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Plant Breeding Working Group Meeting  
18-19 Paush 2075, Soil Science Division, Khumaltar, by ABD

# Plant Breeding Research and Development in **National Genebank: Status, Achievements, Challenges, Opportunities, Future Prospects**



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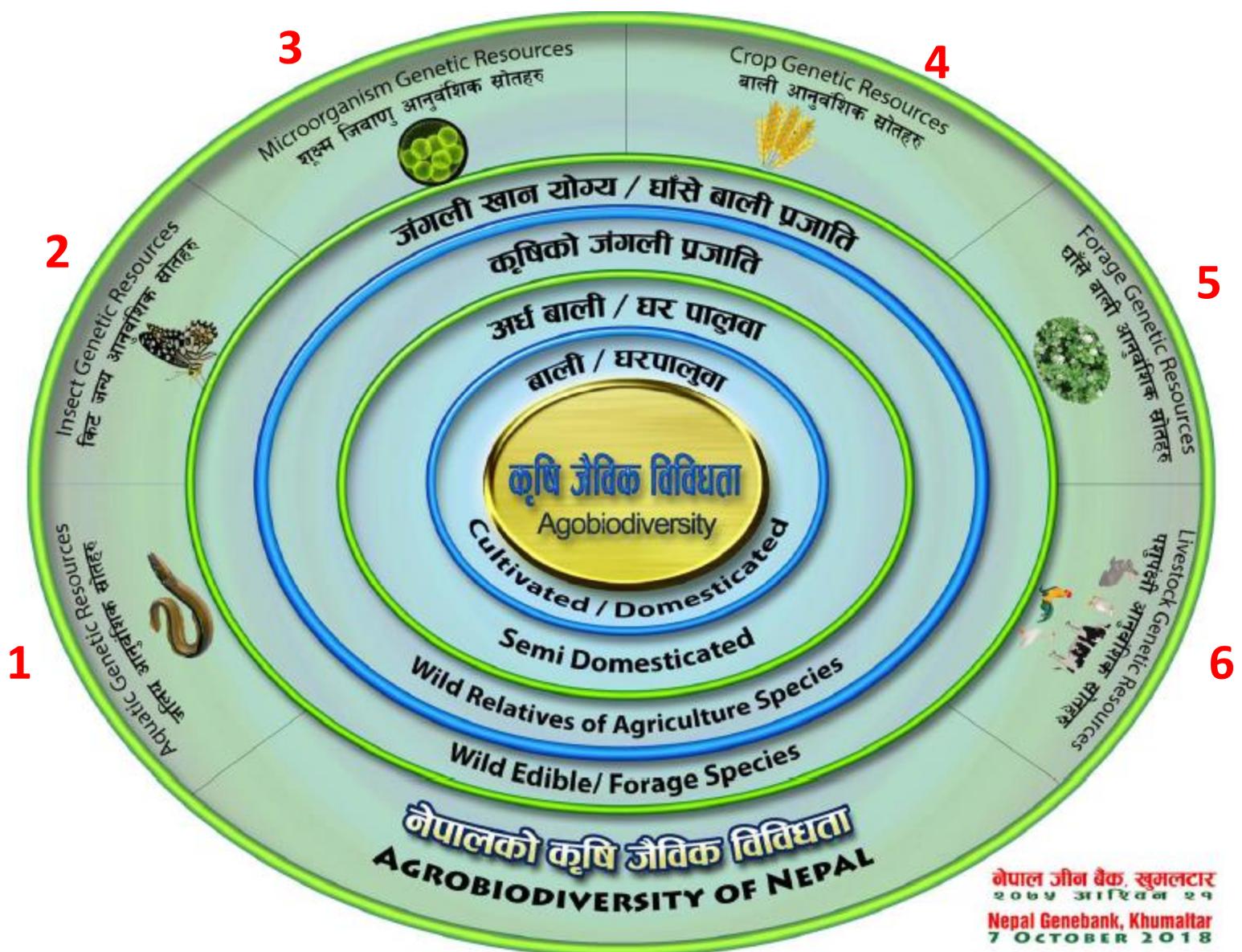
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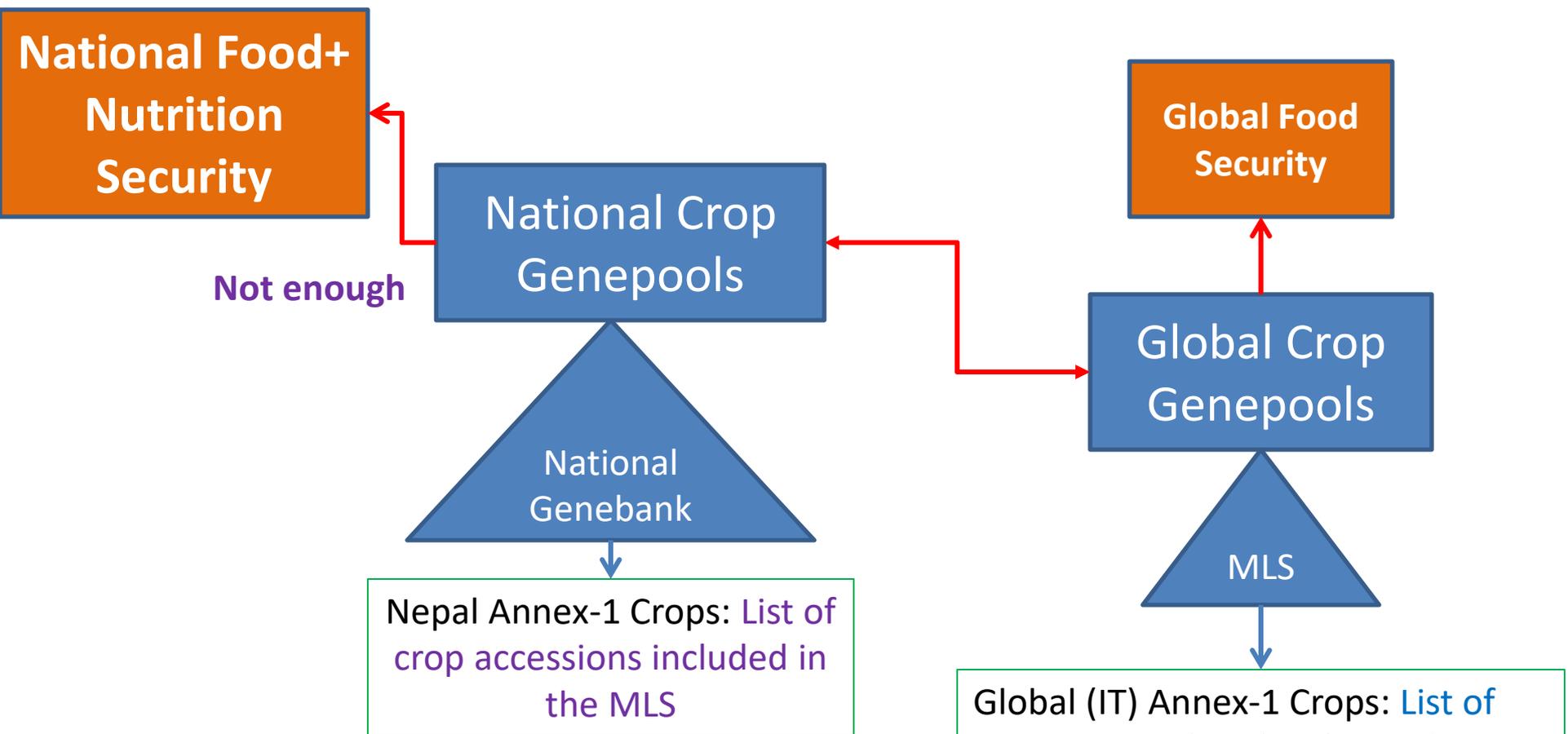


