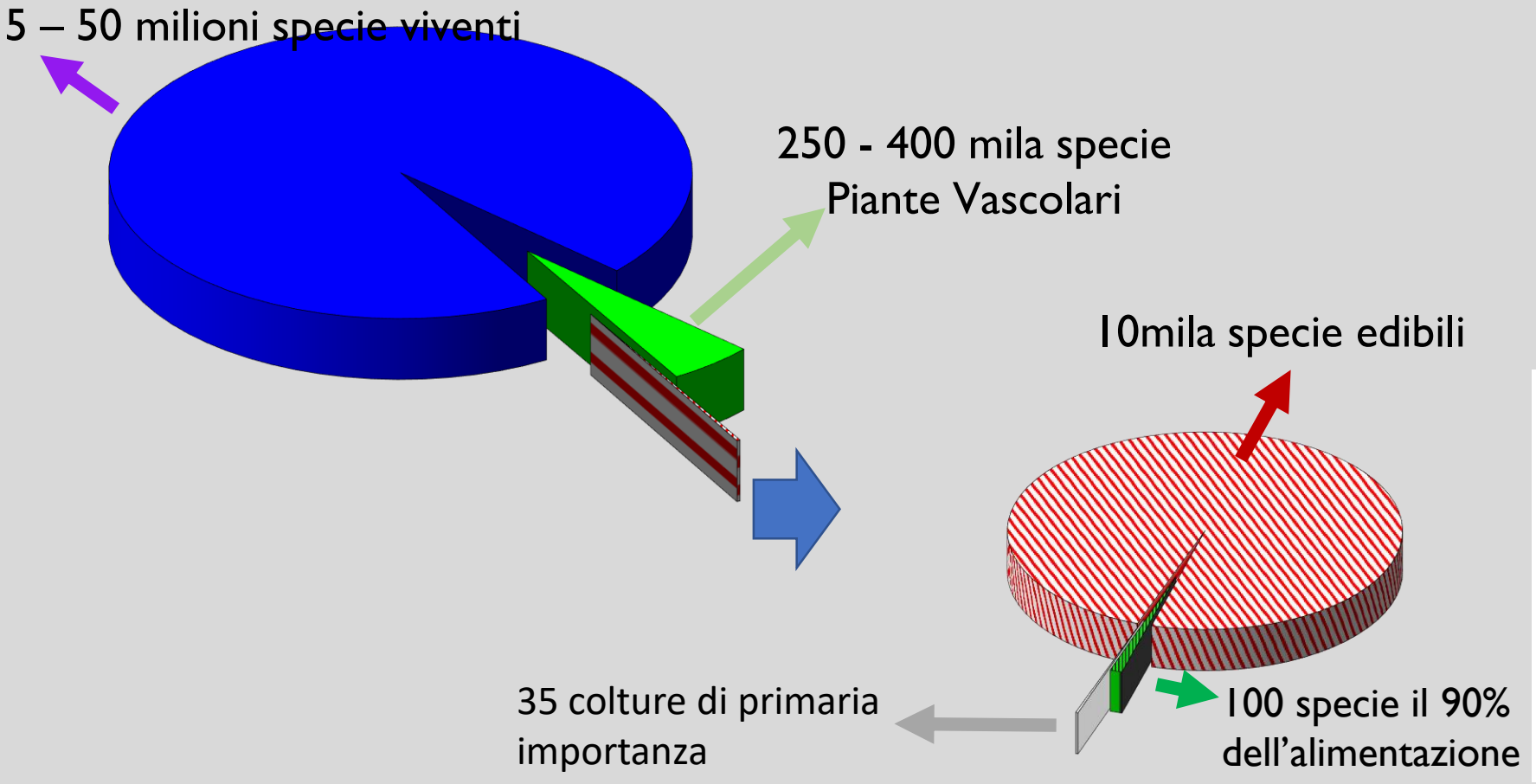
DIPARTIMENTO DI AGRARIA

IL caffè SCIENTIFICO DI AGRARIA
Aula Cinese ore 14.30

Il valore della diversità

Francesco Caracciolo
- Sezione di Economia e Politica Agraria -
18 Settembre 2019

Diversità Biologica e l' (agro-bio)diversità



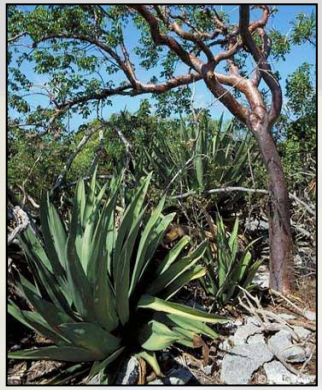
Temi principali della relazione

I. La «diversità» dei valori

II. Il quadro istituzionale ed il sistema di monitoraggio

III. Il valore della «diversificazione».

All'interno della specie (intra-specifica o genetica)



Tra le specie (inter-specifica)

Biosketch e Interessi di Ricerca

2004 Laurea Università di Napoli (STAG)
2005 Master Centro di Portici
2008 PhD Università di Napoli – Economia e Politica Agraria

Research fellowships

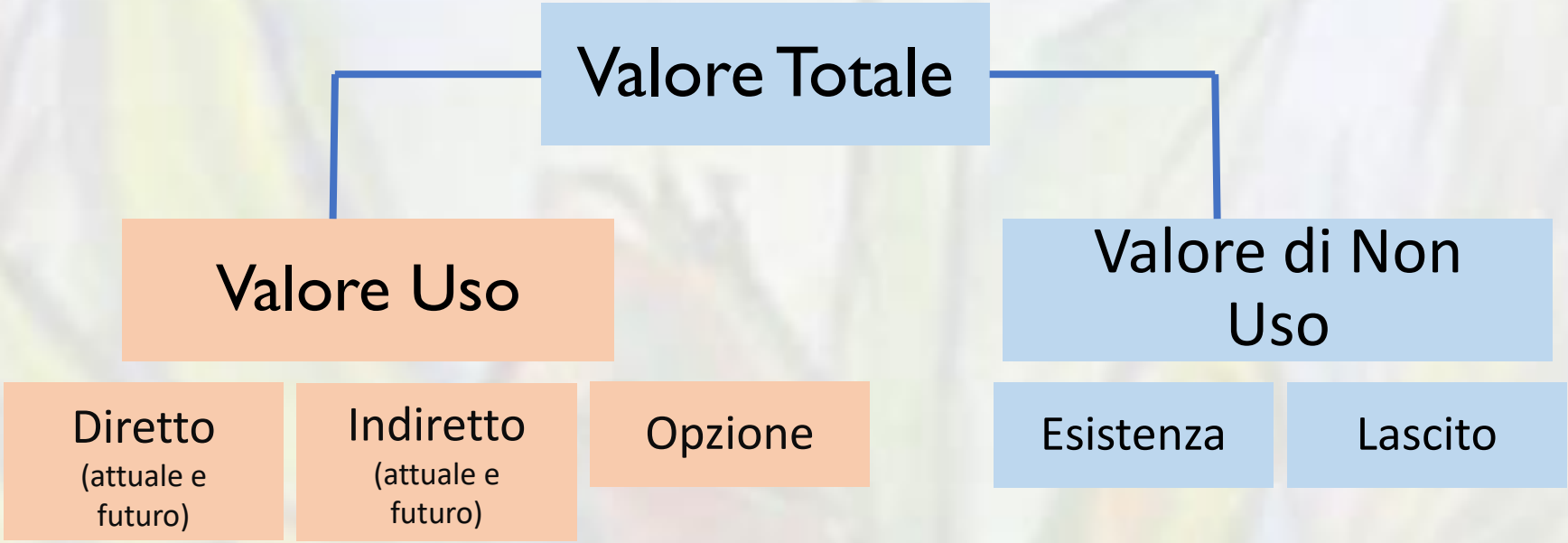
- Reading University – UK
- Università di Napoli – Economia e Politica Agraria
- Bioversity International
- FAO Commission on Genetic Resources
- International Treaty on Plant Genetic Resources

2015 RTDb Università di Napoli
2018 II Fascia Università di Napoli
2018 Honorary Research Fellow Bioversity International - CGIAR

I.La «diversità» dei valori

La diversità dei valori -I

*"I am awed by how little economics can contribute at present to the valuation of genetic resources. A natural explanation is that since most of the genetic resources of interest do not trade in markets, there are no prices. And it is unlikely that price data will soon appear". (*Gardner Brown, 1991)



Source: Pearce, M. and D. Moran (1994)

La diversità dei valori -2

CVM

ELSEVIER

Ecological Economics
Volume 45, Issue 3, July 2003, Pages 445-459

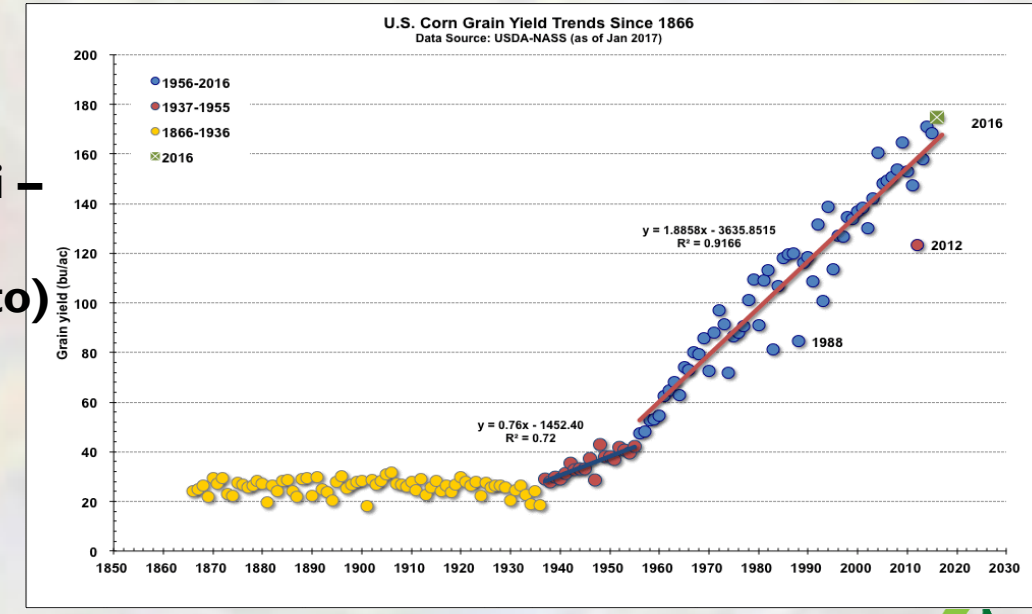
ANALYSIS

Costs and benefits of preserving farm animal genetic resources from extinction: CVM and Bio-economic model for valuing a conservation program for the Italian Pentro horse

Gianni Cicia [a], Elisabetta D'Ercole [b], Davide Marino [b]

Show more

Studi longitudinali – epidemiologici (quasi-esperimento)



Alcune stime del valore economico

1. *Green Revolution*: Responsabile del 1% per anno dell'aumento delle rese in agricoltura fra il 1930-1980 in U.S.A (50% cum.) *Pretty, J. N., et al., 2000. ;Thirtle, C. G., 1985.*
2. 1% di aumento nelle rese è stato stimato aumenti il PIL/procapite dell'1,1% ma con decrescita della popolazione dello 0,36%. (attraverso la diminuizione del tasso di mortalità e di fertilità). *(Gollin et al., 2019)*

Identificazione:

- Il valore creato dal miglioramento genetico non è associabile solo al valore del materiale genetico (attività di miglioramento) mentre in campo l'effetto è "contaminato" dall'adozione di altre trattamenti (i.e irrigazione, pratiche, altri fattori) (*Attribuzione*);
- Difficile ripartire il valore del miglioramento genetico ai diversi «antenati» (*Ripartizione*);

Controfattuale: In assenza di nuove varietà, gli agricoltori avrebbero adottato altre strategie?

