extension support to farming communities during the implementation of the project.

Key Achievements

Key outcomes include capacity building of the key project stakeholders representing Agriculture Research and Development Centers, the National Seed Center, agriculture extension and farming communities on NUS product development and value addition. In addition, demonstrations on millet product diversification and value addition and education and awareness on on-farm conservation and maintenance for the farmers were also key activities accomplished. During earlier phases, a range of activities were implemented, such as nutritional profiling of millet varieties collected from the project sites, biodiversity fairs to promote these crops, and the strengthening of community seed banks (CSBs) to ensure seed availability and safeguard crop diversity, on-station and on-farm seed production and multiplication, seed distribution, provision of post-harvest processing facilities, product development and value addition, as well as farmer training and awareness programs focused on the role of crop diversity in improving food and nutrition security and climate resilience.

Noteworthy achievements included the formation of a National On-Farm Conservation Team composed of researchers, extension agents, and conservationists, which enhanced coordination and knowledge-sharing in the conservation and use of NUS. A total of 375 farmers across all seven project sites participated in educational workshops, which emphasized the importance of maintaining millet diversity and sustainable farming practices. Additionally, 49 finger millet accessions from the National Plant Genebank were evaluated at the Agriculture Research and Development Sub-Centre (ARDSC) in Khangma, leading to the identification of five promising varieties. These were tested and selected through Participatory Variety Selection (PVS) trials and introduced in Yalang and Bumdeyling. Similarly, 26 foxtail millet accessions and two little millet accessions were evaluated, with selected varieties promoted in target areas and shared with three regional research centers: NCOA, Bajo ARDC, and Samtenling ARDC.

Farmer capacity building was a central component, with 114 farmers (54 men and 60 women) from Tading and Dorokha trained by ARDC Samtenling on improved millet seed selection and production practices, along with training on product development for income enhancement. Additionally, 195 farmers (106 women and 89 men) from Bumdeling, Yalang, Wangphu, and Orong received similar training through collaboration between ARDSC Khangma, the Regional Post-Harvest Centre, and the *Dzongkhag* Agriculture Sector. The project also strengthened community seed banks in Bumthang, Gomdar, and Phuntshothang by replenishing seed stocks. Bumthang CSB was refilled with the seeds of sweet and bitter buckwheat, maize, wheat, and barley; similarly, Gomdar CSB has a collection of maize, beans, rice beans, sorghum, and finger millet, while Phuntshothang CSB was stocked with rice, maize, beans, horse gram, sesame, soybean, and niger. These efforts are expected to ensure sustainable seed security and safeguard genetic diversity for resilient farming systems.

On-station maintenance of foxtail millet for seed multiplication at ARDSC Khangma



Key challenges were frequent turnover of key personnel, including those pursuing further education or leaving the sector, which affected continuity. The remote and scattered nature of the project sites also posed logistical difficulties in monitoring and documentation. Nonetheless, these challenges have provided valuable insights that will help guide the design and implementation of similar future initiatives.



**Biodiversity fair with the theme: Preserving our past, Securing our future:
Safeguarding Agro-biodiversity**

The Biodiversity Fair was organized at Tsirang *Dzongkhag* (district) on 17 December 2024, coinciding with the 117th National Day of Bhutan. It was organized with the fund support from the ITPGRFA. It was attended by a total of 700 participants (330 females and 370 males) representing farmers, Community Seed Bank Members (CSB) and extensions from 10 districts, researchers from 4 agriculture research and development centers, Local Government officials (Dzongda, monastic body, Judiciary, and Police), and Parliament representatives, and additionally there were spectators representing schools, monks, and business communities.

The primary objective of the fair was to enhance conservation and sustainable use of PGRFA through collection and conservation in the genebank, encourage farmer to farmer seed and knowledge sharing, and recognize farmers' roles in the conservation, development, and use of PGRFA diversity. The event was covered by Bhutan Broadcasting Service (BBS) on television, radio, and in print media. This has created wider education and awareness on conservation and sustainable use of PGRFA diversity for the audience from different walks of life and NBC's commitment to conservation and sustainable use of biodiversity.



Selection and promotion of Finger millet in farmers field in Bomdelling

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Innovative use of PGRFA

Bhutan is known for its rich biodiversity, and so is the crop diversity. The country's diverse agro-ecological zones, ranging from wet subtropical to alpine, have adapted a wide diversity of traditional crops and varieties. Considering its importance, the PGR service under the NBC has initiated some innovative approaches to conserve, utilize, and enhance its PGRFA to strengthen food security, promote climate resilience, and sustain cultural heritage.

One such measure supported by the project is phenotypic characterization of NUS crops such as finger millet accessions from the national genebank and traditional varieties collected from the project sites.

Phenotypic characterization of 49 accessions of finger millet was carried out at the research and development sub-centre Khangma. Full data collection was carried out only for 22 accessions. The activities were carried out with the following objectives:

- To check the seed viability for the conserved materials.
- To document the different morphological characters of high-altitude accessions conserved in the genebank.
- To study and distinguish the differences between each accession from one another and to identify the useful traits.
- For seed purification and evaluation of productive varieties.

It was found that 90% of the seed samples had a good germination percentage, and only 4 accessions had low germination percentage. The characterization data was documented using the Biodiversity International descriptors and is available for use by the researchers and breeders and other users.

Similarly, the project supported carrying out the collection and phenotypic characterization of traditional finger millet varieties from the Tading and Dorokha project sites. The study was carried out by ARDC Samtenling at its research center. The Center has collected and documented some selective key characters such as plant height, number of tillers, days to 50% flowering, number of fingers per head, finger length (mm), culm branching, blade colour, base leaf sheath colour, leaf angle, flag leaf angle, ear shape, and plant growth habit. The study was carried out for 10 collections from the project sites and 3 improved varieties.

Additionally, a good example of innovative approaches to conserve, utilize, and enhance its PGRFA is nutritional profiling of NUS crops collected from the project sites. A total of 36 millet varieties, comprising 20 finger millets, 14 foxtail millets and 2 little millets were studied for the nutritional profiling of the following parameters: total fat, protein, carbohydrate, fiber, niacin (B3), thiamine, riboflavin, folic acid, phosphorus, potassium, magnesium, sodium, calcium, zinc, iron, manganese and copper. The profiling details for each variety are annexed. The data will be publicly available for research on millet crops and for product development purposes. The study was carried out at the Centre for Advanced Research (CARE Laboratory), Samling Plaza, Babesa, Thimphu, an ISO 17025 accredited lab in Bhutan. The study was done using IS 12711:1989, RA:2015, IS 7219:1973 and FSSAI manual methods.



Selection and promotion of Little millet in farmers field in Orong



Dehusked finger millet grain at Bomdelling

Adaptation to climate change

The NUS Accessions sourced from the National Genebank were evaluated and screened at the ARDSC Khangma for yield, pest and disease tolerance, and adaptation to the project site conditions. To further distribute the NUS germplasm to the farmers of the project sites, the ARDSC Khangma multiplied and produced germplasm of 3 millet species (finger millet, foxtail millet and little millet) during this reporting period. A total of 43 kilograms of NUS seed were multiplied and produced at research on-station plots (5 kg of little millet in 2 varieties; 13 kg of 4 accessions of foxtail millet, and 35 kg of 4 accessions of finger millet). These germplasms were distributed to the project farmers and non-project farmers for cultivation in this season. Increased cultivation and utilization of NUS crops by the farmers would contribute to an increase in on-farm crop diversity, thereby enhancing the resilience of the farming system.



Awareness and demonstration on millet utilization and product diversification under NUS site at Bomdelling

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Awareness and demonstration on millet utilization and product diversification under NUS sites

The Agriculture Research and Development Centers, Wengkhaz and Samtenling, in collaboration with the *Dzongkhag* Agriculture Sectors and NBC, provided awareness and demonstration on millet utilization and product diversification in four project sites. The program was organized in four NUS sites covering 234 millet-growing farmers were provided awareness on millet conservation and demonstrated how to diversify a variety of millet-based products, like cookies, noodles, de-husked grains, spicy snacks, and flour. Along with product development, farmers were also shown on packaging of processed products in appropriate packaging materials and product labeling.

Participation in the above capacity-building programs has built the capacity of the national stakeholders and they are aware of the global situation surrounding the PGRFA and associated policies. Such capacity-building exposures will contribute to aligning and integrating the PGRFA-related national activities with the International Treaty's objectives and goals.



Table 11: Number of participants in the awareness and demonstration on millet utilization and product diversification

Sl. No.	Gewog/Site	Dzongkhag	Participants		Total
			Male	Female	
1	Wangphu	Samdrup Jongkhar	33	28	61
2	Orong	Samdrup Jongkhar	31	44	75
3	Yallang	Tashiyangtse	14	20	34
4	Boomdeling	Tashiyangtse	11	14	25
5	Tading	Samtse	18	12	30
6	Dorokha	Samtse	1	8	9
Total			108	126	234

Ex-country Millet Product Development and Value Addition Training

A week of training was attended by the relevant project stakeholder at the National Food Research Center, Kathmandu, Nepal. It was organized in collaboration with the Community Seed Bank Association of Nepal and the National Food Research Center of Nepal. The training was organized with the following objectives.

- To build technical capacity of farmers' groups and relevant stakeholders to develop a variety of millet-based products through hands-on training.
- To enhance knowledge and skills in processing techniques, standardization, and quality control of millet products in line with food safety and market standards.

- To expose participants to best practices in millet value chain development through institutional visits and knowledge exchange with Nepalese counterparts

A total of 11 participants from various organizations attended the training, and details are presented in table 2 below.

Table 12: No. of participants from different agencies who attended the Training

Sl. No.	Organization	No of Participants	
		Male	Female
1	Farming Community representative of Bumdeyling, Trashi Yangtse	1	2
2	Farming Community representative of Bongo, Chukha	1	0
3	Agriculture Research and Development Center, Wengkhar	0	1
4	Agriculture Extension Trashiyangtse	0	1
5	Agriculture Research and Development Center, Samtenling	1	0
4	National Post Harvest Center	0	1
5	National Center for Organic Agriculture, Yusipang	0	1
6	National Seed Center, Trashiyangtse	1	0
7	National Biodiversity Centre	1	0
Total		5	6

Conclusion

The project was highly relevant, and the objectives were consistent with the local needs of the farming communities. The project outputs in their own small ways contributed to the realization of higher goals of food and nutritional security and improvement of livelihoods of the farming communities. The key strength of the project was that it helped to take forward the initiatives for sustainable conservation, development, and utilization of PGFRA for food and nutritional security and resilient farming systems. It significantly helped to strengthen the on-farm conservation of PGFRA through capacity development of all stakeholders, especially the farmers. The project made a significant contribution to the capacity development, which could not have been achieved from the normal government funds. In particular, the capacity development mostly benefited the women farmers who are responsible for managing the seeds, traditional seed system, and PGFRA at the household level. Overall, the project design and institutional arrangements were highly suitable. The project served as a good platform for interactions between different stakeholders engaged in PGRFA management.

Traditional Millet Cultivation Practices in Zamsa Village, Bongo Gewog, Chukha Dzongkhag

~Jambay Cheda, Tirtha Bdr Katwal and Rinchen Dorji

Introduction

Zamsa village under Bongo Gewog of Chhukha Dzongkhag is located at an elevation of 1,100 meters above sea level and has a total of 18 households. For generations, farmers of Zamsa have lived in harmony with nature and their ancestral land. In this distant village, families have passed down the traditions of farming and livestock rearing for generations. Subsistence, rainfed dryland farming integrated with agroforestry is the most dominant land use practice in this village. The major food crops cultivated are millet, buckwheat, maize, and seasonal vegetables. Among the food crops, millet is a staple food and a primary commodity for food. Despite the introduction of several modern crops and varieties such as potatoes, quinoa, asparagus, and different vegetables, Zamsa farmers continue to cultivate and rely on millets.

Millet Diversity

Farmers cultivate two types of millet, which are finger millet (*Eleusine coracana*) and foxtail millet (*Setaria italica*). There are two types of finger millet landrace, namely “Setho” and “Membja.” Zamsa is home to four different landraces of foxtail millet, each unique in color and character. The four landraces are Ma-cham with red grain, Jab-cham with grey grain, Ka-cham with white grain, and Ling-phub with yellowish grain. Every household plants these two crops and maintains their own seed.



Finger Millet in Phasuma

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Millet Cultivation Practices

Farmers of Zamsa are deeply rooted in the Buddhist tradition and culture. They still continue to practice ancient methods of millet cultivation. Millet cultivation in the village is entirely natural and organic. Farmers do not rely on chemical fertilizers or synthetic inputs. Instead, they depend on farmyard manure and locally available organic matter, preserving the ecological balance and ensuring that the food produced is safe and healthy.

Both finger and foxtail millets are cultivated in dryland and “Tsheri,” which is a controlled slash-and-burn type of land use system in their registered land. Millet is cultivated in Zamsa not once, but twice a year. It is cultivated as a spring and a winter crop. Millets are cultivated as a marginal crop with no external inputs. The only source of nutrients for the crop comes from the cow dung that is left on the field from tethering cattle. Finger millet is either directly seeded by broadcasting or transplanted from a nursery. The sowing time for the spring crop of finger millet is April, and harvested in August. The summer crop of finger millet is sown or transplanted in July and harvested in November. Foxtail millet is directly seeded in dryland or Tsheri between late December and mid-January and harvested in April-May. The predominant cropping patterns are maize-maize, maize-buckwheat, maize-finger millet, maize- foxtail millet, and millet-millet.

Millet cultivation begins by clearing their fields of any debris, weeds, or leftover crop residues. This initial cleaning ensures a clean field and prevents competition for

nutrients during the crops' early growth stages. A unique aspect of their practice includes tethering cattle in the fields for manure before ploughing. This practice enriches the soil with organic manure and improves soil structure. Prior to sowing, or just before the onset of the planting season, farmers prepare the land by ploughing it using traditional bullock-drawn ploughs. This method, while labor-intensive, is sustainable in maintaining the quality and organic content of the soil. Once the field is adequately prepared, seeds are sown using the traditional broadcasting technique. Although this method may not ensure uniform spacing, it is widely practiced due to its simplicity and minimal resource requirement. Farmers typically use a seed rate of approximately 2 kilograms per acre, which aligns with low-input, sustainable agricultural practices. Overall, the low-input, organic approach to millet farming ensures that cultivation is affordable and environmentally friendly.

The harvesting process is carried out manually. Farmers cut the millet heads with sickles and collect them in the bamboo basket. The heads are set out to dry in the sun for several days. This drying phase is crucial to prevent mold and facilitate easier threshing. Once adequately dried, the millet heads are threshed manually by beating them with sticks and sometimes using their feet to separate the grains from the husks. The overall productivity stands at around 800 to 900 kilograms per acre.



Traditional Seed Saving

Seed keeping remains rooted in ancestral wisdom. Rather than threshing all the harvest, villagers select the healthiest millet heads and store them in drums placed in shaded areas of their homes. These seeds remain untouched until the next sowing season, preserving both quality and tradition.

Millet Utilization

Millet holds a revered place in Bhutanese culture. It is one of the nine traditional cereals (*Dru-Na Gu*) that represent the soul of Bhutan's agricultural history and heritage. The uses of millet extend beyond food, as millet plays a vital part in traditional practices and ceremonies. Millet is an essential element in religious and spiritual contexts, especially during annual rituals where the flour is molded into *torms*, a symbolic offering made during Buddhist ceremonies. Millet grain is widely used as a staple in traditional diets, while the flour is used as the base for a variety of products, such as dough, porridge, and noodles. Millet is also commonly used in brewing traditional beverages such as Bangchang, a locally fermented drink that is indispensable for rituals and social occasions.

NUS Project Support

Recognizing the slow decline of millet cultivation, the NCOA, in collaboration with NBC and the Chhukha *Dzongkhag* Agriculture Sector, intervened to support the farmers. Through the ITPGRFA project on Neglected and Under-Utilized Crop Species conservation and sustainable use, we initiated millet conservation and developmental activities at Zamsa. As a result, the millet cultivation in Zamsa village has greatly improved.

According to project farmers, traditionally, millet in Zamsa used to be just enough for self-consumption and annual rituals. This scenario has improved today, and farmers have reported an increase in their production. This shift is largely attributed to the advocacy and awareness of the benefits of millet and the creation of a market. Farmers now sell their millet products (flour and grains) to the local farmers' sales outlets in Gedu and beyond, turning tradition into livelihood. Through the project support farmers have also been supported with a milling machine, flour mill, and threshers to improve the overall value chain of the millet. Further, with increased awareness of millet's nutritional value and its organic cultivation practices, the demand for millet products is increasing.



Consecration of machinery at Zamsa village

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Conclusion

The traditional millet cultivation practices of Zamsa village embody a profound connection between people, land, and culture. In an era increasingly driven by modern agricultural techniques and commercial crops, Zamsa's farmers have upheld their ancestral knowledge and sustainable practices, nurturing millet not just as a crop but as a symbol of identity, resilience, and food security. Their low-input, organic farming system anchored in crop diversity, traditional seed saving, and manual labor offers valuable lessons and is a proven case of sustainability and resilience.

The revival of millet cultivation through the support of the NUS Project has not only enhanced food and nutritional security but has also strengthened the cultural identity and economic resilience of the community. The introduction of milling technology has empowered farmers, enabling them to process and market their produce more efficiently. As a result, millet is no longer a forgotten grain; rather, it is a symbol of revival, self-reliance, and sustainability. The story of Zamsa stands as a testament to the power of community-driven agricultural practices in safeguarding biodiversity and ensuring a nutritious, organic future.

The QMS Blueprint: Ensuring Trust, Transparency, and Traceability in Genebanks through quality management system (QMS)

~Asta M. Tamang, Thukten Sherab, Ugyen Phuntsho, Rinchen Dorji, Cheki Wangmo, and Wang Tshering,

Introduction

Genebanks play a vital role in safeguarding plant genetic resources (PGR) for future generations, ensuring that these resources remain accessible for developing crops essential to feeding the global population (FAO, 2010). In addition to their long-term conservation efforts, gene banks also provide crucial materials to scientists and plant breeders, supporting their crop improvement and breeding programmes (Hintum & Wijker, 2024). These responsibilities are very significant and demand a high level of commitment. Consequently, it is essential that gene bank operations maintain a high standard of quality, which must be consistently assured. An effective quality management system is therefore very critical to ensure that gene banks fulfil their responsibilities and operate at the appropriate level to meet global food and nutritional security needs.

