





Community Seed Banking: Appropriate Practices and Solutions for Food Security

Bhuwon Sthapit
6-9 October 2015, Chiang Mai, Thailand

Outline

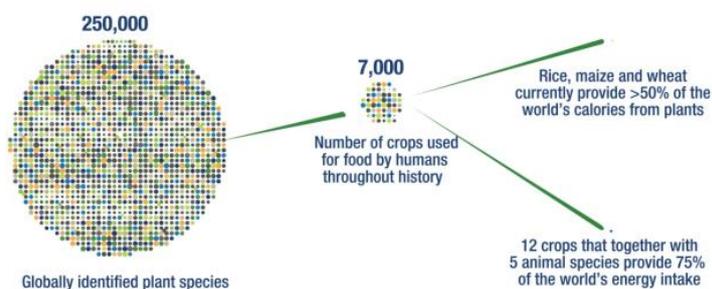
- ✓ Global challenges
- ✓ Biodiversity Initiatives
- ✓ Theory
 - seed systems,
 - farmer seed networks and sources,
 - evolutionary breeding,
 - resilience
- ✓ Misconceptions
- ✓ Case studies and gaps
- ✓ Roles and links
- ✓ A way forward



Challenge: Address shrinking diversity
Objective: Safeguard priority agricultural biodiversity for current and future needs

- Increasing crop yields and improving stress tolerance requires genetic diversity
- Intensification of agricultural systems has substantially reduced biodiversity

Shrinking diversity



Threats

Continued push towards monocultures; shrinking diversity

Consolidation of seed supply into few, large companies

Reduced funds to public sector agricultural research, education and breeding

Consequences

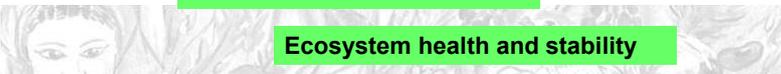
Loss of options to meet public and private needs:

Biotic and abiotic stress

Diet diversity and nutrition

Market and cultural demands

Ecosystem health and stability



Climate change is already happening

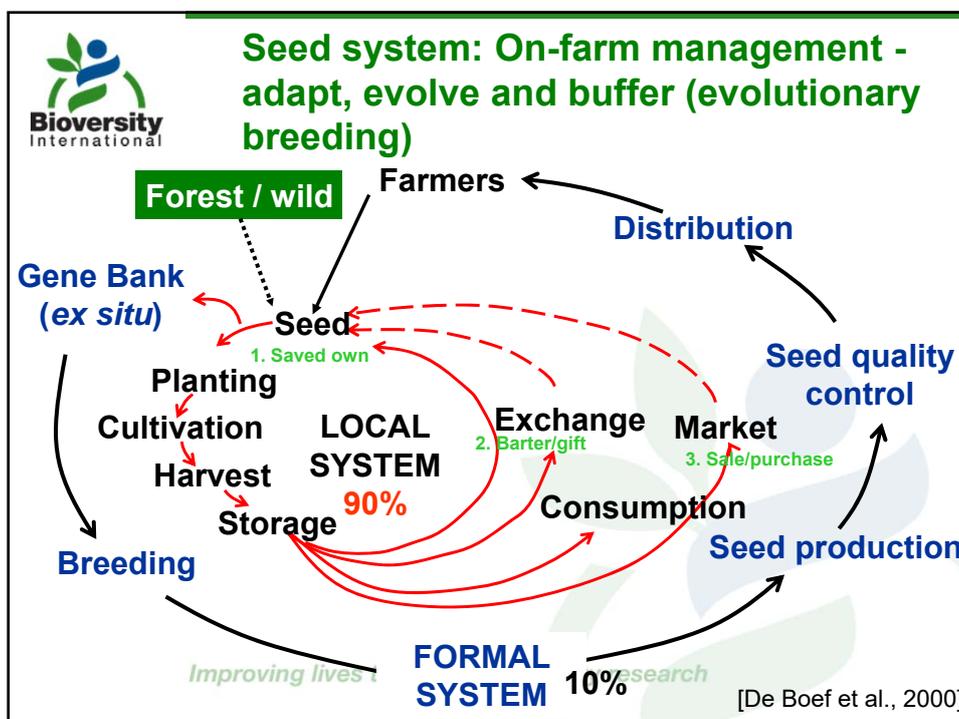
Annual temperature trends: 1976 to 2000

Diseases of concern to the US major crops

- Bacteria causing fire blight in apples
- Ug99 + related strains of stem rust in wheat
- New strains of rice blast disease
- Potato blight is re-emerging

Qualset and Shands, 2005

We cannot predict which new pest or pathogen will develop or how the rain will fall next year -- but we can use agricultural biodiversity to have a diverse set of crop varieties in agricultural systems to increase the options to buffer against an unpredictable change. This explains why on-farm conservation can play key role in future!