Il valore del miglioramento genetico implica la necessità della conservazione?

- Uso relativamente raro da parte dei privati delle accessioni presenti nelle banche dei semi (*seed morgues*) e ridondanza del materiale conservato (duplicazioni);
- Nell'attività di miglioramento si usano generalmente una collezione molto ristretta di materiale (*core*) e raramente si usano materiali genetici non migliorati (ecotipi o var. selvatiche).
- Importanza crescente del controllo ambientale. es. la produzione di latte della Frisona è aumentata a un ritmo costante senza che alcuni nuovi geni vengano introdotti da oltre un secolo.

Diversità genetica agraria conservata (*ex-situ*)

Commodity group	No. of accessions	Wild species (%)	Landraces (%)	Breeding materials (%)	Advanced cultivars (%)	Others (%)
Cereals	3 157 578	5	29	15	8	43
Food legumes	1 069 897	4	32	7	9	49
Roots and tubers	204 408	10	30	13	10	37
Vegetables	502 889	5	22	8	14	51
Nuts, fruits and berries	423 401	7	13	14	21	45
Oil crops	181 752	7	22	14	11	47
Forages	651 024	35	13	3	4	45
Sugar crops	63 474	7	7	11	25	50
Fibre crops	169 969	4	18	10	10	57
Medicinal, aromatic, spice and stimulant crops	160 050	13	24	7	9	47
Industrial and ornamental plants	152 325	46	1	2	4	47
Other	262 993	29	4	2	2	64
Total/overall mean	**6 998 760**	**10**	**24**	**11**	**9**	**46**

Fonte: FAO (2014)

Centri di Ricerca Internazionali in Agricoltura (CGIAR)

Circa 700.000 sono nelle banche del seme - Gruppo Consultivo sulla Ricerca Internazionale in Agricoltura - CGIAR

the Global Seed Vault

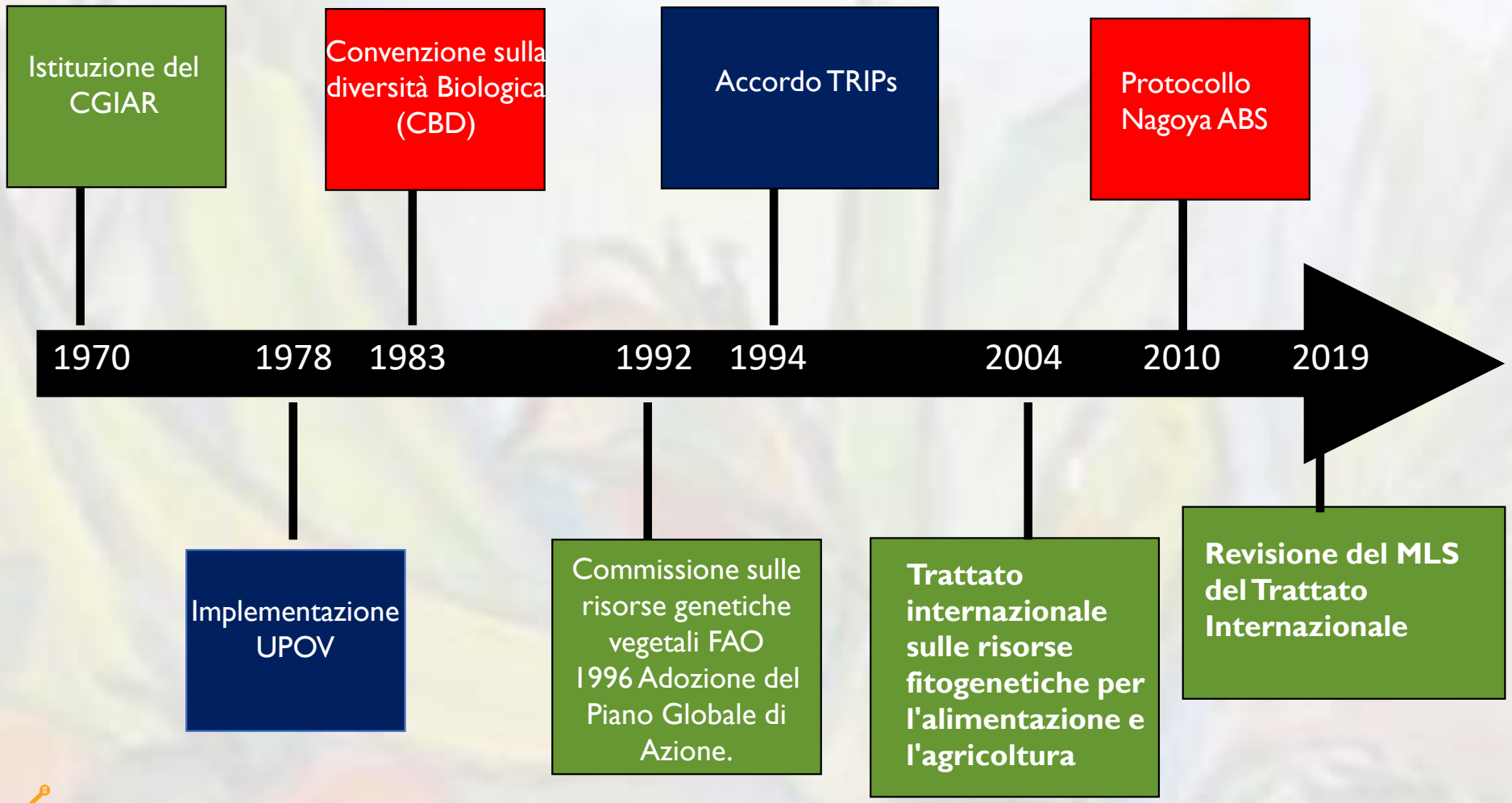
Crisi della produzione associate all'erosione genetica.

Date	Location	Crop	Effects
1846	Ireland	Potato	Famine
1800s	Sri Lanka	Coffee	Farms destroyed
1940s	U.S.A	Various	Crop loss to insects doubled
1943	India	Rice	Famine
1960s	U.S.A	Wheat	Rust epidemic
1970	U.S.A	Maize	$1 billion loss
1970	Philippines, Indonesia	Rice	Tungo virus epidemic
1974	Indonesia	Rice	3 million tons destroyed
1984	Florida, US	Citrus fruits	18 million trees destroyed

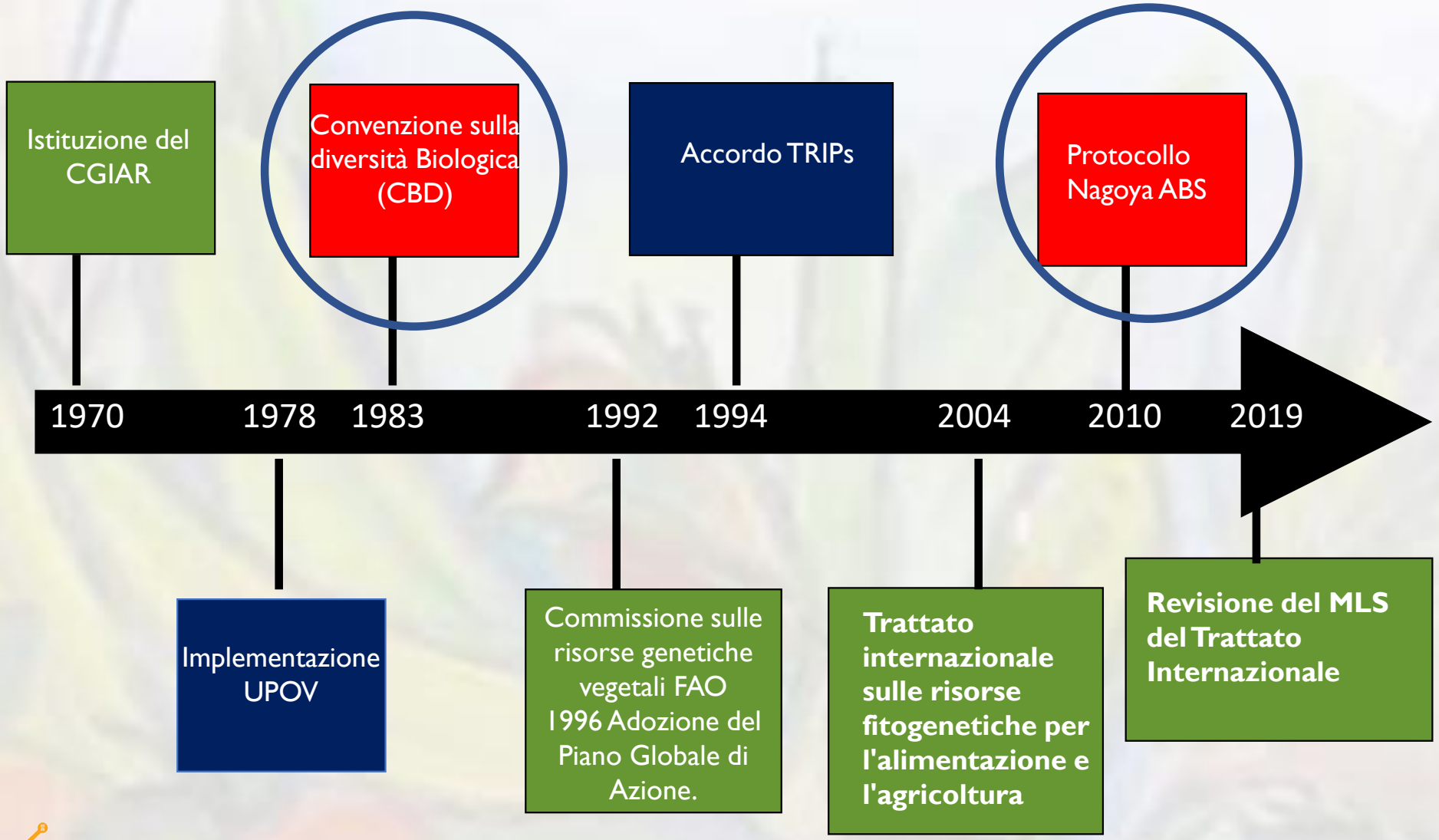
I benefici economici derivanti da aver evitato il danno di una eventuale malattia in grado di colpire, per esempio, la produzione di mais in Brasile, causando una perdita una tantum del 20% fra 45 anni superano di gran lunga il costo del mantenimento di tutte le banche del seme del CGIAR per sempre.