The NBC, MoAL, holds the national mandate for managing PGRFA of the country. Currently, the National Plant Gene bank holds a total of 3750 accessions comprising cereals, legumes, oil seeds, and vegetable seeds for long-term conservation. The gene bank holds unique collections that often reflect regional crops and wild relatives adapted to specific local climates and conditions. Conserving these PGRFA is a shared responsibility of everyone. To achieve this mission, genebanks need to work together by sharing resources, data, and expertise to avoid redundant efforts and ensure that no essential genetic material is missed. Collaboration also allows for coordinated actions in conserving, regenerating, and monitoring seed viability over time. Effective partnership depends on mutual trust, which, in the context of genebanks, involves following established procedures and standards for managing plant genetic resources. To this, the Global Crop Diversity Trust (Crop Trust) assumed coordination of the CGIAR Genebank Platform and began supporting CGIAR genebanks financially; it recognized the importance of a system to monitor their performance and quality. Ensuring transparency in genebank operations was crucial for evaluating their effectiveness and identifying investment needs. As a result, the Crop Trust developed the 'Genebank Quality Management System' and supported its implementation across the CGIAR genebanks and subsequently to the national genebanks project implementing countries through the BOLD project.



Janny van Beem, Genebank Quality Management Specialist, visit at NBC
Photo: Tshering Zangmo

Quality management in a genebank environment

Quality can be managed, although it is difficult to define. According to the ISO 9001 standard for quality management system (ISO 9001, 2015), quality is defined as the “degree to which a set of inherent characteristics [or distinguishing features] of an object fulfils requirements.” An object is described as “anything perceivable or conceivable, including a product, service, process, person, organization, system, or resource.” Using this definition, the quality of a genebank can be understood as “the extent to which it achieves its intended objectives.” These objectives are generally well-established and center around two primary elements: conserving plant genetic resources (PGR) for future generations and ensuring their availability to meet the needs of current users (FAO, 2016).

Although there is broad agreement on these key elements, interpretations of what constitutes ‘conservation’ and ‘access’ can differ among genebanks. Discussions on ‘conservation’ often emphasize technical details, such as how frequently seed viability should be tested or the optimal number of plants in a regeneration plot. On the other hand, ‘access’ tends to be shaped more by policy issues, including who is entitled to access the material and under what conditions. Despite these varying interpretations, it remains crucial to ensure that a genebank's objectives are achieved as effectively as possible. A quality management system is a vital tool that helps genebanks reach these goals efficiently. As might be expected, quality management involves overseeing all activities and tasks necessary to maintain a desired level of excellence and achieve set objectives. This typically includes key elements such as quality planning, quality control, and quality improvement (Hintum & Wijker, 2024).

Quality Management refers to a globally recognized system or tool that helps direct the genebank's activities to meet user needs and regulatory requirements and provide evidence of continuous improvement in efficiency and effectiveness. In other words, QMS provides evidence that excellence is a habit.

Quality Management Systems

A genebank's QMS has two overarching objectives. It defines the necessary activities to ensure that genebanks meet all policy and technical standards and outlines ways to achieve continual quality improvement in the genebank's administrative, technical and operational performance. As a result, it allows genebank users, regulatory bodies and donors to recognize and confirm the competence, effectiveness and efficiency of genebanks.

The Genebank QMS serves as a comprehensive framework for managing genebank functions and overseeing their monitoring, auditing, and external review processes. It offers several advantages over generic quality management systems by being:

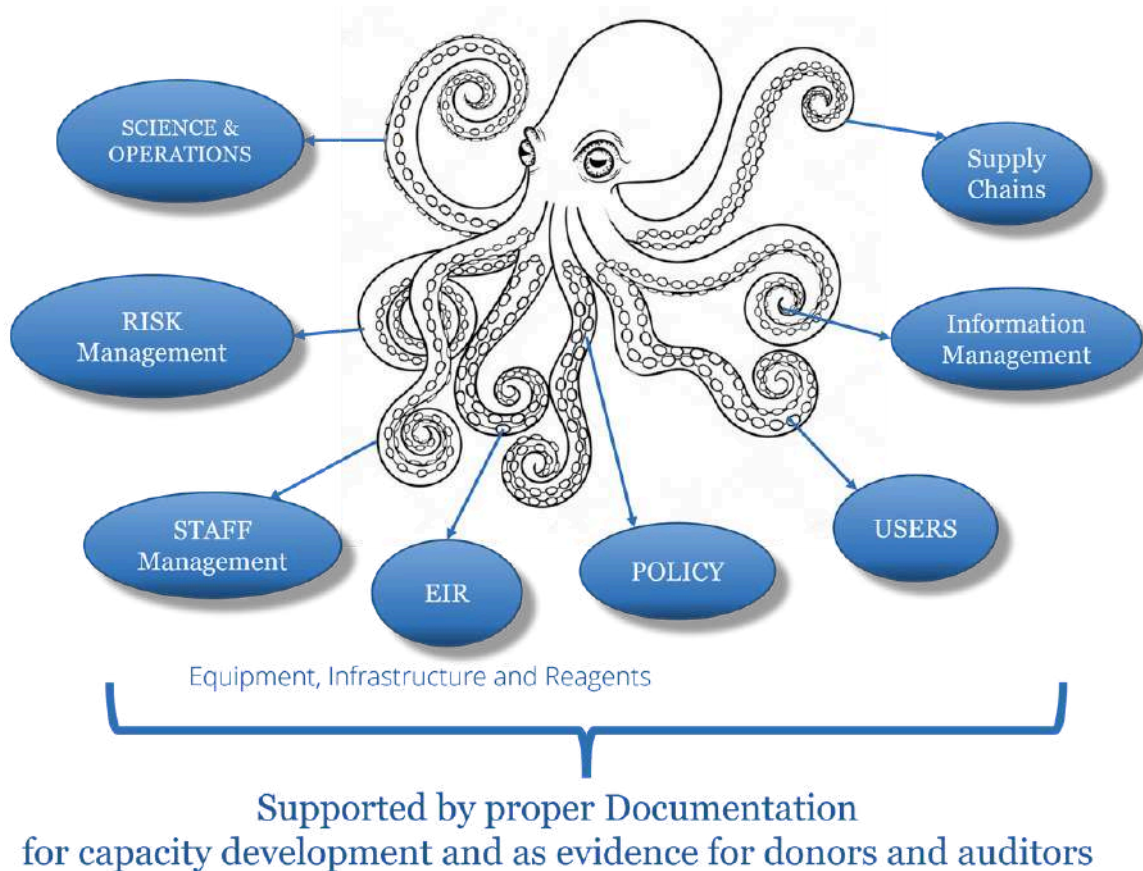
- **Standard-specific:** Grounded in genebank-specific standards and performance targets, rather than relying on broad, generalized quality benchmarks.
- **Comprehensive:** Applied across all aspects of genebank operations—from acquisition to distribution—rather than limited to selected tasks or procedures.
- **Internally motivated:** Encourages collective and individual accountability, resulting in improved technical performance across operations.
- **Efficient:** Once implemented, it minimizes paperwork while maintaining robust documentation practices.
- **Responsive:** Flexible enough to incorporate evolving topics such as protocol refinement, policy updates, and emerging risks.
- **Context-sensitive:** Designed to be tailored to the unique needs and conditions of individual genebanks.
- **Collaborative:** Adaptable for use across networks of genebanks, enabling harmonization and sharing of templates and procedures across countries, crops, and conservation systems.

At the heart of the Genebank QMS, there are eight interconnected components that form the foundation of quality management. The system places strong emphasis on the science of conservation, providing a clear rationale for each adopted procedure, such as factors influencing seed longevity, cost-effective conservation strategies, and maximizing the utility of genetic collections. Scientific research and genebank operations are mutually supportive, with curators and researchers working closely to enhance procedures and drive continuous improvement.

The SOPs are central to the QMS, enabling genebanks to document, validate, refine, and share their operational processes. This standardized approach allows for the development and adoption of shared policies and practices for specific functions—such as acquisition and distribution—especially for similar crop types across the system.

The QMS applies to all genebank operations, staff capacity and succession, infrastructure and work environments, equipment, information technology and data management, user satisfaction, risk management, and operational policies.

Each genebank has specific requirements and procedures, but all can use the same approach and templates to tailor QM to their specific crops and conservation methods.



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The 8 elements of QMS

Fundamentals of Genebank Operation

According to CGIAR Genebank (2025), the QMS covers every aspect of genebank operations, including the acquisition of accessions, distribution to users, and offsite safety duplication of collections. During the acquisition and preparation of samples for conservation, the genebank ensures that its procedures align with applicable national and international laws, adhere to CGIAR and genebank policies, and meet established international technical standards. Conservation procedures are designed to maximize the longevity of samples and minimize the need for regeneration, incorporating appropriate monitoring, safeguards, and efficient strategies for assigning samples to active and base collections.

Regeneration is carried out to maintain enough seed with adequate viability, following best practices to preserve genetic integrity and ensure long-term seed longevity. Characterization and evaluation procedures generate valuable information that complements an accession's passport data. The genebank applies standardized methods and recognized descriptors for characterizing accessions. Additionally, it collaborates with partners to evaluate performance across various environmental conditions, assessing traits such as yield, resistance to pests and diseases, nutritional value, and tolerance to abiotic stresses.

Distribution is carried out in compliance with international regulations, enabling genebanks to provide adequate samples of seeds or other planting material upon request, free from quarantine pests and diseases. Offsite safety duplication is vital for all accessions, with established procedures to renew duplicates as needed.

Information and data management play a critical role in genebank operations, supported by comprehensive policies and procedures to safeguard the integrity of all data related to the genebank and its accessions. Backup, recovery, and restoration measures are just as essential for data as they are for the physical conservation of accessions. Germplasm health is preserved in conserved accessions, ensuring that distributed samples comply with international phytosanitary certification standards.

Legal Instruments and Standards

Genebanks maintain documentation demonstrating compliance with all relevant treaties, conventions, laws, and guiding principles. These include:

- The 2014 FAO Genebank Standards
- The CGIAR Principles on the Management of Intellectual Assets
- The Convention on Biological Diversity
- The International Convention for the Protection of New Varieties of Plants (UPOV)
- The International Plant Protection Convention
- The International Treaty on Plant Genetic Resources for Food and Agriculture
- The Standard Material Transfer Agreement

Risk Management

Given their mandate to conserve crop diversity over the long term, genebanks must conduct comprehensive risk assessments. For each identified risk, appropriate mitigation measures are in place. This includes immediate response protocols—such as in the event of a fire—with staff fully trained and prepared to fulfill their responsibilities. Risk mitigation also encompasses a business continuity plan, complete with emergency procedures and a recovery strategy.

User Satisfaction

Genebanks are committed to thoroughly understanding and addressing the needs of their users to ensure the relevance and effectiveness of their services. They implement systematic monitoring processes to regularly assess user satisfaction and gather valuable feedback. This ongoing evaluation allows genebanks to identify areas for improvement and respond promptly to user concerns or suggestions. By actively incorporating user input into their operations, genebanks enhance their quality management and maintain strong, productive relationships with the users they serve.

The genebank's QMS guarantees that facilities and equipment safeguard the collections against damage from unforeseen events. Similarly, staff working conditions are regularly monitored to address health and safety concerns and ensure compliance with local regulations.

Templates and Checklists

Genebanks have access to a range of templates, checklists, and briefs to assist in developing their own policies and procedures. Comprehensive support and training are offered to guide genebank operations throughout the entire process.

Verification and Certification

Independent verification or validation of each genebank's quality management is crucial to demonstrate that the genebank adheres to its documented standard operating procedures and updates them as needed. Certification serves as formal acknowledgment that the genebank has achieved a specified level of quality management implementation, instilling confidence in all stakeholders regarding the genebank's competence.

- In 2008, CIP was the first genebank in the world to receive ISO 17025 accreditation.
- CIMMYT's Seed Health Lab attained ISO 17025 accreditation in 2007.
- CIMMYT's genebank gained ISO 9001 certification in 2013.

The following activities sustain your QMS:

1. Update documentation relevant to the eight elements of QMS (policy, science, risk, staff, EIR, Users, Information Management, Supply chain).
2. Capture and register improvement events either through internal efforts or external recommendations. Keep evidence of improvements and communicate with them.
3. Utilize Key Performance Indicators (KPIs) and Trends: identify the key metrics that effectively communicate your trends, such as the cost of conserving an accession or the number of days required to process a consignment for distribution.
4. Monitor emerging conservation guidelines and changes to the FAO standards (Quality Management, 2025).

The Genebank QMS does not constitute a formal quality certification system; however, by promoting the use of standardized templates and approaches at our genebank and embedding these within system-level audits and reviews, it helps institutions establish a recognizable and adaptable quality management framework. This framework can be customized to fit different crops, conservation strategies, geographic contexts, and financial capacities.

When properly implemented and regularly monitored, the QMS enhances administrative, technical, and operational efficiency while ensuring compliance with international standards. As a result, genebank users, regulatory authorities, and donors can place greater trust in Genebank QMS as a means of verifying and validating the effectiveness and competence of genebank operations (Lusty et al., 2021).

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BOLD Project WP3 Phase 1

Bridging the Gap: Strengthening the Link Between Genebanks and Seed Systems in Bhutan

~Ola T. Westengen, Wang Gyeltshen, Asta M. Tamang, Rinchen Dorji, Thukten Sherab, Ugyen Phuntsho, Wang Tshering and Cheki Wangmo

Introduction

BOLD (Biodiversity for Opportunities, Livelihoods, and Development) is a major 10-year project to strengthen food and nutrition security worldwide by supporting the conservation and sustainable use of crop diversity. The project works with national gene banks, pre-breeding and seed system partners globally. Funded by the government of Norway, BOLD is led by the Global Crop Diversity Trust in partnership with the Norwegian University of Life Sciences (NMBU) and the ITPGRFA.

The overall goal of the project is to strengthen food and nutrition security by supporting the conservation and use of crop diversity in gene banks. One of the five work packages in BOLD, **Gene Banks and Seed Systems (WP3)**, led by NMBU, aims to strengthen the linkages between national gene banks and other seed system actors.

Gene banks and Seed systems

Gene banks serve as a rich source of diversity for farmers, researchers, and plant breeders to utilize in their quest to produce more and superior food, especially considering challenges such as those posed by the climate crisis. However, they often prioritize the conservation aspects of their work. Gene banks should not simply serve as ‘museums’ where seeds are frozen in time. They should instead play an active role in the seed systems that farmers use to broaden their crop choices, which in turn supports robust production systems and diverse diets. While some of the crop diversity in gene bank collections has been utilized by plant breeders and researchers, and some gene banks have interacted directly with farmers, there is a greater need for active distribution of these precious resources. This is made complex by the fact that around 80% of seed exchanges in developing countries take place in the informal sector, such as local markets or exchanges between farmers, which are not sufficiently catered to by current research or formal plant breeding and seed systems.



Conceptual framework identifying five factors to describe seed systems. The three in light green are basic "functions" that seed systems deliver. These are activities that seed system actors are engaged with. The two in dark green (seed governance and food system drivers) are broader contextual factors that influence how the seed system functions. Graphic © NMBU

Currently, the diversity from gene banks is predominantly directed through formal breeding. This involves the development of varieties, their release, seed multiplication, certification, and then distribution to farmers—a process that is quite extensive.

The Gene Banks and Seed Systems segment of the BOLD Project is dedicated to enhancing the connections between gene banks and other elements of seed systems.

This initiative, spearheaded by the NMBU, will initially focus on determining the most effective ways to fortify the relationship between gene banks and other stakeholders in seed systems in developing nations. The objective is to ensure that farmers have access to the crop diversity they require. This necessitates technical and institutional innovations that are specific to each context. These could vary from setting up new partnerships for seed multiplication between gene banks and entities like farm cooperatives or commercial seed companies to reassessing the roles of gene banks in relation to other organizations in the seed sector.

Study Objectives

The study was structured around three core objectives:

i) Characterization of Bhutan's National Seed System:

The first step involved mapping the institutional landscape of Bhutan's seed system at the national level. This included identifying key actors across seed system functions—conservation, variety development, seed production, dissemination, and governance—and analyzing their roles, interlinkages, and challenges. The aim was to evaluate the strengths and weaknesses within the existing system and identify opportunities for improved coordination.

ii) Local Seed System Analysis:

The second step focused on understanding the realities at the farm level. Through focus group discussions (FDG) and key informant interviews (KII) conducted in ten *gewogs* representing diverse agroecological zones and ethnolinguistic groups, the study examined farmers' crop preferences, sources of seed, and the challenges they face in accessing quality seed. Particular attention was given to the concept of seed security, defined as the availability, accessibility, and quality of seed, as well as the suitability of crop varieties to local needs.

iii) Conceptualizing and Validating Pathways for Seed System Improvement:

Drawing from both national and local analyses, the third objective was to formulate pathways for improving seed system functions. These pathways aim to bridge the gap between conservation and use of crop diversity and were validated through a national Roundtable Workshop (RTW) consultation, ultimately informing pilot projects for seed system strengthening.



Round table workshop participants in Tsirang

The main project development has been initiated and finalized, which will be implemented by the Department of Agriculture (DoA) in collaboration with NMBU for strengthening the seed system in the country.

Methodologies and Framework

The study employed a multi-level, function-based characterization framework. It avoided binary classifications of “formal” vs. “informal” seed systems and instead focused on analyzing core functions (diversity management, seed production, and dissemination) and contextual factors (seed governance and food system drivers).

At the national level, data were collected through:

- KII with stakeholders from institutions such as NBC, ARDCs, NSC, MoAL, NGOs, and private seed companies.
- Document review of policies and legal instruments like the Biodiversity Act (2022) and the Seed Rules and Regulations (2018).

At the local level, the research team conducted:

- Focus Group Discussions (FGDs) with 111 farmers across 10 *gewogs*.
- Interviews with community seed banks, extension officers, and regional seed growers.