Global context: Access for farmers a secure source of locally adapted seed

Country	Crop	Contribution of farmer seed system (source) %	Reference
Burkina Faso	Sorghum	95	Kabore, 2000
Mexico	Maize	75	Ortega-Packka et al., 2000
Morocco	Durum wheat	87	Mellas, 2000
Nepal	Rice	97	Baniya et al., 2003

In India alone-100 million farms-15-20% of them use seed from the regular seed trade; the remaining 80 m farms depend on self saved seed or seed supply from farmers! (Swaminathan, 1998)



Himalayan Superfoods

www.libird.org
facebook.com/libirdkochautari

 <p>Amaranth (<i>latte, marsha</i>)</p> <p>Amaranth is considered as a nutritious grain in the high mountain communities and as an iron rich leafy vegetable in the rest of the country. Amaranth grain is grown here and a great source of protein and the essential amino acids lysine, especially important for vegetarians. It can be part of a nutritious breakfast for busy children. Amaranth is considered an ideal feeding food by various cultures. Over 25 types of amaranth is reported from India predominantly for this purpose annually.</p>	 <p>Barley & Naked Barley (<i>Jau & Uwa</i>)</p> <p>One of the oldest grains to be cultivated, barley has been grown for over 5000 years. Monks have consumed barley as a nutritious breakfast food that helps the body conserve energy in cold weather. Barley is an excellent source of complex carbohydrates that helps lower cholesterol levels and the risk of type-2 diabetes. Pearled barley can be used in nutritious soups, while barley grains and grits can be consumed as part of a healthy and nutritious breakfast for busy children in Kathmandu and Kuluwamdi.</p>	 <p>Beans (<i>simi</i>)</p> <p>The high diversity of beans have been an important source of vegetable protein for the people in the high mountains of Nepal, where dietary and nutritional diversity is especially limited. Beans of different shapes, sizes and colours are cultivated and consumed as a means providing wholesome nutritional benefits. These mountain beans are now becoming increasingly popular among urban consumers.</p>	 <p>Buckwheat (<i>phapar</i>)</p> <p>Buckwheat is considered as a gluten free food and a leafy vegetable. Rich in fibre and more nutrients such as magnesium, copper, and manganese, it is a good alternative for people at risk of diabetes and cardiovascular diseases. Leafy buckwheat contains the chemical cells that improves blood circulation. Mountain communities in Nepal have used leafy buckwheat as a treatment for bleeding gums. Honey made from buckwheat flower has a distinct taste and is a common usage remedy.</p>
 <p>Finger Millet (<i>kodo</i>)</p> <p>Finger millet is a good source of calcium, iron, fibre, and amino acids making it important for blood and bone health, better digestion and muscle repair. The hardy leafy finger millet stems and midrib are eaten in blood soup. It is a good alternative grain for people at risk of diabetes. It has cultural importance in mountain communities for preparation of food (like chitaki) essential in every ceremony. Consequently, it needs to be preserved for its role in maintaining the local diversity of finger millet.</p>	 <p>Foxtail Millet (<i>kaguno</i>)</p> <p>This widely named small millet is a traditional staple food grown in the high parts of the high mountain landscape. It is a grain used in the regular consumption of hardy millet leads to a significant fall in blood glucose, making it a useful food to help manage and prevent diabetes. Foxtail millet features a variety of uses, from being eaten as a food, a hearty porridge or used to brew alcoholic beverages. Foxtail millet cooked with milk and sugar (dahi) in a pudding makes an excellent and equine dessert.</p>	 <p>Proso millet (<i>chino</i>) has among the lowest water requirements of any cereal crop making it an incredibly climate resilient crop. It is a gluten free food, packed with a variety of essential nutrients, protection to parasites, which contributes to improve overall health. Proso millet is traditionally consumed in the mountain communities as a staple food, cooked in the form of khaki where access to rice is still limited.</p>	 <p>The famous Jaula diversity of rice sets the record for being grown at the highest elevation, over 3000 metres above sea level in Chitwan, Nepal. The high mountains of Nepal are important for cold tolerant genes in rice. Our Chitwan rice has become the most important variety in Bhutan and Bangladesh covering around 8% of their rice area. Increasingly, rice of different hues and colours are increasingly popular in global markets for their novelty and nutrient (antioxidants and minerals). It is time for Annapurna Rice to have its day in the sun.</p>

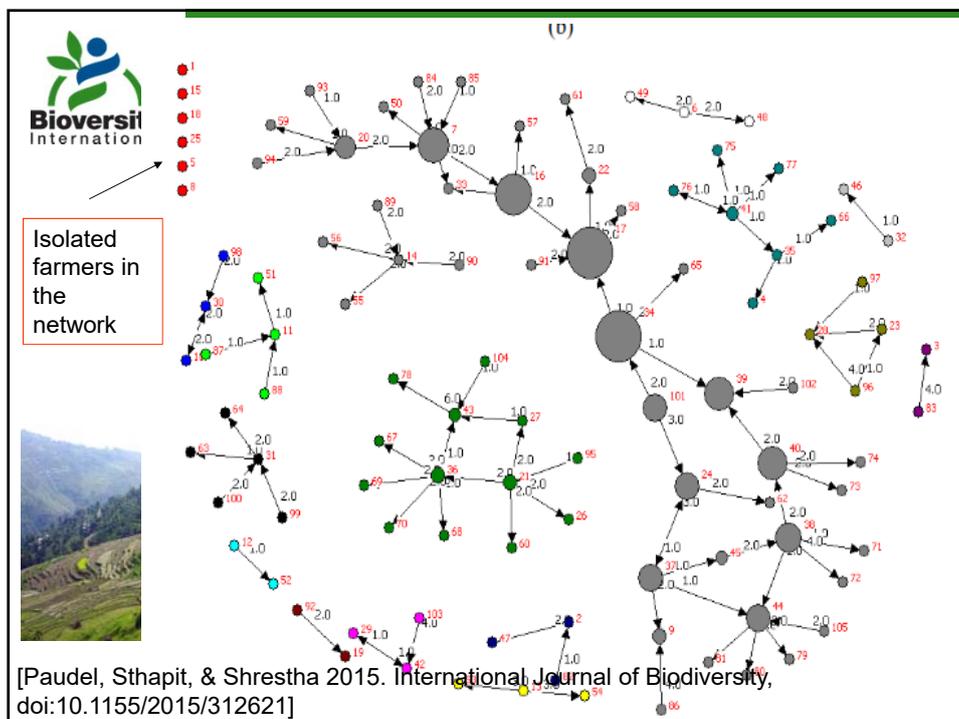
Collaborating for Research and Promotion of Alternative Crops in Nepal