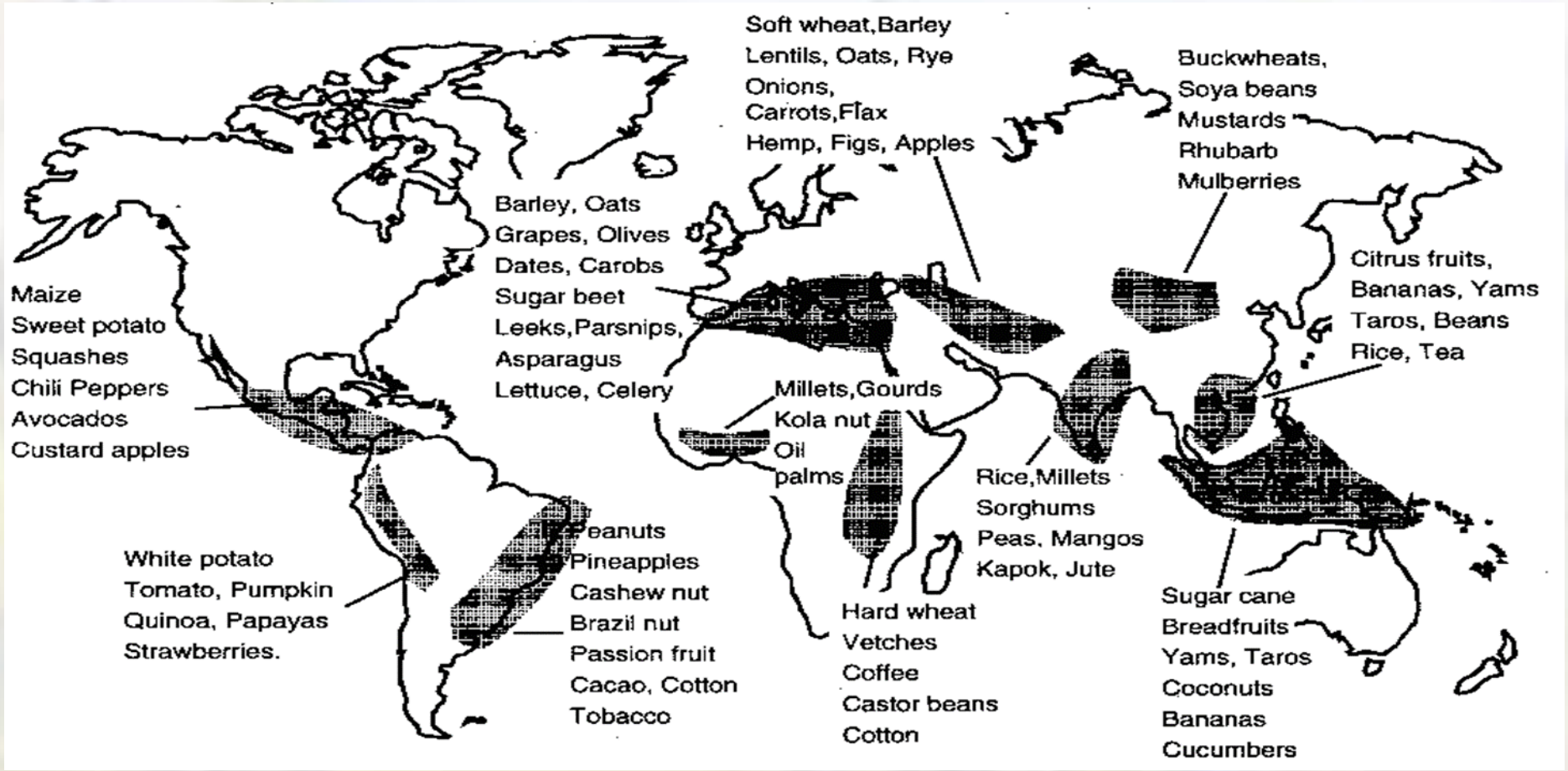
II. La governance ed il monitoraggio

Il sistema «complesso»



Il sistema «complesso»




Soft wheat,Barley
Lentils, Oats, Rye
Onions,
Carrots,Flax
Hemp, Figs, Apples
Buckwheats,
Soya beans
Mustards
Rhubarb
Mulberries
Barley, Oats
Grapes, Olives
Dates, Carobs
Sugar beet
Leeks,Parsnips,
Asparagus
Lettuce, Celery
Citrus fruits,
Bananas, Yams
Taros, Beans
Rice, Tea
Maize
Sweet potato
Squashes
Chili Peppers
Avocados
Custard apples
Millets,Gourds
Kola nut
Oil
palms
Rice,Millets
Sorghums
Peas, Mangos
Kapok, Jute
Peanuts
Pineapples
Cashew nut
Brazil nut
Passion fruit
Cacao, Cotton
Tobacco
White potato
Tomato, Pumpkin
Quinoa, Papayas
Strawberries.
Hard wheat
Vetches
Coffee
Castor beans
Cotton
Sugar cane
Breadfruits
Yams, Taros
Coconuts
Bananas
Cucumbers

Convention on Biological Diversity

Protocollo di Nagoya su Accesso e condivisione dei benefici (2010)

Art 6.1 "Access to genetic resources for their utilization shall be subject to the prior informed consent of the Party providing such resources that is the country of origin of such resources"

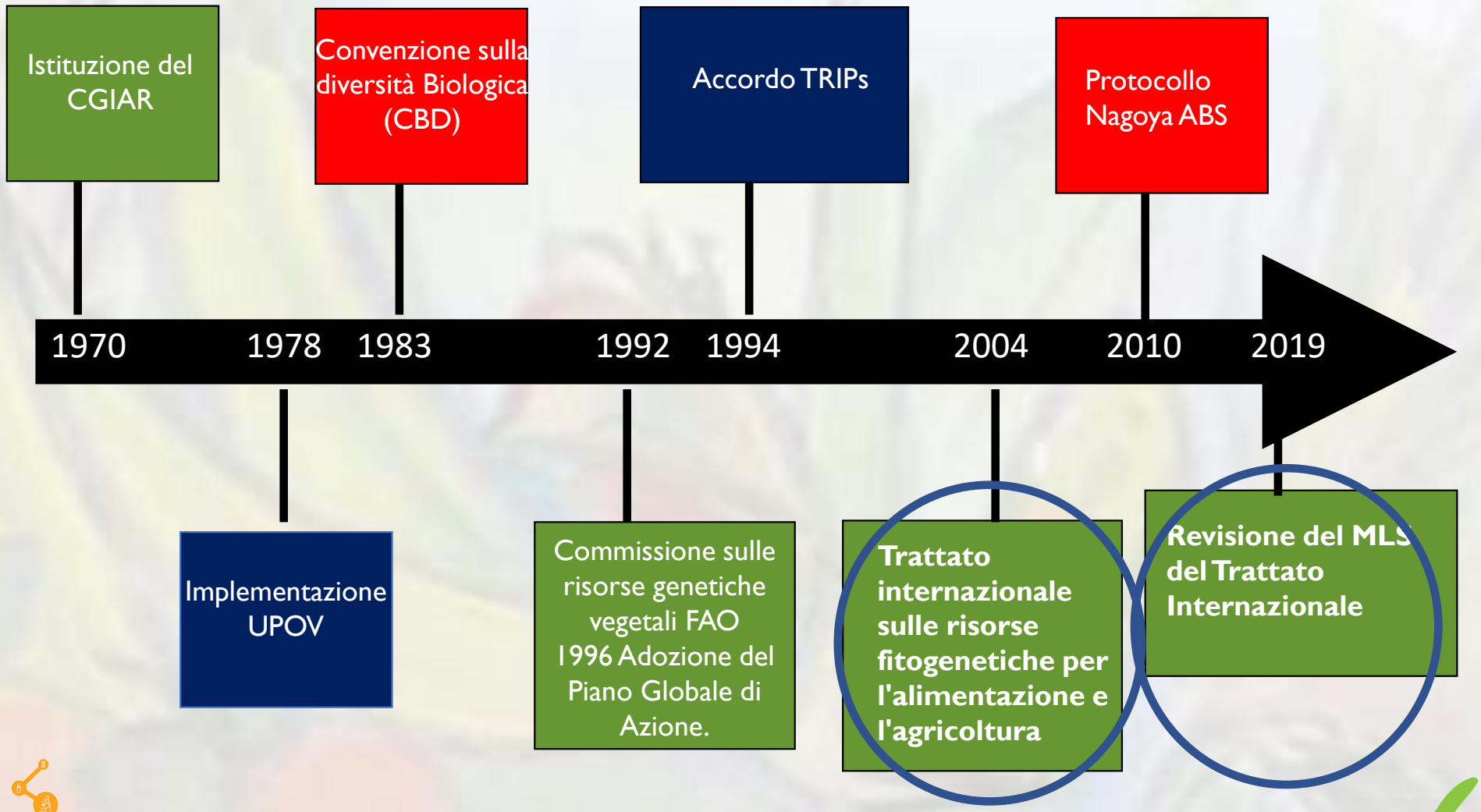
Art 5.1 and 5.2 "Benefits arising from the utilization of genetic shall be shared in a fair and equitable way with the Party providing such resources including local and indigenous communities concerned, based on mutually agreed terms"

Art. 5.3 and 5.5 "To implement paragraph 1 above, each Party shall take legislative, administrative or policy measures, as appropriate."

118 paesi contraenti

(esc USA, Italia)

Il sistema «complesso»



The International Treaty
ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

Trattato internazionale sulle risorse fitogenetiche per l'alimentazione e l'agricoltura

Definisce per 64 colture (80% alimentazione) l'accesso, l'uso e lo scambio completamente libero attraverso un Sistema Multilaterale d'accesso e di condivisione dei benefici .