The conceptual framework used helped trace how actors across the seed value chain contribute to seed security outcomes and where gaps persist.

Key Findings

1. Structure and Dynamics of the National Seed System

Bhutan’s national seed system is predominantly public-sector driven, with the NBC leading the conservation of plant genetic resources and the ARDCs overseeing variety development. The National Seed Centre (NSC) plays a central role in seed production and dissemination.

However, active plant breeding programs are minimal. Most new varieties are introduced from international sources such as CGIAR centres and evaluated locally. Between 1988 and 2023, 310 varieties were released, excluding forages, mostly vegetables (128 varieties). Breeding efforts are limited to evaluation and adaptation, with little ongoing selection or crossing.

The private sector remains underdeveloped, contributing mainly to vegetable seed production and import. Regulatory challenges, such as slow variety registration, bureaucratic hurdles, and limited incentives for private sector engagement, hinder broader participation.

2. Seed Production and Dissemination

The NSC operates seven stations across various agroecological zones dedicated to seed production. Additionally, NSC coordinates over 500 Registered Seed Growers (RSGs)—individual farmers or farmer groups certified by the Bhutan Food and Drug Authority (BFDA) for seed production. These RSGs receive training on key aspects of quality seed production for specific crops, and their outputs are monitored and certified by BFDA. Meanwhile, the ARDCs are responsible for maintaining breeder and foundation seeds.

Bhutan Alpine Seed (BAS) is currently the sole private seed company in Bhutan engaged in its own seed production. BAS cultivates seeds on its land in Paro and partners with farmers who serve as contract seed producers. The company produces significant quantities of various vegetable seeds, and for certain crops such as cabbage and spices like coriander, it supplies more seed than the NSC, though they face competition from subsidized public seed.

Challenges in production include:

- Mismatch between seed supply and demand forecasts.
- Inadequate storage and post-harvest handling.
- Pest damage and infrastructure gaps, particularly in remote areas.

Seed dissemination is largely through government extension networks, with fixed pricing policies to ensure equitable access. However, this model limits responsiveness to local preferences and reduces incentives for innovation, particularly in the private sector.

3. Farmers' Seed Systems and Seed Security Outcomes

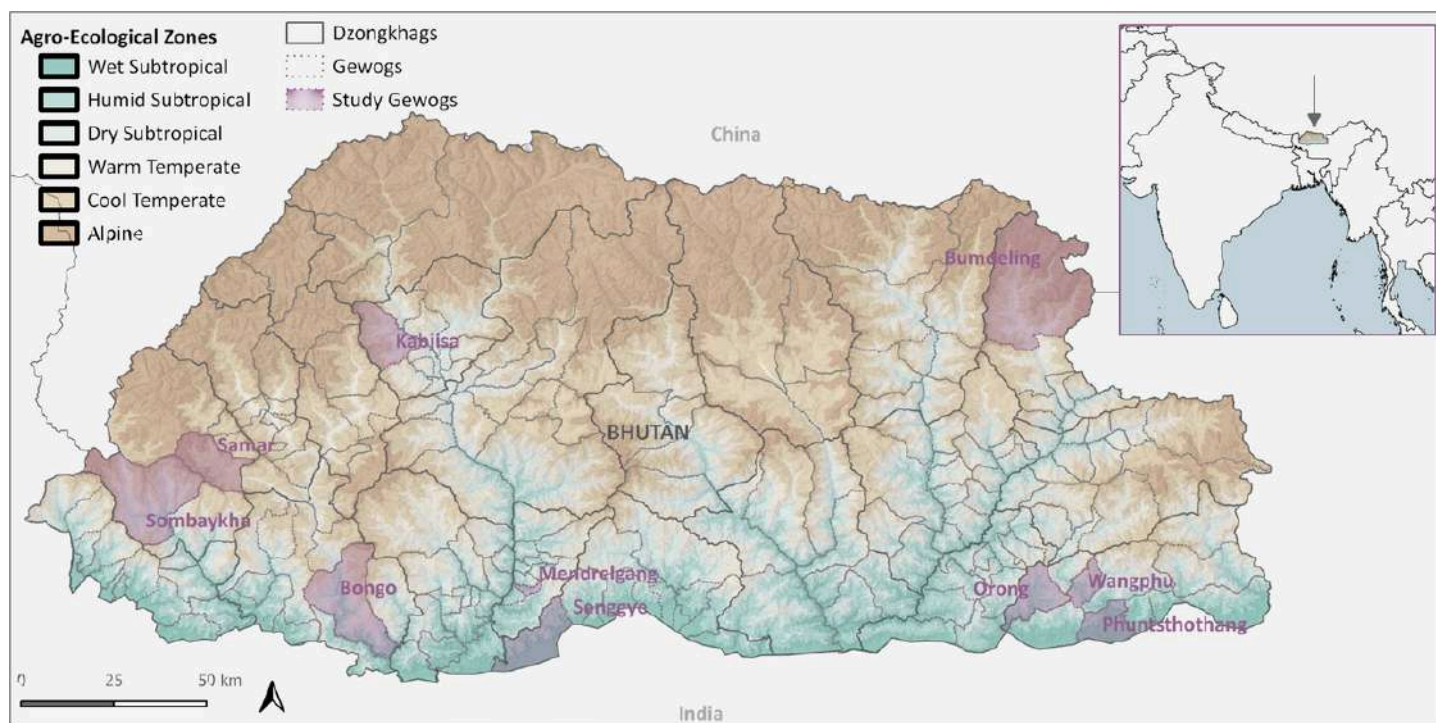
Focus group discussions were held in ten *gewogs* strategically selected to capture the diversity of Bhutan's agroecological zones, ethnolinguistic groups, and geographic regions (see Table 2 and Figure 2). This selection aimed to reflect the social and environmental factors shaping farmers' crop preferences. A total of 111 farmers took part in the discussions, with participation ranging from 10 to 32 individuals per *gewog*. At each location, the *Gewog* Agriculture Extension and

Gewog Administration offices were instructed to invite farmers who actively cultivate crops, ensuring a balanced representation in terms of gender, age, and chiwog distribution within the *gewog*. While this balance was largely achieved, some sites had relatively low female participation (refer to Table 6). FGDs revealed that most farmers rely on farm-saved seed, especially for staples like rice, maize, and buckwheat. For vegetables, however, the formal system is more dominant.

Table 13: Overview of the ten study sites selected for the local seed system characterization and number of FGD participants per *gewog*

Agro-ecological zone	<i>Gewog</i> (Municipality)	<i>Dzongkhag</i>	Ethnolinguistic groups*						#FGD participants (% female)
			B	K	L	N	S	Y	
Wet Subtropical	Phuentsholing	Samdrup Jongkhar		X	X	X	X		32 (66%)
	Senggye	Sarpang			X		X		13 (46%)
Humid Subtropical	Mendrelgang	Tsirang	X	X	X	X	X		11 (36%)
Dry Subtropical	Bongo	Chukha				X			11 (55%)
	Kabjisa	Punakha				X			17 (59%)
Warm Temperate	Orong	Samdrup Jongkhar					X		20 (60%)
	Sombaykha	Haa			X	X			10 (20%)
	Wangphu	Samdrup Jongkhar					X		23 (9%)
	Bumdeling	Trashig Yangtse						X	30 (50%)
Cool Temperate	Samar	Haa				X			19 (63%)

*Ethnolinguistic groups are as follows: B=Brokpa, K=Khengpa, L=Lhotsampa, N=Ngalop, S=Sharchop, Y=Yangtsepa (Zalakhia dialect)



Map of study gewogs and agroecological zones

Key crops across sites included:

- **Staples:** maize, rice, potato, sweet buckwheat
- **Vegetables and spices:** chili, mustard, cabbage, ginger.
- **Cash crops:** cardamom, orange, arecanut.

Seed security was found to vary by crop and region. Issues identified include:

- Low seed replacement rates (e.g., 8.6% for rice and 13.5% for maize—far below recommended levels).
- Limited varietal turnover.
- Uneven access to improved varieties.
- Storage and viability issues due to inadequate infrastructure.

Cultural dimensions were also significant. Many crops hold ritual and spiritual value, forming part of Bhutan's “*Dru-na-gu*” (Nine Fundamental Crops). Gender roles influenced crop choices, with women prioritizing crops for household consumption and men focusing on income-generating crops.

Farmers shared various local customs and beliefs that shape their seed use practices. Among the most mentioned were traditional views on auspicious days for sowing, drying, storing, giving, acquiring, or purchasing seed. Some also referred to superstitions surrounding certain crops believed to bring misfortune. While these beliefs varied across communities, one account from Phuntshothang FGD illustrates the general sentiment: “*The jackfruit tree is seen as a bad omen, as its roots spreading toward the front of a house are believed to bring misfortune. People say that seeing a fruit-bearing jackfruit tree may lead to a shortened life or sudden*

bad luck.” Similarly, growing papaya in front of the house is considered inauspicious. Mango trees are also viewed with caution; according to oral tradition, the person who plants a mango tree may have a shortened life after its fruits are harvested and consumed.

Additionally, sharing or giving seeds on Tuesdays and Fridays is discouraged due to “Yangza,” which are considered lucky or spiritually significant days of the week. Certain days on the Bhutanese lunar calendar, specifically the 3rd, 9th, and 19th, are regarded as “insect days,” during which no sowing or planting should occur, as doing so is believed to result in pest outbreaks or disease in the village.

These customs are rooted in ancestral knowledge and oral traditions passed down through generations. However, with the growing influence of education and modern technology, such beliefs are gradually fading among the younger, more inquisitive generation.

Farmers’ Perspectives on Enhancing Access to Crop Diversity and Quality Seed

When participants (FGDs) were asked how farmers’ access to diverse, high-quality planting materials could be improved, the most frequently mentioned suggestion raised in 6 out of 10 focus group discussions was to strengthen farmers’ capacity for seed production and storage at the local level.

Some participants pointed out that strengthening farmers’ own seed production would lessen their reliance on government distribution programs, especially for crops such as vegetables and potatoes. In several focus group discussions, farmers highlighted issues related to timeliness and, in some cases, such as cabbage, the quality of seed distribution in their communities. Others emphasized that simply receiving seeds is insufficient; they also require greater technical support on planting techniques and crop management practices. Finally, farmers in several *gewogs* also stressed the need to develop additional income-generating activities.

**ABSTRACTS OF PUBLISHED JOURNAL ARTICLES
FROM JULY 2023 TO JUNE 2025**





***Zeuxine drukyulensis* (Orchidaceae), a new jewel orchid from Bhutan Himalaya**

~Phub Gyeltshen, Kinley Rabgay, Kezang Tobgay & Pankaj Kumar

An interesting new species of jewel orchid, *Zeuxine drukyulensis* is described and illustrated from warm broadleaved forests in western Bhutan. It is closely allied to *Zeuxine nervosa* and *Zeuxine rolfeana*, however, differs in various morphological characters, primarily the structure, size and colour of the flower. The new species is assessed as Data Deficient (DD) as per the IUCN Red List guidelines.

Published in *Phytotaxa* 690 (1): 123–129, 2025.

DOI: <https://doi.org/10.11646/phytotaxa.690.1.11>

A new variety of *Musa balbisiana* (Musaceae) from Bhutan

~Phub Gyeltshen, Phuentsho, Krishna P. Dhimal & Nima Dorji

There are seven varieties of *Musa balbisiana* (Musaceae) in the South and Southeast Asia. Here, *Musa balbisiana* var. *bhutanensis* P. Gyeltshen, is described and illustrated as a new variety from central Bhutan. It resembles *M. balbisiana* var. *balbisiana* and var. *elavazhai*, but differs from them by having a longer peduncle, oblong to broadly ovate bracts, a creamy anther with pink tinge, and shorter and more numerous seeds per fruit. The conservation status of the new variety is assessed as Data Deficient (DD).

Published in *Annales Botanici Fennici* 62 (1), 67–73. 2025.

DOI: <https://doi.org/10.5735/085.062.0111>

Addition of Five Orchid Species to the Flora of Bhutan

~Phub Gyeltshen, Kinley Rabgay, Phuentsho, Kezang Tobgay & Pema Namgyel

Bhutan, situated in the eastern part of the Himalaya Biodiversity Hotspot, is renowned for its rich flora and fauna. This biodiversity is attributed to the country's multiple biogeographic origins, diverse topography, ecological complexity, and varied climatic and soil conditions. However, much of the flora remains under-collected, with many taxa yet to be discovered. From June 2022 to March 2024, floristic studies were conducted in Bhutan, leading to the discovery of five orchid species not previously recorded in the country: *Bulbophyllum crabro*, *B. rigidum*, *Cymbidium tortisepalum* var. *longibracteatum*, *Galeola cathcartii*, and *Liparis kumokiri*. These species are scientifically documented for the first time in Bhutan. Detailed descriptions, type information, updated global distribution, ecology, and colour plates of the recorded species are provided.

Published in *LANKESTERIANA* 24(2): 205–216. 2024.

DOI: <http://dx.doi.org/10.15517/lank.v24i2.61573>

The first record of *Hemiorchis pantlingii* King (Zingiberaceae) in the flora of Bhutan

~Phub Gyeltshen & Chogyal Tashi

A botanical exploration carried out in Samtse District (south-western Bhutan) in 2019 led to the discovery of the rare perennial herb *Hemiorchis pantlingii*. It was found in shaded areas within a subtropical plantation forest of *Shorea robusta* Gaertn. at an elevation of 386 m. This species differs from *H. rhodorrhachis* in lateral staminodes, with apex $\pm$ truncate, yellow to orange-yellow, but also labellum mid-region distinctly raised with a single broad keel, and apical projection – a single blunt lobe. The plant is assessed as near threatened (NT) under the IUCN Red List categories and criteria.

Published in *Biodiversity: Research and Conservation* 77: 1–5, 2025.

DOI: <http://dx.doi.org/10.14746/biorc.2025.77.1>

New records of flowering plants for the Flora of Bhutan

~Phub Gyeltshen, Kezang Tobgay, Phuentsho Phuentsho, Karma Sangay, Karma D. Dorji,
David Long & Sangay Dema

The present study was designed to assess the diversity of native flora in Bhutan, focusing on collecting specimens for long-term conservation and research. Three exotic and 16 native plant species were confirmed as new records to the Flora of Bhutan: *Achimenes longiflora*, *Biophytum reinwardtii*, *Breynia macrantha*, *Bridelia assamica*, *Burmannia nepalensis*, *Ceropegia khasiana*, *Diospyros lanceifolia*, *Goniothalamus sesquipetalis*, *Gymnocladus assamicus*, *Grewia serrulata*, *Hypericum podocarpoides*, *Ipomoea triloba*, *Lippia alba*, *Melastoma malabathricum*, *Ormosia robusta*, *Peliosanthes maheswariana*, *Phlogacanthus curviflorus*, *Sterculia lanceolata* and *Vincetoxicum belostemma*. These additional findings will enhance our understanding of plant diversity in Bhutan and contribute to advancing botanical knowledge in the region. Brief descriptions, including information on types, phenology, and distribution for each species, are provided to facilitate identification and conservation.

Published in *Korean Journal of Plant Taxonomy* 2025; 55(2): 88-102.

DOI: <https://doi.org/10.11110/kjpt.2025.55.2.88>

New Records of two *Impatiens* species (Balsaminaceae) and updated distribution notes on *Impatiens falcifera* in Bhutan

~Phub Gyeltshen, Pema Tobgay, Kezang Tobgay & Phuentsho Phuentsho

Two species of *Impatiens*, viz., *I. gamblei* Hook.f. and *I. laevigata* Wall. ex Hook.f. & Thomson, are reported here as new additions to the flora of Bhutan. Additionally, the distribution of *I. falcifera* Hook.f. in Bhutan is discussed. *Impatiens falcifera* and *I. gamblei* belong to sect. *Racemosae*, while *I. laevigata* is classified in sect. *Semeiocardium* based on four-carpellate ovary.

Published in *Journal of the Indian Association for Angiosperm Taxonomy* 35(2): 1–8, 2025.

DOI: <https://dx.doi.org/10.22244/rheedea.2025.35.02.01>

Preliminary Findings of Rapid Inventory and Documentation of Traditional Knowledge associated with Biological Resources in Bhutan

~Mani Prasad Nirola, Chencho Dorji, Jamyang Choden, Leki Wangchuk, Choki Gyeltshen, Karma Dema Dorji, Tashi Yangzome Dorji & Kezang Wangchuk

The rapid national inventory and documentation of traditional knowledge associated with biological resources, Education and advocacy programs on the Access and Benefit Sharing (ABS) and Traditional Knowledge (TK) was studied in all 205 *gewogs* in Bhutan. Semi-structured, open-ended questionnaires and audio-visual devices were used to interview the TK holders and collect information. 19,075 people in all 205 *Gewogs* were familiarized with ABS and TK. A total of 789 TK holders were recorded, with the greatest number of participants in the age group (51-60). Around 46 different types of diseases were found to be treated by TK holders and 162 species of medicinal plants in 151 genera and 71 families were recorded, with the family Asteraceae having the highest number of species. The highest number of medicinal plant species had a herb life form, and the lowest were ferns. The most widely practiced preparation methods by TK holders were in the form of paste, sap, powder, decoction and infusion, either administered orally or applied topically. Amongst different plant parts used, the whole plant was most often used.

