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Post-disaster Revival of the Local Seed System and Climate Change Adaptation: A Case Study of Earthquake Affected Mountain Regions of Nepal

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The devastating earthquake that hit Nepal on 25 April 2015 most severely impacted rural farm households particularly in remote and risk-prone mountainous regions. Here, farmers' food security is highly dependent on the use of self-saved and locally exchanged seeds of traditional crops and crop varieties. The official estimate by the Government of Nepal indicated that stored food grains and seeds amounting to more than NPR 8 billion (US\$80 million) were lost and about 60% of households' food and seed stocks were completely destroyed by the mega earthquake and subsequent aftershocks (FAO, 2015).

Seed is at the heart of restoring food security for farmers and their families in disaster affected areas. Seed aid interventions are commonly used in post-disaster agricultural relief operations. However, they are not always successful as they are complex to organise and manage, context-specific, often implemented in a hurry and without the required experience and expertise in seed systems and seed security analysis (Sperling *et al.*, 2006). To respond to the immediate disaster caused by the earthquake, significant efforts were made by the national government, international donors and non-government organisations to rescue human beings and provide immediate relief material to the disaster affected households. However, no immediate initiatives were made in affected areas to rescue seeds and endangered native crop varieties as a means to quickly revive and strengthen the local seed system. Considering the critical role of local crop diversity and the local seed system in remote and risk-prone mountainous regions, Bioversity International in partnership with the National Gene Bank and LI-BIRD (Local Initiatives for Biodiversity, Research and Development) implemented a seed rescue and seed

recovery programme immediately after the disaster with the funding support of the Global Crop Diversity Trust and the Genetic Resource Policy Initiative-Phase 2 project (Bioversity International, 2016). The output of the research activities carried out in the last one year to revive local seed system capacity in earthquake affected areas to adapt to changing climatic conditions in 7 of the 26 most affected districts as identified by the Post Disaster Need Assessment (PDNA) of the Government of Nepal (NPC, 2015) are presented here.

Methodology

This study was carried out in earthquake affected districts of the central and western mountains of Nepal involving rescue seed collection missions, conservation, characterisation, multiplication, seed exchange and repatriation of collected seeds. The collection missions were carried out in 7 earthquake affected districts including 326 farmers in 22 village development committees (VDCs) representing 2-4 VDCs from each district within the mountain landscapes (high mountains, middle mountains and lower hills). The study employed several tools and techniques including literature review, participatory rural appraisal, consultation meeting with district agricultural development offices (DADO) and other stakeholders to locate earthquake affected villages and communities and identify specific sample households and vulnerable farmers to undertake collection missions. Sample seed collection and survey of farmers with specifically designed passport data format were carried out including 138 farmers from 4 districts (Gorkha, Lamjung, Dhading and Manakwanpur) representing western cluster (Gorkha epicenter) and 188 farmers from 3 districts (Dolakha, Ramechhap and Sindhupalchowk) representing eastern cluster (Dolakha epicenter).

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At the community level, participatory rural appraisal tools (PRA) such as transect walk, focus group discussion, four cell analysis and participatory seed exchange (PSE) were employed to assess local crop diversity, identify rare and endangered landraces and exchange and distribute farmer preferred seeds of local crop varieties among communities in the affected areas to safeguard diversity and rebuild the local seed system. The collected seeds are currently processed, characterised, multiplied and conserved in the National Gene Bank for future availability to adapt to changing climate conditions in disaster affected areas.