# Introduction





# Objective



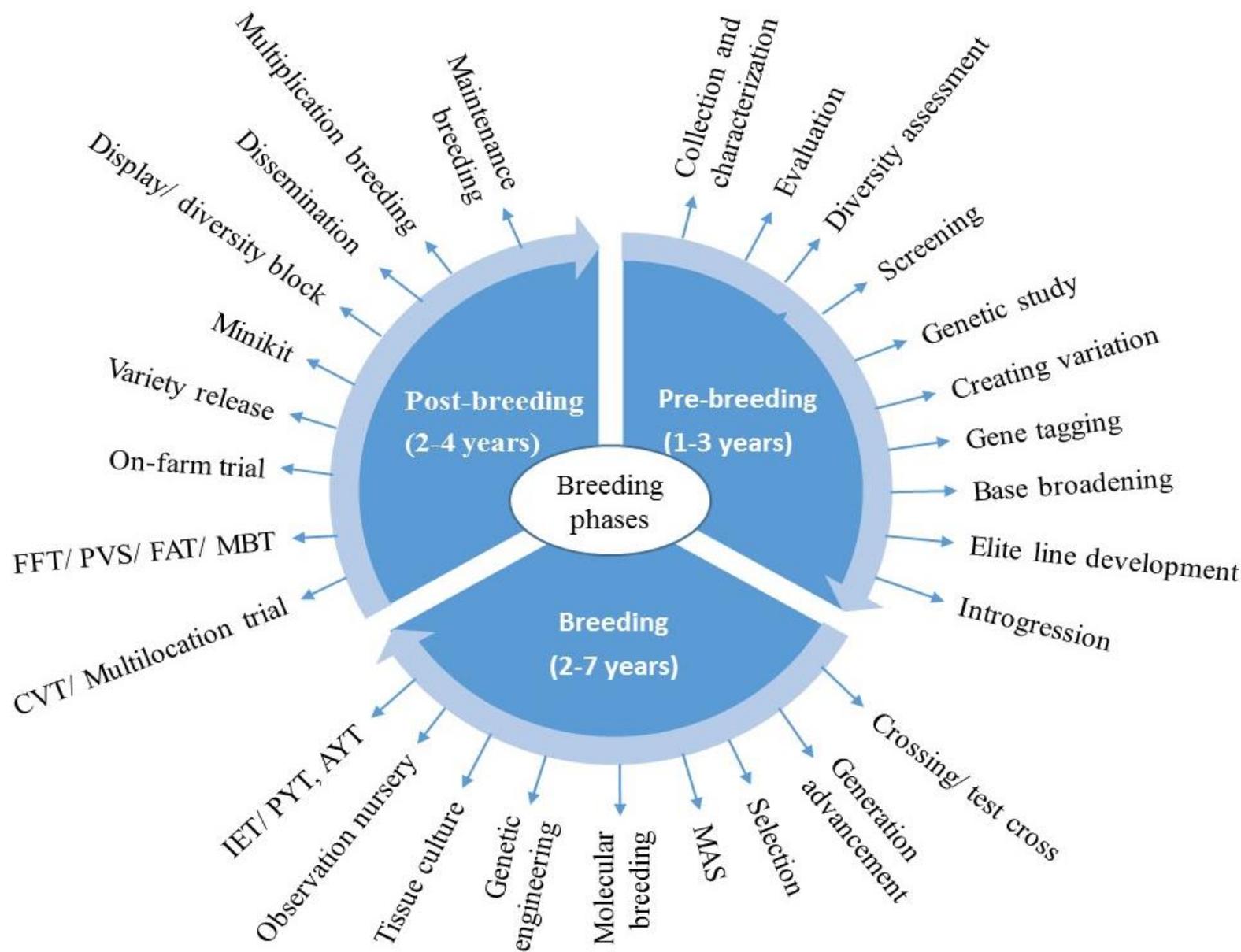
## Breeding strategy

Evolutionary vs non-evolutionary ; Diversity vs uniformity ; Specific vs wide adaptation

- Global (IT) Annex-1 Crops: List of crops covered under the MLS
- A. Food Crops
  - 52 Genus (35 crops)
- B. Forage Crops
  - 81 species (29 forage crops)