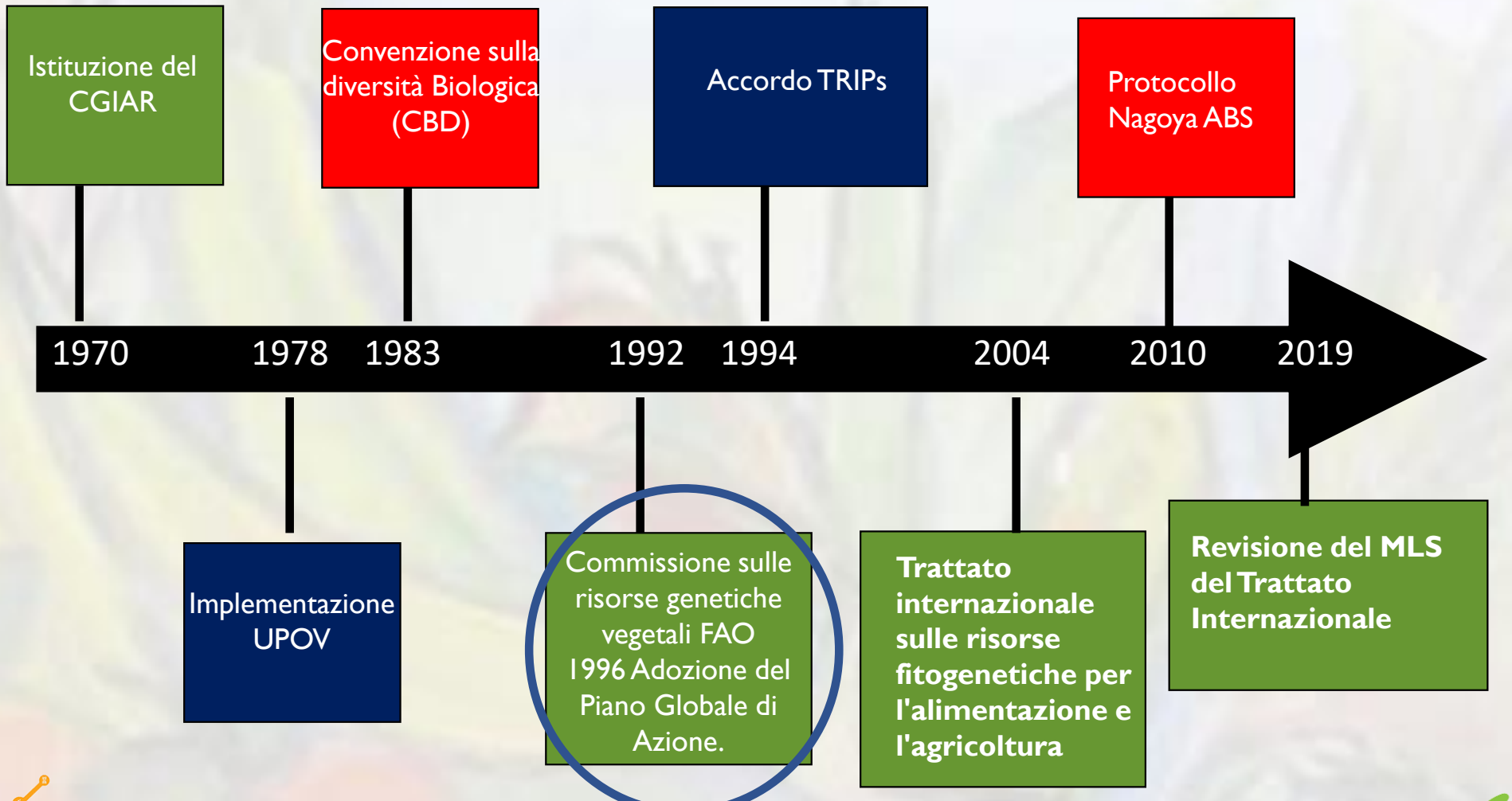
Impossibilità di poter esercitare IPR. In caso di IPR obbligo di condividere i benefici (in percentuale attraverso il fatturato) attraverso il "benefit sharing fund".

Il BSF è destinato a progetti di sviluppo per le comunità locali per l'uso sostenibile delle risorse genetiche.

146 paesi contraenti (inc. US e Italia)

Revisione del 2019 estenderà il numero di colture ed istituirà il "subscription system".

Il sistema «complesso»



La governance - 4

In situ conservation and management

- [ ] **1.** Surveys and inventories
- [x] **2.** On-farm management and improvement
- [ ] **3.** Disaster situations
- [ ] **4.** Crop wild relatives and wild food plants

Ex situ conservation

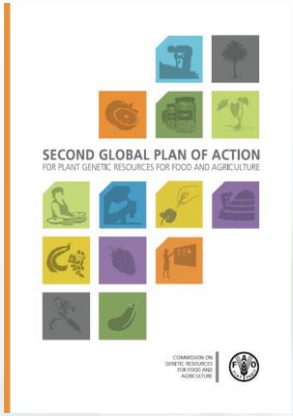
- [ ] **5.** Targeted collecting
- [ ] **6.** Germplasm collections
- [ ] **7.** Regeneration of accessions

Sustainable use

- [ ] **8.** Characterization and evaluation
- [ ] **9.** Plant breeding
- [ ] **10.** Crop diversification
- [x] **11.** Development and commercialization of varieties
- [ ] **12.** Seed production and distribution

Building sustainable institutional and human capacities

- [ ] **13.** National programmes
- [ ] **14.** Networks
- [ ] **15.** Information systems
- [ ] **16.** Monitoring and safeguarding genetic diversity
- [ ] **17.** Human resource capacity
- [ ] **18.** Public awareness



- Progress in the implementation of each priority activity of the Second GPA is currently assessed at country and global level through a set of 63 quantitatively defined and measurable indicators adopted by the Commission.

La governance - 4

November 2014 BACKGROUND STUDY PAPER NO. 67

Food and Agriculture Organization of the United Nations | Organisation des Nations Unies pour l'alimentation et l'agriculture | Продовольственная и сельскохозяйственная организация Объединенных Наций | Organización de las Naciones Unidas para la Alimentación y la Agricultura

COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

HIGHER-ORDER COMPOSITE INDICES FOR PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE TARGETS

by

Francesco Caracciolo[1], Carlo Cafiero[2] and Stefano Diulgheroff[3]

E

IISD / SDG KNOWLEDGE HUB
A project by IISD

NEWS | COMMENTARY | EVENTS | ACTORS | REGIONS | SDGS

ELSA TSIOUMANI, PH.D.
Thematic Expert on Biodiversity (Greece)

18 December 2014

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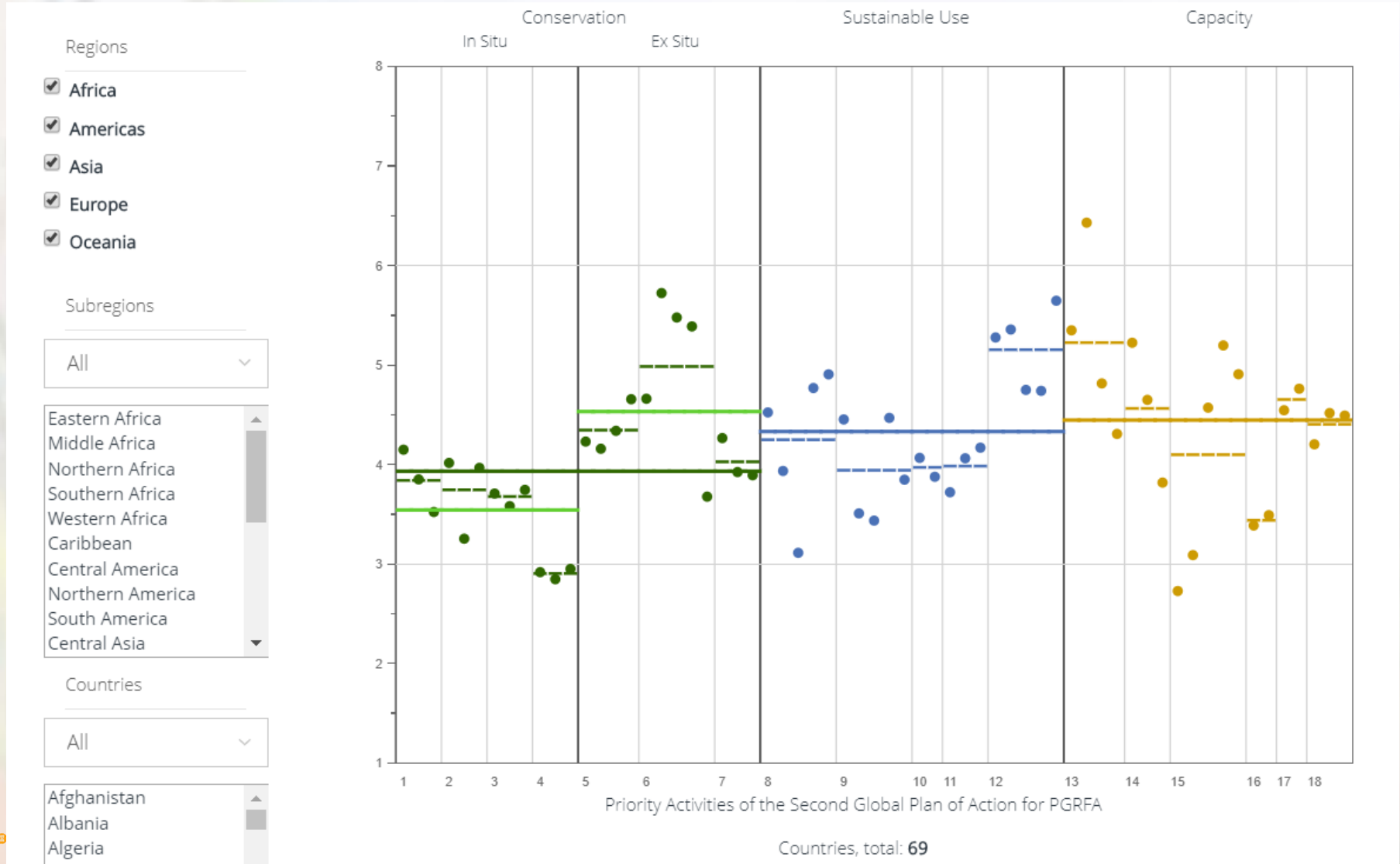
CGRFA Circulates Study on Higher-Order Composite Indices for Targets on Plant Genetic Resources

