IMAS

Impacto de las Modalidades de Acceso a las Semillas sobre la diversidad de recursos genéticos en agricultura

The high genetic diversity of *Chenopodium quinoa* Willd and its global expansion.

cirad
AGRICULTURAL RESEARCH FOR DEVELOPMENT

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FINANCÉ PAR ANR

IYQ-2013, New York, 20/02/13
OFFICIAL LAUNCH OF THE INTERNATIONAL YEAR OF QUINOA

Quinua
2013 Año Internacional
Un futuro sembrado
hace miles de años

"The General Assembly of the United Nations declared 2013 as the IYQ, recognizing that, through their knowledge and practices, the Andean indigenous peoples have maintained, controlled, protected and preserved in its natural state quinoa, including its numerous landraces and local crop wild relatives, as food for present and future generations. "

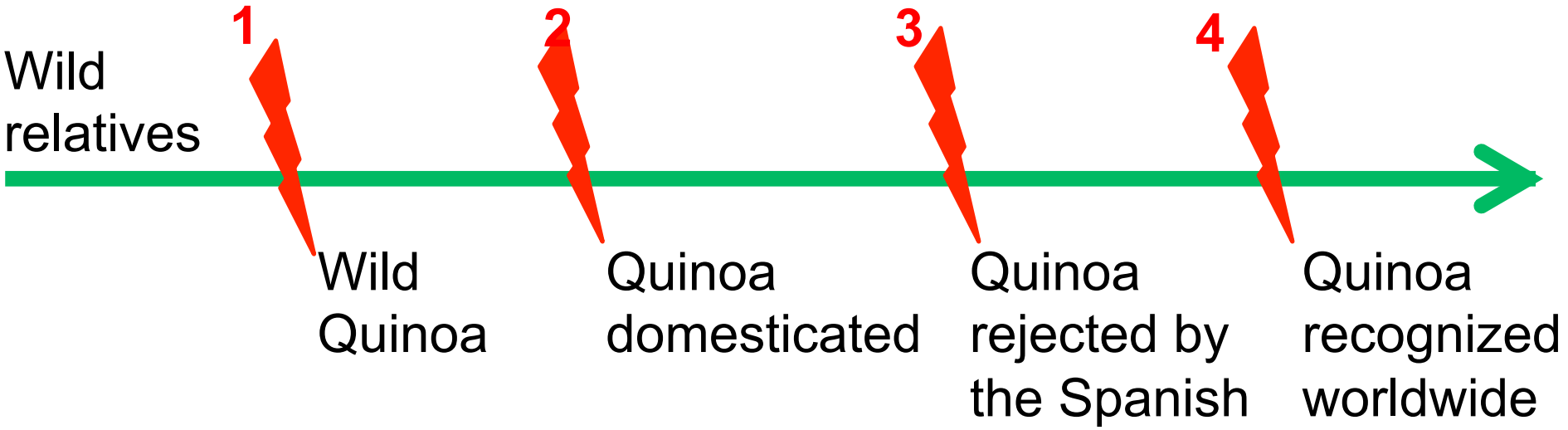
"Main objective of the IYQ:

- To focus world attention on the **potential role of quinoa biodiversity**,

… in **food security**, **nutrition** and **poverty eradication**

Oficina Regional para
América Latina y el Caribe

Evolutionary dynamics of quinoa



Origin of the actual quinoa

Diploid ancestor (2x)

Pariente A- femenino (2x)
Chenopodium standleyanum
América templada

Pariente B- masculino (2x)
Chenopodium album
(o C. ficifolium?)
Eurasia

Tetraploid ancestor (New world)
C. berlandieri*, *C. hircinum

Chenopodium pallidicaule
(Kañiwa)

Chenopodium quinoa (quinoa),
Chenopodium nuttalliae (huauzontle),
Other 4*x* types

Adapted from Jellen et al, 2013

Mayores parientes silvestres de la quinoa actual

C. berlandieri

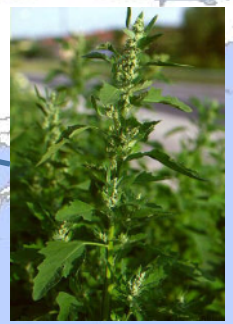
C. berlandieri berlandieri (Maleza en EEUU, Canada)

C. berlandieri nuttaliae (cultivated en Mexico)

C. album

Weed in Europe

Cultivated en Asia



Center of origin of the quinoa (H. Wilson)

C. quinoa

Domesticated,

Cultivated en Los Andes (Colombia, Ecuador, Perú, Bolivia, Chile y Argentina)

C. hircinum

Weed

South America

4 000 km

Quinoa was domesticated near Lake Titicaca

Domestication is a long and dynamic process

Infra-specific diversity of crops is an invaluable asset, created and maintained by all farmers in the world