# Objective...





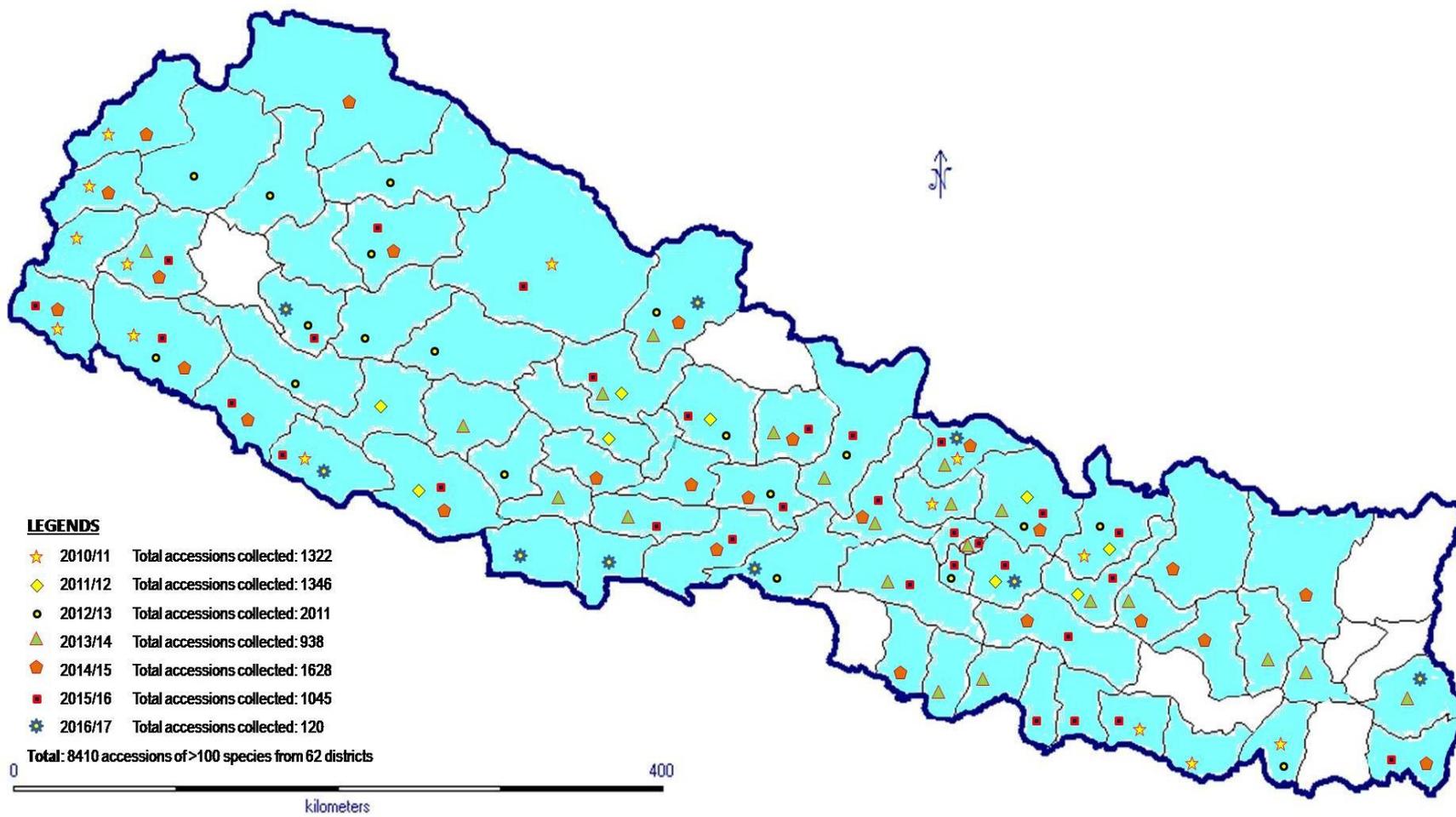
# Plant Breeding Research Project and Activities

- Management of agricultural plant genetic resources
  - Collection, characterization
  - Molecular markers in agrobiodiversity
  - Evaluation and prebreeding
- Local crop project
  - Participatory landrace enhancement, repatriation
- Crop wild relatives
  - Collection and in-situ characterization





# Achievements: Collections during last 7 years





# Achievement: Pre-breeding

हंसराज धान : Upland, scented



डल्ले काको : Gynoecious lines



सेतो भण्टा :  
High yielder





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## Achievements: Registration of landraces

- Broad leaf mustard: Gujmujje Rayo, Dunde Rayo
- Amaranth: Ramechhap Hariyo Latte
- Bean: Dolakha Ghiu Simi, Dolakha Pahelo Simi
- Proso millet: Duddhe Chino
- Rice: Ekle, Bayerni, Kalo Jhinuwa, Pahele, Rato Anati
- Foxtail millet: Kalo Kaguno