STORY HIGHLIGHTS

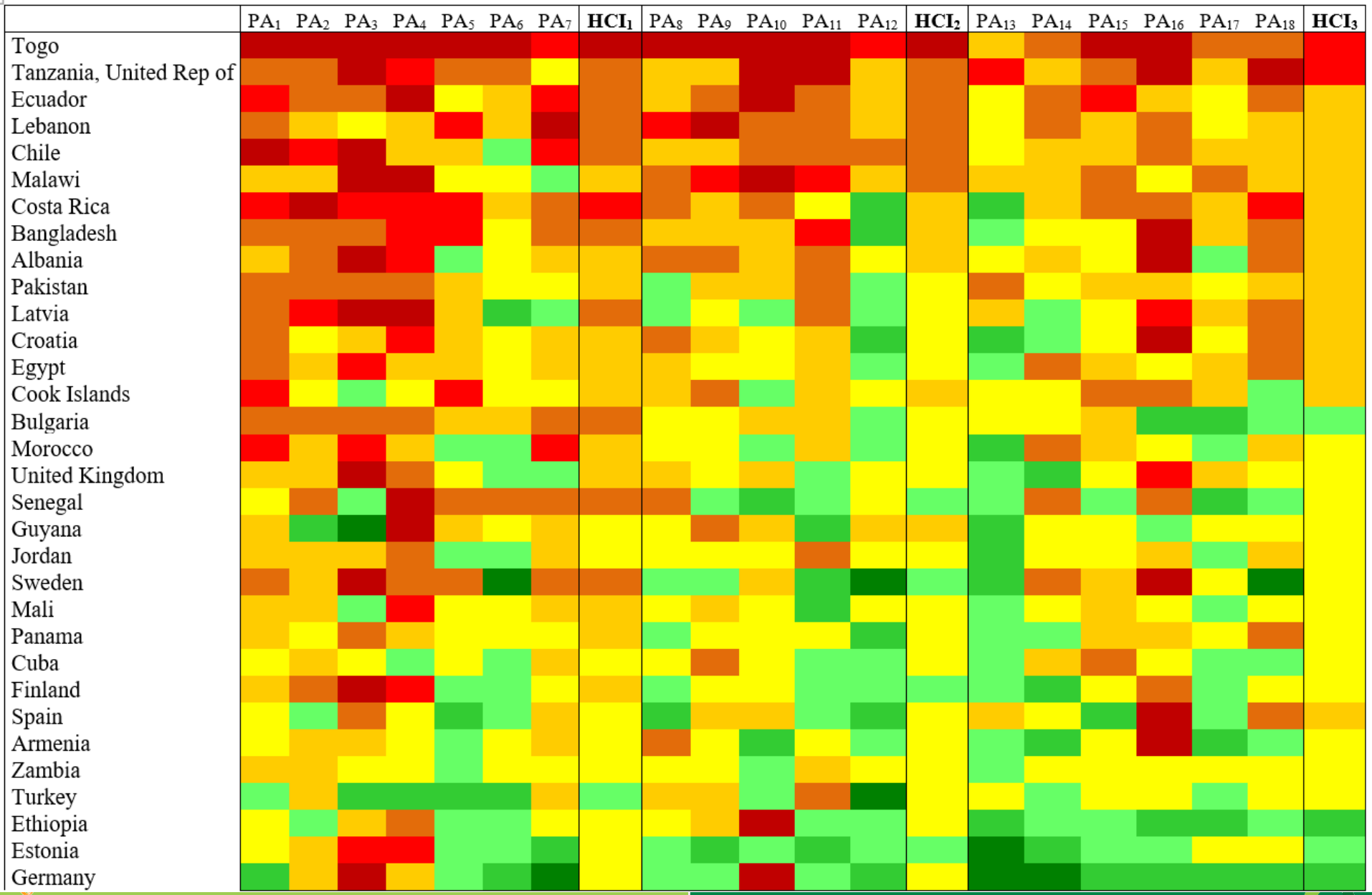
In preparation for its fifteenth session, to be held 19-23 January 2015 at the Food and Agriculture Organization of the UN (FAO) Headquarters in Rome, Italy, the FAO Commission on Genetic Resources for Food and Agriculture (CGRFA) has published a study that proposes higher-order composite indices for the targets on plant genetic resources of the second Global Plan of Action for Plant Genetic Resources for Food and

Monitoring second GPA implementation



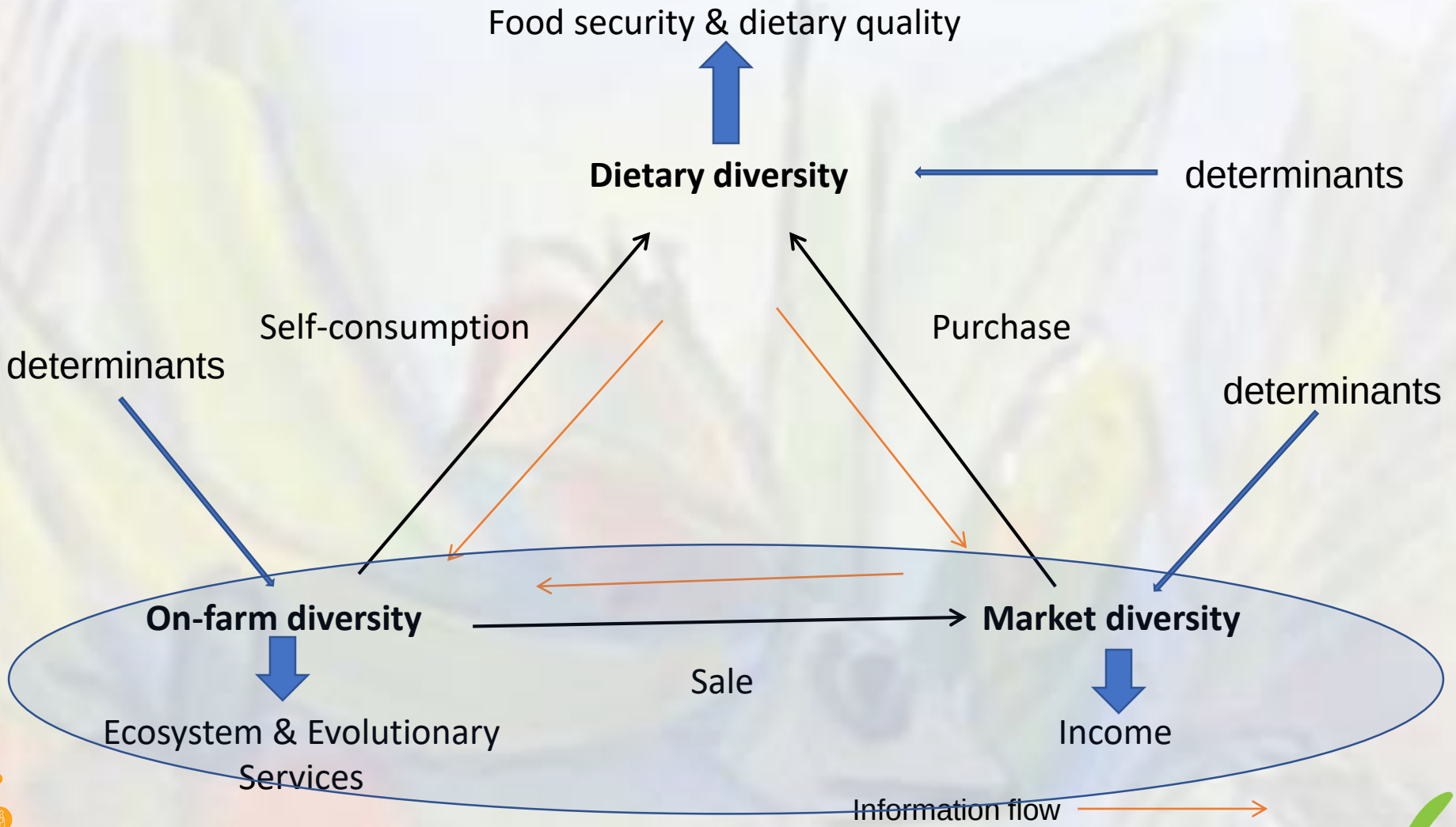
http://www.fao.org/wiews/data/domains/monitoring-framework/en/

Monitoring second GPA implementation



III. Il valore della diversificazione

Le tre dimensioni dell'agro-biodiversità



Specializzazione vs Diversificazione

Specializzazione

- Specializzarsi in una o poche specie in vendita dove sono più competitive e Raggiungere economie di scala
- Accedere a fattori di produzione più economici e facilitare la vendita della produzione
- Le entrate generate dalla specializzazione in una o poche specie, permettono di acquistare una maggiore diversità di alimenti sul mercato
- Non è necessario produrre alimenti per l'autoconsumo

Diversificazione

- Poter consumare ciò che si produce seguendo le proprie preferenze (inc. culturali)
- Raggiungere economie di scopo "efficienze prodotte dalla varietà, non dal volume" (Goldhar & Jelinek, 1983), date dalle condizioni eterogenee di suolo e clima.
- Vantaggi di gestione del rischio (riduzione vulnerabilità a shock di mercati e climatici).

Specializzazione vs Diversificazione

nature plants

LETTERS

PUBLISHED: 30 MARCH 2015 | ARTICLE NUMBER: 15033 | DOI: 10.1038/NPLANTS.2015.33

Complementary effects of species and genetic diversity on productivity and stability of sown grasslands

nature plants

Letter | Published: 22 February 2016

Multi-country evidence that crop diversification promotes ecological intensification of agriculture

PNAS

Impacts of plant diversity on biomass production increase through time because of species complementarity

Bradley J. Cardinale*†, Justin P. Wright‡, Marc W. Cadotte*, Ian T. Carroll*, Andy Hector§, Diane S. Srivastava¶, Michel Loreau‖, and Jerome J. Weis*

*Department of Ecology, Evolution, and Marine Biology, University of California, Santa Barbara, CA 93106; ‡Department of Biology, Duke University, Durham, NC 27708; §Institute of Environmental Sciences, Universität Zürich, Winterthurerstrasse 190, 8057 Zürich, Switzerland; ‖Department of Biology, McGill University, Montreal, QC, Canada H3A 1B1; and ¶Department of Zoology, University of British Columbia, Vancouver, BC, Canada V6T 1Z4

Il valore della diversificazione - 4

Assessing the Effectiveness of Projects Supporting On-Farm Conservation of Native Crops: Evidence From the High Andes of South America

MAURICIO R. BELLON [a], ELISABETTA GOTOR [a] and FRANCESCO CARACCIOLO [b,*]
[a] *Bioversity International, Maccarese (RM), Italy*
[b] *University of Naples Federico II, Portici (Na), Italy*

WORLD DEVELOPMENT
The multi-disciplinary international journal devoted to the study and promotion of world development

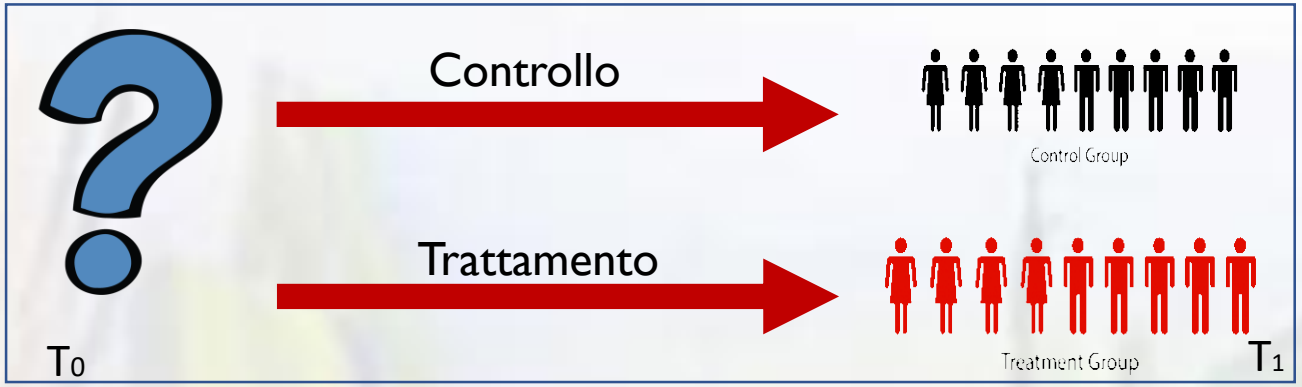
26 interventi analizzati
6 Scelti per indagine di campo