Contribution of informal seed sources to livelihood of mountain farmers, Nepal

Crops	Humla (2000m)	Jumla (2000m)	Lamjung (1500)	Dolkha (1700)
Amaranth	100	100	100	100
Barley	100	100	100	97
Beans	100	85	83	72
Buckwheat	100	100	100	95
Finger millet	100	100	100	97
Foxtail millet	100	100	100	97
Perso millet	100	100	100	NA
Rice	96	76	98	95
Total				

GEF LLI-BIRD Baseline survey, 2014



Multi-functionality of farmer seed system:

Germplasm base

- diversity, flexibility, selection

Seed production and quality

- germination, disease problems, quantity

Seed availability and distribution

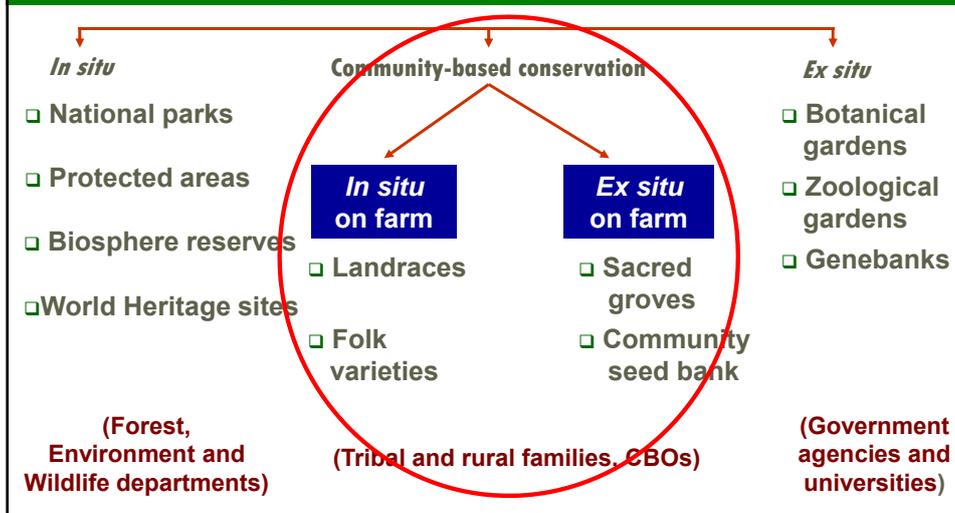
- seed sources, networks, markets

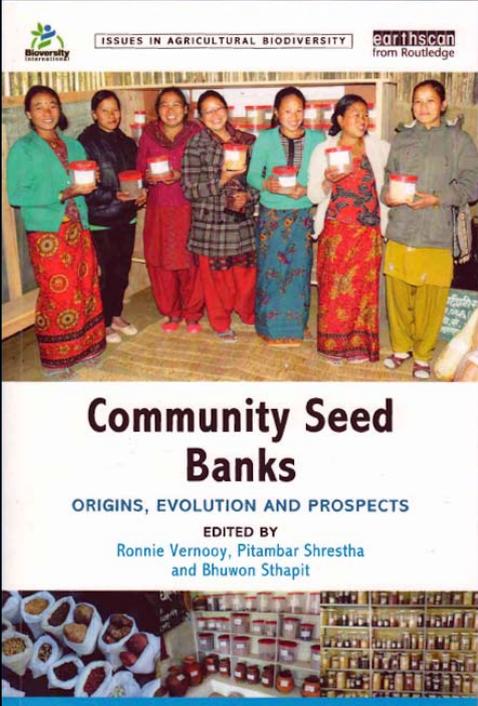
Knowledge and information

- growing methods, utilization, knowledge of new materials, traits trade off

Complementary Conservation Strategies

Integrated Conservation Methods





Community Seed Banks
ORIGINS, EVOLUTION AND PROSPECTS
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Article

The Multiple Functions and Services of Community Seedbanks

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Abstract: Although community-level seed-saving initiatives have existed in many countries around the world for about 30 years, they have rarely been the subject of systematic scientific enquiry. Based on a combination of a literature review and field research, we present a novel comprehensive conceptual framework that focuses on the multiple functions and services provided by community-based seed-saving efforts, in particular community seed banks. This framework is output oriented and complements an input oriented typology of community seed banks presented in 1997. The framework identifies three core functions: conserving genetic resources; enhancing access to and availability of diverse local crops; and ensuring seed and food sovereignty. The framework can be used for analysis of existing seed-saving initiatives and serve as a guide for the establishment of new community seed banks. In addition, it can inform the development or revision of national policies or strategies to support community seed banks. The framework's utility is illustrated by three case studies of community seed banks in Bangladesh, Guatemala and Nepal.