Results and Discussion

The post-earthquake assessment showed that the severely affected areas are mostly the mountainous regions of western and central Nepal that have diverse landscapes with wide variation in cropping patterns, crop diversity and disaster impact in terms of crop cultivar loss. Altogether, a total of 764 samples of 47 crop species covering cereals, pseudo-cereals, vegetables, oilseeds and spices were collected from 7 earthquake affected districts representing western cluster (4 districts) and eastern cluster (3 districts). About 80% of the collected germplasm was processed for conservation in the National Gene Bank. The collected seed samples and survey information from sample farmers were processed and analysed for their use in conservation, multiplication and distribution back to affected communities. The earthquake led a major loss of diversity of local crop varieties due to destruction of storage structures, burial of stored seeds and damage of agricultural lands. However, the major perceived causes of genetic erosion occurring in the surveyed areas and germplasm at risk are the *ad hoc* distribution of large amounts of improved, untested seeds as relief material from external agencies, the sudden migration of farmers after the disaster and attraction of rural farm households towards other alternative income generating options. About 10% of the collected samples were endangered varieties that need special efforts for future conservation and use. To organise the rescue collection of endangered landraces by visiting household after a disaster turned out to be a challenging task due to the heavy damages caused in the communities, the state of shock of people affected, and the hesitance to share with other the few possessions left in the hands of affected farmers. More specific study findings by cluster are presented below:

I. Western Cluster Representing Gorkha Epicenter

From the western clusters (4 districts), a total of 320 accessions of 47 species of crops (cereals, legumes, vegetables, oilseeds, spices) were collected of which 185 were common (no risk of extinction), 55 were endangered, 19 were rare based on distribution and 61 were at risk of loss due to the earthquake. The earthquake led to many crop landraces acquiring the endangered status. The remaining seeds were rescued and sent for conservation in the National Gene Bank. Of the total collection, the highest numbers of endangered seed samples were collected from Gorkha with 28, followed by Dhading (25), Makwanpur (14) and Lamjung (12).

II. Eastern Cluster Representing Dolakha Epicenter

In the eastern cluster, a rescue collection was undertaken in the three most severely hit districts (Sindhupalchowk, Dolakha and Ramechhap) where 444 samples of seeds were collected representing 46 crop species covering major cereals, legumes, vegetables, oilseeds and spices (Sthapit and Gautam, 2016). Of these, 78% of the samples were processed for conservation in the National Gene Bank for safety duplication. Participatory Seed Exchange (PSEs) were organised in 6 VDCs of the three districts in December 2015 as part of the post-earthquake seed recovery programme. In the PSEs, 485 farmers brought 2,058 samples of seeds from three districts to share and 503 farmers took 1,249 samples of seeds from the seed exchange process. Legumes, vegetables and cereals were most prominent in the seed exchange programme. On average, 41% of the varieties were cultivated by less than 5% of the households in each of the locations that are considered to be endangered. Over 98% of the exchanges consisted of locally adapted varieties not in the national official list of 605 notified varieties of Nepal. The PSEs also highlighted the pivotal role of women farmers in seed conservation and exchange.

Conclusions

The most endangered and valuable local seeds of traditional crops were rescued from earthquake affected areas, characterised and conserved in the National Genebank. Farmer's preferred ones are multiplied and shared with disaster affected local communities through PSE and diversity kits distribution. Over 90% of the

collected and shared seeds in the earthquake affected local communities were not in the official national notified list of varieties in Nepal, which demonstrates the valuable complementary role PSE can play to strengthen the local seed system. Some of the rescue collected seeds and those shared back with local communities were also rare, endangered and not in the collection list of the National Gene Bank of Nepal. The process of rescue collection and PSEs adopted after disaster have improved *ex situ* and *on-farm* conservation and enhanced access of locally adapted crop seeds and varieties not readily available in the market. This has also helped to restore lost diversity, revive and strengthen the local seed system and safeguard biodiversity of native crops to adapt to more extreme, changeable and uncertain climatic conditions facing the Nepal Himalayas. The strategy has been useful in building national capacity and resilience to cope with future disasters and laying a foundation for community seed banks. Based on the experience and lessons learned from this study, we recommend collection, conservation and repatriation of farmer preferred seeds regularly through participatory seed exchanges. We also recommend to link the National Gene Bank to the establishment and operations of (newly formed) community seed banks in disaster prone areas as a building block toward an integrated seed system and to be able to more effectively adapt to changing climate and market needs.

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