Table 1. *Projects studied*

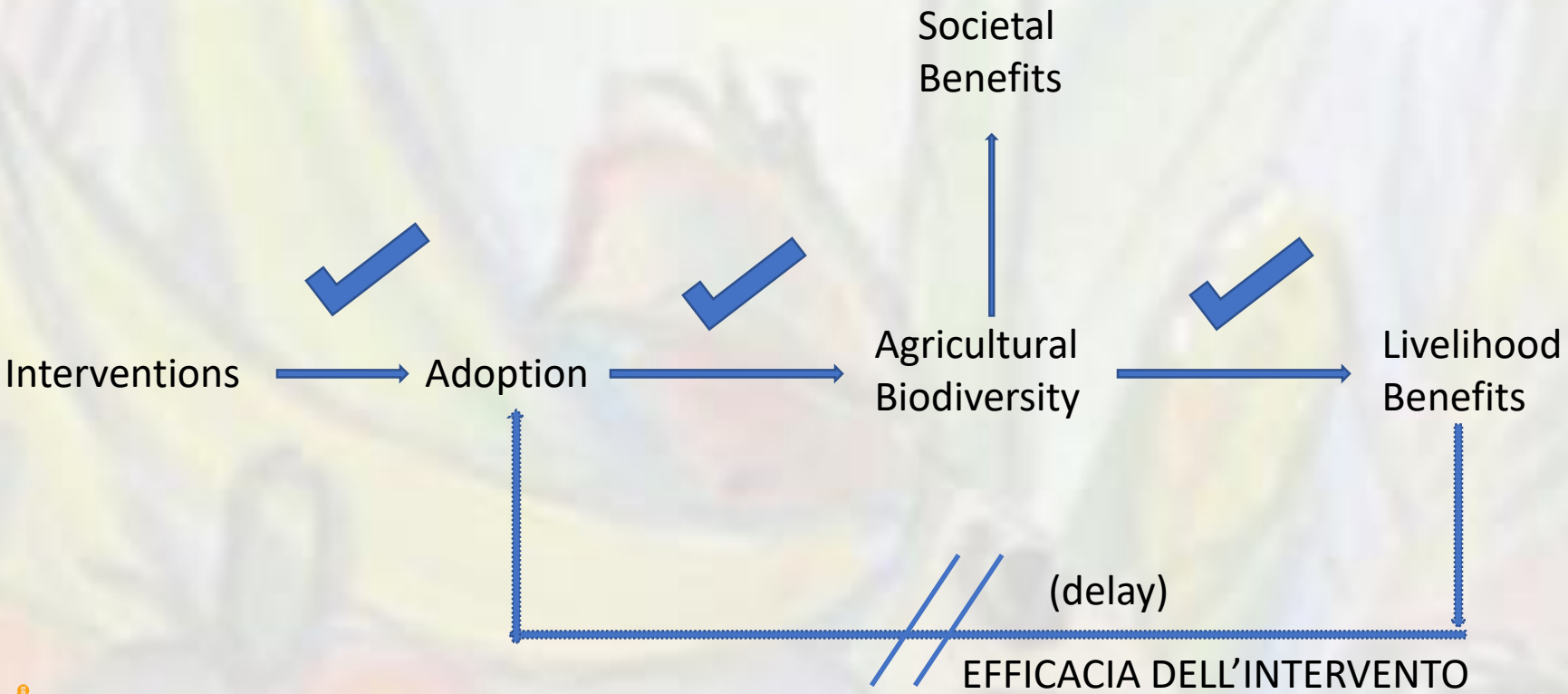
ID	Country	Project name	General objective	Target species	Implementing agency	Donor	Period
A	Ecuador	Promotion of Andean Crops for Rural Development in Ecuador[a]	To promote rural development through the complementary conservation and the sustainable use of plant genetic resources of underutilized native crops of the inter-Andean valleys of Ecuador, through the collaboration between rural communities of Cotacachi, researchers and national and international agencies	Multiple species	The Union of Peasant and Indigenous Organizations of Cotacachi (UNORCAC)	US Department of Agriculture	2002–05 2006–08
B	Peru	Biodiversity of Andean Tubers: Strengthening the On-farm Conservation and Food Security of Andean Tubers in the Fragile Ecosystems of the Southern Peruvian Highlands	To strengthen the dynamics of in-situ conservation of Andean tubers and improve food security and income of the high Andean communities of the Cusco Region	Oca Ulluco Maswa Potatoes	University of Cuzco/ Centro Regional de Investigación en Diversidad Andina (CRIBA)	McKnight Foundation	1995–99 2001–05
C	Peru	Native Potato: Improved production of native Potatoes in the Andean Highlands of Peru	To increase food security of native Quechua and Aymara communities in the southern high Andean region of Peru by improving the production and marketing of native potato varieties	Potatoes	Intermediate Technology Development Group (ITDG)	McKnight Foundation	2005–09
D	Bolivia	Enhancing the Contribution of Neglected and Underutilized Crops to Food Security and to Incomes of the Rural Poor	To contribute to raising the incomes and strengthening the food security of small farmers and rural communities around the world through securing and exploiting the full potential of the genetic diversity contained in neglected and underutilized species	Quinoa Cañahua	Bioversity Int. & Fundación PROINPA	International Fund for Agricultural Development	2001–03 2007–09
E	Bolivia	National Genetic Resources System for Food and Agriculture, Andean Grains	To ensure the conservation of High Andean Grain germplasm and increase its usability through a coordinated effort between the Active Germplasm Bank of the Subsystem, the Work Collections and other strategic alliances	Quinoa Cañahua	Fundación PROINPA	Gov't of Bolivia	2003–08

[a] UNORCAC is a peasant organization with a long history of work in the region and on issues of biodiversity, thus the specific project analyzed here built on previous interventions, so in that case the observed changes cannot be attributed solely to a particular project, but should be seen more as the impact of UNORCAC.

Il valore della diversificazione - 5

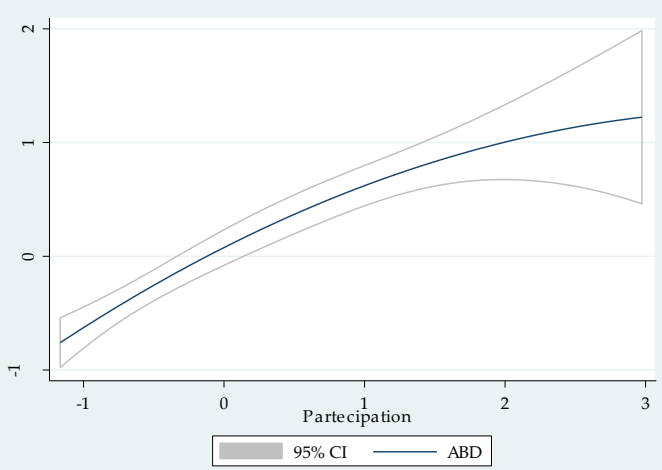


~1.000 Osservazioni

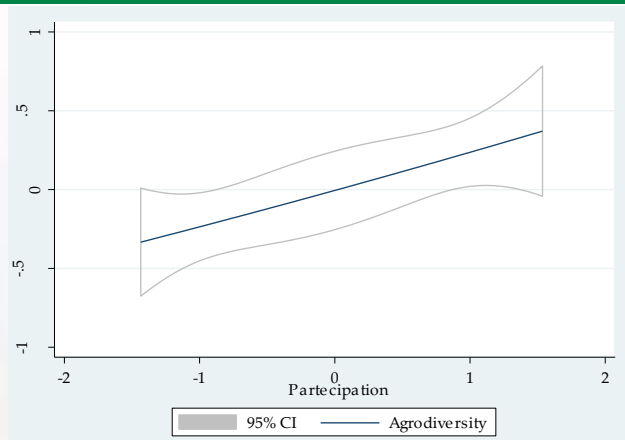


Source: Bellon, M., Gotor, E. and Caracciolo F. 2015.

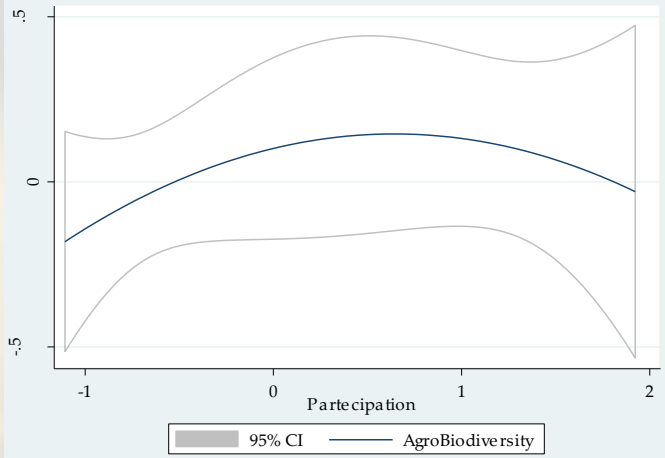
Il valore della diversificazione - 6



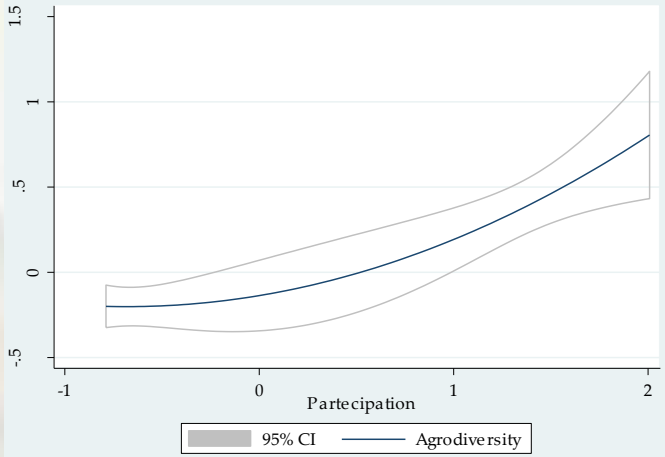
Equador



Perù (CRIBA



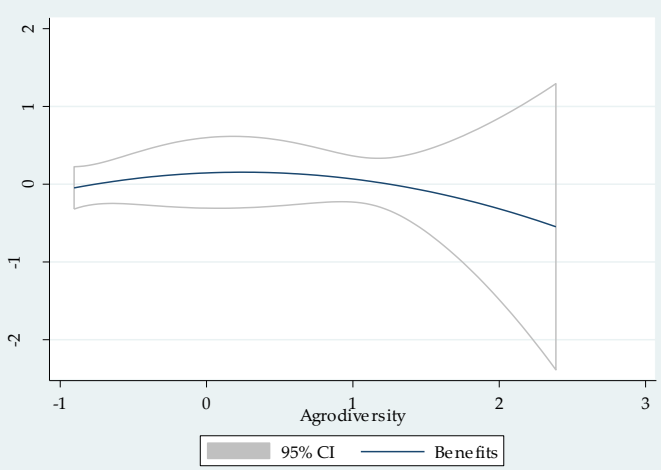
Perù (ITDG)