Keywords: agricultural biodiversity; conservation of biodiversity; plant genetic resources; community seed banks; farmers' rights; food sovereignty; seed sovereignty; Bangladesh; Guatemala; Nepal

35 Case studies review 25 Countries

- Diverse actors diverse objectives
- Differences
 - Origin and evolution
 - Functions and activities
 - Governance, management and cost
 - Technical operations
 - Support and networking
 - Policy and legal environment
 - Sustainability
- Analysis of new scope, opportunities and partnership
 - "Out of box" initiative



Origins and Evolution of Community Seed Banks

Timeline	
1975	USA-Based Seed Savers Network established by Diane and Kent Whealy to preserve heirloom varieties
1986	PGR Ethiopia, Seed for Survival Program supported by USC, Canada to re-integrate local varieties in local seed system Australian seed networks and seed library in Europe
1992-1996	The Philippines by SEARICE and CONSERVE; Brazil, Chile; UBNING, Bangladesh, CTDZ Zimbabwe, DDS, ADS, Green Foundation, Gene Campaign and MS Foundation, India, USC Canada-Asia
2003 to date	LI-BIRD/Bioversity International/Development Fund Norway/Oxfam, Action Aid etc in number of countries

NGOs are key player in past & now Governments taking interest!

Seed Savers Exchange Network



Conceptual framework: Classification of global community seed banks by functions

Functions	Case study examples (book chapter)
Conservation	Bhutan, Malaysia, Mexico and Rwanda
Access and availability	Burundi, Canada, Costa Rica and Uganda
Conservation and Access & Availability	Bolivia, Brazil, China, Guatemala, Honduras, India, Mali, Nepal, Nicaragua, South Africa, Sri Lanka, USA, Trinidad, Zimbabwe
Conservation; Access & Availability & Seed and food sovereignty	Bangladesh, Brazil, Nepal and Spain

Result: Multiple functions; Diverse actors/Diverse objectives

Governance, Management and Cost

- Legitimacy, and Rules and regulations
- Daily operations and management governed by collective actions, social capital building, voluntary work, empowerment
- Accountability, transparency and leadership
- Roles and responsibilities
- Building local capacity
- How much it cost to establish CSB?
- 1000\$ to \$10000





Technical operation and issues



- Community and site selection
- Choosing crop species and varieties
- Collecting seed and planting materials
- Documenting, sharing and communicating information
- Storing seed, structure, methods, monitoring
- Regenerating seed
- Distribution system and tracking

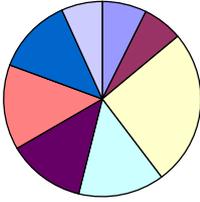
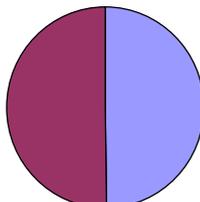
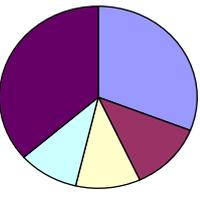
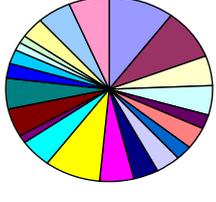