Published in Biodiversität und Naturlausstattung im Himalaya VIII. - Erfurt 2024

Farming in Protected Areas (PAs) of Bhutan; challenges and mitigation measures taken by farmers

~Kezang Wangchuk, Mani Prasad Nirola, Jamyang Choden, Leki Wangchuk, Pema Lhamo & Tshering Zangmo

In Protected Areas (PAs) of Bhutan, we recorded the farming system practiced by the farmers residing in the PAs, their challenges while farming and the measures they take against the challenges. The study area encompassed eight PAs covering 43 *gewogs*. Semi-commercial and open-ended questionnaires were used to interview the residents of the PAs. We interviewed 254 participants of which 206 were male and 48 were female. The study recorded that the farmers in the PAs practice subsistence farming however, now most of the farmers have ventured into semi-commercial farming. Rice and maize were found to be the main crops grown by the farmers in the PAs and chilies and potatoes were their mainly grown vegetables. As a part of the farming system, livestock was also reared by the farmers in the PAs and Cattle were reported to be the most raised livestock. However, they reported challenges too while farming such as crops damaged by pests and diseases, human-wildlife conflict (livestock and crop depredation by wild animals), and invasive species. For such problems, farmers have taken measures against them which were cultural as well

Published in Biodiversität und Naturlausstattung im Himalaya VIII. - Erfurt 2024

Genomic, climatic, and cultural diversity of maize landraces from the Himalayan Kingdom of Bhutan

~Asta Tamang, Mercy Wairimu Macharia, Leonardo Caproni, Mara Miculan, Svenja Mager,
Jemal Seid Ahmed, Tashi yangzome, Mario Enrico Pe & Matteo Dell'Acqua

Societal Impact Statement

Bhutan is an ancient kingdom in the Himalayan range and one of the most rugged, geodiverse, and mountainous agricultural countries in the world. Historically secluded and geographically isolated, Bhutan is a hotspot for Himalayan agrobiodiversity where small-scale agriculture supports the livelihoods of a large share of the resident population. Here, Bhutanese maize agrobiodiversity is explored to unlock its adaptation potential using genomics and participatory variety selection in combination with climate research. We show that Bhutanese traditional farmers maintain a wealth of diversity that may support the sustainable intensification of maize cropping in the Himalayas and beyond.

Summary

- Bhutan, an ancient kingdom enshrouded in the Himalayas, hosts largely untapped agrobiodiversity that may harness genetic variation useful for adaptation to local climates and user needs.
- Here, we genotyped-by-sequencing 351 pooled samples of local maize (*Zea mays* L.) landraces, the entire collection of the Bhutan National Gene Bank, comparing their genomic diversity with maize from other countries in the Himalayan range. We reconstructed the adaptation of Bhutanese maize to historical and projected climates, identifying areas of future maladaptation. We then run a common garden experiment involving local smallholder farmers in a participatory evaluation of landraces' performance, aiming at the identification of quantitative trait nucleotides (QTNs) contributing to adaptation, performance, and farmers' choice.
- We found that Bhutanese maize agrobiodiversity is unique in the Himalayan range, and a locus on Chromosome 5 supports the differentiation of three distinct genetic clusters. We found that a portion of current genomic diversity can be associated with the Bhutanese landscape and that maize cultivation in the southwest of the country may be negatively impacted by projected climates. We also found that Bhutanese maize agrobiodiversity is large and may contribute to adaptation and improvement. A genome-wide association study identified 117 QTNs for climatic adaptation, agronomic performance, and farmers' preferences.
- Our results show that Bhutanese maize landraces are a unique source of genetic agrobiodiversity for local adaptation. We found that the integration of genomics, climate science, and participatory methods can speed up the identification of genetic factors contributing to the sustainable intensification of maize cultivation in the Himalayas and beyond.

DOI: 10.1002/ppp3.10513

ANNEXURES



Annexure 1: Samples collected from Shompangkha and Gakidling Gewogs

Sl. No.	Crop Name	Local Name	Variety Name	Scientific Name
01	Black gram	Dal	Dal Changlo	<i>Vigna mungo</i>
02	Rice bean	Singye	Singye	<i>Vigna umbellata</i>
03	Cow peas	Nangmay	Nangmay	<i>Vigna unguiculata</i>
04	Bean	Bori	Gew bori	<i>Phaseolus vulgaris</i>
05	Rice bean	Dal	Pahelo dal	<i>Vigna umbellate</i>
06	Bean	Bori	Dulal bori	<i>Phaseolus vulgaris</i>
07	Sweet buckwheat	Faphar	Methray faphar	<i>Fagopyrum esculentum</i>
08	Finger millet	Kodo	Rato kodo	<i>Eleusine coracana</i>
09	Mustard	Tori	Sheto tori	<i>Brassica juncea</i>
10	Popcorn	Makai	Murali makai	<i>Zea mays</i>
11	Paddy	Dhan	Rato mama	<i>Oryza sativa</i>
12	Paddy	Dhan	Mashino dhan	<i>Oryza sativa</i>
13	Paddy	Dhan	Sheto mama	<i>Oryza sativa</i>
14	Paddy	Dhan	Chota bhog dhan	<i>Oryza sativa</i>
15	Paddy	Dhan	Mansure	<i>Oryza sativa</i>
16	Bean	Bori	Dulal bori	<i>Phaseolus vulgaris</i>
17	Bean	Bori	Gew bori	<i>Phaseolus vulgaris</i>
18	Bean	Bori	Kanchi bori	<i>Phaseolus vulgaris</i>
19	Sorghum	Junailo	Junailo	<i>Sorghum bicolor</i>
20	Maize	Makai	Paheli makai	<i>Zea mays</i>
21	Finger millet	Kodo	Kali kodo	<i>Eleusine coracana</i>
22	Bean	Bori	Pothray bori	<i>Phaseolus vulgaris</i>
23	Mustard	Tori	Kalo tori	<i>Brassica juncea</i>
24	Perilla	Silam	Kalo silam	<i>Perilla frutescens</i>
25	Black gram	Dal	Kalo dal	<i>Vigna mungo</i>
26	Mustard	Tori	Sorshong tori	<i>Synapsis alba</i>
27	Mung bean	Dal	Pahelo dal	<i>Vigna radiata</i>
28	Pigeon pea	Dal	Rori dal	<i>Cajanus cajan</i>
29	Paddy	Dhan	Dikur 11	<i>Oryza sativa</i>
30	Paddy	Dhan	Timburay	<i>Oryza sativa</i>
31	Paddy	Dhan	Choto mashino	<i>Oryza sativa</i>
32	Bean	Bori	Dulal bori	<i>Phaseolus vulgaris</i>
33	Paddy	Dhan	Kalo tura	<i>Oryza sativa</i>
34	Paddy	Dhan	Ranjit dhan	<i>Oryza sativa</i>
35	Mung bean	Dal	Pailo dal	<i>Vigna radiata</i>

Annexure 2: Samples collected from Gomdar, Wangphu, Orong and Phuntsohang Gewogs

1. Gewog: Gomdar			
Crop	No. of Seed Samples Collected	No. of Varieties	Remarks
Maize	7	2	3 Popcorn and 4 flint
Barley	4	2	3 naked and 1 covered
Oat	1	1	
Finger millet	3	2	2 closed head and 1 open head
Amaranth	1	1	
Bean	13	3	5 dwarf and 7 indeterminate/climber, 1 lablab
Buckwheat	4	2	Sweet: 2 Bitter; 2
Cowpeas	2	2	Black and yellow grains
Rice bean	3	3	Different colours
Sorghum	1	1	
Mustard	5	3	1 sample Janapatse, 2 memser, 1 memba changlo
Pea	2	2	Stringy and stringless pods
Pumpkin	2	2	Wa brumsha and Dangpo brumsha
Chilli	2	2	Orongpa and Zurka
Cucumber	2	2	Mumphung tukuli and Jamdar Mumphung
Leek	2	2	Pressure la (Single bulb and multiple bulbs)
Tamarillo	1	1	
Radish	1	1	
Perilla	2	2	White and black
	58	36	

2. Gewog: Wangphu			
Crop	No. of Seed samples collected	No. of varieties	Remarks
Paddy (upland)	1	1	Sambara
Maize	6	2	1 pop and 7 flint
Barley	3	2	2 naked and 1 closed
Buckwheat	3	2	1 Bitter and 2 Sweet
Amaranth	1	1	
Sorghum	1	1	
Foxtail millet	2	1	
Finger millet	1	1	
Cowpea	1	1	
Rice bean	4	4	Different seed coat colour
Pigeon pea	1	1	
Soyabean	1	1	

Bean	11	2	5 dwarf and 6 indeterminate
Pea	2	2	
Chilli	3	1	
Cucumber	2	1	
Garlic	1	1	
Mustard	1	1	
Perilla	2	1	
Potato	2	2	
Pumpkin	2	2	
	51	31	

3. Gewog: Orong			
Crop	No. of Seed sample collected	No. of varieties	Remarks
Upland paddy	2	1	Dryland and wet land
Sweet Buckwheat	3	1	
Perilla frutescens	3	2	2 black seed coat and 1 white
Rice bean	13	9	Different coloured seed coats
Bean	12	12	Dwarf 5, indeterminate 7, different coloured seed coat
Maize	4	1	1 popcorn, 3 flint type different colour grains
Pea	1	1	
Chilli	1	1	
Cow pea	3	1	
Mustard	2	1	1 leafy and 1 yellow seeds
Little millet	3	1	
Foxtail millet	8	5	Different local names
Quinoa	1	1	
Finger millet	3	2	Open and closed heads
Mustard green	2	1	1 Considered unique
Sorghum	1	1	
Barley	4	2	2 naked
Bitter Buckwheat	1	1	
Pumpkin	1	1	
Soya bean	3	2	white and black seed coat
Pea	2	2	Stringy and non-stringy pods
Oat	1	1	
	74	50	

4. Gewog: Phuntshothang			
Crop	No. of Seed samples collected	No. of varieties	Remarks
Paddy	10	10	
Sweet Buckwheat	1	1	
Perilla	1	1	
Rice bean	3	3	
Bean	4	2	1 winged bean
Horse gram	2	1	
Maize	1	1	
Chilli	1	1	
Cow pea	1	1	
Mustard green	1	1	Tall and healthy plant
Foxtail millet	1	1	
Quinoa	1	1	
Finger millet	2	2	
Sorghum	1	1	
Bottle gourd	1	1	
Pumpkin	1	1	
Soya bean	1	1	
Turmeric	1	1	
Sesame	1	1	
Linseed	1	1	
Niger	1	1	
	37	32	

Annexure 3: Species diversity and varietal diversity with No. of participants in the three *Gewogs* of Tsirang *Dzongkhag*

Sl. No.	Gewog	Species Diversity	Varietal Diversity	No. Participants (Farmers)	
				Male	Female
1	Tsirang Toed	48	112	22	11
2	Goserling	57	135	20	10
3	Sergithang	55	163	24	8

Annexure 4: Species diversity and varietal diversity with no. of participants in the five *Gewogs* of Sarpang *Dzongkhag*

Sl. No.	Gewog	Species Diversity	Varietal Diversity	No. of participants (Farmers)	
				Male	Female
1	Gelephu	45	119	19	9
2	Sametelling	66	132	10	16
3	Chudzom	55	135	16	4
4	Dekiling	68	150	23	8
5	Sengye	44	92	9	6

A total of 29 varieties of cereals,pulses and beans were collected from these five *Gewogs*

Sl. No.	Crop Name	Local Name	Variety name	Place of collections
1	Maize (<i>Zea mays.</i>)	Makai	Payilo Makai	Pelrithang Khatae
			Payilo Makai	Samtelling
2	Paddy (<i>Oryza sativa</i>)	Dhan	Mama	Pelrithang Khatae
			Ranjeet	Pelrithang Khatae
			Shaeto Masino	Pelrithang Khatae
			Agumsali	Mendrelgang
			Champha	Mendrelgang
			Mongshirae Masino	Mendrelgang
			Phowdae	Dolongang
			Katikay Masino	Dolongang
			Choti	Lapsakha
			Jhabki	Samtenling
			Sarki	Samtelling
			Khampi	Samtelling
3	Beans (<i>Phaseolus</i> Sp.)	Bore	Dulal Bore	Pelrithang Khamae
			Gew Bore	Pelrithang Khamae
			Chirbirae Bore	Pelrithang Khamae
			Thangrae Bore	Dzomlingthang Khamae
			Pothina Bore	Dzomlingthang
			Bore	Sariphu
4	Buckwheat (<i>Fagopyrum</i> Sp.)	Phafer	Mithae Phafer	Dzomlingthang, Dolongang and Lapsakha
			Titae Phafer	Dolonggang
5	Mustard (<i>Brassica</i> sp.)	Tori	Kopi Tori	Dzomlingthang
6	Niger (<i>Guizotia abyssinica</i>)	Philingay	Philingay	Dolonggang
7	Finger millet (<i>Eleusine coracana</i>)	Kodo	Payilo Kodo	Yarphelling
			Murkay Kodo	Samtelling
8	Pulses/Grams	Mosham (<i>Vigna</i> sp.)	Mosham	Yarphelling
		Black gram/Kalo dal	Kalo dal	Samtelling
		Horse gram	Gahat	Sariphu, Samtelling

Annexure 5: Collections from Togto Gom village of Bongo Gewog

Sl. No.	Crop Name	Local Name	Varieties	Scientific Name
01	Finger millet	Memja	Gurum	<i>Eleusine coracana</i>
02	Bitter buckwheat	Bjoo	Bjoo	<i>Fagopyrum tartaricum</i>
03	Bean	Semchu	Semchu naap	<i>Phaseolus vulgaris</i>
04	Amaranth	laem	laem	<i>Amaranthus hybridus L.</i>
05	Coriander	Yoesey	Yoesey	<i>Coriandrum sativum</i>
06	Maize	Geza	Geza Sep	<i>Zea mays</i>
07	Maize	Geza	Geza Sep	<i>Zea mays</i>
08	Wheat	Kaa	Kaa	<i>Triticum aestivum</i>
09	Finger Millet	Memja	Gurum	<i>Eleusine coracana</i>
10	Pea	Boesem	Boesem	<i>Pisum sativum</i>
11	Cucumber	Gen	Gen	<i>Cucumis sativu</i>
12	Sweet Buckwheat	Geray	Geray	<i>Fagopyrum esculentum</i>
13	Bean	Semchu	Semchu Kaap	<i>Phaseolus vulgaris</i>
14	Amaranth	laem	laem	<i>Amaranthus hybrudus L.</i>
15	Bitter Buckwheat	Bjoo	Bjoo	<i>Fagopyrum tartaricum</i>
16	Wheat	Kaa	Kaa	<i>Triticum aestivum</i>
17	Bean	Semchu	Semchu bokthrom	<i>Phaseolus vulgaris</i>
18	Maize	Geza	Geza	<i>Zea mays</i>
19	Pea	Boesem	Boesem	<i>Pisum sativum</i>
20	Mustard green	Dye	Dye	<i>Brassica juncea</i>
21	Turnip	Yundo	Yundo	<i>Brassica rapa</i>
22	Paddy	Jaa	Kamja	<i>Oryza sativa</i>
23	Maize	Geza	Geza	<i>Zea mays</i>
24	Pumpkin	Kakur	Chukakur	<i>Cucurbita maxima</i>

Annexure 6: Collections from Sarpang Dzongkhag

SL. No.	Crop Name	Local Name	Varieties Name	Scientific Name	Gewog
01	Paddy	Dhan	Mashino dhan	<i>Oryza sativa</i>	Tareythang
02	Mustard	Tori	Tori	<i>Brassica juncea</i>	Tareythang
03	Cow pea	Bore	Yundai bori	<i>Phaseolus vulgaris</i>	Tareythang
04	Mungbean	Dal	Pailo dal	<i>Vigna radiata</i>	Tareythang
05	Snakegourd	Chichindra	Chinchindra	<i>Trichosanthes cucurmerina</i>	Tareythang
06	Maize	Makai	Rato makai	<i>Zea mays</i>	Tareythang
07	Sorghum	Junailo	Junailo	<i>Sorghum bicolor</i>	Tareythang
08	Finger millet	Kodo	Junkay kodo	<i>Eleusine coracana</i>	Tareythang
09	Finger millet	Kodo	Murkay kodo	<i>Eleusine coracana</i>	Tareythang
10	Bean	Bore	Dulal bori	<i>Phaseolus vulgaris</i>	Tareythang
11	Chilli	Khorsani	Sailai Khorsani	<i>Capsicum annum</i>	Tareythang
12	Brinjal	Baigun	Baugun syano	<i>Solanum melongena</i>	Tareythang
13	Pumpkin	Pharsay	Hajayray pharsay	<i>Cucumis maxima</i>	Tareythang
14	Lablab bean	Karagai	Karagai shemei	<i>Lablab purpureus</i>	Tareythang
15	Ash gourd	Kubendra	Kubendra	<i>Benincasa hispida</i>	Tareythang
16	Popcorn	Makai	Murali makai	<i>Zea mays</i>	Tareythang
17	Horsegram	Gauhat	Gauhat	<i>Macrotyloma uniflorum</i>	Tareythang
18	Blackgram	Dal	Phusra dal	<i>Vigna mungo</i>	Tareythang
19	Bean	Bore	Kawshey shebi	<i>Phaseolus vulgaris</i>	Tareythang
20	Foxtail millet	Kaguni	Kaguni	<i>Setaria italica</i>	Tareythang
21	Finger millet	Kodo	Sheto kodo	<i>Eleusine coracana</i>	Tareythang
22	Maize	Makai	Paile makai	<i>Zea mays</i>	Tareythang
23	Mungbean	Dal	Pailo dal	<i>Vigna radiata</i>	Tareythang
24	Rice bean	Mosham	Mosham	<i>Vigna umbellata</i>	Tareythang
25	Sorghum	Junailo	Junailo	<i>Sorghum bicolor</i>	Tareythang
26	Pigeon pea	Rori	Sheto rori	<i>Cajanus cajan</i>	Tareythang
27	Rice bean	Masham	Masham	<i>Vigna umbellata</i>	Tareythang
28	Bean	Bore	Kawshey bori	<i>Phaseolus vulgaris</i>	Tareythang
29	Rice bean	Banmara	Banmara	<i>Vigna umbellata</i>	Tareythang
30	Bean	Bore	Dulal bori	<i>Phaseolus vulgaris</i>	Tareythang
31	Soya bean	Badmus	Sheto badmus	<i>Glycine max</i>	Tareythang
32	Pigeon pea	Rari dal	Rato raridal	<i>Cajanus cajan</i>	Tareythang
33	Cowpea	Bore	Majay bori	<i>Vigna unguiculata</i>	Tareythang
34	Chilli	Khorsani	Tharay khorsani	<i>Capsicum annum</i>	Tareythang
35	Horsegram	Gauhat	Gauhat	<i>Macrotyloma uniflorum</i>	Tareythang
36	Perilla	Silam	Silum	<i>Perilla frutencens</i>	Tareythang
37	Bottle gourd	Chindo	Chindo	<i>Lagenaria siceraria</i>	Tareythang
38	Bitter gourd	Kaurila	Kaurila	<i>Momordica charantia</i>	Tareythang