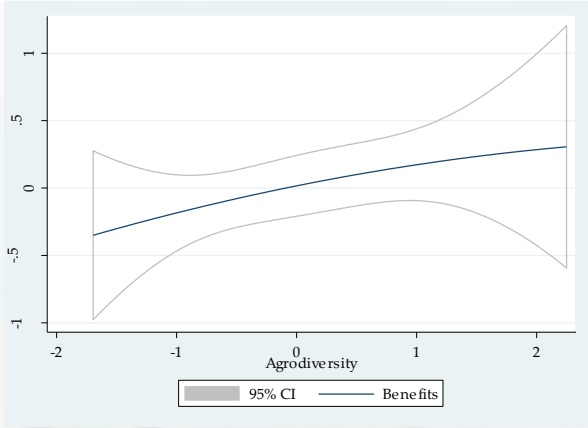
BOLIVIA

Adoption → Agricultural Biodiversity → Livelihood Benefits

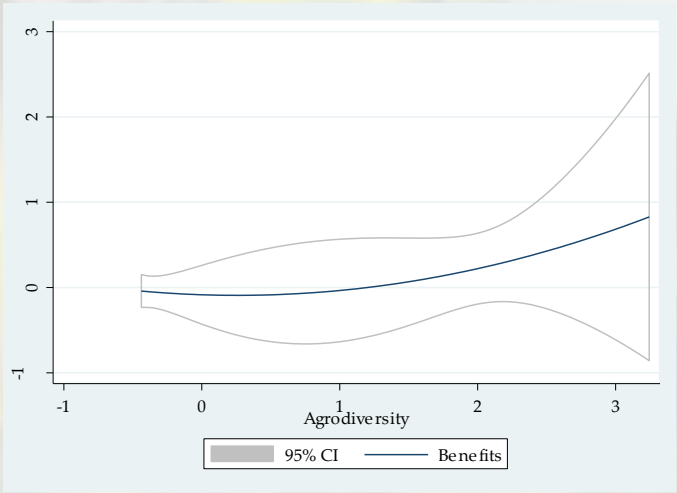
Il valore della diversificazione - 7



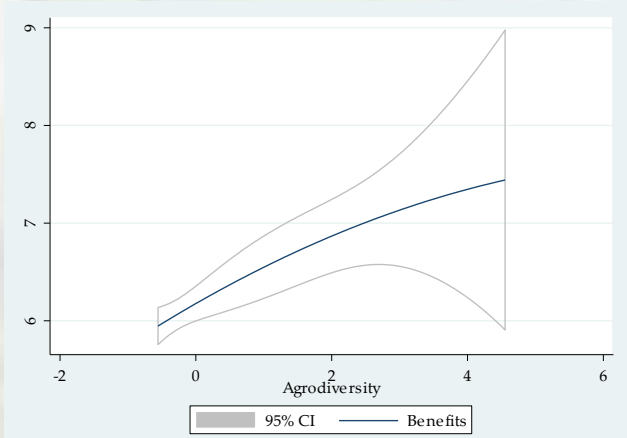
Equador



Perù (CRIBA)



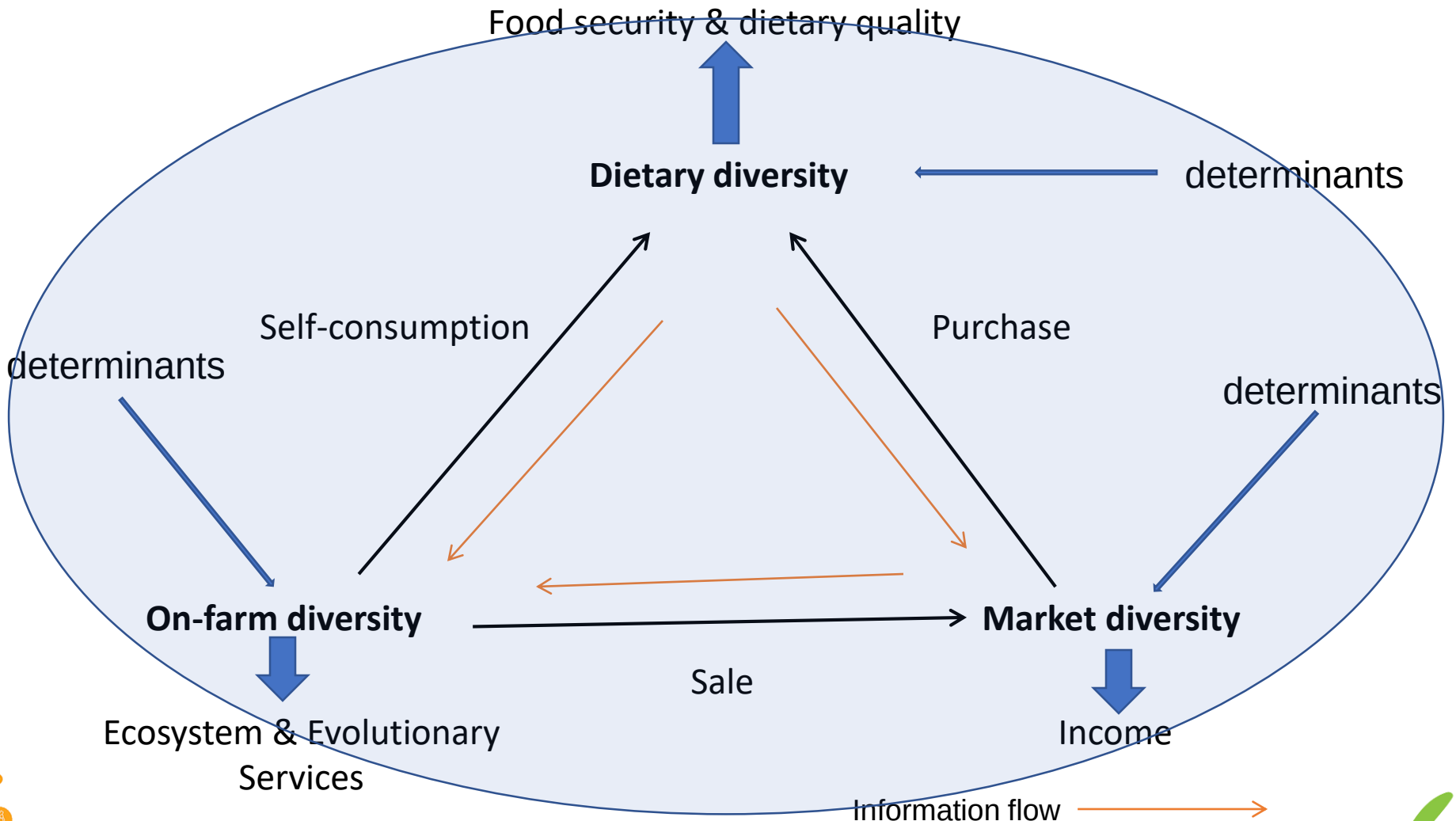
Perù (ITDG)



BOLIVIA

Adoption → Agricultural Biodiversity → Livelihood Benefits

Le tre dimensioni dell'agro-biodiversità



Case study: Maize-based systems in Southern Benin, West Africa

RESEARCH ARTICLE

On-Farm Diversity and Market Participation Are Positively Associated with Dietary Diversity of Rural Mothers in Southern Benin, West Africa

PLOS ONE

Mauricio R. Bellon[1]*, Gervais D. Ntandou-Bouzitou[2], Francesco Caracciolo[3]

1 Bioversity International, Maccarese, Italy, **2** Bioversity International, Cotonou, Benin, **3** University of Naples Federico II, Portici, Italy

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Diversità della Dieta.

"Il numero di differenti alimenti o gruppi di alimenti consumati nel corso di un determinato periodo di tempo" (Ruel, 2003)

La diversità della dieta è fortemente associata all'adeguatezza dell'apporto di nutrienti (Bellon et al., 2016)

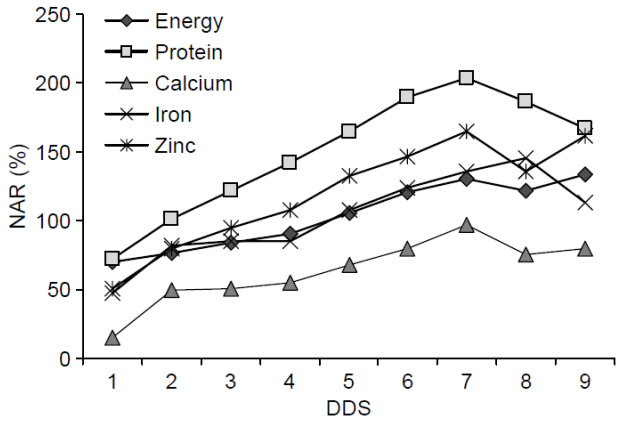


Fig. 1 Mean nutrient adequacy ratio (NAR, expressed as %) of energy and nutrients at different levels of dietary diversity score (DDS)

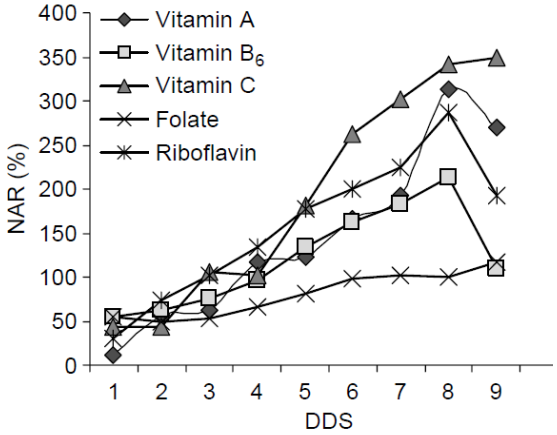


Fig. 2 Mean nutrient adequacy ratio (NAR, expressed as vitamins at different levels of dietary diversity score (DDS)