Bhuvan Shrivastava
Walter de Boer

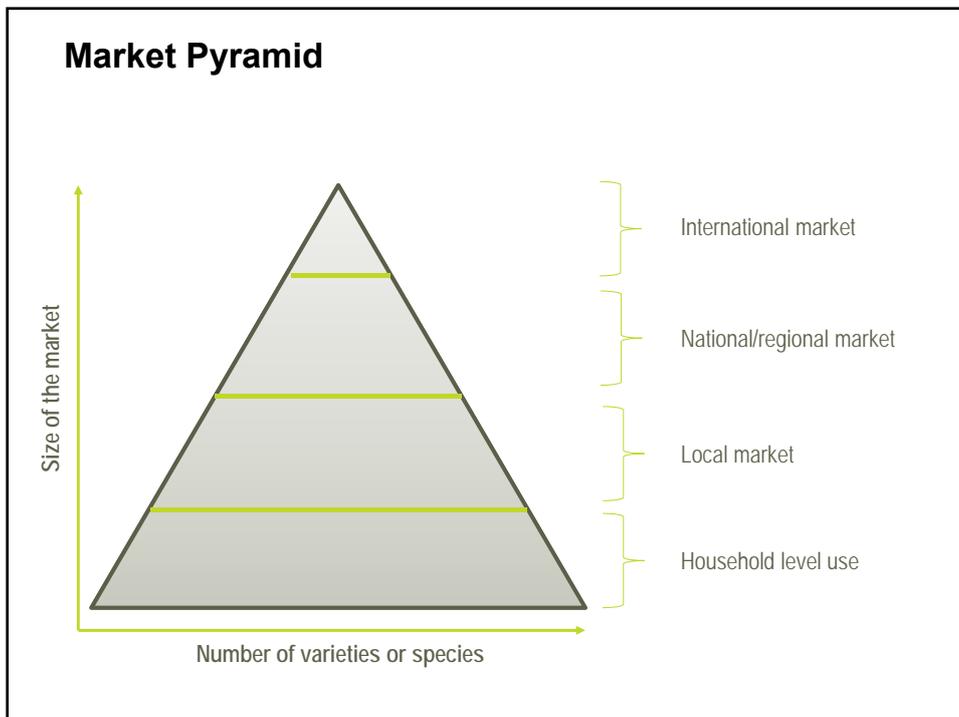
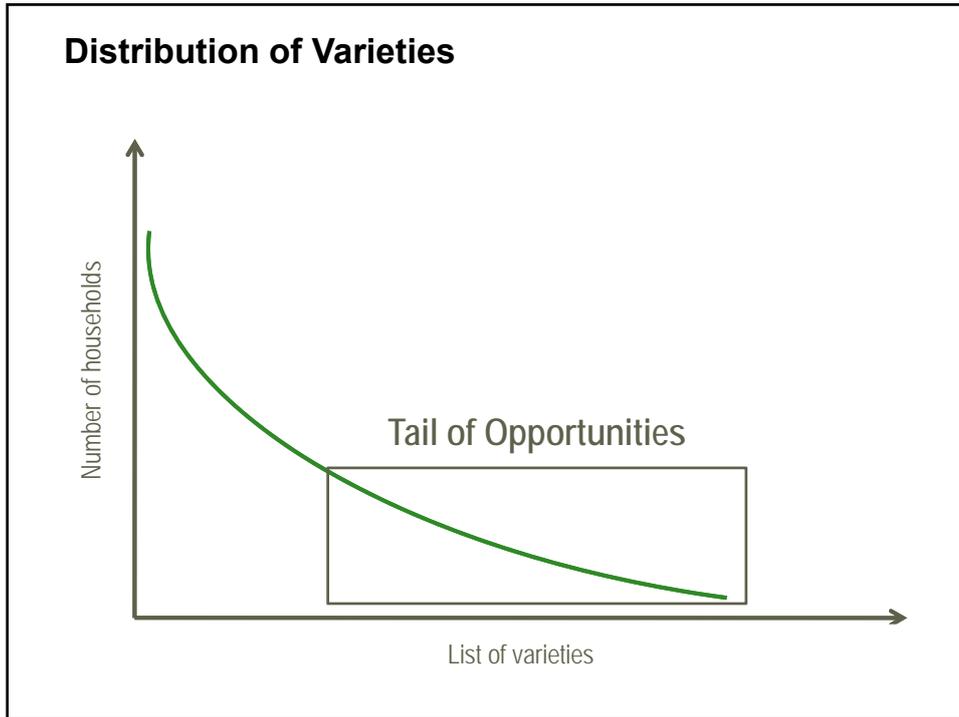


Choosing crops and varieties- rare/unique

Large areas		
Small areas		
	many households	few households

[Sthapit et al., 2006]





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A risk-minimizing argument for traditional crop varietal diversity use to reduce pest and disease damage in agricultural ecosystems of Uganda

ALS

Richness

Anthraco

Richness

Diversity to manage disease/pests

Epsa Palikhe

Bhuvon Sthapit

Role: Source of mixture varieties or portfolio of crop diversity

Seed Storage

- ❖ Goal in storing seeds is to slow metabolic processes-dry and cold (sleep)
- ❖ Maximizing seed longevity:
 - ❖ Start with good quality seed
 - ❖ Keep them appropriately dry
 - ❖ Keep them as cold as possible
 - ❖ Minimize exposure to light
 - ❖ Minimize access to air
 - ❖ Minimize changes in conditions
 - ❖ Exclude insects and rodents
- ❖ Longevity doubles for every 1% reduction in seed moisture content and for every 5°C drop in temp.
- ❖ Short-term storage: 5–10°C
- ❖ Long-term storage: -18°C

