



Documentation and monitoring agrobiodiversity for adaptation to climate change

S. Padulosi, G. Meldrum, W. Rojas,
O. King and S. Sthapit



Enabling poor rural people to overcome poverty



CLIMATE
CHANGE
AGRICULTURE AND
FOOD SECURITY



International Conference on “Agrobiodiversity to manage risks and empower the poor”

H10 Roma Città Hotel, Rome, Italy, 27-29 April 2015

Outline

- Introduction
- Role of documentation and monitoring
- Approaches, methods and tools & results
- The way forward

Introduction

Vision: complementary ex situ-in situ efforts (static & dynamic method) particularly relevant for documentation & monitoring of cultivated species as most of 7.4 Mil accessions in ex situ refer to few major crops and CWR. Majority of 7000 species of food crops conserved on farm. Our knowledge on these extremely limited. **This work highly strategic to build resilient agricultural /associated livelihood systems**

Ex situ- In situ synergy: the benefits

Local benefits

Identification of resilient varieties; access to strategic resources to cope with climate change, food insecurity etc; prevention of GD and IK erosion; more effective use of ABD for livelihood; strengthened culture and self esteem; empowerment of vulnerable & poor.

National benefits

Prevention of diversity/culture loss; mechanism to monitor/guide re-introduction; robust conservation strategy; enhanced use incl. adaptation to climate change across country.

International benefits

Better understanding and monitoring of centers of crop diversity (“hot spots”) where alleles of useful traits of global crops likely to occur (incl. for adaptation/ resistance to biotic-abiotic factors).

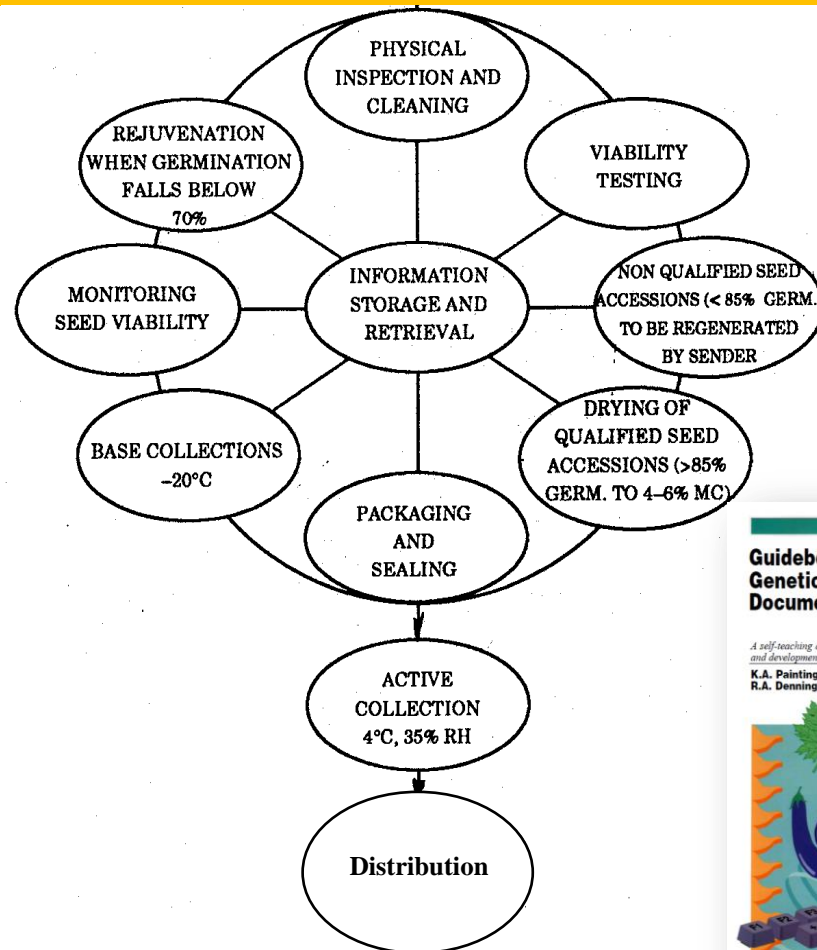
The ex situ world: Use of information

- Managing resources in GB efficiently
- Setting conservation priorities & guide development national conservation strategies
- Adding value to germplasm for users (e.g. seed4needs type of intervention)
- Support research (genetic diversity, nutrition etc)
- Support public awareness campaigns

Use of genebank information

To guide numerous operations:

- Which samples must be urgently regenerated?
- What are the consequences of not regenerating certain samples?
- How much land is required
- Where the work will be carried out
- How many accessions will be regenerated at each site..



Guidebook for Genetic Resources Documentation

A self-teaching approach to the understanding, analysis and development of genetic resources documentation
K.A. Painting, M.C. Perry,
R.A. Denning and W.G. Ayad



Descriptors for
Tea
(*Camellia sinensis*)



Descriptors for
Hawthorn

Descriptors for
Banana
(*Musa spp.*)

IPGRI
Descriptors for
Citrus

Descriptors for
Tomato

IPGRI
Descriptors for
Rocket
Eruca spp.

Bioversity International
Descriptors for

Bioversity International
Descriptors for

Bioversity International
Descriptors for

but huge gap to fill for underutilized crops!

UNDER UTILIZED MEDICINAL RARE AND SPECIES

Quinoa
Cereales y Leguminosas

PRONPA

INIAF
Instituto Nacional de Investigación Agraria y Alimentaria

IFAD
Enabling poor rural people to overcome poverty





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Castilla-La Mancha

Unión Europea
Fondo Europeo de Desarrollo Regional

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106/200

GIS data and their application..