39	Bean	Bore	Katikay bori	<i>Phaseolus vulgaris</i>	Tareythang
40	Solanum sp	Khalangje	Khalangje	<i>Solanum sp.</i>	Tareythang
41	Paddy	Bara	Sungsung bara	<i>Oryza sativa</i>	Tareythang
42	Paddy	Bara	Khamtey	<i>Oryza sativa</i>	Umling
43	Finger millet	Kongpo	Pratala kongpo	<i>Eleusine coracana</i>	Umling
44	Maize	Asham	Asham	<i>Zea mays</i>	Umling
45	Bitter gourd	Khala	Khala	<i>Fagopyrum tataricum</i>	Umling
46	Pigeon pea	Dal	Dal	<i>Cajanus cajan</i>	Umling
47	Paddy	Ray	Khamtey red	<i>Oryza sativa</i>	Umling
48	Paddy	Ray	Bhur kamja	<i>Oryza sativa</i>	Umling
49	Paddy	Ray	Attay	<i>Oryza sativa</i>	Umling
50	Coriander	Yoesey	Yoesey	<i>Coriandrum sativum</i>	Umling
51	Bean	Bore	Pothoray bori	<i>Phaseolus vulgaris</i>	Umling
52	Pumpkin	Kakur	Kakur	<i>Cucumis maxima</i>	Umling
53	Chilli	Ema	Ema kaap	<i>Capsicum annum</i>	Umling
54	Finger millet	Kongpo	Kongpo	<i>Eleusine coracana</i>	Umling
55	Paddy	Bara	Kamja	<i>Oryza sativa</i>	Umling
56	Paddy	Mashino	Chotay Mashino	<i>Oryza sativa</i>	Umling
57	Foxtail millet	Yangra	Yangra chema	<i>Setaria italica</i>	Umling
58	Maize	Asham	Warong ashram	<i>Zea mays</i>	Umling
59	Rice bean	Singgye	Singye balingmei	<i>Vigna umbellata</i>	Umling
60	Adzuki bean	Shakpu	Shakpu tsalo	<i>Vigna angularis</i>	Umling
61	Lablab bean	Oray	Patang oray	<i>Lablab purpureus</i>	Umling
62	Finger millet	Kongpo	Mutamo kongpo	<i>Eleusine coracana</i>	Umling
63	Bean	Oray	Bumthangpa oray	<i>Phaseolus vulgaris</i>	Umling
64	Finger millet	Kongpo	Pratala kongpo	<i>Eleusine coracana</i>	Umling
65	Lablab bean	Oray	Patang oray	<i>Lablab purpureus</i>	Umling
66	Paddy	Bara	Kamja	<i>Oryza sativa</i>	Chhuzanggang
67	Bean	Oray	Brokpaling oray	<i>Phaseolus vulgaris</i>	Chhuzanggang
68	Bean	Oray	Bobbok oray	<i>Phaseolus vulgaris</i>	Chhuzanggang
69	Cowpea	Oray	Nangmai	<i>Vigna unguiculata</i>	Chhuzanggang
70	Ricebean	Shingey	Shingey	<i>Vigna umbellata</i>	Chhuzanggang
71	Maize	Asham	Asham	<i>Asham daza</i>	Chhuzanggang
72	Mungbean	Shingye	Shingye	<i>Vigna radiata</i>	Chhuzanggang
73	Paddy	Bara	Tsirang zam	<i>Oryza sativa</i>	Chhuzanggang
74	Mungbean	Dali	Dali	<i>Vigna radiata</i>	Chhuzanggang
75	Okra	Bindi	Bindi	<i>Abelmoshus esculenta</i>	Chhuzanggang
76	Paddy	Bara	Khamtey	<i>Oryza sativa</i>	Chhuzanggang
77	Paddy	Bara	Bangtar khamtey	<i>Oryza sativa</i>	Chhuzanggang
78	Finger millet	Kongpo	Pratala kongpo	<i>Eleusine coracana</i>	Chhuzanggang
79	Paddy	Bara	Diku-11	<i>Oryza sativa</i>	Chhuzanggang

80	Paddy	Bara	Agam salay	<i>Oryza sativa</i>	Chhuzanggang
81	Perilla	Nam	Nam changloo	<i>Perilla frutescens</i>	Chhuzanggang
82	Maize	Asham	Asham	<i>Zea mays</i>	Chhuzanggang
83	Paddy	Dhan	Ranjit dhan	<i>Oryza sativa</i>	Chhuzanggang
84	Paddy	Dhan	Dorkhay dhan	<i>Oryza sativa</i>	Chhuzanggang
85	Paddy	Dhan	Kali bhog dhan	<i>Oryza sativa</i>	Chhuzanggang
86	Rice bean	Singye	Singye	<i>Vigna umbellata</i>	Chhuzanggang
87	Sweet buckwheat	Guntsung	Guntsung	<i>Fagopyrum esculentum</i>	Chhuzanggang
88	Paddy	Mashino	Choti mashino	<i>Oryza sativa</i>	Chhuzanggang
89	Soya bean	Badmus	Kalo badmus	<i>Glycine max</i>	Chhuzanggang
90	Chilli	Khorsani	Thray khursani	<i>Capsicum annum</i>	Sershong
91	Tomato	Lambenda	Lambenda chungku	<i>Solanum Lycopersicum</i>	Sershong
92	Paddy	Khamtey	Khamtey (White)	<i>Oryza sativa</i>	Sershong
93	Paddy	Bara	Maule	<i>Oryza sativa</i>	Sershong
94	Finger millet	Kongpo	Pratala kongpo	<i>Eleusine coracana</i>	Sershong
95	Chilli	Ema	Ema Naap	<i>Capsicum annum</i>	Sershong
96	Paddy	Bara	Musali	<i>Oryza sativa</i>	Sershong
97	Lab lab bean	Gamashey	Gamashey hem	<i>Phaseolus vulgaris</i>	Sershong
98	Mungbean	Dal	Dal	<i>Phaseolus vulgaris</i>	Sershong
99	Soya bean	Lebe	Lebe	<i>Phaseolus vulgaris</i>	Sershong
100	Paddy	Mauli	Mauli	<i>Oryza sativa</i>	Sershong
101	Cowpea	Bore	Tunay bori	<i>Vigna unguiculata</i>	Sershong
102	Paddy	Dhan	Agamsali dhan	<i>Oryza sativa</i>	Sershong
103	Mungbean	Dal	Pailo dal	<i>Vigna radiata</i>	Sershong
104	Bean	Bore	Thangray bori	<i>Phaseolus vulgaris</i>	Sershong
105	Cowpea	Bore	Katikay bori	<i>Vigna unguiculata</i>	Sershong
106	Bean	Bore	Tunay bori	<i>Phaseolus vulgaris</i>	Sershong
107	Sesame	Til	Til (white)	<i>Sesamum indicum</i>	Sershong
108	Sesame	Til	Til (black)	<i>Sesamum indicum</i>	Sershong
109	Finger millet	Kodo	Murkay kodo	<i>Eleusine coracana</i>	Sershong
110	Hyacinth bean (Lablab)	Bore	Shebi	<i>Lablab purpureus</i>	Sershong
111	Brinjal	Baigun	Undra baigun	<i>Solanum melongena</i>	Sershong
112	Maize	Makai	Makai	<i>Zea mays</i>	Sershong
113	Bean	Bore	Bore	<i>Phaseolus vulgaris</i>	Sershong
114	Kidney bean	Bore	Bore	<i>Phaseolus vulgaris</i>	Sershong
115	Soya bean	Badmus	Sheto badmus	<i>Glycine max</i>	Sershong
116	Bean	Bore	Gew bori	<i>Phaseolus vulgaris</i>	Sershong
117	Bean	Bore	Paile bori	<i>Phaseolus vulgaris</i>	Jigmecholing

118	Bean	Bore	Duday bori	<i>Phaseolus vulgaris</i>	Jigmecholing
119	Bean	Bore	Dulal bori	<i>Phaseolus vulgaris</i>	Jigmecholing
120	Crow beak	Olachoto	Olachoto	<i>Cyclanthera pedata</i>	Jigmecholing
121	Mustard green	Saag	Saag	<i>Brassica juncea</i>	Jigmecholing
122	Mustard	Tori	Kalo tori	<i>Brassica juncea</i>	Jigmecholing
123	Tamarillo	Golbera	Shingi lambenda	<i>Solanum betaceum</i>	Jigmecholing
124	Pumpkin	Pharsey	Hajarey Pharsey	<i>Cucurbita maxima</i>	Jigmecholing
125	Bean	Bore	Pothoray bori	<i>Phaseolus vulgaris</i>	Jigmecholing
126	Maize	Makai	Palio makai	<i>Zea mays</i>	Jigmecholing
127	Maize	Makai	Rato makai	<i>Zea mays</i>	Jigmecholing
128	Sweet buckwheat	Fapher	Methray fapher	<i>Fagopyrum esculentum</i>	Jigmecholing
129	Maize	Asham	Asham changlo	<i>Zea mays</i>	Jigmecholing
130	Maize	Makai	Sheti makai	<i>Zea mays</i>	Jigmecholing
131	Popcorn	Makai	Murali makai	<i>Zea mays</i>	Jigmecholing
132	Soya bean	Badmus	Sheto badmus	<i>Glycine max</i>	Jigmecholing
133	Lab lab bean	Shebi	Latay subi	<i>Lab lab purpureus</i>	Jigmecholing
134	Chilli	Dally	Dally khursani	<i>Capsicum annum</i>	Jigmecholing
135	Finger millet	Kodo	Junkay kodo	<i>Elesusine coracana</i>	Jigmecholing
136	Soya bean	Badmus	Sheto badmus	<i>Glycine max</i>	Jigmecholing
137	Pigeon pea	Dal	Rari dal	<i>Cajanus cajan</i>	Jigmecholing
138	Mustard green	Sounp	Sounp	<i>Brassica sp.</i>	Jigmecholing
139	Gourd	Chichindra	Chichindra	<i>Cucurbita sp.</i>	Jigmecholing
140	Garden cress	Changsur	Changsur	<i>Lepidium sativum L.</i>	Jigmecholing
141	Paddy	Dhan	Sanu mashino	<i>Oryza sativa</i>	Jigmecholing
142	Paddy	Dhan	Dorakhay dhan	<i>Oryza sativa</i>	Jigmecholing
143	Gourd	Lauka	Lauka	<i>Cucurbita sp.</i>	Jigmecholing
144	Black gram	Dal	Kalo dal	<i>Vigna mungo</i>	Jigmecholing
145	Pumpkin	Pumpkin	Pharsey	<i>Cucurbita sp.</i>	Jigmecholing
146	Rice bean	Masham	Masham	<i>Vigna umbellata</i>	Jigmecholing
147	Paddy	Dhan	Kalo dhan	<i>Oryza sativa</i>	Jigmecholing
148	Bean	Bore	Bore	<i>Phaseolus vulgaris</i>	Jigmecholing
149	Maize	Makai	Pailo makai	<i>Zea mays</i>	Jigmecholing
150	Paddy	Dhan	Mashino dhan	<i>Oryza sativa</i>	Jigmecholing
151	Mustard	Tori	Kalo tori	<i>Brassica juncea</i>	Jigmecholing
152	Coriander	Dhanya	Dhanya	<i>Coriandrum sativum</i>	Jigmecholing
153	Chilli	Khursani	Kalo thrarase	<i>Capsicum annum</i>	Gelephu
154	Maize	Asham	Asham tsalo	<i>Zea mays</i>	Gelephu
155	Finger millet	Kongpo	Mutamo kongpo	<i>Zea mays</i>	Gelephu
156	Mustard	Tori	Kalo tori	<i>Brassica juncea</i>	Samtelling
157	Bean	Bore	Kanchi bori	<i>Phaseolus vulgaris</i>	Samtelling

158	Sweet buckwheat	Faphar	Mithray faphar	<i>Fagorum esculentum</i>	Samtelling
159	Paddy	Dhan	Ranjeet	<i>Oryza sativa</i>	Samtelling
160	Bean	Bore	Kanchi bori	<i>Phaseolus vulgaris</i>	Samtelling
161	Soya bean	Badmus	Sheto badmus	<i>Glycine max</i>	Samtelling
162	Mung bean	Dal	Pailo dal	<i>Vigna radiata</i>	Samtelling
163	Rice bean	Mashem	Mashem	<i>Vigna umbellata</i>	Samtelling
164	Kidney bean	Bore	Dulal bori	<i>Phaseolus vulgaris</i>	Samtelling
165	Black gram	Dal	Kalo dal	<i>Vigna mungo</i>	Samtelling
166	Soya bean	Badmus	Sheto badmus	<i>Glycine max</i>	Samtelling
167	Maize	Makai	Pailo makai	<i>Zea mays</i>	Samtelling
168	Paddy	Dhan	Mama	<i>Oryza sativa</i>	Samtelling
169	Paddy	Dhan	Champa dhan	<i>Oryza sativa</i>	Samtelling
170	Paddy	Dhan	Kalo dhan	<i>Oryza sativa</i>	Samtelling
171	Paddy	Dhan	Kalo jeera dhan	<i>Oryza sativa</i>	Samtelling
172	Mung bean	Dal	Paile dal	<i>Vigna radiata</i>	Samtelling
173	Paddy	Dhan	Choti mashino	<i>Oryza sativa</i>	Samtelling
174	Paddy	Dhan	Jabki dhan	<i>Oryza sativa</i>	Samtelling
175	Finger millet	Kodo	Fangray kodo	<i>Eleusine coracana</i>	Samtelling
176	Paddy	Mama	Rato mama	<i>Oryza sativa</i>	Samtelling
177	Paddy	Bara	Agumsale	<i>Oryza sativa</i>	Samtelling
178	Bean	Oray	Oray tsalo	<i>Phaseolus vulgaris</i>	Samtelling
179	Rice bean	Singye	Singye katang	<i>Vigna umbellata</i>	Samtelling
180	Maize	Ashom	Ashom tsalo	<i>Zea mays</i>	Samtelling
181	Black gram	Shakpu	Shakpu	<i>Vigna mungo</i>	Samtelling
182	Pigeon pea	Dal	Rari dal	<i>Cajanus cajan</i>	Dekiling
183	Finger millet	Kodo	Sheto kodo	<i>Eleusine coracana</i>	Dekiling
184	Black gram	Dal	Kalo dal	<i>Vigna mungo</i>	Dekiling
185	Finger millet	Kodo	Tharay kodo	<i>Eleusine coracana</i>	Dekiling
186	Finger millet	Kodo	Murkay Kodo	<i>Eleusine coracana</i>	Dekiling
187	Bitter buckwheat	Faphar	Tithay faphar	<i>Fagopyrum esculentum</i>	Dekiling
188	Sweet buckwheat	Faphar	Methray faphar	<i>Fagopyrum esculentum</i>	Dekiling
189	Paddy	Dhan	Mashino dhan	<i>Oryza sativa</i>	Dekiling
190	Paddy	Dhan	Basmati	<i>Oryza sativa</i>	Dekiling
191	Soya bean	Badmus	Badmus	<i>Glycine max</i>	Dekiling
192	Mustard	Tori	Tori	<i>Brassica juncea</i>	Dekiling
193	Bean	Bore	Dulal bori	<i>Phaseolus vulgaris</i>	Dekiling
194	Pumpkin	Pharsey	Parai pharsey	<i>Cucurbita maxima</i>	Dekiling
195	Cucumber	Kakra	Thrulo kakra	<i>Cucumis sativus L.</i>	Dekiling
196	Gourd	Chichindra	Chichindra	<i>Cucurbita sp.</i>	Dekiling
197	Bitter gourd(white)	Karila	Sheto karila	<i>Mordica charantia L.</i>	Dekiling

198	Pumpkin	Pharsey	Hajarey pharsey	<i>Cucurbita maxima</i>	Dekiling
199	Paddy	Dhan	Dhan	<i>Oryza sativa</i>	Dekiling
200	Paddy	Dhan	Agumsali dhan	<i>Oryza sativa</i>	Dekiling
201	Bean	Bore	Tunay bori	<i>Phaseolus vulgaris</i>	Dekiling
202	Mustard green	Saag	Kalo saag	<i>Brassica juncea</i>	Dekiling
203	Mungbean	Dal	Paile dal	<i>Vigna radiata</i>	Dekiling
204	Soya bean	Badmus	Sheto badmus	<i>Glycine max</i>	Dekiling
205	Foxtail millet	Yangra	Chama yangra	<i>Setaria italica</i>	Dekiling
206	Finger millet	Kongpo	Pratala kongpo	<i>Eleusine coracana</i>	Dekiling
207	Bean	Oray	Oray	<i>Phaseolus vulgaris</i>	Dekiling
208	Paddy	Bara	Sibsoo	<i>Oryza sativa</i>	Dekiling
209	Bitter buckwheat	Khala	Khala	<i>Fagopyrum tartaricum</i>	Dekiling
210	Maize	Makai	Murali makai	<i>Zea mays</i>	Chhudzom
211	Bean	Bore	Dulal bori	<i>Phaseolus vulgaris</i>	Chhudzom
212	Bitter buckwheat	Faphar	Tithay faphar	<i>Fagopyrum tartaricum</i>	Chhudzom
213	Rice bean	Banmara	Banmara	<i>Vigna umbellata</i>	Chhudzom
214	Paddy	Dhan	Kalo dhan	<i>Oryza sativa</i>	Chhudzom
215	Pumpkin	Pharsey	Pharsey	<i>Cucurbita sp.</i>	Chhudzom
216	Soya bean	Badmus	Kalo badmus	<i>Glycine max</i>	Chhudzom
217	Mustard green	Saag	Rai saag	<i>Brassica juncea</i>	Chhudzom
218	Bean	Semi	Karangay semi	<i>Phaseolus vulgaris</i>	Chhudzom
219	Chilli	Khorsani	Dally khorsani	<i>Capsicum annum</i>	Chhudzom
220	Mustard	Tori	Kalo tori	<i>Brassica juncea</i>	Chhudzom
221	Bean	Bore	Kanchi bori	<i>Phaseolus vulgaris</i>	Chhudzom
222	Finger millet	Kodo	Sheto kodo	<i>Eleusine coracana</i>	Chhudzom
223	Sweet buckwheat	Faphar	Mithray faphar	<i>Fagopyrum esculentum</i>	Chhudzom
224	Black gram	Dal	Kalo dal	<i>Vigna mungo</i>	Chhudzom
225	Mustard	Tori	Kalo tori	<i>Brassica juncea</i>	Chhudzom
226	Paddy	Dhan	Mashino dhan	<i>Oryza sativa</i>	Chhudzom
227	Maize	Makai	Kalo makai	<i>Zea mays</i>	Chhudzom
228	Sorghum	Junailo	Junailo (Sheto)	<i>Sorghum bicolor</i>	Chhudzom
229	Sorghum	Junailo	Junailo (Rato)	<i>Sorghum bicolor</i>	Chhudzom
230	Paddy	Dhan	Khudungay	<i>Oryza sativa</i>	Chhudzom
231	Finger millet	Kodo	Dally kodo	<i>Eleusine coracana</i>	Chhudzom
232	Maize	Makai	Sheti makai	<i>Zea mays</i>	Chhudzom
233	Paddy	Dhan	Sukhumay dhan	<i>Oryza sativa</i>	Chhudzom
234	Maize	Makai	Sheti makai	<i>Zea mays</i>	Shompangkha
235	Wheat	Gown	Gown	<i>Triticum aestivum</i>	Shompangkha
236	Soya bean	Badmus	Kalo badmus	<i>Glycine max</i>	Shompangkha
237	Soya bean	Badmus	Sheto badmus	<i>Glycine max</i>	Shompangkha
238	Mustard	Tori	Kalo tori	<i>Brassica juncea</i>	Shompangkha
239	Black gram	Dal	Kalo dal	<i>Vigna mungo</i>	Shompangkha