Storage Insect Control using Drying Beads

Six months storage

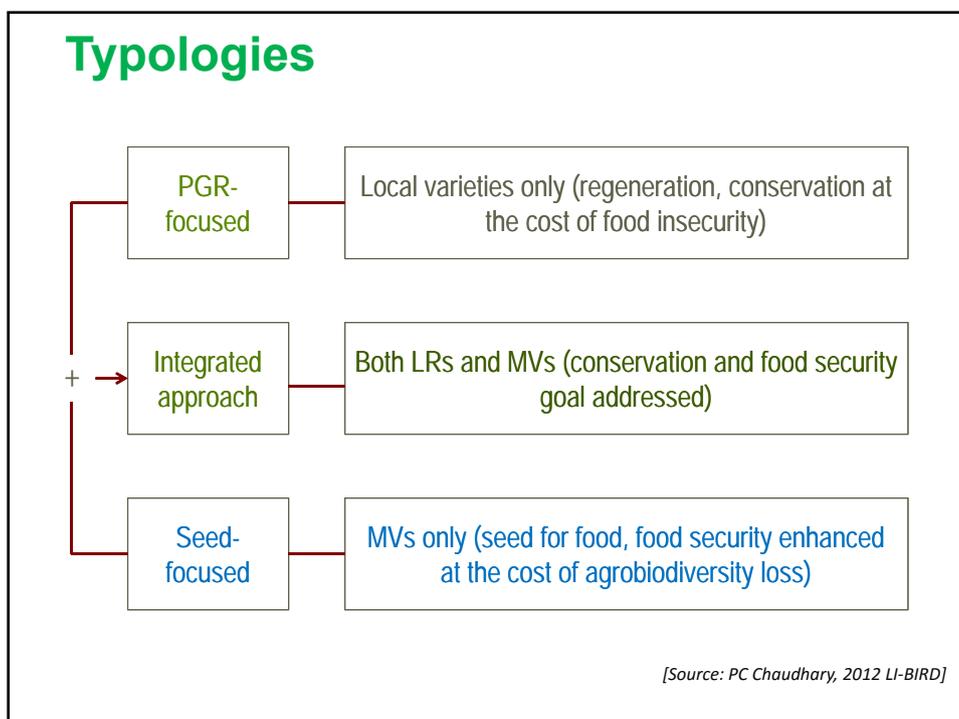
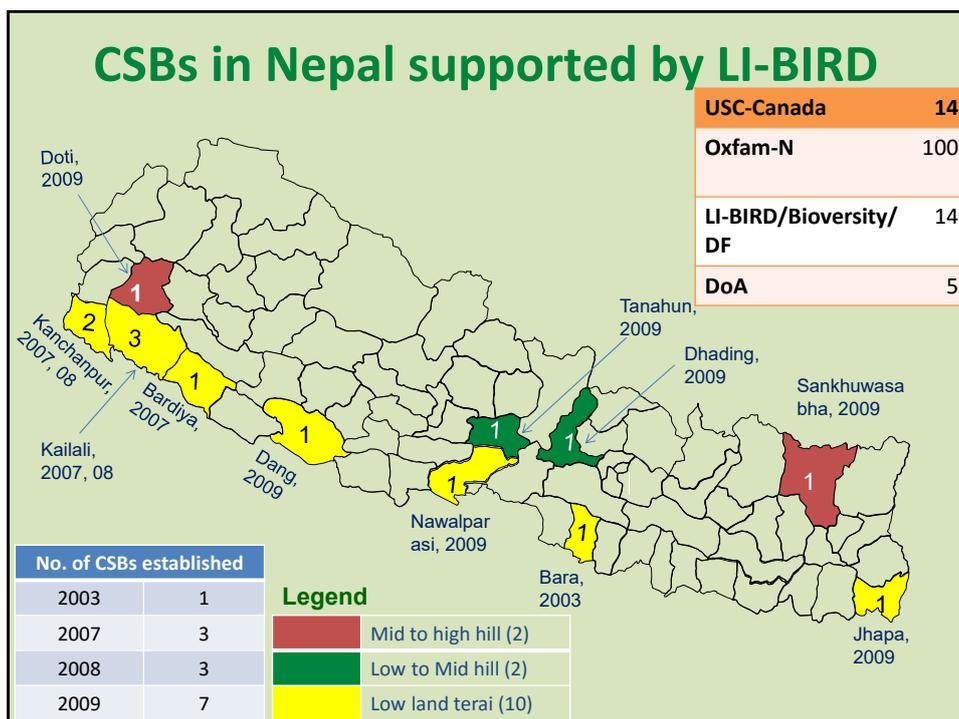
Without beads	With beads
69% infestation	0% infestation

(Source: Karnataka Kisanik, ANGRAU Hyderabad, India)






Nepal Case study:
 A local solution to improve access to quality seed,
 safeguard of diverse crop varieties, and secure food
 security





Hypothesis and research questions

- ❑ Whether or not CSB improve access of unique, endangered and rare local varieties?
- ❑ Whether CSB improve equitable access of seed to marginalized and poor smallholder farmers?
- ❑ Whether CSBs address farmer's concern of seed accessibility or availability or both?
- ❑ Are CSBs relevant and appropriate interventions where social seed networks are strong, open and well-connected?
- ❑ Whether CSBs can be a platform of open source of seed exchange and social learning?
- ❑ What are key drivers of success and failures ?
- ❑ What are key principles that ensure sustainability of CSBs after completion of the project?