Show Results By Genebanks

Your selection contains **625163** accessions

Show Results By Species

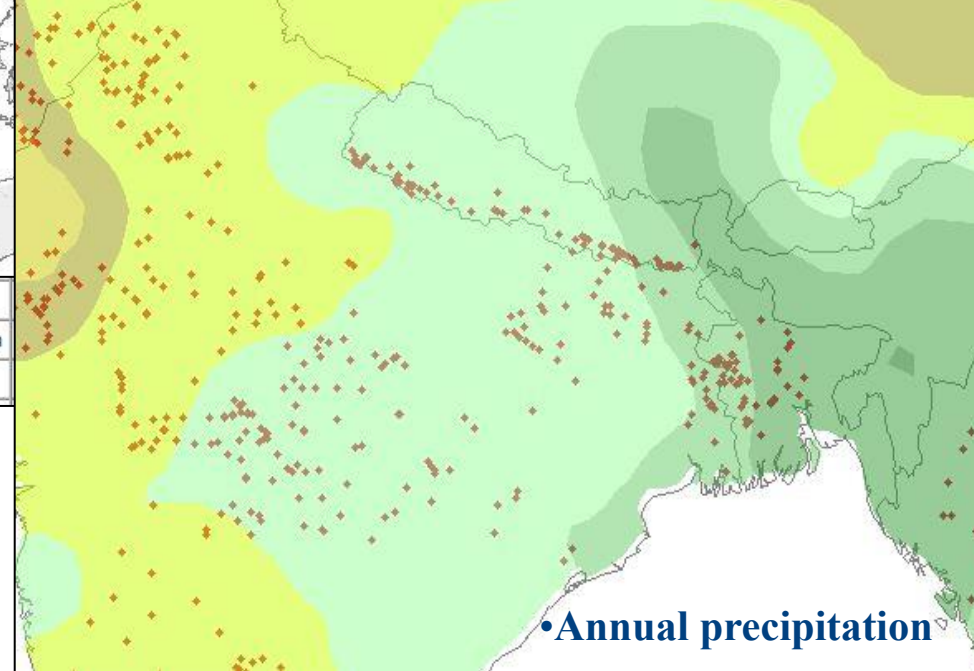
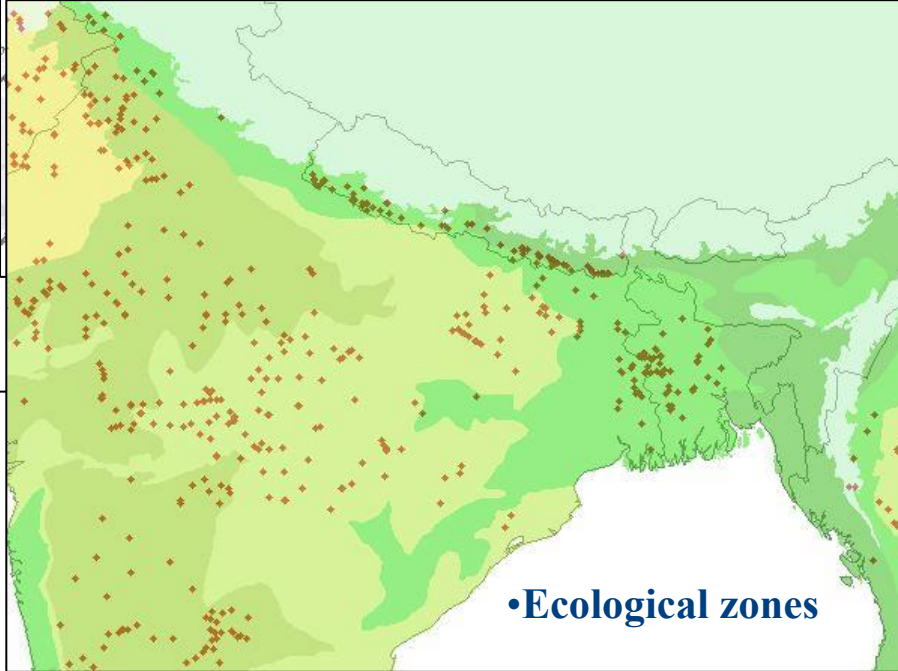
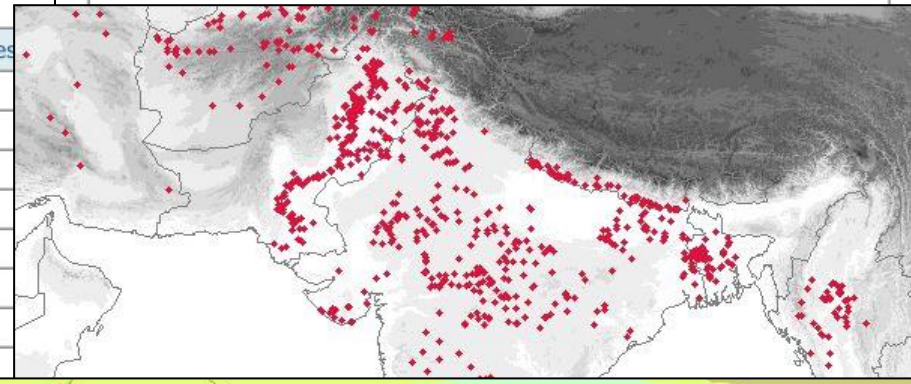
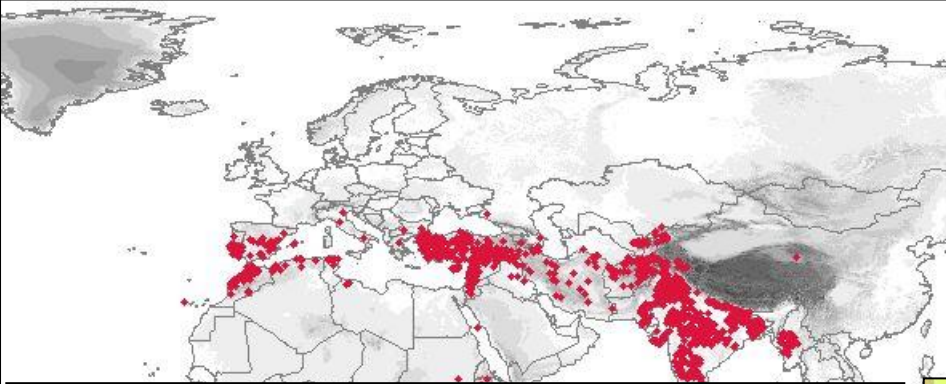
Your selection contains **625163** accessions

Number of records found: 314

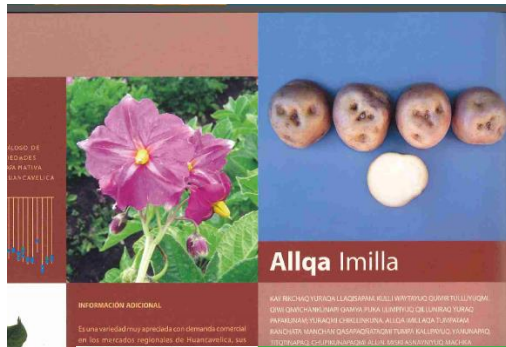
Show Results By Regions Of Country Source

Your selection contains **625163** accessions

/



Gene bank catalogue books..



Aji cerezo

Especie: *Capsicum annuum* L.

Código Nacional: PER017633
Sitio de colecta: Lambayeque

Datos agronómicos
Hábito de crecimiento: Erecta
Rendimiento: 0.4 kg/planta
Rango de referencia: 0.045 - 7.3 kg/planta
Mediana de referencia: 0.75 kg

Uso actual
Platos típicos: Espesado, sudado, apastado, arroz con pato, chigüinito, cañiro con fideos, causa fermentada, sopa de chorizo, papas de causa, chirimoyo

Características del fruto fresco
Color fruto maduro: Rojo oscuro
Forma del fruto: Casi redondo
Longitud del fruto: 2.2 cm
Diámetro del fruto: 1.8 cm
Peso del fruto: 6.8 g

Productos potenciales según experto
Por extraer

Características bioquímicas notables
Contenido moderado de capsaicinoides

Caracterización bioquímica del fruto seco (valor, promedio y rango de referencia)

Localidad	Capsaicinoides mg/100 g	Vitamina E mg/100 g	Capacidad Anti-oxidante mmol/100 g	Flavonoides mg/100 g	Quercetina mg/100 g	Azúcar g/100 g	Grasa g/100 g
Huancal	272.4	nd	4.0	3.6	2.7	8.4	11.1
Rango	1.0 - 1,736.2	0.2 - 33.3	2.0 - 9.2	1.3 - 27.0	1.3 - 22.6	8.4 - 39.5	2.2 - 23.1


Biodiversity International

Catalogue of Conserved Coconut Germplasm

Bourdeix R, Batugal P, Oliver JT, George MLC, editors

COCENT

.. and online DB







**A safety network
for our crops**

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Homepage / Resources / Germplasm Databases / International Multicrop Databases

Share:    

International Multicrop Databases

- [AVGRIS - The AVRDC Vegetable Genetic Resources Information System](#)
- [Crop Wild Relative Global Portal](#)
- [PGR Forum](#)
- [GENESYS](#)
- [Mansfeld's World Database for Agricultural and Horticultural Crops](#)
- [WIEWS](#)
- [EU plant variety database](#)
- [Millenium Seed Bank Seed Lists](#)
- [SESTO - Northern Europe Gene Bank Documentation System of Plant Genetic Resources](#)
- [The Harlan and de Wet Crop Wild Relative Inventory](#)

Related Information

Links

Taxonomy support

- [Grin Taxonomy for plants](#)
- [The International Plant Names Index](#)
- [Mansfeld's World Database for Agricultural and Horticultural Crops](#)
- [Searchable World Wide Web Multilingual Multiscript Plant Name Database](#)
- [Taxonomic Nomenclature Checker](#)

Resources

- Germplasm Databases**
 - [EURISCO Catalogue](#)
 - [ECPGR Central Crop Databases](#)
 - [Germplasm Collecting Mission Database](#)
- International Multicrop Databases**
- National Multicrop Databases**
- Publications**
- Project reports**
- Links**
- Public Awareness**
- Latest News**

<http://www.ecpgr.cgiar.org/resources/germplasm-databases/international-multicrop-databases/>

Monitoring BD

1. This is done almost entirely for wild species. IUCN approach
2. Cultivated species **NOT contemplated-** (some wild relatives)
3. Objectives is to asses through a rigorous system status of populations of vulnerable taxa.