240	Sorghum	Junailo	Junailo	<i>Sorghum bicolor</i>	Shompangkha
241	Mung bean	Dal	Pailo dal	<i>Vigna raidata</i>	Shompangkha
242	Finger millet	Kodo	Rato kodo	<i>Eleusine coracana</i>	Shompangkha
243	Bean	Bore	Bore	<i>Phaseolus vulgaris</i>	Shompangkha
244	Maize	Makai	Pailo makai	<i>Zea mays</i>	Shompangkha
245	Paddy	Dhan	SM dhan	<i>Oryza sativa</i>	Senggey
246	Finger millet	Kodo	Bagney kodo	<i>Eleusine coracana</i>	Senggey
247	Cowpea	Bore	Majay bori	<i>Vigna uguiculata</i>	Senggey
248	Mung bean	Dal	Pailo dal	<i>Vigna radiata</i>	Senggey
249	Maize	Makai	Makai	<i>Zea mays</i>	Senggey
250	Mustard	Tori	Kalo tori	<i>Brassica juncea</i>	Senggey
251	Mustard green	Soup	Soup	<i>Brassica sp.</i>	Senggey
252	Bean	Bore	Makai bori	<i>Phaseolus vulgaris</i>	Senggey
253	Niger	Phelingay	Phelingay	<i>Guizotia abyssinica</i>	Senggey
254	Horsegram	Gauhat	Gauhat	<i>Macrotyloma uniflorum</i>	Senggey
255	Finger millet	Kodo	Kalo kodo	<i>Eleusine coracana</i>	Senggey
256	Sesame	Til	Til (Black)	<i>Sesamum indicum</i>	Senggey
257	Mustard	Peka	Peka	<i>Brassica juncea</i>	Senggey
258	Soya bean	Sem	Sem	<i>Glycine max</i>	Senggey
259	Finger millet	Memja	Memja	<i>Eleusine coracana</i>	Senggey
260	Paddy	Dhan	Ranjeet	<i>Oryza sativa</i>	Senggey
261	Paddy	Dhan	Choti dhan	<i>Oryza sativa</i>	Senggey
262	Paddy	Dhan	Kalo dhan	<i>Oryza sativa</i>	Senggey

Annexure 7: Seed Accession and Collection Details (2023-24)

#	Scientific Name	Family	Type	Place of Collection	Elevation (m)
1	<i>Trema cf. orientalis</i>	Ulmaceae	Tree	Gakiling, Haa	830
2	<i>Alangium alpinum</i>	Alangiaceae	Tree	Gakiling, Haa	833
3	<i>Neolamarckia cadamba</i>	Rubiaceae	Tree	Tamangdangra, Samtse	760
4	<i>Wrightia arborea</i>	Apocynaceae	Tree	Yoseltse, Samtse	350
5	<i>Balakata baccata</i>	Euphorbiaceae	Tree	Yoseltse, Samtse	349
6	<i>Neolamarckia cf. cadamba</i>	Rubiaceae	Tree	Alay, Chukha	504
7	<i>Symplocos dryophila</i>	Symplocaceae	Tree	Ganglakha, Chukha	1705
8	<i>Magnolia doltsopa</i>	Magnoliaceae	Tree	Darla, Chukha	1302
9	<i>Viburnum erubescens</i>	Caprifoliaceae	Tree	Microtop, Chukha	2278
10	<i>Prunus nepalensis</i>	Rosaceae	Tree	Tshachilakha, Chukha	1892
11	<i>Acronycha pedunculata</i>	Rutaceae	Tree	Senchikha, Chukha	710
12	<i>Polygala arillata</i>	Polygalaceae	Tree	Microtop, Chukha	1971
13	<i>Sloanea dasycarpa</i>	Elaeocarpaceae	Tree	Buna Sangsusa, Chukha	2032
14	<i>Toona ciliata</i>	Meliaceae	Tree	Alay & Kezari, Chukha	1560
15	<i>Ilex fragilis</i>	Aquifoliaceae	Tree	Microtop, Chukha	2387
16	<i>Rhododendron pogonopyllum</i>	Ericaceae	Shrub	Kyitsugang, Wangdue	4503
17	<i>Rhododendron nivale</i>	Ericaceae	Shrub	Kyitsugang, Wangdue	4503
18	<i>Rhododendron cf. hypanthum</i>	Ericaceae	Shrub	Kyitsugang, Wangdue	4503
19	<i>Primula umbratilis</i> var. <i>alba</i>	Primulaceae	Herb	Kyitsugang, Wangdue	4460
20	<i>Primula tasriensis</i>	Primulaceae	Herb	Kyitsugang, Wangdue	4461
21	<i>Rhododendron seutosum</i>	Ericaceae	Shrub	Kyitsugang, Wangdue	4503
22	<i>Rhododendron anthopogon</i>	Ericaceae	Shrub	Kyitsugang, Wangdue	4125
23	<i>Rhododendron lanatum</i>	Ericaceae	Tree	Kyitsugang, Wangdue	4100
24	<i>Swertia hookeri</i>	Gentianaceae	Herb	Kyitsugang, Wangdue	4127
25	<i>Swertia wardii</i>	Gentianaceae	Herb	Kyitsugang, Wangdue	4120
26	<i>Meliosma pinnata</i>	Sabiaceae	Herb	Menchuna, Punakha	2270
27	<i>Grewia eriocarpa</i>	Tiliaceae	Tree	Rubesa, Wangdue	1447
28	<i>Illicium griffithii</i>	Schisandraceae	Tree	Menchuna, Punakha	2270
29	<i>Toona ciliata</i>	Meliaceae	Tree	Alay & Kezari, Chukha	1560
30	<i>Calophyllum polyanthum</i>	Calophyllaceae	Tree	Alay & Kezari, Chukha	1560
31	<i>Symplocos lucida</i>	Symplocaceae	Tree	Darachu, Tsirang	1917
32	<i>Dobinea vulgaris</i>	Aceraceae	Shrub	Darachu, Tsirang	1637
33	<i>Glachiodin</i>	Euphorbiaceae	Tree	Yebilabtsa, Zhemgang	1378
34	<i>Diospyros lanceifolia</i>	Rosaceae	Tree	Yebilabtsa, Zhemgang	752
35	<i>Vitex quinata</i>	Lamiaceae	Tree	Praling, Zhemgang	490
36	<i>Bridelia cf. glauca</i>	Phyllanthaceae	Tree	Ngangla, Zhemgang	603
37	<i>Glochidion cf. heyneanum</i>	Euphorbiaceae	Tree	Thungphu, Pemagatshel	1725
38	<i>Bridelia cf. pubescens</i>	Euphorbiaceae	Tree	Orong, Samdrupjongkhar	950
39	<i>Trema cf. orientalis</i>	Ulmaceae	Tree	Gakiling, Haa	830
40	<i>Alangium alpinum</i>	Alangiaceae	Tree	Gakiling, Haa	833
41	<i>Neolamarckia cadamba</i>	Rubiaceae	Tree	Tamangdangra, Samtse	760
42	<i>Wrightia arborea</i>	Apocynaceae	Tree	Yoseltse, Samtse	350
43	<i>Balakata baccata</i>	Euphorbiaceae	Tree	Yoseltse, Samtse	349
44	<i>Neolamarckia cf. cadamba</i>	Rubiaceae	Tree	Alay, Chukha	504
45	<i>Symplocos dryophila</i>	Symplocaceae	Tree	Ganglakha, Chukha	1705
46	<i>Magnolia doltsopa</i>	Magnoliaceae	Tree	Darla, Chukha	1302
47	<i>Viburnum erubescens</i>	Caprifoliaceae	Tree	Microtop, Chukha	2278
48	<i>Prunus nepalensis</i>	Rosaceae	Tree	Tshachilakha, Chukha	1892
49	<i>Acronycha pedunculata</i>	Rutaceae	Tree	Senchikha, Chukha	710
50	<i>Polygala arillata</i>	Polygalaceae	Tree	Microtop, Chukha	1971
51	<i>Sloanea dasycarpa</i>	Elaeocarpaceae	Tree	Buna Sangsusa, Chukha	2032
52	<i>Toona ciliata</i>	Meliaceae	Tree	Alay & Kezari, Chukha	1560

Annexure 8: Details of Living Accessions (2023-24)

#	Species Name	Family	Type	Place of Collection	Elevation (m)
1	<i>Ceropegia</i> cf. <i>attenuata</i>	Apocynaceae	Herb	Gakiling, Haa	903
2	<i>Acampe rigida</i>	Orchidaceae	Orchid	Rangtse, Haa	811
3	<i>Ceropegia</i> cf. <i>bhutanica</i>	Apocynaceae	Herb	Sangbaykha-Ama, Haa	1881
4	<i>Aeschynanthus</i> cf. <i>sikkimensis</i>	Gesneraceae	Herb	Dorokha, Samtse	789
5	<i>Goodyera</i> sp.	Orchidaceae	Orchid	Dorokha, Samtse	789
6	<i>Cleisostoma</i> cf. <i>filiforme</i>	Orchidaceae	Orchid	Sipsoo, Samtse	452
7	<i>Globa andrisonii</i>	Zingibaraceae	Herb	Tamangdangra, Samtse	634
8	<i>Calanthe sylvatica</i>	Orchidaceae	Orchid	Phaktshoding, Chukha	1940
9	<i>Goodyera foliosa</i>	Orchidaceae	Orchid	Phaktshoding, Chukha	1940
10	<i>Sonerila khasiana</i>	Melastomataceae	Herb	Buna Sangsusa, Chukha	2049
11	<i>Impatiens</i> sp.	Balsaminaceae	Herb	Buna Sangsusa, Chukha	2049
12	<i>Ceropegia pubescens</i>	Apocynaceae	Herb	Buna Sangsusa, Chukha	2043
13	<i>Ceropegia bhutanica</i>	Apocynaceae	Herb	Tshachilakha, Chukha	1895
14	<i>Begonia</i> cf. <i>josephii</i>	Begoniaceae	Herb	Alay, Chukha	1342
15	<i>Begonia</i> sp.	Begoniaceae	Herb	Alay, Chukha	1032
16	<i>Impatiens</i> sp.	Balsaminaceae	Herb	Kezari & Sinchula Chukha	1658
17	<i>Ceropegia</i> cf. <i>hookeri</i>	Apocynaceae	Herb	Alay, Chukha	1032
18	<i>Monolophus secunda</i>	Zingiberaceae	Herb	Alay, Chukha	487
19	<i>Gastrochilus pseudodistichus</i>	Orchidaceae	Orchid	Microtop, Chukha	2298
20	<i>Einkanthus defluxus</i>	Ericaceae	Tree	Tashigang, Tphu	2980
21	<i>Spirea bella</i>	Rosaceae	Shrub	Tashigang, Tphu	3012
22	<i>Nephrolepis cordifolia</i>	Nephrolepidaceae	Fern	Punakha	1540
23	<i>Gaultheria</i> sp.	Ericaceae	Shrub	Tashigang, Tphu	1406
24	<i>Luculia gratissima</i>	Rubiaceae	Shrub	Punakha	1406
25	<i>Acer</i> sp.	Sapindaceae	Tree	Tashigang, Tphu	1406
26	<i>Tenacetum</i> sp.	Asteraceae	Herb	Chelela	3670
27	<i>Phiaus</i> sp.	Orchidaceae	Orchid	Punakha	1406
28	<i>Eria</i> sp.	Orchidaceae	Orchid	Punakha	1406
29	<i>Calanthe</i> sp.	Orchidaceae	Orchid	Punakha	1406
30	<i>Dendrobium chrysanthemum</i>	Orchidaceae	Orchid	Punakha	1406
31	<i>Epiginius</i> sp.	Orchidaceae	Orchid	Punakha	1406
32	<i>Bulbophyllum</i> sp.	Orchidaceae	Orchid	Punakha	1406
33	<i>Flickingeria</i> sp.	Orchidaceae	Orchid	Punakha	1406
34	<i>Ceratostigma griffithii</i>	Plumbaginaceae	Shrub	Paro	2250
35	<i>Cymbidium lencifolium</i>	Orchidaceae	Orchid	Punakha	1406
36	<i>Ceropegia</i> sp.	Orchidaceae	Orchid	Thinleygang, Punakha	1938
37	<i>Begonia menchunaensis</i>	Orchidaceae	Orchid	Menchuna, Punakha	2200
38	<i>Acampe papillosa</i>	Orchidaceae	Orchid	Lhamoizhingkha, Dagana	178
39	<i>Spathoglottis jetsuniae</i>	Orchidaceae	Orchid	Ngangla, Zhemgang	923
40	<i>Leparis</i> sp.	Orchidaceae	Orchid	Ngangla, Zhemgang	924
41	<i>Aristolochia assamica</i>	Aristolochiaceae	Herb	Deezama, Pemagatshel	757
42	<i>Crawfordia campanulacea</i>	Gentianaceae	Climber	Bensingonpa, Pemagatshel	1481
43	<i>Peperomia</i> cf. <i>tetraphylla</i>	Piperaceae	Herb	Orong, Samdrupjongkhar	940
44	<i>Ceropegia</i> cf. <i>attenuata</i>	Apocynaceae	Herb	Gakiling, Haa	903
45	<i>Acampe rigida</i>	Orchidaceae	Orchid	Rangtse, Haa	811
46	<i>Ceropegia</i> cf. <i>bhutanica</i>	Apocynaceae	Herb	Sangbaykha-Ama, Haa	1881
47	<i>Aeschynanthus</i> cf. <i>sikkimensis</i>	Gesneraceae	Herb	Dorokha, Samtse	789
48	<i>Goodyera</i> sp.	Orchidaceae	Orchid	Dorokha, Samtse	789
49	<i>Cleisostoma</i> cf. <i>filiforme</i>	Orchidaceae	Orchid	Sipsoo, Samtse	452
50	<i>Globa andrisonii</i>	Zingibaraceae	Herb	Tamangdangra, Samtse	634
51	<i>Calanthe sylvatica</i>	Orchidaceae	Orchid	Phaktshoding, Chukha	1940