# Achievement: SDG: FSF: 6 tech for a single crop



Diversity fair

Community seed bank

Mechanization for processing

Participatory plant breeding

Product diversification

Diversity field school





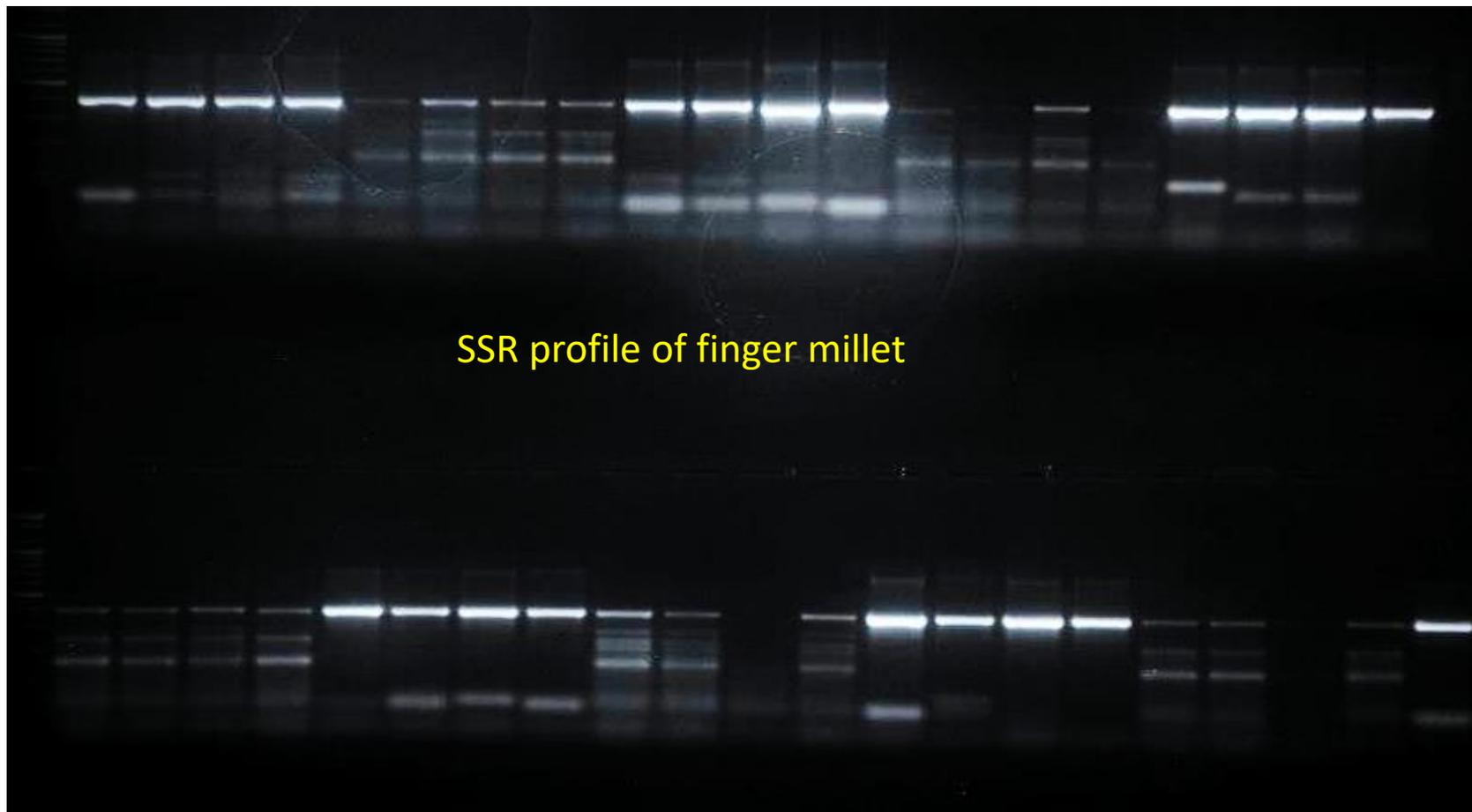
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# DNA Profiling and Screening



# EPB in National Genebank

**Blast?**  
Jumli  
Marshi: 3  
collections

**2015**

Mix and  
grow



Adopted to 3050  
m altitude

**2016**

Based on morphotypes and grain color



Khaire



Kalo



Rato



Ghajale

**2017**

Mix, grow,  
select



Blast tolerant,  
broad genetic  
base pop



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# Achievements: Publication: >100

**Conservation and Utilization of Agricultural Plant Genetic Resources in Nepal**

Proceedings of 2<sup>nd</sup> National Workshop  
22-23 May 2017, Dhulikhel

Editors:  
Bal Krishna Joshi  
Hari Bahadur KC  
Anil Kumar Acharya



**The State of Nepal's Biodiversity for Food and Agriculture**



**Rice Science and Technology in Nepal**  
(A historical, socio-cultural and technical compendium)



## Released and Promising Crop Varieties

for Mountain Agriculture in Nepal (1959-2016)