IUCN Red List of Threatened Species



THE IUCN RED LIST
OF THREATENED SPECIES™



Scientific / rigorous criteria

CRITERIA

A

Population reduction

B

Restricted geographic range

C

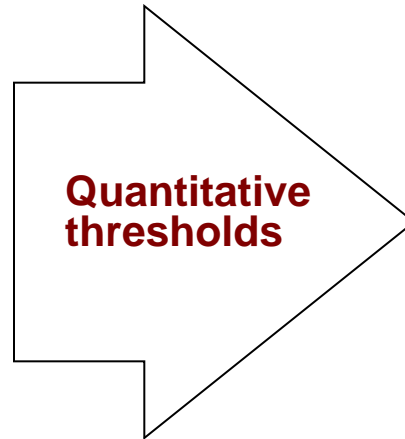
Small population size & decline

D

Very small or restricted population

E

Quantitative analysis



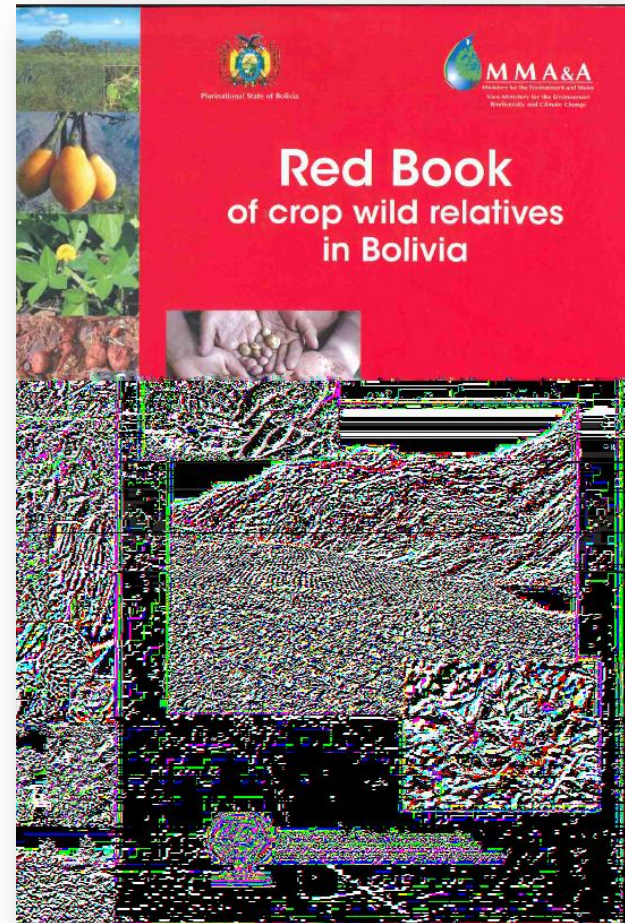
THREATENED CATEGORIES

Critically Endangered (CR)

Endangered (EN)

Vulnerable (VU)

Red Lists for wild species



The 'in situ/on farm world'

1. Proper documentation of crop diversity and IK helps farmers to **optimize use** of resources in coping with change (climate, market, cultural, others)
2. Helps making an **informed decision** on crop cultivations
3. Facilitates **sharing** of genetic resources and IK among users (reinforce community resilience)
4. Helps **understanding** what has been lost, what is under threat for prevent variety loss and/or guide re-introductions
5. Providing **proof of ownership by community** in bio-piracy cases
6. Help understanding the Physical (crop) and Social (IK) **Livelihood Assets** of HH/community, linked to cultural identity, ancestors' heritage and strategic in building self esteem..

Approaches, methods and tools for on farm conservation and management

1. Simple logbook
2. Gathering IK (publications & other products)
3. Custodian farmers' catalogues
4. Community Biodiversity Registers
5. Five Cells Analysis method
6. Red List for cultivated species
7. Farmers' descriptors lists
8. Documentation/ monitoring during seed fairs

Simple logbook

Food Seed Inventory.ods - OpenOffice.org Calc

File Edit View Insert Format Tools Data Window Help

Arial 10 B / U

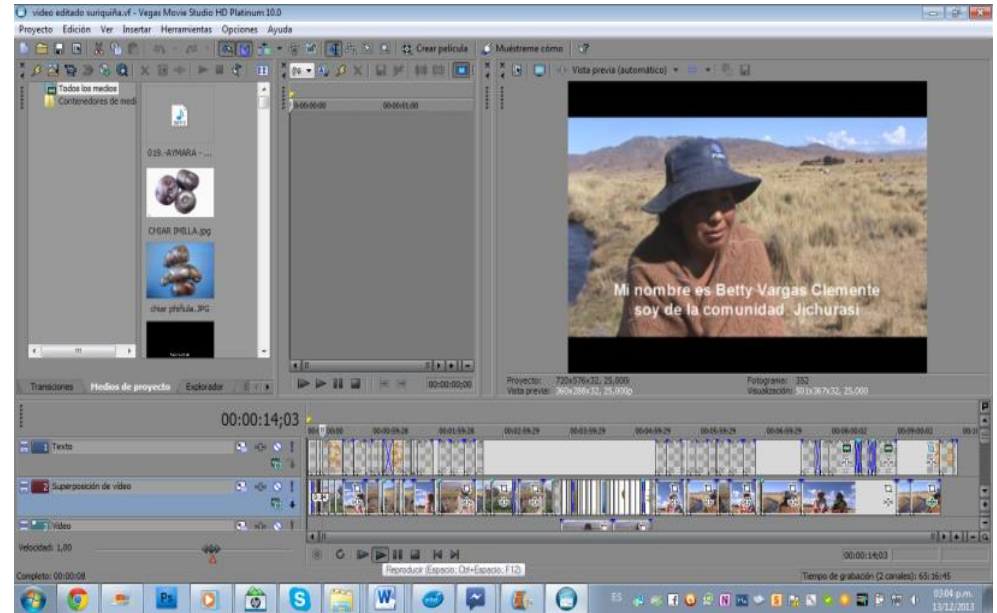
H63 = Brown cherry, good tart flavor

	A	B	C	D	E	F	G	H
34	'Sandul Moldovan'	2009	7	Amishland Heirloom Seeds	beefsteak	pink beefsteak		Mideast?
35	'Giant Belgium'	2009	25	Tomato Growers Supply Company	2 - 5lbs beefsteak	pink beefsteak		Great flavor, giant
36	'Rovesta'	2009	30	Tomato Growers Supply Company	6-8oz	red ribbed	yes	Vigorous, European
37	'Jaune Flamme'	2009	12	Totally Tomatoes	medium	gold/orange		Prolific, great taste
38	'Jetsonic'	2009	20	Totally Tomatoes	7oz	medium red	N	Vigorous, disease resistance: N
39	'Italian Goliath'	2009	20	Totally Tomatoes	8oz	red beefsteak	VFFNTA	Disease resistant, large red
40	'Purple Calabash'	2009	40	Tomato Growers Supply Company	medium	3" purple ruffled		Very purple, ruffled, flat fruits, prolific, great taste
41	'Matt's Wild Cherry'	2009	20	Amishland Heirloom Seeds	cherry	red cherry	yes	Small cherry, prolific, disease resistant
42	'Lemon Boy'	2009	30	Tomato Growers Supply Company	7oz	large yellow orange beefsteak	VFN	Disease resistant, very yellow, hybrid
43	'Sunray'	2008	30	Totally Tomatoes	8-10oz	orange beefsteak	VF	Looks like pack was stepped on, seeds maybe damaged
44	'Green Grape'	2008	10	Pinetree Seeds	cherry	green cherry		Also a 2005 packet
45	'Peach Blow Sutton'	2006	15	Pinetree Seeds	5-7oz	medium mottled orange bicolor red pleated		Very pretty fruits

Women farmers sharing their knowledge on the biological cycle and control of weevils in Cachylaya (Bolivia) -increasing incidence due to CC



Documenting and safeguarding IK



Recording IK of custodians to safeguard knowledge and build memory bank of key people for identity of community..