52	<i>Goodyera foliosa</i>	Orchidaceae	Orchid	Phaktshoding, Chukha	1940
53	<i>Sonerila khasiana</i>	Melastomataceae	Herb	Buna Sangsusa, Chukha	2049
54	<i>Impatiens</i> sp.	Balsaminaceae	Herb	Buna Sangsusa, Chukha	2049
55	<i>Ceropegia pubescens</i>	Apocynaceae	Herb	Buna Sangsusa, Chukha	2043
56	<i>Ceropegia bhutanica</i>	Apocynaceae	Herb	Tshachilakha, Chukha	1895
57	<i>Begonia</i> cf. <i>josephii</i>	Begoniaceae	Herb	Alay, Chukha	1342
58	<i>Begonia</i> sp.	Begoniaceae	Herb	Alay, Chukha	1032
59	<i>Impatiens</i> sp.	Balsaminaceae	Herb	Kezari & Sinchula Chukha	1658
60	<i>Ceropegia</i> cf. <i>hookeri</i>	Apocynaceae	Herb	Alay, Chukha	1032
61	<i>Monolophus secunda</i>	Zingiberaceae	Herb	Alay, Chukha	487
62	<i>Gastrochilus pseudodistichus</i>	Orchidaceae	Orchid	Microtop, Chukha	2298
63	<i>Corylopsis himalayana</i>	Hamamelidaceae	Tree	Chabcha, Chukha	2218
64	<i>Quercus lanata</i>	Fagaceae	Tree	Chabcha, Chukha	2520
65	<i>Yushania maling</i>	Poaceae	Shrub	Tshimasham, Chukha	2521
66	<i>Viburnum erubescens</i>	Caprifoliaceae	Shrub	Tshimasham, Chukha	2272
67	<i>Viburnum grandiflorum</i>	Caprifoliaceae	Shrub	Tshimasham, Chukha	2322
68	<i>Cardiocrinum giganteum</i>	Liliaceae	Hern	Chabcha, Chukha	2218
69	<i>Prunus carmesina</i>	Rosaceae	Tree	Geling, Chukha	1911
70	<i>Prunus napaulensis</i>	Rosaceae	Tree	Geling, Chukha	1911
71	<i>Spiraea micrantha</i>	Rosaceae	Shrub	Geling, Chukha	1911
72	<i>Spiraea bella</i>	Rosaceae	Shrub	Geling, Chukha	1911
73	<i>Pteris wallichiana</i>	Pteridaceae	Fern	Tshimasham, Chukha	2272
74	<i>Asparagus filicinus</i>	Asparagaceae	herb	Tshimasham, Chukha	2272
75	<i>Woodwardia unigemmata</i>	Blechnaceae	Fern	Tanalum, Chukha	2150
76	<i>Pteris</i> cf. <i>altissima</i>	Pteridaceae	Fern	Tanalum, Chukha	2150
77	<i>Onychium japonicum</i>	Pteridaceae	Fern	Tanalum, Chukha	2218
78	<i>Drynaria propinqua</i>	Polypodiaceae	Fern	Chabcha, Chukha	2218
79	<i>Pyrrosia boothii</i>	Polypodiaceae	fern	Chabcha, Chukha	2218
80	<i>Asplenium wilfordii</i>	Aspleniaceae	Fern	Chabcha, Chukha	2218
81	<i>Polypodium vulgare</i>	Polypodiaceae	Fern	Taktikoti, Chukha	1910
82	<i>Cheilanthes bicolor</i>	Pteridaceae	Fern	Wangkha, Chukha	1911
83	<i>Corylopsis himalayana</i>	Hamamelidaceae	Tree	Chabcha, Chukha	2218
84	<i>Quercus lanata</i>	Fagaceae	Tree	Chabcha, Chukha	2520
85	<i>Yushania maling</i>	Poaceae	Bamboo	Tshimasham, Chukha	2521
86	<i>Viburnum erubescens</i>	Caprifoliaceae	Tree/Shrub	Tshimasham, Chukha	2272
87	<i>Viburnum grandiflorum</i>	Caprifoliaceae	Tree/Shrub	Tshimasham, Chukha	2322
88	<i>Cardiocrinum giganteum</i>	Liliaceae	Herb	Chabcha, Chukha	2218
89	<i>Prunus carmesina</i>	Rosaceae	Tree	Geling, Chukha	1911
90	<i>Prunus napaulensis</i>	Rosaceae	Tree	Geling, Chukha	1911
91	<i>Spiraea micrantha</i>	Rosaceae	Shrub	Geling, Chukha	1911
92	<i>Spiraea bella</i>	Rosaceae	Shrub	Geling, Chukha	1911
93	<i>Pteris wallichiana</i>	Pteridaceae	Fern	Tshimasham, Chukha	2272
94	<i>Asparagus filicinus</i>	Asparagaceae	Herb	Tshimasham, Chukha	2272
95	<i>Woodwardia unigemmata</i>	Blechnaceae	Fern	Tanalum, Chukha	2150
96	<i>Pteris</i> cf. <i>altissima</i>	Pteridaceae	Fern	Tanalum, Chukha	2150
97	<i>Onychium japonicum</i>	Pteridaceae	Fern	Tanalum, Chukha	2218
98	<i>Drynaria propinqua</i>	Polypodiaceae	Fern	Chabcha, Chukha	2218
99	<i>Pyrrosia boothii</i>	Polypodiaceae	Fern	Chabcha, Chukha	2218
100	<i>Asplenium wilfordii</i>	Aspleniaceae	Fern	Chabcha, Chukha	2218
101	<i>Polypodium vulgare</i>	Polypodiaceae	Fern	Taktikoti, Chukha	1910
102	<i>Cheilanthes bicolor</i>	Pteridaceae	Fern	Wangkha, Chukha	1911

103	<i>Rhododendron maddenii</i>	Ericaceae	Tree	Bunakha, Chhukha	2083
104	<i>Rhododendron arboreum</i>	Ericaceae	Tree	Tashigang Goenpa, Thimphu	3047
105	<i>Rhododendron barbatum</i>	Ericaceae	Tree	Changaphu, Thimphu	3674
106	<i>Rhododendron thomsonii</i>	Ericaceae	Tree	Changaphu, Thimphu	3674
107	<i>Rhododendron keysii</i>	Ericaceae	Tree	Changaphu, Thimphu	3674
108	<i>Rhododendron lepidotum</i>	Ericaceae	Tree	Tashigang Goenpa, Thimphu	3047
109	<i>Leycesteria formosa</i>	Caprifoliaceae	Shrub	Tashigang Goenpa, Thimphu	3041
110	<i>Tsuga dumosa</i>	Pinaceae	Tree	Tashigang Goenpa, Thimphu	3041
111	<i>Picea spinulosa</i>	Fabaceae	Shrub	Changaphu, Thimphu	3683
112	<i>Juniperus recurva</i>	Scrophulariaceae	Tree	Changaphu, Thimphu	3683
113	<i>Abies densa</i>	Polygalaceae	Tree	Changaphu, Thimphu	3683
114	<i>Euonymus tingens</i>	Celastraceae	Tree	Tashigang Goenpa, Thimphu	3130
115	<i>Enkianthus deflexus</i>	Ericaceae	Shrub	Tashigang Goenpa, Thimphu	3130
116	<i>Betula utilis</i>	Aquifoliaceae	Tree	Tashigang Goenpa, Thimphu	3122
117	<i>Daphniphyllum chartaceum</i>	Hydrangeaceae	Tree	Tashigang Goenpa, Thimphu	3122
118	<i>Pieris formosa</i>	Hydrangeaceae	Shrub	Changaphu, Thimphu	3683
119	<i>Vaccinium nummularia</i>	Apocynaceae	Shrub	Changaphu, Thimphu	3683
120	<i>Hydrangea heteromalla</i>	Scrophulariaceae	Tree	Tashigang Goenpa, Thimphu	3047
121	<i>Bergenia ciliata</i>	Saxifragaceae	Herb	Chapcha, Chhukha	2216
122	<i>Quercus lanata</i>	Fagaceae	Tree	Chapcha, Chhukha	2050
123	<i>Corylopsis himalayana</i>	Hamamelidaceae	Tree	Bunakha, Chhukha	2086
124	<i>Nephrolepis cordifolia</i>	Nephrolepidaceae	Fern	Bunakha, Chhukha	2086
125	<i>Myrsine semiserrata</i>	Myrsinaceae	Tree	Tashigang Goenpa, Thimphu	3130
126	<i>Berberis praecipua</i>	Berberidaceae	Shrub	Tashigang Goenpa, Thimphu	3146
127	<i>Gaultheria semi-infera</i>	Ericaceae	Shrub	Tashigang Goenpa, Thimphu	3146
128	<i>Acer campbelii</i>	Sapindaceae	Tree	Tashigang Goenpa, Thimphu	3047
129	<i>Acer pectinatum</i>	Sapindaceae	Tree	Tashigang Goenpa, Thimphu	3047
130	<i>Spiraea micrantha</i>	Rosaceae	Shrub	Tashigang Goenpa, Thimphu	3048
131	<i>Spiraea bella</i>	Rosaceae	Shrub	Tashigang Goenpa, Thimphu	3048
132	<i>Philadelphus tomentosus</i>	Hydrangeaceae	Shrub	Tashigang Goenpa, Thimphu	3048
133	<i>Deutzia corymbosa</i>	Hydrangeaceae	Shrub	Tashigang Goenpa, Thimphu	3073
134	<i>Symplocos dryophila</i>	Symplocaceae	Tree	Tashigang Goenpa, Thimphu	3146
135	<i>Symplocos sumuntia</i>	Symplocaceae	Tree	Tashigang Goenpa, Thimphu	3146
136	<i>Smilax myrtillus</i>	Smilacaceae	Shrub	Tashigang Goenpa, Thimphu	3146
137	<i>Magnolia globosa</i>	Magnolaceae	Tree	Tashigang Goenpa, Thimphu	3146
138	<i>Coelogyne corymbosa</i>	Orchidaceae	Orchid	Bunakha, Chhukha	2086
139	<i>Liparis cespitosa</i>	Orchidaceae	Orchid	Ula, Wangdue Phodrang	1485
140	<i>Phalaenopsis taenialis</i>	Orchidaceae	Orchid	Bunakha, Chhukha	2086
141	<i>Dendrobium fimbriatum</i>	Orchidaceae	Orchid	Ula, Wangdue Phodrang	1456
142	<i>Dendrobium sp.</i>	Orchidaceae	Orchid	Ula, Wangdue Phodrang	1456
143	<i>Dendrobium devonianum</i>	Orchidaceae	Orchid	Ula, Wangdue Phodrang	1456
144	<i>Dendrobium nobile</i>	Orchidaceae	Orchid	Ula, Wangdue Phodrang	1456
145	<i>Cymbidium iridioides</i>	Orchidaceae	Orchid	Ula, Wangdue Phodrang	1456
146	<i>Cymbidium hookerianum</i>	Orchidaceae	Orchid	Ula, Wangdue Phodrang	1456
147	<i>Dendrobium terminale</i>	Orchidaceae	Orchid	Ula, Wangdue Phodrang	1456
148	<i>Eria ferruginea</i>	Orchidaceae	Orchid	Bunakha, Chhukha	2096
149	<i>Cleisostoma discolor</i>	Orchidaceae	Orchid	Ula, Wangdue Phodrang	2096
150	<i>Pleione humilis</i>	Orchidaceae	Orchid	Ula, Wangdue Phodrang	1480
151	<i>Luisia zeylanica</i>	Orchidaceae	Orchid	Ula, Wangdue Phodrang	1456
152	<i>Vanda cristata</i>	Orchidaceae	Orchid	Ula, Wangdue Phodrang	1456
153	<i>Oberonia sp.</i>	Orchidaceae	Orchid	Ula, Wangdue Phodrang	1456

Annexure 9: Seed Accession and Collection Details (2024-25)

Sl. No.	Species Name	Family	Type of Plant	Place of Collection	Elevation (m)
1	<i>Acer pectinatum</i>	Sapindaceae	Tree	Bongzam	3204
2	<i>Acer campbellii</i>	Sapindaceae	Tree	Dorji Gonpa, Trongsa	2769
3	<i>Corylus ferox</i>	Betulaceae	Tree	Dorji Gonpa, Trongsa	2872
4	<i>Acer campbellii</i>	Sapindaceae	Tree	Between Pelela to Nobdhing	3036
5	<i>Viburnum mullaha</i>	Adoxaceae	Tree	Chendebje, Trongsa	2378
6	<i>Sorbus wallichii</i>	Rosaceae	Tree	Chendebje, Trongsa	2378
7	<i>Cotoneaster microphyllus</i>	Rosaceae	Shrub	Pelela, Wangdue	3370
8	<i>Acer caudatum</i>	Sapindaceae	Tree	Between Pelela to Nobdhing	3036
9	<i>Viburnum foetidum</i>	Adoxaceae	Shrub	Limbukha, Punakha	2151
10	<i>Dodecadenia grandiflora</i>	Lauraceae	Tree	Nobdhing, Wangdue	2830
11	<i>Heynea trijuga</i>	Meliaceae	Tree	wangdue phodrang	1194
12	<i>Illicium griffithii</i>	Schisandraceae	Tree	Toedpisa, Punakha	2181
13	<i>Photinia</i> sp.	Rosaceae	Tree	Limbukha, Punakha	2136
14	<i>Paphiopedilum</i>	Orchidaceae	Orchid	Rukha, Wangdue	1321
15	<i>Neocinnamomum</i>	Lauraceae	Tree	Lapsakha, Punakha	2004
16	<i>Magnolia doltsopa</i>	Magnoliaceae	Tree	Kabji Hoka Tsho	2128
17	<i>Symplocos lucida</i>	Symplocaceae	Tree	Btw dangchu and Nobdhing	2715
18	<i>Euptelea pleiosperma</i>	Eupteleaceae	Tree	Dangchu, Wangdue	2259
19	<i>Rosa macrophylla</i> Lindl.	Rosaceae	Shrub	Bongzam,	3273
20	<i>Lonicera acuminata</i>	Caprifoliaceae	Tree	Bongzam,	3273
21	<i>Sorbus rufopilosa</i>	Rosaceae	Tree	Bongzam	3152
22	<i>Magnolia campbellii</i>	Magnoliaceae	Tree	Between chendebje and trongsa	2386
23	<i>Magnolia campbellii</i>	Magnoliaceae	Tree	Dorji Gonpa, Trongsa	2879
24	<i>Sorbus thibetica</i>	Rosaceae	Tree	Pelela, Wangdue	3346
25	<i>Sorbus thibetica</i>	Rosaceae	Tree	Tashigang gonpa	3072
26	<i>Acacia farnesiana</i>	Fabaceae	Shrub	Wangdue Phodrang	1250
27	<i>Magnolia globosa</i>	Magnoliaceae	Tree	Dochula, Thimphu	3185
28	<i>hydrangea heteromala</i>	Hydrangeaceae	Tree	Between Pelela to Nobdhing	3036
29	<i>Lobelia</i> sp.	Campanulaceae	Herb	Between Pelela to Nobdhing	3036
30	<i>Quercus lamilosa</i>	Fagaceae	Tree	Khailakha, Wangdue	2345
31	<i>Abelmoschus manihot</i>	Malvaceae	Herb	Wangdue phodrang	1250
32	<i>Buddleja macrostachya</i>	Scrophulariaceae	Tree	Sengor, Mongar	2767
33	<i>Buddleja colvilei</i>	Scrophulariaceae	Tree/Shrub	Yotongla, Bumthang	3350
34	<i>Cornus</i> sp. white	Cornaceae	Tree	Rinchen Bumpa, Lhuntse	2352
35	<i>Pittosporum nepaulensis</i>	Pittosporaceae	Tree	Budur, Lhuntse	1025
36	<i>Sorbus insignii</i>	Rosaceae	Tree	Dorji gonpa, Trongsa	3046
37	<i>Gymnocladus assamicus</i>	Fabaceae	Tree	Kariphu gonpa, Khoma	2108
38	<i>Quercus thomsoniana</i>	Fagaceae	Tree	Goenpakarp top, Khoma, Lhuntse	2678
39	<i>Alpinia</i> cf <i>malaccensis</i>	Zingiberaceae	Herb	Nganglam, Pemgatshel	732
38	<i>Quercus thomsoniana</i>	Fagaceae	Tree	Goenpakarp top, Khoma, Lhuntse	2678
39	<i>Alpinia</i> cf <i>malaccensis</i>	Zingiberaceae	Shrub	Nganglam, Pemgatshel	2678
40	<i>Magnolia doltsopa</i>	Magnoliaceae	Tree	Darla, Chukha	1302
41	<i>Viburnum erubescens</i>	Caprifoliaceae	Tree	Microtop, Chukha	2278
42	<i>Prunus nepalensis</i>	Rosaceae	Tree	Tshachilakha, Chukha	1892
43	<i>Acronycha pedunculata</i>	Rutaceae	Tree	Senchikha, Chukha	710
44	<i>Polygala arillata</i>	Polygalaceae	Tree	Microtop, Chukha	1971
45	<i>Sloanea dasycarpa</i>	Elaeocarpaceae	Tree	Buna Sangsusa, Chukha	2032
46	<i>Toona ciliata</i>	Meliaceae	Tree	Alay & Kezari	1560

Annexure 10: Details of Living Accessions (2024-25)

Sl. No.	Species Name	Family	Place of Collection	Elevation (m)
1	<i>Hydrangea heteromalla</i>	Hydrangeaceae	Tashigang Goenpa, Thimphu	3072
2	<i>Sorbus karchungii</i>	Rosaceae	Tashigang Goenpa, Thimphu	3072
3	<i>clematis montana</i>	Ranunculaceae	Tashigang Goenpa, Thimphu	3053
4	<i>Ainsliaea latifolia</i>	Asteraceae	Tashigang Goenpa, Thimphu	3113
5	<i>Gamblea ciliata</i>	Araliaceae	Tashigang Goenpa, Thimphu	3102
6	<i>Streptopus simplex</i>	Liliaceae	Dochula	3185
7	<i>Paphiopedilum fairrieianum</i>	Orchidaceae	Rukha	1352
8	<i>Euptelea pleiosperma</i>	Eupteleaceae	Dangchu, Wangdue	2259
9	<i>Phoenix</i> sp.	Araceae	Rukha, Wangdue	806
10	<i>Paphiopedilum fairrieianum</i>	Orchidaceae	Rukha, Wangdue	1321
11	<i>Eria coronaria</i>	Orchidaceae	Limbukha, Punakha	2133
12	<i>Coelogyne</i> sp.	Orchidaceae	Dangchu, Wangdue	2259
13	<i>Epigeneium</i> sp.	Orchidaceae	Dangchu, Wangdue	2259
14	<i>Dendrobium densiflorum</i>	Orchidaceae	Rukha, Wangdue	1359
15	<i>Dendrobium nobile</i>	Orchidaceae	Dangchu, Wangdue	1359
16	<i>Bulbophyllum</i> sp.	Orchidaceae	Dangchu, Wangdue	2259
17	<i>Dendrobium fimbriatum</i>	Orchidaceae	Rukha, Wangdue	951
18	<i>Hoya carnosa</i>	Apocynaceae	Rukha, Wangdue	806
19	<i>Cymbidium erythreum</i>	Orchidaceae	Rukha, Wangdue	1359
20	<i>Buddleja colvilei</i>	Scrophulariaceae	Pelela, Wangdue	3354
21	<i>Bulbophyllum</i> cf. <i>obrienianum</i>	Orchidaceae	Khariphu, Khoma, Lhuntse	2108
22	<i>Cymbidium tracyanum</i>	Orchidaceae	Gonpakarp top, Khoma	2510
23	<i>Bulbophyllum</i> cf. <i>roseopictum</i>	Orchidaceae	Gonpakarp top, Khoma	2510
24	<i>Begonia silletensis</i>	Begoniaceae	Bet. Panbang & Gashari	726
25	<i>Thrixpermum</i> cf. <i>pygmaeum</i>	Orchidaceae	Gonpakarp top, Khoma	2510
26	<i>Bulbophyllum gamblei</i>	Orchidaceae	Khomadung, Lhuentse	1657
27	<i>Bulbophyllum</i> cf. <i>emarginatum</i>	Orchidaceae	Khomadung, Lhuentse	1780
28	<i>Liparis</i> cf. <i>petiolata</i>	Orchidaceae	Khomadung, Lhuentse	1780
29	<i>Bulbophyllum</i> cf. <i>viridiflorum</i>	Orchidaceae	Khomadung, Lhuentse	1780
30	<i>Bulbophyllum</i> cf. <i>cylindraceum</i>	Orchidaceae	Khomadung, Lhuentse	1780
31	<i>Eria</i> sp. 1	Orchidaceae	Khomadung, Lhuentse	1780
32	<i>Anoetochilus brevilabris</i>	Orchidaceae	Khomadung, Lhuentse	1780
33	<i>Goodyera viridiflora</i>	Orchidaceae	Khomadung, Lhuentse	1780
34	<i>Bulbophyllum</i> sp. 1	Orchidaceae	Khomadung, Lhuentse	1657
35	<i>Bulbophyllum odoratissimum</i> cf. var. <i>racemosum</i>	Orchidaceae	Khomadung, Lhuentse	1657
36	<i>Bulbophyllum</i> sp. 2	Orchidaceae	Khomadung, Lhuentse	1657
37	<i>Bulbophyllum</i> cf. <i>depressum</i>	Orchidaceae	Khomadung, Lhuentse	1657
38	<i>Chilochista</i> sp.	Orchidaceae	Khomadung, Lhuentse	1780
39	<i>Elatostema</i> cf. <i>morobens</i>	Urticaceae	Khenay, Trashigang	2088
40	<i>Panisea demissa</i>	Orchidaceae	Khenay, Trashigang	2088
41	<i>Gastrochilus calciolaris</i>	Orchidaceae	Khenay, Trashigang	2088
42	<i>Bulbophyllum</i> sp. 3	Orchidaceae	Khenay, Trashigang	2088
43	<i>Bulbophyllum kingii</i>	Orchidaceae	Khenay, Trashigang	2088
44	<i>Eria</i> sp. 2	Orchidaceae	Khenay, Trashigang	2088
45	<i>Chilochista densiflora</i>	Orchidaceae	Buli, Zhemgang	1590
46	<i>Bulbophyllum</i> sp. 4	Orchidaceae	Buli, Zhemgang	1590
47	<i>Bulbophyllum</i> cf. <i>sarcophyllum</i>	Orchidaceae	Buli, Zhemgang	1590
48	<i>Bulbophyllum leopardinum</i>	Orchidaceae	Chimung, Pemagatshel	1750
49	<i>Cymbidium erythreum</i>	Orchidaceae	Chimung, Pemagatshel	1750
50	<i>Cymbidium iridioides</i>	Orchidaceae	Chimung, Pemagatshel	1750
51	<i>Zingiber chrysanthemum</i>	Zingiberaceae	Yangkhar, Pemagatshel	1560
52	<i>Hoya</i> cf. <i>linearis</i>	Apocynaceae	Chimung, Pemagatshel	1750
53	<i>Malaxis</i> sp.	Orchidaceae	Chimung, Pemagatshel	1750