Bal Krishna Joshi, Madan Raj Bhatta, Krishna Hari Ghimire, Mahendra Khanal, Suk Bahadur Gurung, Rajeev Dhakal and Bhuwon Sthapit



## Rebuilding Local Seed System of Native Crops in Earthquake Affected Areas of Nepal

Proceedings of National Sharingshop  
18 December 2017, Kathmandu

Editors : Bal Krishna Joshi & Devendra Gauchan



## Plant breeding history

## Future Smart Food

## Implementing the International Treaty on Plant Genetic Resources for Food and Agriculture in Nepal: Achievements and Challenges



## International Treaty on Plant Genetic Resources for Food and Agriculture and Multilateral System (ITPGRFA-MLS) Implementation Strategy and Action Plan (IMISAP) 2018-2025

## Policy, Bills

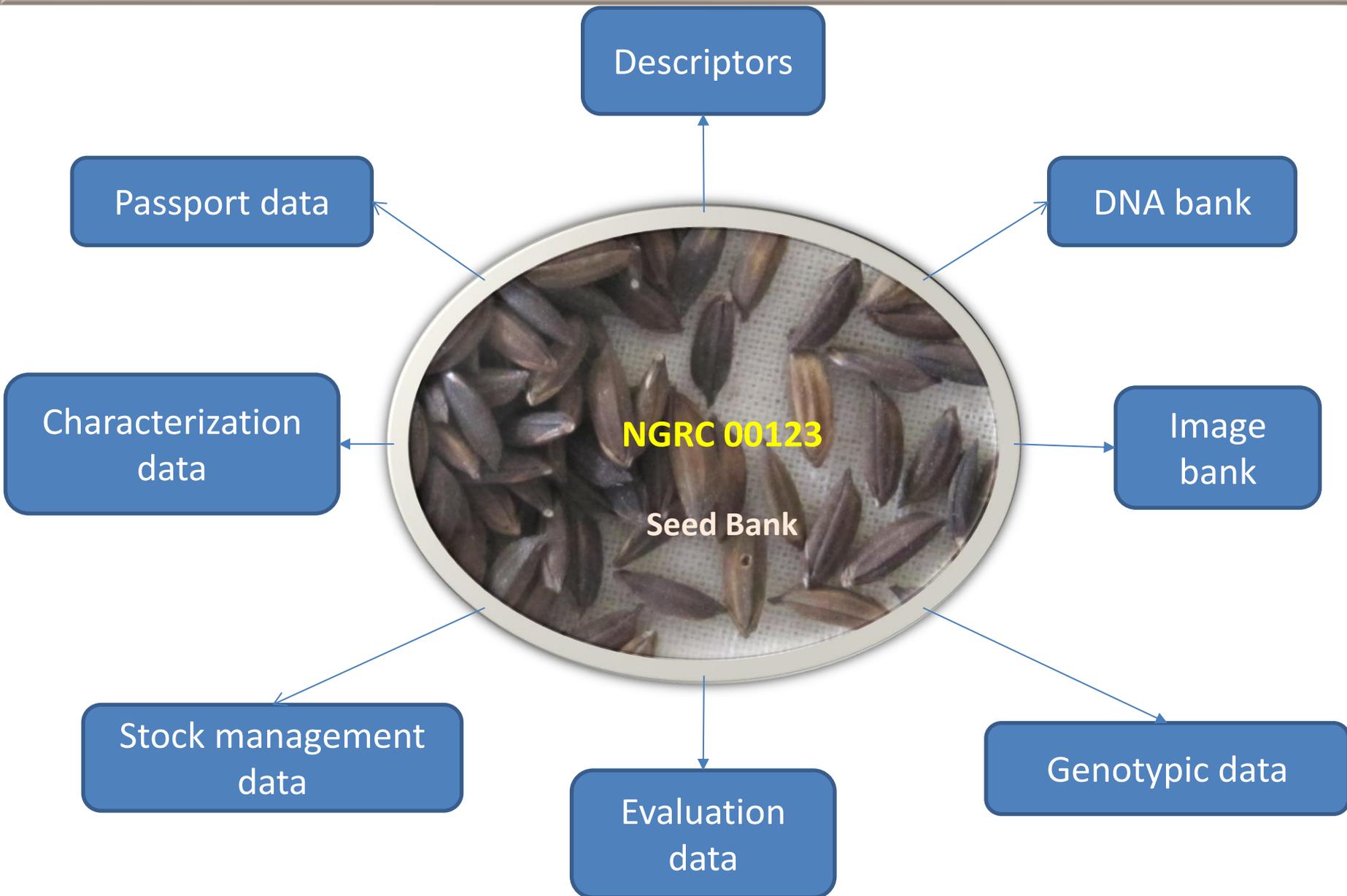
Change in Nepal Himalayas

**BASELINE SURVEY REPORT**  
HANKU, JUMLA | DECEMBER 2016

Jisha Pallikhey, Sajal R Sthapit, Subash Gautam, Devendra Gauchan, Bharat Bhandari, Bal Krishna Joshi and Bhuwon Ratna



## 4.8. Database Management





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## Concept Initiated by Nepal Genebank

1. Accessioning system	21. Global and national gene pools
2. Agrobiodiversity rich farmers, conservation mind	22. Image bank
3. Agro gene sanctuary	23. Landrace as geo indicator
4. Aqua pond genebank	24. Landrace enhancement and conservation (LEC)
5. Black box	25. Landraces catalog and registration
6. Community genebank (community seed bank and community field genebank)	26. Livestock farm genebank
7. Conservation ladder	27. MLS, CAC, GAC
8. Crop specific park and CWR conservation in Protected areas	28. Nepal annex-1 crops
9. Cultivar mixture (varietal blend)	29. Pre breeding
10. Diversity block	30. Red zoning, red listing
11. Diversity fair	31. Repatriation
12. Diversity field school	32. Safety duplication and safety backup
13. Diversity kit	33. School field genebank
14. Diversity rich solution	34. Seed herbaria and agricultural plant herbaria
15. DNA bank	35. Sharingshop
16. Editshop	36. Tissue bank
17. Evolutionary plant breeding	37. Village level field genebank
18. Germplasm rescue mission	38. Virtual workshop
19. GIS + CAT	39. Writeshop
20. Household genebank (household seed bank, household field genebank)	40. Agro plantation



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## Challenges

- Collections from remote areas