Custodian farmers' catalogues



"Planilla de registro" adopted by women custodians in Suriquina (Bolivia)

Custodian farmers from Coromata Media (Bolivia) and their collections. Mr Gregorio Apaza, championing with 8 crops and total of 104 varieties conserved (IFAD NUS data 2012)

Cultivos	Gregorio Apaza	Roxana Espinoza	Anastasia Laura	Natividad Quenta	Rosmery vda. de Quispe	Miguelina Quispe
Papa	68	26	38	15	16	50
Oca	5	-	1	1	-	1
Isaño	-	-	1	-	-	-
Papalisa	-	-	1	1	-	-
Quinua	3	1	1	1	2	-
Cañahua	4	1	-	1	2	3
Cebada	5	1	-	-	-	-
Avena	1	1	-	1	1	-
Trigo	-	1	-	-	-	-
Haba	15	3	-	4	-	-
Arveja	3	-	-	-	-	-
TOTAL	104	34	42	24	21	54

Names of vars. grown by custodian farmers in Coromata (Bolivia)

IFAD NUS 2012-13

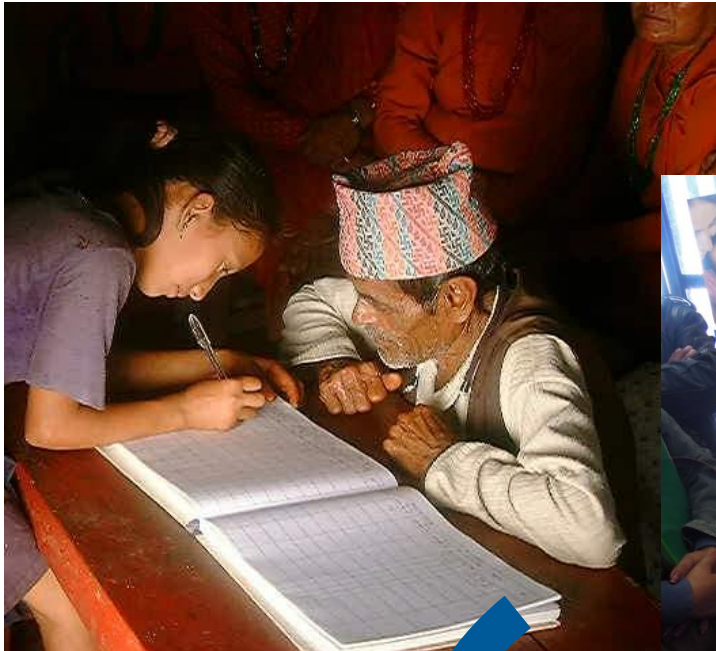
Cultivos	Nombre de las Variedades				
Papa	Axahuri	Janqu phiñu	Pala blanco	Saytu luqi	
	Chiar axahuri	Janqu yari	Pala negro	Waca lajra	
	Chiar chixi isla	Jipisquitu	Papa chinita	Wawa chara	
	Chiar chixi surimana	Kaisalla	Papa manzana	Waycha	
	Chiar imilla	Q'aqa wila waycha	Pepino	Wila chixi surimana	
	Chiar surimana	Q'aqa surimana	Peruano	Wila imilla	
	Chiar taraqu	Qullu kauna	Phiñu rojo	Wila pala	
	Chixi chuqipitu	Kuntur cayu	Pitikalla	Wila phiñu	
	Chixi pala	Kuntur piqi	Poqoya	Wila pitikalla	
	Chixi phiñu	Leki kayu	Pureja	Wila taraqu	
	Chixi taraqu	Luqa	Qhealla	Wila yari	
	Choclito	Marad pala	Qhuchhi jipilla	Wila zaqampaya	
	Janqu axahuri	Morad axahuri	Q´ita	Yurima	
	Janqu chixi surimana	Morad chuqipitu	Qhuchhi jaqima	Zapallo holandes	
	Janqu chuqipitu	Morad surimana	Qhuchhiqallu	Zapallo morad nairani	
	Janqu imilla	Morad taraqu	Rari kaisalla	Zaqampaya	
	Janqu kaisalla	Negro jinchu	Saitu luki		
	Janqu pala	Oqallu axahuri	Sani		
	Oca	Qheni	Wari chuchulla	Qillu apilla	Zapallo
	Isaño	Qilu isaño	Chixi isaño		
Papalisa	Qillu ullucu				
Quinua	Chuqipitu	Janqu jupha	Blanquita	Jacha grano	
Cañahua	Chuqi chilliwa	Chuqipitu	Illimani	Kullaca	
Haba	Uchuculu	Usnayo	Janqu jawasa		
Cebada	Chiar cebada	Janqu cebada			
Avena	Janqu avena				

Custodian farmers from 8 target communities of Bolivia presenting and exchanging their local varieties of native crops at the First national Custodian farmer workshop organized in Batallas on 11 November 2013 (IFAD NUS)

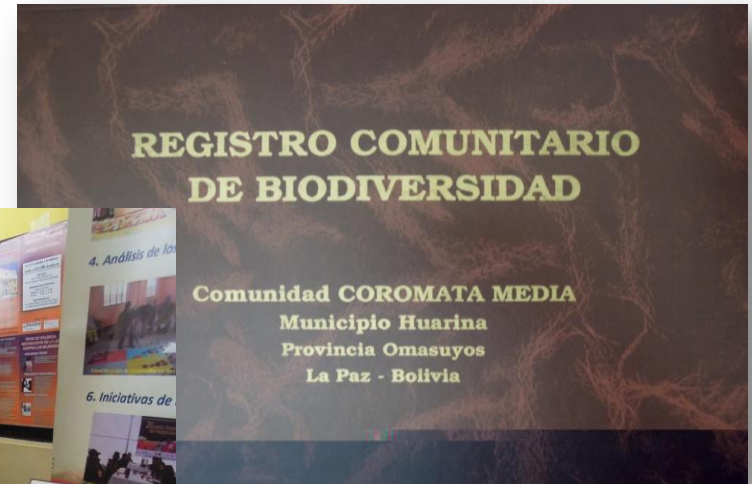


Community Biodiversity Registers (CBR)