54	<i>Daphne ludlowii</i>	Thymelaeaceae	Sengor, Mongar	3412
55	<i>Gaultheria</i> sp.	Ericaceae	Namling, Mongar	2694
56	<i>Rubus lineatus</i>	Rosaceae	Namling, Mongar	2694
57	<i>Meconopsis gakyidiana</i>	Papaveraceae	Merak	3516
58	<i>Rhododendron kesangiae</i>	Ericaceae	Mendrula, Merak	3243
59	<i>Rhododendron neriiflorum</i>	Ericaceae	Sheytemi, Merak	2836
60	<i>Rhododendron falconeri</i>	Ericaceae	Sheytemi, Merak	2836
61	<i>Rhododendron lindleyi</i>	Ericaceae	Sheytemi, Merak	2836
62	<i>Rhododendron kendrickii</i>	Ericaceae	Sheytemi, Merak	2836
63	<i>Rhododendron lindleyi</i>	Ericaceae	Thrakthre, Sakteng	2465
64	<i>Rhododendron kendrickii</i>	Ericaceae	Thrakthre, Sakteng	2465
65	<i>Rhododendron grande</i>	Ericaceae	Sheytemi, Merak	2585
66	<i>Rhododendron arborum</i>	Ericaceae	Sheytemi, Merak	2585
67	<i>Daphne bholua</i>	Thymelaeaceae	Mendrula, Merak	3243
68	<i>Rhododendron virgatum</i>	Ericaceae	NobdHING, Wangdue	2594
69	<i>Hoya species</i>	Apocynaceae	Rukha, Wangdue	807
70	<i>Dendrobium densiflorum</i>	Orchidaceae	Rukha, Wangdue	1214
71	<i>Dendrobium transparens</i>	Orchidaceae	Rukha, Wangdue	883
72	<i>Dendrobium nobile</i>	Orchidaceae	Rukha, Wangdue	1219
73	<i>Luisia</i> sp.	Orchidaceae	Rukha, Wangdue	1213
74	<i>Coelogyne</i> sp.	Orchidaceae	Rukha, Wangdue	1220
75	<i>Vanda cristata</i>	Orchidaceae	Rukha, Wangdue	1300
76	<i>Dendrobium jenkinsii</i>	Orchidaceae	Wangdue-Tsirang highway	1051
77	<i>Cymbidium</i> sp.	Orchidaceae	Dayu, Rukha	1237
78	<i>Pyrrosia</i> sp.	Polypodiaceae	Dayu, Rukha	1153
79	<i>Vanda</i> sp.	Orchidaceae	Road to Ada tsho	1358
80	<i>Eria</i> sp.	Orchidaceae	Road to Morakha	1246
81	<i>Rhododendron dalhousiae</i>	Ericaceae	Jumja area, Chukha	2085
82	<i>Rhododendron vaccinioides</i>	Ericaceae	Jumja area, Chukha	2085
83	<i>Rhododendron niveum</i>	Ericaceae	Selela FMU, Haa	3096
84	<i>Rhododendron camelliflorum</i>	Ericaceae	Selela FMU, Haa	3096
85	<i>Rhododendron pendulum</i>	Ericaceae	Selela FMU, Haa	3032
86	<i>Primula smithiana</i>	Primulaceae	Chelela, Haa	3553
87	<i>Rhododendron campylocarpum</i>	Ericaceae	Chelela, Haa	3548
88	<i>Rhododendron setosum</i>	Ericaceae	Chelela, Haa	3563
89	<i>Rhododendron cinnabarinum</i>	Ericaceae	Chelela, Haa	3682
90	<i>Primula griffithii</i>	Primulaceae	Chelela, Haa	3550
91	<i>Rhododendron triflorum</i>	Ericaceae	Chelela, Haa	2819
92	<i>Rhododendron anthopogon</i>	Ericaceae	Chelela, Haa	3759
93	<i>Viburnum erubescens</i>	Adoxaceae	Dochula, Thimphu	3050
94	<i>Rhododendron arboreum</i>	Ericaceae	Chelela, Haa	3548
95	<i>Trichotosia dasyphylla</i>	Orchidaceae	Logchina, Chukha	2030
96	<i>Oreorchis foliosa</i>	Orchidaceae	Tergola, Haa	2882
97	<i>Corylopsis himalayana</i>	Hamamelidaceae	Bjizam, Trongsa	2000
98	<i>Spirea bella</i>	Rosaceae	Chelela, Haa	3682
99	<i>Anemone</i> sp.	Ranunculaceae	Chelela, Haa	3682
100	<i>Dendrobium fimbriatum</i>	Orchidaceae	Ula, Wangdue Phodrang	1456
101	<i>Dendrobium devonianum</i>	Orchidaceae	Ula, Wangdue Phodrang	1456
102	<i>Dendrobium nobile</i>	Orchidaceae	Ula, Wangdue Phodrang	1456
103	<i>Leycesteria formosa</i>	Caprifoliaceae	Tashigang Goenpa, Thimphu	3041
104	<i>Magnolia globosa</i>	Magnolaceae	Tashigang Goenpa, Thimphu	3146

Annexure 11: Detailed Nutrition Profile Report

SL.No	Crop and variety name	Nutrition Parameter and Value																
		Total Fat in g /100	Protein in g/ 100	Carbohydrate in g/100g	Fiber in g /100	Niacin (B3) in mg/100	Thiamine in mg/100	Riboflavin in mg/100 g	Folic acid in mcg /100 g	P in mg /100 g	K in mg /100 g	Mg in mg /100 g	Na in mg /100 g	Ca in mg /100 g	Zn in mg /100 g	Iron in mg /100 g	Mn in mg /100 g	Cu in mg /100 g
	Finger millet																	
1	Chakrey (6)	5.8	9.3	38	3.8	3.3	0.28	0.18	45	137	118	66	2.5	3	1	1.6	0.8	0.34
2	Chakrey (4)	5.6	9.1	36	3.6	3.1	0.26	0.16	43	136	116	66	2.3	2.6	0.7	1.4	0.6	0.32
3	Sharav	5.3	8	33	3	2.3	0.21	0.12	42	130	110	60	2.2	2.2	1.1	1.4	0.32	0.32
4	Sham Sham kongphu	5.4	9	34	3.4	3	0.24	0.14	41	134	115	64	2.1	2.4	0.55	1.2	0.54	0.31
5	Sertho	5.1	9	34	3.5	3	0.21	0.13	42	131	113	60	2.3	2.7	1	1.2	0.35	0.34
6	Serey	5	8	33	3	2	0.2	0.1	42	130	110	60	2.1	2	1	1.4	0.32	0.32
7	Ran Long	5.5	8.1	33.2	3.2	2.5	0.23	0.14	42.2	130	111	61	2.4	2.3	1.2	1.4	0.32	0.34
	Mutuma Kongpu																	
8	(Wangphu)	5.3	8.3	33.3	3.3	2.3	0.23	0.13	42.3	132	110	62	2.1	2.1	1	1.7	0.35	0.35
9	Mutuma Kongpu	5.5	9	35	3.5	3	0.25	0.15	42	135	116	65	2.2	2.5	0.6	1.3	0.55	0.32
10	Mutuma Kongpu (Gomdar)	5.7	8.7	33.7	3.7	2.7	0.27	0.16	42.6	135	111	64	2.4	2.1	1	1.7	0.35	0.35
11	Gashey	5.5	9	35	3.9	3	0.25	0.15	42	135	118	63	2.5	3	1	1.5	0.7	0.33
12	Ja tho	5.6	9.1	36	3.8	3.1	0.26	0.16	43	136	119	64	2.6	3	1	1.6	0.8	0.34
13	Ja Long	5.4	8.4	33.1	3.1	2.8	0.21	0.13	41	131	111	60	2.1	2.3	1.3	1	0.31	0.35
14	Kongpu Tsalo (Gomdar)	5.6	8.6	33.6	3.6	2.6	0.26	0.16	42.6	135	111	64	2.3	2.1	1	1.7	0.35	0.35
15	Khoshomo	5.9	9.4	39	3.9	3.4	0.29	0.19	46	139	119	66	2.6	3	1	1.7	0.9	0.35
16	Kakrey/Chakrey	5.7	9.2	37	3.7	3.2	0.27	0.17	44	137	118	66	2.4	2.7	1	1.5	0.7	0.33
17	Memja	5.3	8	33	3	2.2	0.2	0.12	42	130	110	60	2.2	2.2	1	1.4	0.32	0.32
18	Ma long	5.7	9.1	37	3.9	3.2	0.27	0.17	44	137	119	65	2.6	3	1	1.7	0.9	0.35
19	Long Long	5.4	9.1	35	3.6	3.1	0.23	0.14	42	132	114	61	2.3	3	1	1.3	0.3	0.34
20	Long Ja	5.6	8.2	33.3	3.3	2.6	0.24	0.15	42.3	131	111	60	2.5	2.4	1.3	1.5	0.33	0.35

Sl.No	Crop and variety Name	Nutrition parameter and Value																
		Total Fat in g /100 g	Protein in g/ 100 g	Carbohydrate in g/100g	Fiber in g /100 g	Niacin (B3) in mg /100 g	Thiamine in mg /100 g	Riboflavin in mg /100 g	Folic acid in mcg /100 g	P in mg /100 g	K in mg /100 g	Mg in mg /100 g	Na in mg /100 g	Ca in mg /100 g	Zn in mg /100 g	Iron in mg /100 g	Mn in mg /100 g	Cu in mg /100 g
1	Ak tshak	5.1	8.1	33.1	3.1	2.1	0.21	0.11	42.1	131	110	61	2.1	2.1	1	1.5	0.33	0.33
2	Apchi yangra (Wangphu)	5.4	8.4	33.4	3.4	2.4	0.24	0.14	42.4	133	111	63	2.1	2.1	1	1.7	0.35	0.35
3	Chema Yangra (Gomdar)	5.8	8.8	33.8	3.8	2.8	0.28	0.17	42.6	136	111	64	2.5	2.1	1	1.7	0.35	0.35
4	Chera (Philuma) -LM	5.5	8.5	33.5	3.5	2.5	0.25	0.15	42.5	134	111	64	2.2	2.1	1	1.7	0.35	0.35
5	Chera serbu (Philuma)- LM	5.9	8.9	33.9	3.9	2.9	0.29	0.17	42.6	137	111	64	2.6	2.1	1	1.7	0.35	0.35
6	Rongshong Yangra (Philuma)	5.8	8.8	33.8	3.8	2.8	0.28	0.16	42.5	137	111	64	2.5	2.1	1	1.6	0.34	0.34
7	Neltsak	5.1	8.6	33	3.3	3.1	0.21	0.13	40	130	111	60	2.1	2.5	1	1	0.33	0.34
8	Gasha Yangra	5.3	9	33	3.3	3	0.23	0.13	40	133	114	63	2	2.3	0.5	1.2	0.53	0.3
9	Drang Tsak	5.8	9.3	38	3.9	3.3	0.28	0.18	45	138	119	66	2.6	3	1	1.7	0.9	0.34
10	Dom Bhuri	5.1	8.5	33.2	3.2	3	0.2	0.14	40	130	110	60	2	2.4	1	1	0.3	0.35
11	Doga	5	8.7	33	3.4	3	0.2	0.12	41	130	112	60	2.2	2.6	1	1.1	0.34	0.34
12	Jab Chham	5.5	8.5	33.2	3.2	2.5	0.21	0.12	42	130	111	61	2.4	2.1	1.2	1.6	0.3	0.35
13	Krapei Yangra	5.2	8.2	33.2	3.2	2.2	0.22	0.12	42.2	131	110	62	2.1	2.1	1	1.6	0.34	0.34
14	Kachum	5.1	8	33	3	2.1	0.2	0.11	42	130	110	60	2.2	2.1	1	1.4	0.32	0.32
15	Machum	5.4	8	33.1	3.1	2.4	0.22	0.13	42.1	130	110	60	2.3	2.3	1.2	1.4	0.32	0.33
16	Ma tsak	5.4	9	34	3.9	3	0.24	0.14	42	135	115	62	2.4	3	1	1.4	0.6	0.34

Annexure 12: The formal seed system in Bhutan by function

Function	Actors	Policies and legal frameworks
Conservation and management of crop diversity	The National Biodiversity Centre (NBC) has the national mandate for conservation and management of PGRFA.	Biodiversity Act (2022) compliant with the Convention on Biological Diversity and the International Treaty on Plant Genetic Resources.
Breeding and variety release	The Agricultural Research and Development Centres (ARDCs) and Agriculture Research and Development Sub-Centres (ARDSC) are responsible for public crop research, including variety development/evaluation and release. Variety release is the responsibility of the Variety Release Committee and the National Seed Board under the Ministry of Agriculture and Livestock.	Variety release: Currently, governed by the Seed Act (2000) and the National Seed Rules and Regulations (2018). A new Agriculture Bill (2024) is proposed to replace the Seed Act (as well as the Pesticide Act (2000)). A Legislative Impact Assessment (LIA) of the new bill was prepared by DoA. The LIA was also presented to the MoAL-GNH Committee. The MoAL-GNH Committee has suggested to make a thorough review and present it to MoAL-GNH committee again. The LIA will then be submitted to the National Council seeking approval for the formulation of new Agriculture Bill.
		IPR/PVP: According to the Biodiversity Act (2022), NBC is responsible for variety registration and sui generis PVP regulation (Including both Farmers' and Breeders' Rights).
Seed production	The National Seed Centre (NSC) is a public seed company doing the bulk of the formal seed production at four NSC regional centres and through Registered Seed Growers (groups or individual farmers). The private seed company Bhutan Alpine Seed produce seed for sale in Bhutan and abroad. Bhutan Seedlings-Talo also produce seedlings and sell to farmers. Seed certification is done by BFDA (earlier BAFRA). Community-Based Seed Production groups (CBSP) (Mostly local varieties and some improved OPVs). The seeds are produced from foundation seeds provided by the ARDCs. Pending formal registration.	Seed production and certification: Currently governed by the Seed Act (2003) and the National Seed Rules and Regulations (2018). These will be replaced by the Agriculture Bill
Seed dissemination	District Agricultural Officer (DAO) & Gewog Agriculture Office distributes seed from NSC through the Gewog. Agriculture Extension Officers at the local level. The price is set by the government and is the same in the entire country. Agricultural Seeds and Service Registered (ASSR) distributes seed from NSC (against 10% commission). The three private seed companies sell directly to farmers: -Bhutan Alpine Seed (vegetables) -Reva Seed Enterprise (commissioned sale of Syngenta and Bayer vegetable seeds) -Bhutan Seedlings (vegetables and fruits) The NSC regional centres distribute some seeds directly to farmers. ARDC also does some direct distribution to farmers. A few NGOs are involved in seed dissemination. Most notably Tarayana and the Samdrup Jongkhar Initiative (SJI).	Certification of seeds and seed sellers. Currently, governed by the Seed Act (2003) and the National Seed Rules and Regulations (2018). These will be replaced by the Agriculture Bill. Seed providers and seed companies must be registered and can only sell registered varieties. But the Seed Rules and Regulations Act and the Biodiversity Act protect farmers rights to sell seeds of unregistered varieties.
Overall	Ministry of Agriculture and Livestock	Food and nutrition security policy (2023) Agriculture Bill (in the making) Bhutan Food System Pathway (2021)