Community Driver: Rapid erosion of rice landraces in Kochorwa, Bara (Shrinking local crop diversity and options)

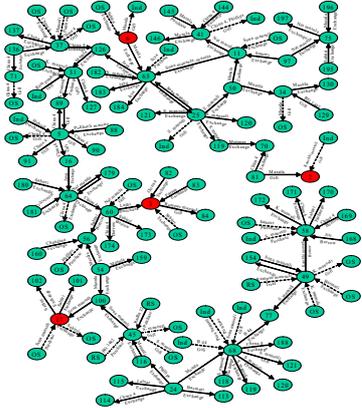
Year of study and type	No. of LRs/MVs		No. of growers		% of area occupied by	
	LRs	MVs	LRs	MVs	LRs	MVs
Baseline 1998 (n=202 HHs)	33 ↓	20	137 ↓	-	16.7 ↓	83.3
CBR 2003 (n=349 HHs)	14 ↓	26	111 ↓	-	3.4 ↓	96.6

Note: LRs=Landrace, MVs=Modern varieties, HHs=Households, CBR=Community biodiversity Register

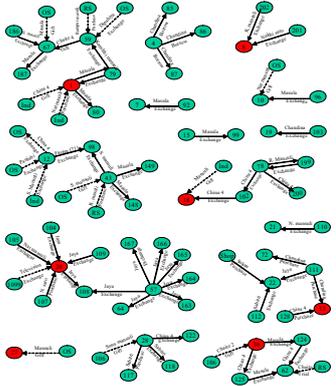
[Source: Adapted and modified from Rana et al., 2000]

Community Driver: Weakening social seed networks

Non-commercial: Resilient to climate change



Commercial area: Vulnerable to climate change and adversity



[Paudel D, Sthapit BR and P Shrestha 2015. An Analysis of Social Seed Network and Its Contribution to On-Farm Conservation of Crop Genetic Diversity in Nepal," International Journal of Biodiversity, vol. 2015, Article ID 312621, 13 pages, 2015. doi:10.1155/2015/312621]



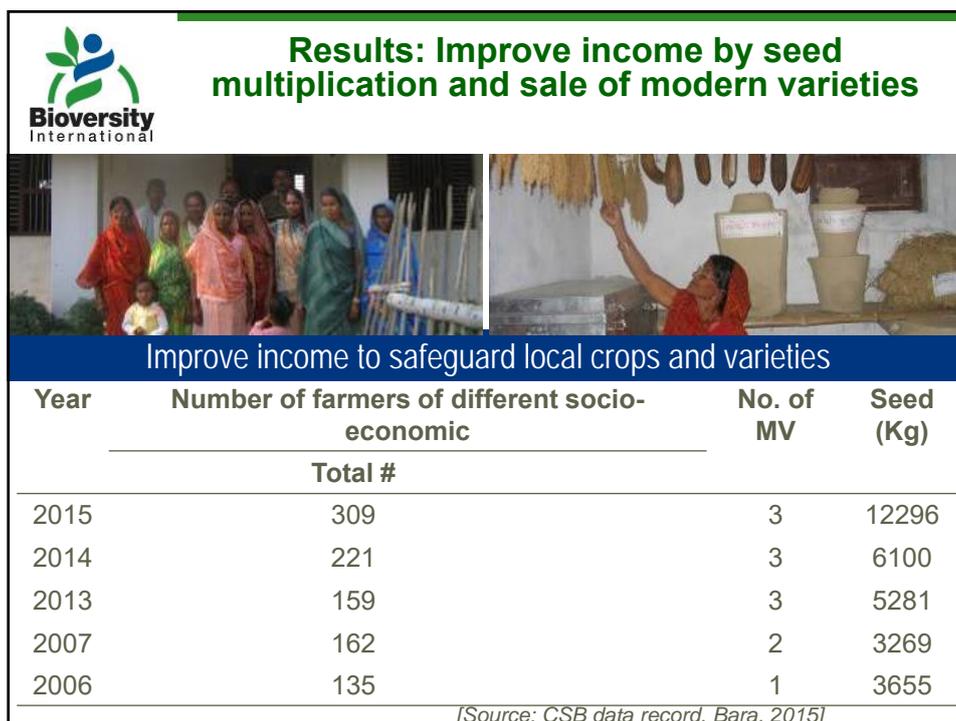
Results: Improve access of local varieties for poor smallholder farmers and social equity