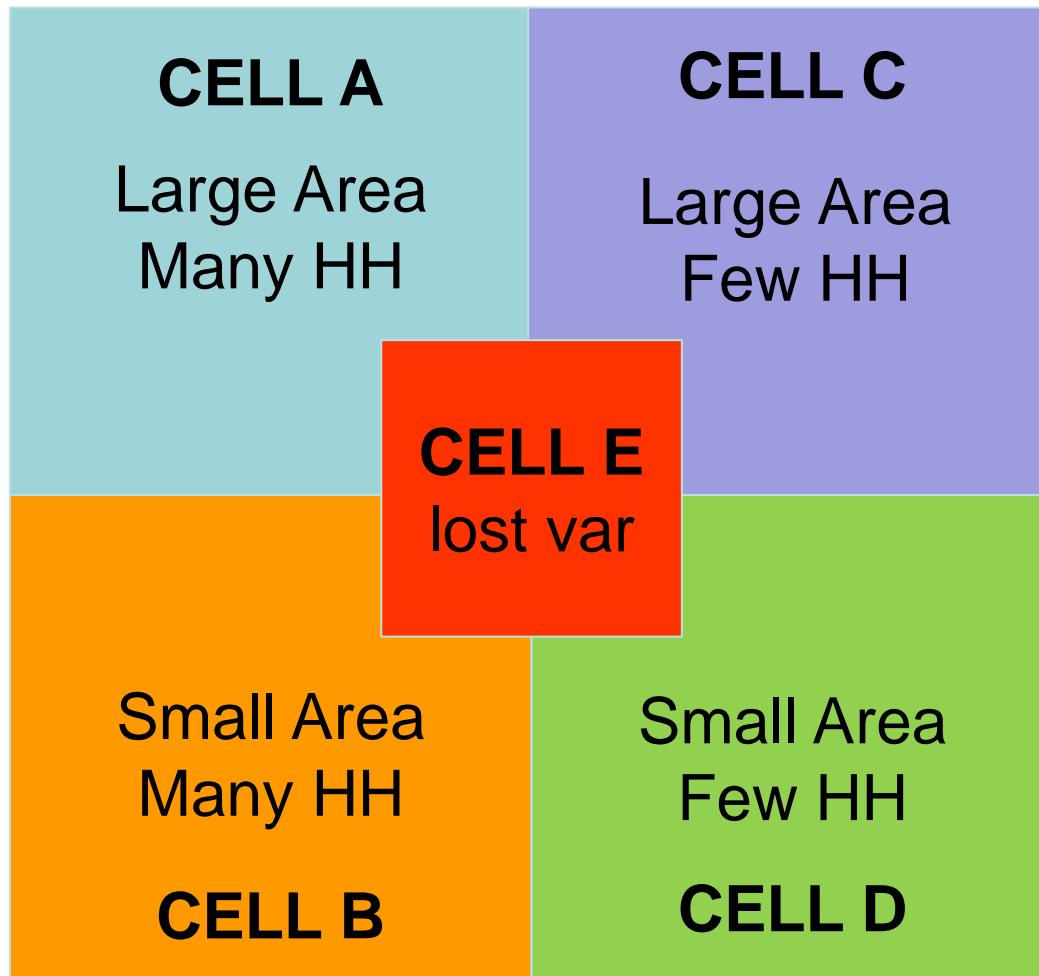
Nepal



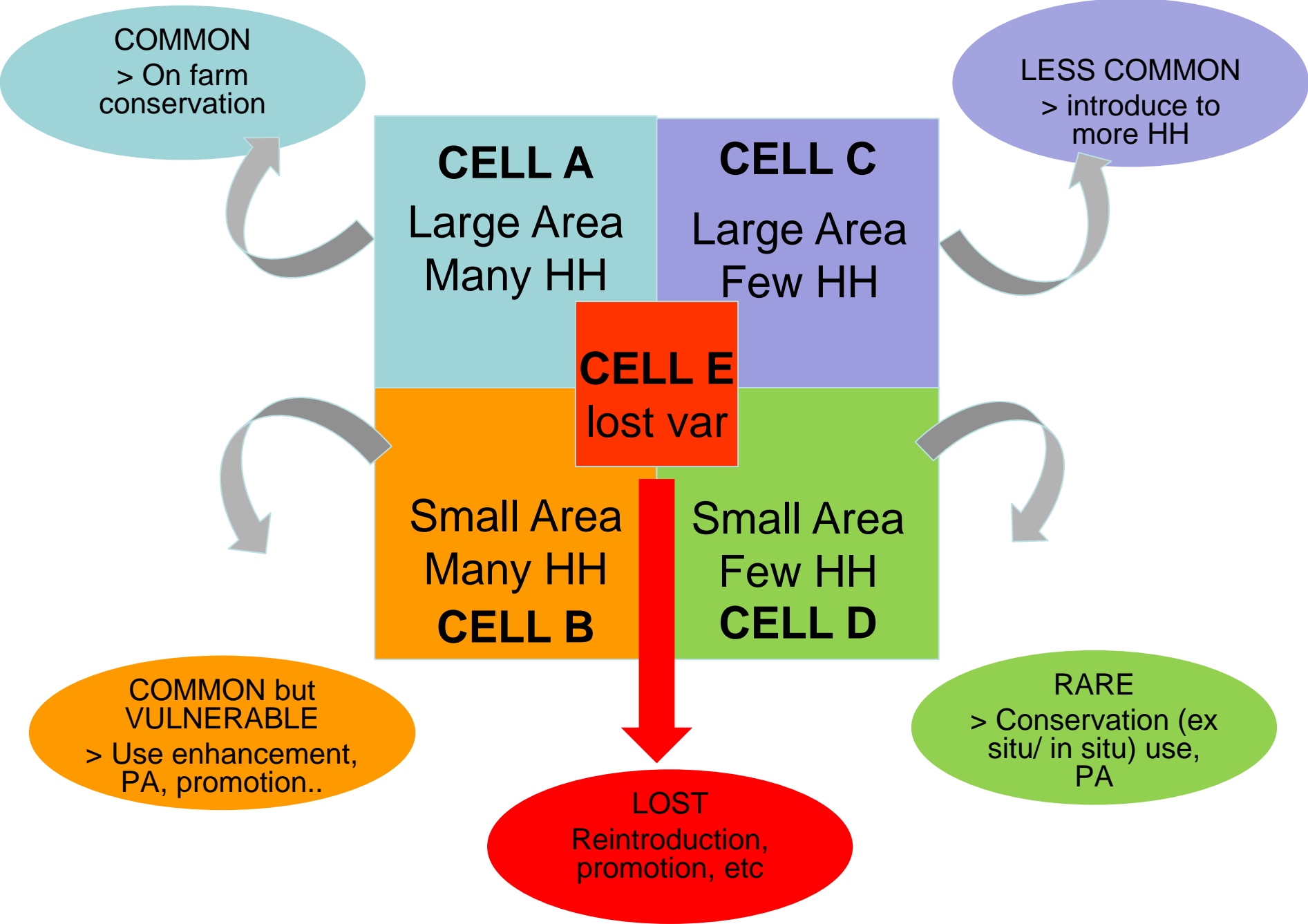
Bolivia



Five Cells Analysis method



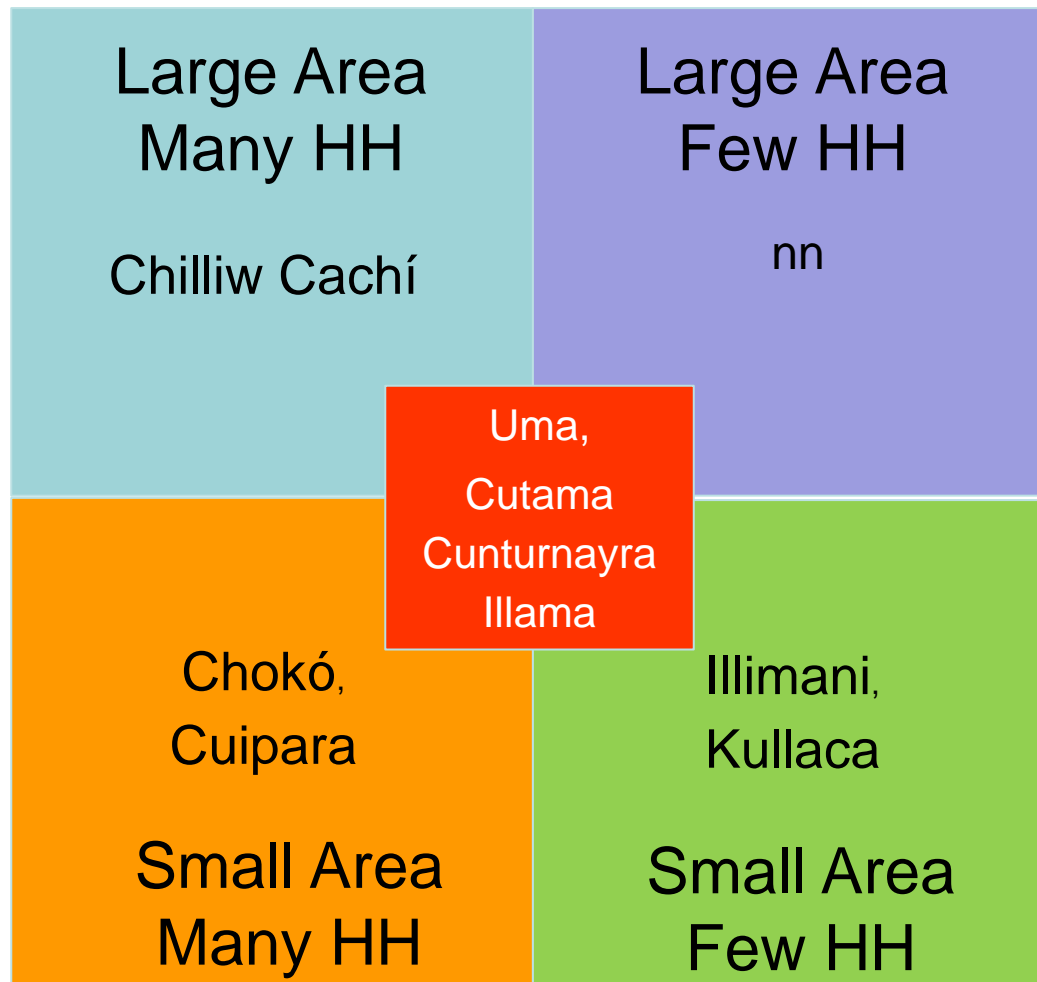
1. Applied to both crop diversity and Indigenous Knowledge (latter very limited)
2. Community based assessment;
3. Thresholds variable (crop, level of use, manag. practices, culture;- ex. potato: 45 families correspond to many families and 20 correspond to few families; large area is 2500 m² and small area is 500 m² - Corqueamaya, Bolivia)



Results of the FCA method in Cachilaya (Bolivia) applied to potatoes (2013-14 data)



Results of the FCA method applied to cañahua in Rosapata and Erbenkalla (Bolivia, 2013-14 data)



- **PEOPLE INTEREST FOR RARE VARS CAN BE LEVERAGED FOR MARKETING PURPOSES:** Yari var. and other lost/rare were found highly prized in local markets as well as Peruvian and Chilean markets
- **Market interventions could be very helpful in supporting reintroductions.**
- **An information system to provide local growers with relevant market information re offer and demand would be indeed very helpful to support local vars.**