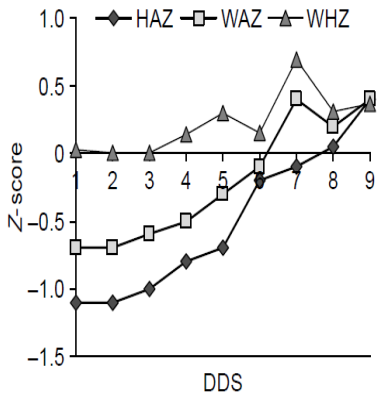


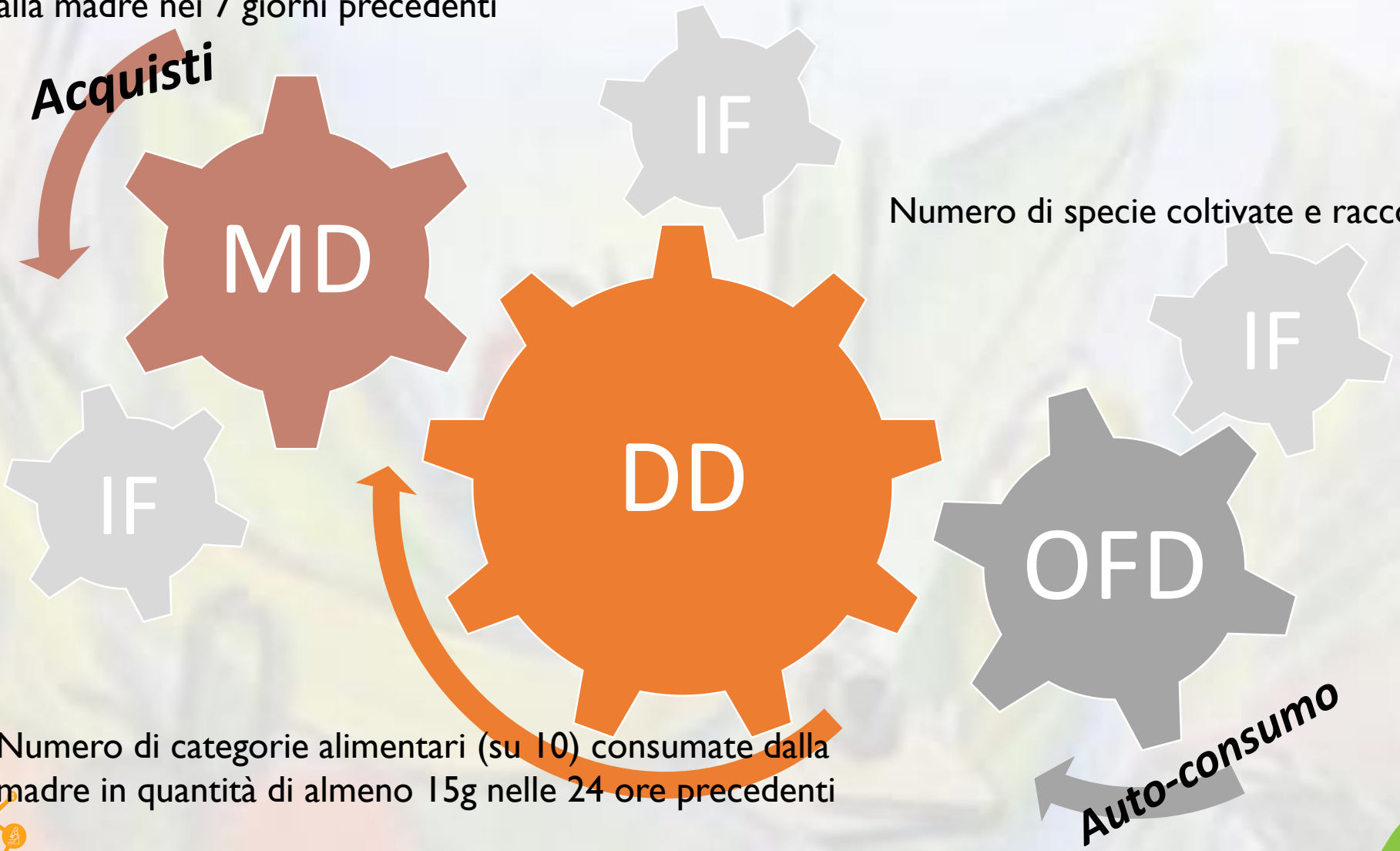
Fig. 3 Mean anthropometric *Z*-scores (WAZ – weight-for-age; HAZ – height-for-age; WHZ – weight-for-height) at different levels of dietary diversity score (DDS)

Source: Steyn et al., 2005 Public Health Nutrition: 9(5), 644–65

Il valore della diversificazione - II

60 villaggi, 15 famiglie/villaggio
selezione casuale ~ **900**

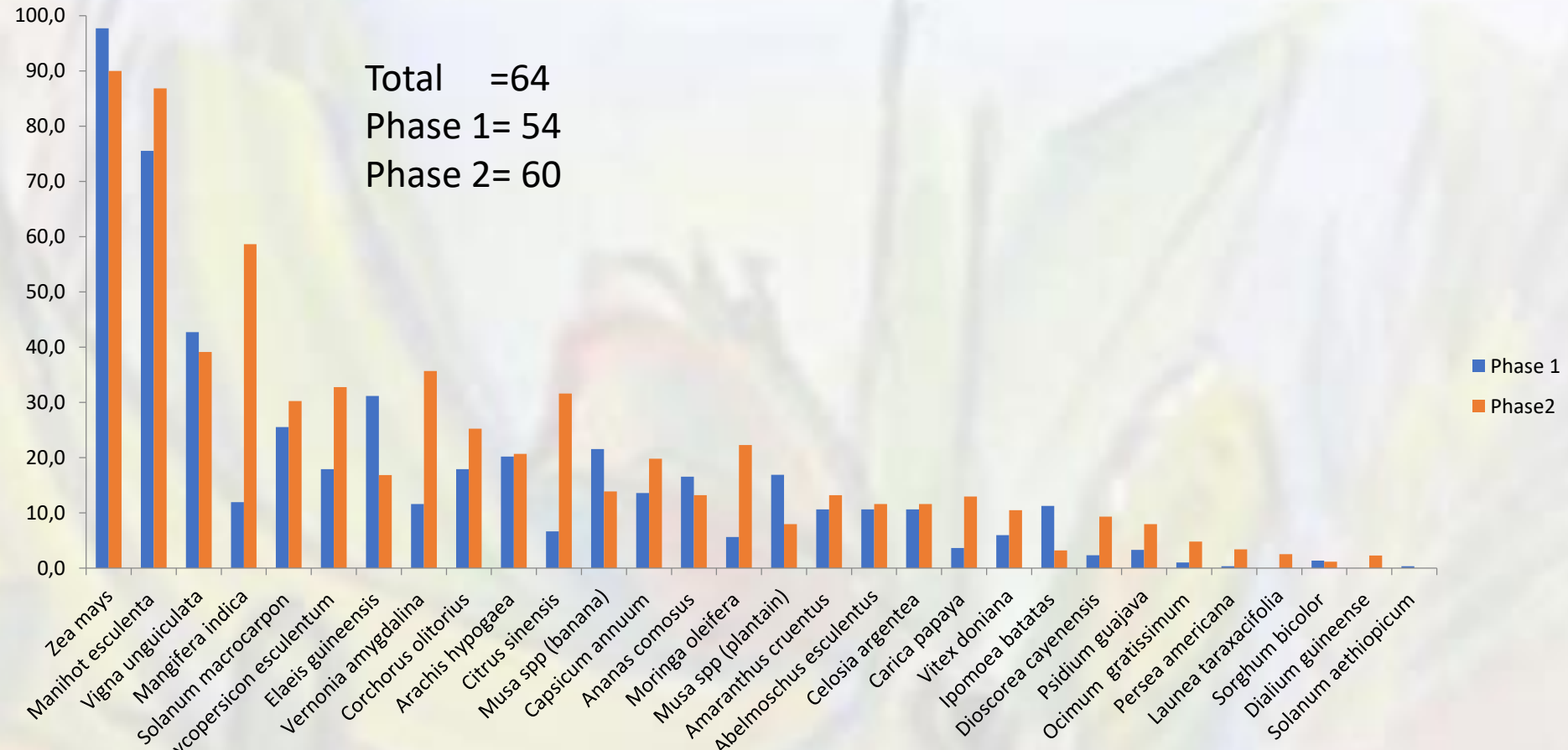
Numero di alimenti acquistati al mercato dalla madre nei 7 giorni precedenti



Numero di specie coltivate e raccolte

Numero di categorie alimentari (su 10) consumate dalla madre in quantità di almeno 15g nelle 24 ore precedenti

Frequenza specie coltivate in azienda e/o usate per autoconsumo



Alcune specie coltivate in azienda e/o usate per autoconsumo

Table 6. Results of a system of simultaneous equations[1] modeling OFD, MD and DD as outcome variables.

Variable	On-Farm Diversity		Market Diversity		Dietary Diversity	
Constant	6.592	*	17.865		2.898	
On-Farm Diversity					0.036	*
Market Diversity					0.023	*
Landholdings	0.11	***	-0.315			
Square of landholdings	-0.005	*	0.002			
Socioeconomic Index	-0.017		1.148	**		
Urban market-shed	0.543	***	-0.794		0.093	
Semi-urban market-shed	-0.083		-2.653	*	-0.023	
Travel time	0.016	***	-0.196	***	0.007	
Square of travel time	-0.0002	***	0.001	**	-0.0006	
No. non-agricultural income sources father	0.018		0.285		-0.013	
Agriculture rated very important income source father	0.5	***	-0.27		-0.054	
Agriculture rated important income source father	0.485	***	-0.225		-0.08	
No. non-agricultural income sources mother	0.153	***	0.225		-0.025	
Agriculture rated very important income source mother	0.362	***	-2.512	***	-0.009	
Agriculture rated important income source mother	0.383	***	-0.507		-0.052	
Mother age	-0.007	*	0.097	*	-0.001	
Mother education	-0.004		0.306	**	0.002	
Mother ethnicity (Aizo)	0.051		-3.026	***	0.062	
Family size	0.031	**	0.053		-0.001	
Temperature range	-1.247	*	-5.349		-0.297	
Coefficient of variation precipitation	-0.038		0.711		-0.039	
Precipitation range	0.001		-0.06		0.004	
Season (dry)	-0.516	***	-1.153	*	0.208	***

[1]N = 880. Robust standard errors clustered at the household level to account for the fact that some households are represented twice in the data. Estimates of standard-errors do not vary significantly to those reported if clustered at the village level.
Significance at the .05, .01, .001 level indicated by *, **, *** respectively for a two-tail t-test

- I coltivatori di mais sono più che coltivatori di mais. Le famiglie rurali si affidano a molte specie: coltivate e raccolte.

- Tutte le famiglie partecipano ai mercati; L'agricoltura «solamente» di sussistenza è un mito.

- La produzione per l'autoconsumo e per il mercato sono obiettivi complementari. Produzioni (e varietà) tradizionali e migliorate coesistono in azienda.

Conclusione

Incertezza delle sfide del futuro

- I futuri incrementi di produttività dipenderanno dalle risorse genetiche?
- In che modo il cambiamento climatico e altre sfide modificheranno il valore delle risorse genetiche?
- L'editing genetico è un sostituto o un complemento delle risorse genetiche?
- In che modo la tecnologia modificherà le risposte a queste domande?

Evaluation of Five Emerging Biotechnologies for Maize

K. M. Menz and C. F. Neumeyer

Scientists were surveyed as part of an assessment of five emerging biotechnologies that are potentially applicable to commercial US maize production by the year 2000. The largest gains expected by scientists were from plant growth regulators, followed by photosynthetic enhancement, cell or tissue culture, and biological nitrogen fixation. *(Accepted for publication 23 February 1982)*

"*The consequences of genetic engineering for commercial maize production are less likely to be in yield enhancement and more likely to be in cost reduction*"

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IT/GB-8/ACFSRM-11/19/5 Funding Strategy Target Setting: cost based methodology.

DIPARTIMENTO DI AGRARIA

IL caffè SCIENTIFICO DI AGRARIA
Aula Cinese ore 14.30

Contaminanti chimici nel nostro piatto, è la dose che fa il veleno??

Teresa Cirillo

9 Ottobre 2019