- Uses (>85% research on foreign germplasm)
- Screening (DNA markers and inducing environment)
- Gene tagging and marker identification (genetic study poor)
- Phenotype breeding/ Genotype breeding/ Molecular breeding/ Metabolite breeding/ Genetic engineering



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# Opportunities

- Global gene pools
- National gene pools
- Many unique landraces, nutritious and globally important germplasm
- Red zones and endangered + rare germplasm



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# Future Strategies on Crop Improvement

- Plan for coming year
  - Prebreeding
  - Collaborative germplasm regeneration, characterization, collection and multiplication
- Research on different disciplines
  - Genomics / GIS and CAT
  - Plant protection
  - Nutrition
- On-farm conservation
  - Collaborative germplasm regeneration, characterization, collection and multiplication
  - Participatory evolutionary plant breeding, landrace enhancement
  - Repatriation Community field genebank, school field genebank, community orchard, religious site field genebank



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# Future Strategies...

- Training
  - Field genebank related training
  - Provincial workshop on agrobiodiversity
  - Agrobiodiversity bill and regulation
- Publication
  - Station genetic resources profile
  - Agrobiodiversity book
  - Plant breeding standard
  - APGR database
  - Genebank operation manual





## Key Message and Conclusion

- Many potential landraces
- Accessioning system
- Use of local germplasm and CWR in research
- Site specific and evolutionary variety
- Landrace registration





## Plant Breeding: So many areas within a subject

- Evolutionary breeding
- Analytical breeding
- Molecular breeding
- Crop breeding
- Crop improvement
- Heterosis breeding
- Resistance breeding
- Mutation breeding
- Polyploidy breeding
- Inbreeding
- Shuttle breeding
- Participator plant breeding (PPB)
- Landrace enhancement and conservation (LEC)
- Combination breeding
- Conventional breeding
- Classical breeding
- Backcross breeding
- Introgressive breeding
- Population breeding
- Transgressive breeding
- Quality breeding
- Stress resistance breeding
- Multiline breeding
- Maintenance breeding
- Space breeding
- Genetic engineering



Thanks