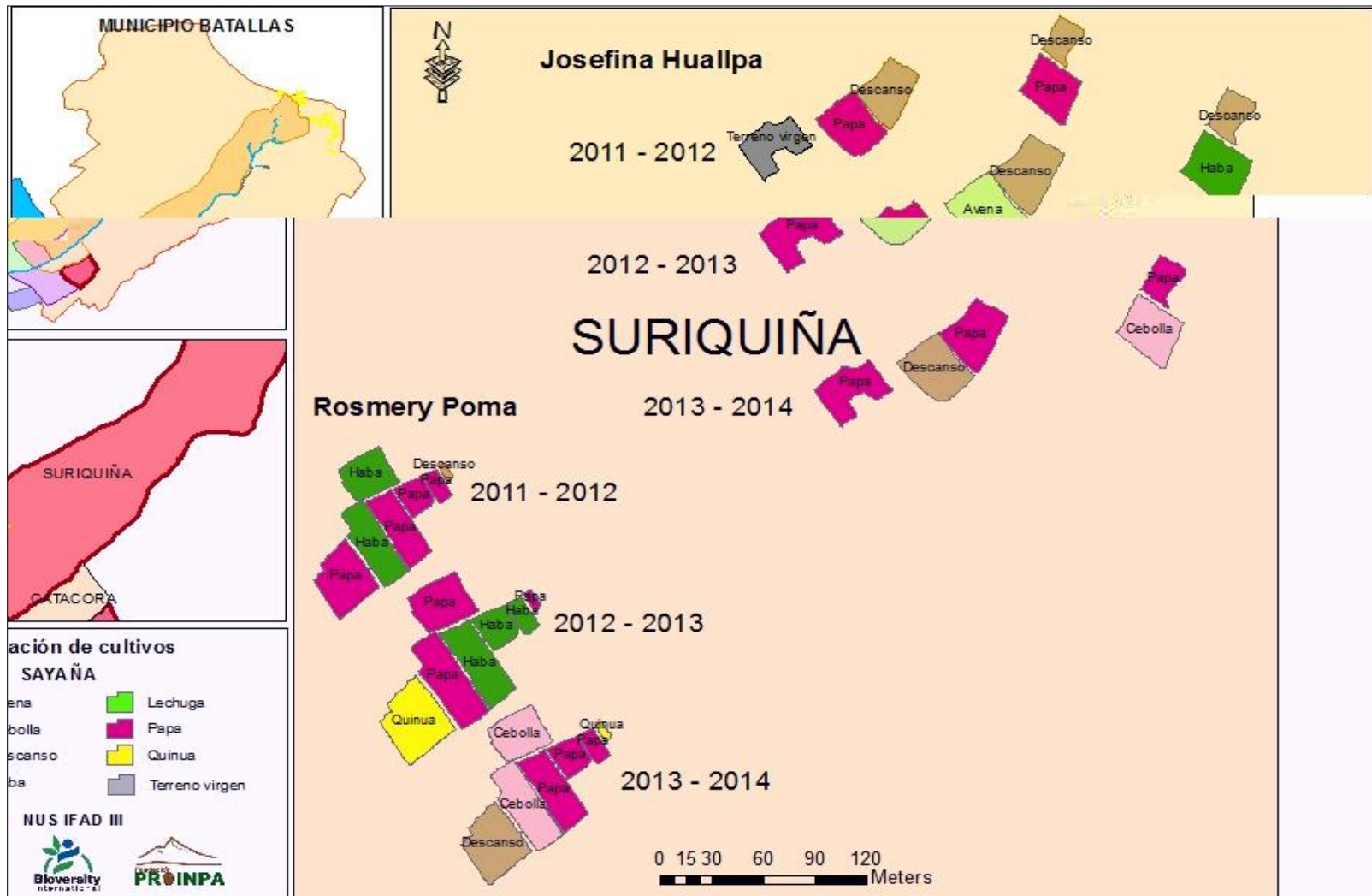
Community planning for conservation purposes of potato among custodian farmers in Coromata Media (Bolivia) in 2013 (based on FCA results)

Comunidades	Agricultores Custodios	Superficie de papa sembrada (m ²)	Número de variedades
	Rene Huallpa Yujra	2254	35
	Ricardo Vargas	1114	32
Cachilaya	Viviana Herrera	1544	57
	Elías Vargas	1066	45
	Natividad Quenta	2657	25
	Adelio Laura Quispe	3129	43
Coromata Media	Marcos Apaza	2991	48
	Maria Lucy Quispe	1208	28
	Marina Quispe	4106	32

Community planning for conservation purposes of potato by the Cachilaya community gene bank (Bolivia) based on FCA results (2013)

No	Variedades	Especie	No	Variedades	Especie
1	Waycha	Solanum tuberosum	8	Q'aqa surimana	Solanum stenotum
2	Axahuri	Solanum ajanhuri	9	Bolivia 29	
3	Chiar imilla	Solanum tuberosum	10	Janqu zacampaya	Solanum stenotum
4	Yurima	Solanum stenotum	11	Lloqallito	
5	Qhaty kusillu		12	Luki	Solanum juzepzukii
6	Zaqampaya	Solanum stenotum	13	Zapallito	Solanum goniocalix
7	Chiar surimana	Solanum stenotum	14	Choquepitu	Solanum cortilubum

Understanding the dynamics



RED LIST for cultivated plants: a totally different approach!!



Here we are not interested to monitor the **'last plant of a certain in cultivation'**..

Our goal is to monitor cultivated varieties to secure their **effective use** by people so as to meet sustainably their livelihood needs.

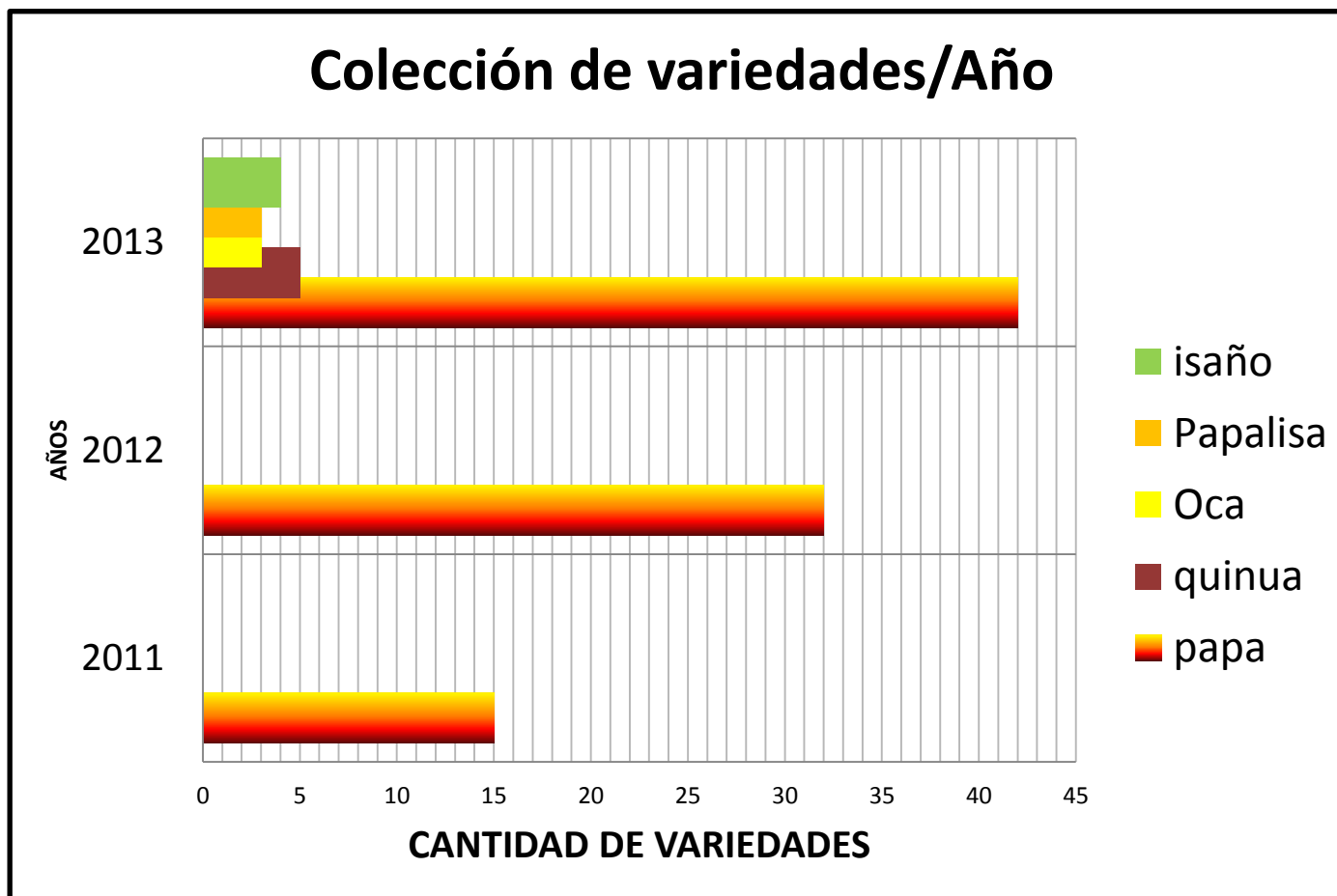
We do so by documenting permanent drops in use below a certain threshold, beyond which the variety would **no longer provide the expected benefits to the community**..