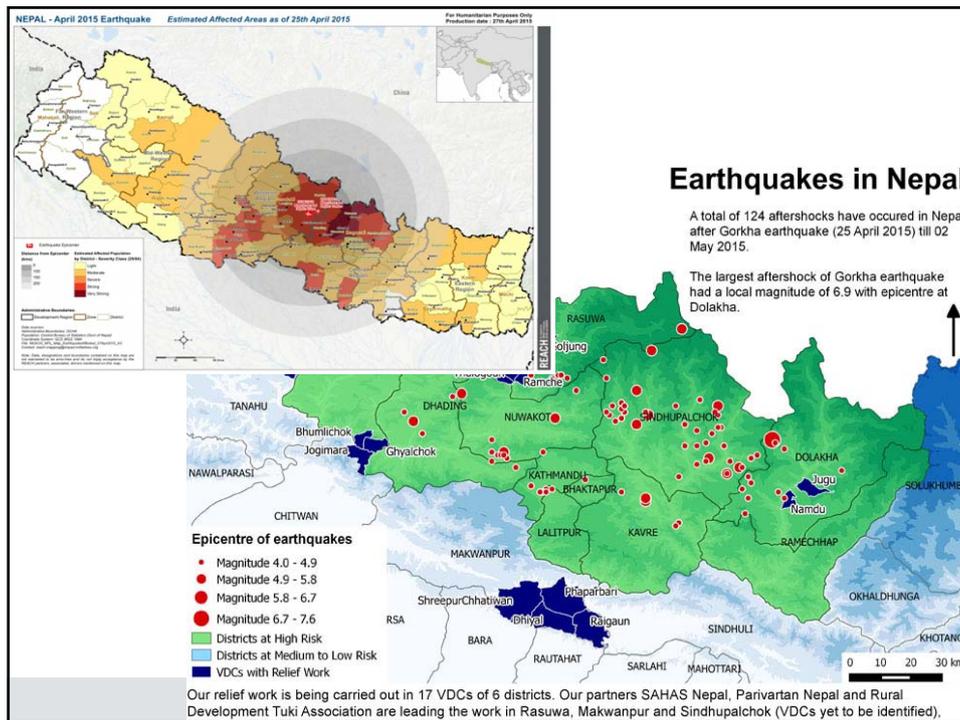



Improve access to landraces: Pro-poor women farmers

Year	Number of farmers of different socio-economic				Total	No. of landrace	Seed (Kg)
	Rich	Medium	Poor				
2007	23 (23)	34 (33)	45 (44) ↑	102	28 ↑	103	
2006	7 (11)	25 (39)	32 (50) ↑	64	21 ↑	80	
2005	17 (20)	37 (42)	33 (38)	87	23	197	
2004	6 (17)	14 (40)	15 (43)	35	13	69	
2003	5 (12)	19 (48)	16 (40)	40	11	87	

[Source: Pitambar Shrestha and BR Sthapit, 2008]





Emerging roles of Community seed bank in seed relief and reiving local seed system



9750 kg truthfully labelled rice seeds supplied to suitable earthquake affected areas

Income for a single CSB: USD 3600 (NPR 358,750)

Pride: Able to help earthquake affected families



(Credit: P Shrestha, LI-BIRD)



Participatory seed exchange at the meeting held in community seed bank



Improved access to unique materials and information to wider groups (Diversity kits)

Luffa cylindrica L. Traits: aroma, taste, delayed net

- **Good practices**
- Diversity fairs
- Diversity blocks
- Diversity kits
- CBR
- Community seed bank



1998
1 HH Diversity fair

2000
Diversity block 7HH

2001
70 Diversity kits

2002
195 HHs

1998
Rare

↓

2002
Common

Improved access by community actions; many examples

Big task shared by many citizens: Amaranth Diversity Kits in Jumla

www.libird.org
facebook.com/libirdkochautari



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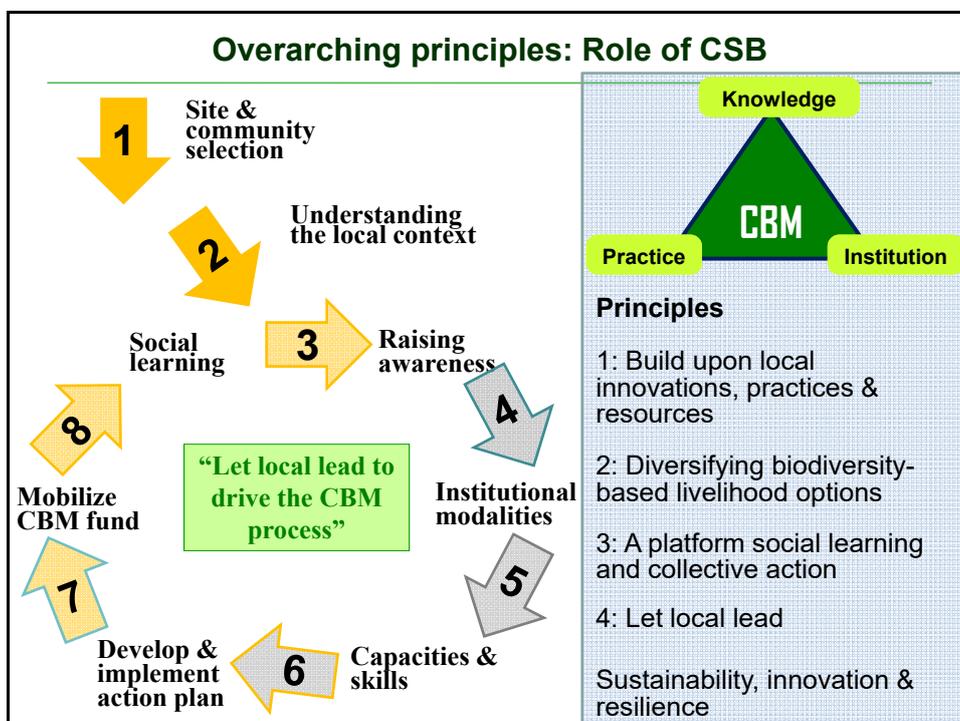
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Collaborating for Research and Promotion of Alternative Crops in Nepal







Take home message

- New roles of community seed banks and national gene banks are emerging and new scope and opportunities
- Cultivate partnership for creating space for country specific innovation in this field
- Misconception-let's science drive the process of understanding and appreciating
- Strengthen technical capacity of community seed banks (introduce * system by NGB)
- Link to PPB/PVS and crowdsourcing approach
- Policy space for CSB (Seed regulatory framework, Farmer's Rights, ABS/Nagoya protocol)
- Potential platform of community biodiversity management and social learning and change (institutional issue)