Monitoring and reintroduction of minor millets in Kolli Hills (India)

Variety	Villages					
	Padasolai	Sempoothu valavu	Thirupuli Oorpuram	Puliyampatti	Thuvarapallam	Valukulipatti
Kodo Millet (<i>Paspalum scrobiculatum</i>)						
Illangkelvaragu	Popular	Popular	Threatened	-	Popular	-
Panivaragu	-	-	-	-	-	Threatened
Perunkelvaragu	Threatened	Popular	Popular	Cultivated	Lost	-
Sattaikelvaragu	-	--	Lost	Cultivated	-	Threatened
Thirivaragu	-	-	-	-	-	Lost
Little Millet (<i>Panicum sumatrense</i>)						
Karumsamai	-	-	-	-	-	Lost
Kattavettisamai	-	-	Lost	Lost	-	Cultivated
Malliyasamai	Lost	Lost	Lost	Popular	Lost	Threatened
Perumsamai	Threatened	Popular	Lost	-	-	Threatened
Sadanjsamai	Popular	Threatened	-	-	-	Lost
Foxtail Millet (<i>Setaria italica</i>)						
Koranthinai	-	-	-	Threatened	Threatened	-
Mookanthinai	-	-	-	-	-	Lost
Palanthinai	Threatened	Cultivated	Threatened	-	-	Lost
Senthinai	-	-	-	-	Popular	Lost

Exchange among communities to reintroduce lost varieties

crops acquired by Corqueamaya and Jichurasi communities after IFAD NUS intervention since 2011



RED LIST, REINTRODUCTIONS AND NETWORKING AMONG COMMUNITIES..

1. Corqueamaya and Jucharasi obtained seeds of potato variety Luq'i from Achiri (Municipality Caquiaviri) and planted in the 2013-2014 crop season.
2. The variety Luq'i which was in **danger of being lost in both communities** is now no longer under threat thanks to this community-to-community seed exchange promoted by the project

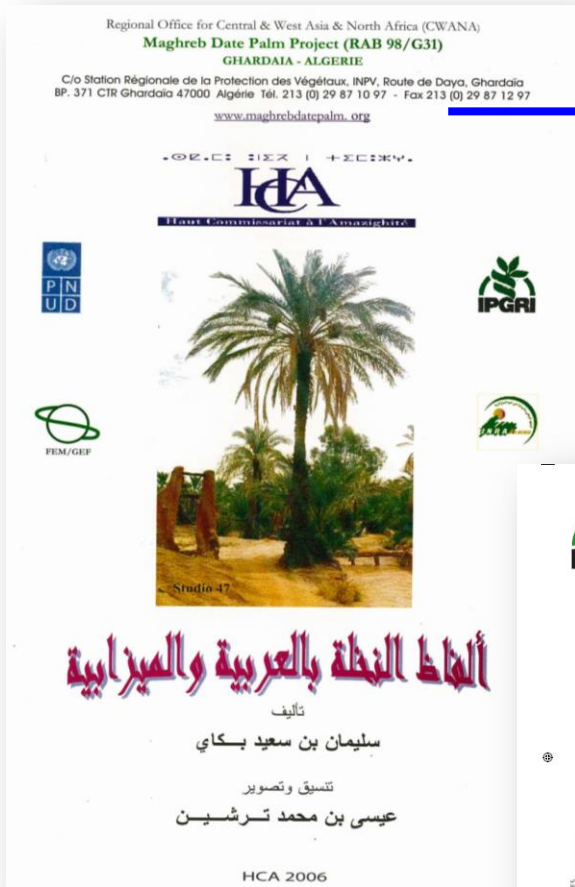
DOCUMENTATION AND REINTRODUCTION ON FARM

1. Loss of lupine in Cachilaya (Bolivia) attributable to the long production cycle of that crop, and the low level of resistance to frost which too often did not allow the plant to set seeds.
2. Interestingly, farmers reported that lupine was lost also because families in the community are **no longer familiar** with food preparations made out from this crop..
3. Both these findings (agronomic and social) guided researchers and farmers **in identifying better varieties more adapted to changing climate and intervening with use-enhancement actions** (community-based workshops to promote uses, dissemination of recipe books, etc.)

FARMER DESCRIPTOR LISTS



Slimane Bekkay of Algeria, date palm farmer, awarded in 2009 by the Mayor of Rome for his exceptional role as Custodian of Mediterranean biodiversity



ⵜⴰⴳⴷⵓⴷⴰ ⵜⴰⴷⵣⴰⵢⵔⵉⵜ ⵜⴰⴳⴷⵓⴷⴰ ⵜⴰⴷⵣⴰⵢⵔⵉⵜ



“Tamazight” Language of the Amazigh people of North Africa



New concept of DL: meet all users' need (not just breeders)!!

Towards a new DL Concept

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ISSN 1479-2621

Plant Genetic Resources: Characterization and Utilization; 1–6
doi:10.1017/S1479262115000040

Descriptors for on-farm conservation and use of *Butia odorata* natural populations

Claudete Clarice Mistura^{1*}, Rosa Lía Barbieri², Caroline Marques Castro², Stefano Padulosi³ and Adriana Alercia³

¹CNPq/Embrapa Clima Temperado, BR 392, Km 78, Caixa Postal 403, CEP 96010-971, Pelotas, RS, Brazil, ²Embrapa Clima Temperado, BR 392, Km 78, Caixa Postal 403, CEP 96010-971, Pelotas, RS, Brazil and ³Bioversity International, Via dei Tre Denari, 472/a 00057 Maccaresse (Fiumicino), Rome, Italy



Descriptors for
farmers' knowledge
of plants



Documentation & monitoring during seed fairs



1er CONCURSO
de **AGROBIODIVERSIDAD**
y **USOS** de los **CULTIVOS ANDINOS**

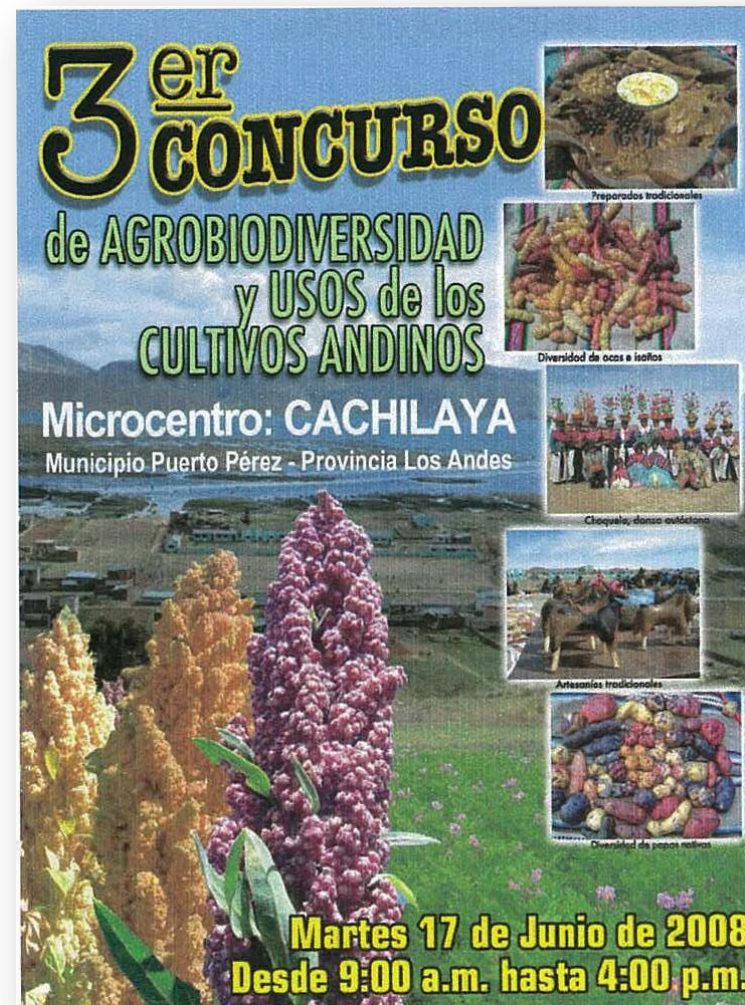
Microcentro Santiago de Okola
Municipio Puerto Mayor Carabuco
Provincia Camacho - La Paz

Sábado 24 de mayo de 2008
Desde 9:00 a.m. hasta 5:00 p.m.

Organizan:



Auspician:



3er CONCURSO
de **AGROBIODIVERSIDAD**
y **USOS** de los **CULTIVOS ANDINOS**

Microcentro: CACHILAYA
Municipio Puerto Pérez - Provincia Los Andes

Preparados tradicionales

Diversidad de ocos e isoflos

Cloqueo, danza outléono

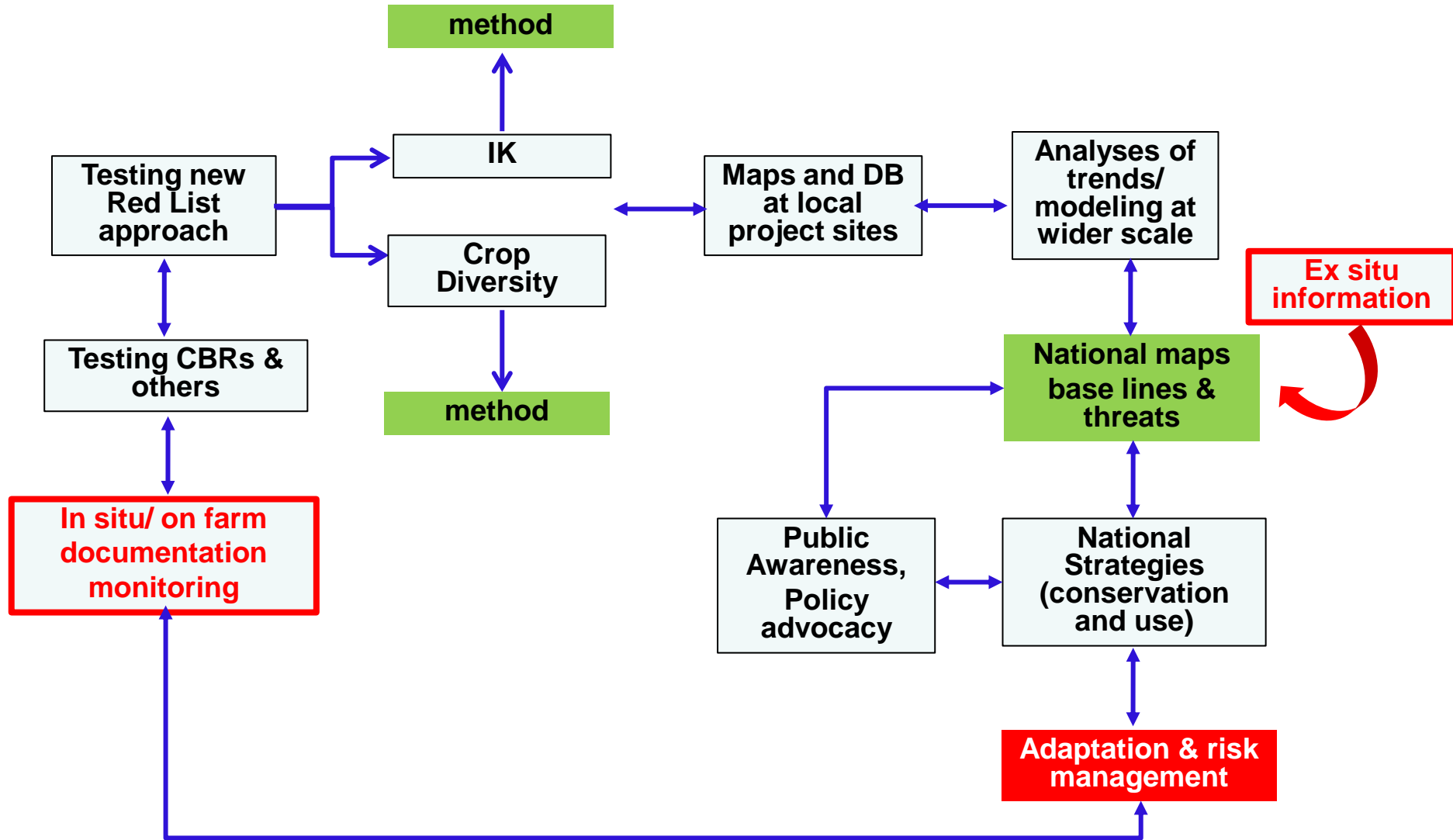
Artesanos tradicionales

Chusqueño de la zona rural

Martes 17 de Junio de 2008
Desde 9:00 a.m. hasta 4:00 p.m.

COROMATA MEDIA CUSTODIANS (2013)	Papa	Quinua	Cañahua	Oca	Isaño	Papalisa	Cebada	Avena	Trigo	Haba	Arveja	Total
Encarna Quenta	13	-	-	-	-	-	-	-	-	-	-	13
Julia Quispe	8	5	9	2	5	4	1	3	3	15	4	56
Alberto Flores	13	-	-	-	-	-	-	-	-	6	-	19
Petrona Ronquillo	24	1	1	-	-	-	-	1	1	-	1	29
Felipa Mamani	10	-	-	-	-	-	-	-	-	-	-	10
Regina Pugarico	26	-	-	-	-	-	-	-	-	-	-	26
Sonia Quispe	36	1	1	-	-	-	-	-	-	-	-	38
Antonia Choquehuanca	24	1	1	-	-	-	-	1	2	-	-	29
Salome Espinoza	40	1	2	7	-	1	3	1	2	5	1	63
Teodocia Quenta	20	-	-	-	-	-	-	-	-	-	-	20
Roxana Quispe	24	1	2	4	-	1	-	-	1	3	1	33
Maximo Quispe	23	1	2	2	-	1	-	-	1	3	1	34
María Asencia Quispe	10	-	-	-	-	-	-	-	-	1	-	11
Vicenta Miranda	27	2	1	2	-	-	1	1	2	2	-	38
Eustaquia Quispe	25	1	1	-	-	-	-	-	-	-	-	27
Emiliana Quispe	29	-	-	-	-	-	-	-	-	-	-	29
Marina Quispe	61	-	-	-	-	-	-	-	-	-	-	61
Antonia Miranda	11	1	1	-	3	-	-	-	1	1	-	18
Maritza Miranda	19	-	-	-	3	-	-	-	-	-	-	22
Juana Rosa Miranda	6	-	-	2	4	-	-	-	-	4	-	16
Toribia Quispe	27	-	-	-	-	-	-	-	-	-	-	27
Rufina Torrez	-	4	17	-	3	-	-	-	-	4	-	28
Mauricia Quispe	46	9	7	-	-	-	2	2	3	9	2	80
Rosmery Quispe	14	1	1	-	-	-	1	-	-	-	-	17

VISION: Ex situ-in situ information flow



Understanding, recognition, policy support!!

Bioversity International

Strengthening the role of custodian farmers in the national conservation programme of Nepal

Sajal Sthapit, Gennifer Meldrum, Stefano Padulosi and Nadia Bergamini, Editors

Proceedings from the National Workshop
31 July to 2 August 2013, Pokhara, Nepal

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Bolivia leads the way in recognizing farmers as custodians of agricultural biodiversity

29 May 2014

Bolivia recognizes custodian farmers of agricultural biodiversity as key contributors to the conservation of biodiversity, food and income security – now and in the future – to sustain and nourish the planet.

The Bolivian Government through the Instituto Nacional de Innovación Agropecuaria y Forestal – INIAF (National Institute of Agricultural and Forestry Innovation), has just announced that within the framework of the Network of Germplasm Banks of the National System of Genetic Resources, custodian farmers are important and complementary

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2014: Bolivia recognizes custodian farmers and include them into its national conservation programme..