Wild relatives

Domestication

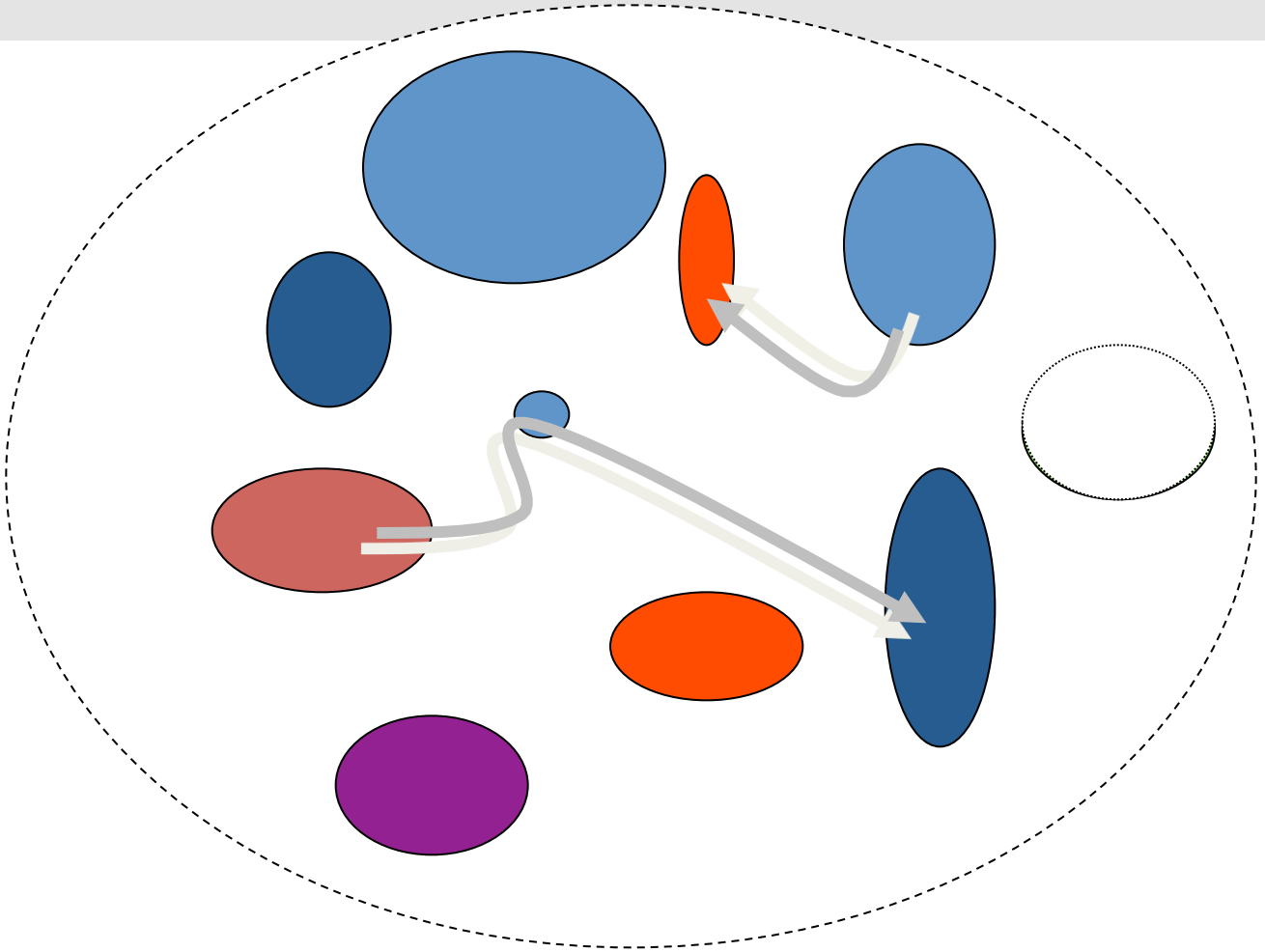
Cultivated Quinoa

Adaptation
Differentiation

Farmers
Landraces

Diversity of crop landraces
= *an open metapopulation*

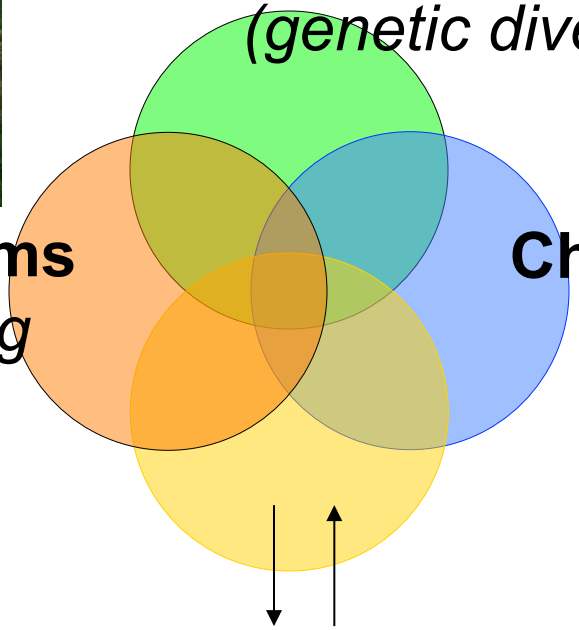
=> Permanent evolution and adaptation to environmental contexts



Why and how farmers maintain genetic diversity of their crops?

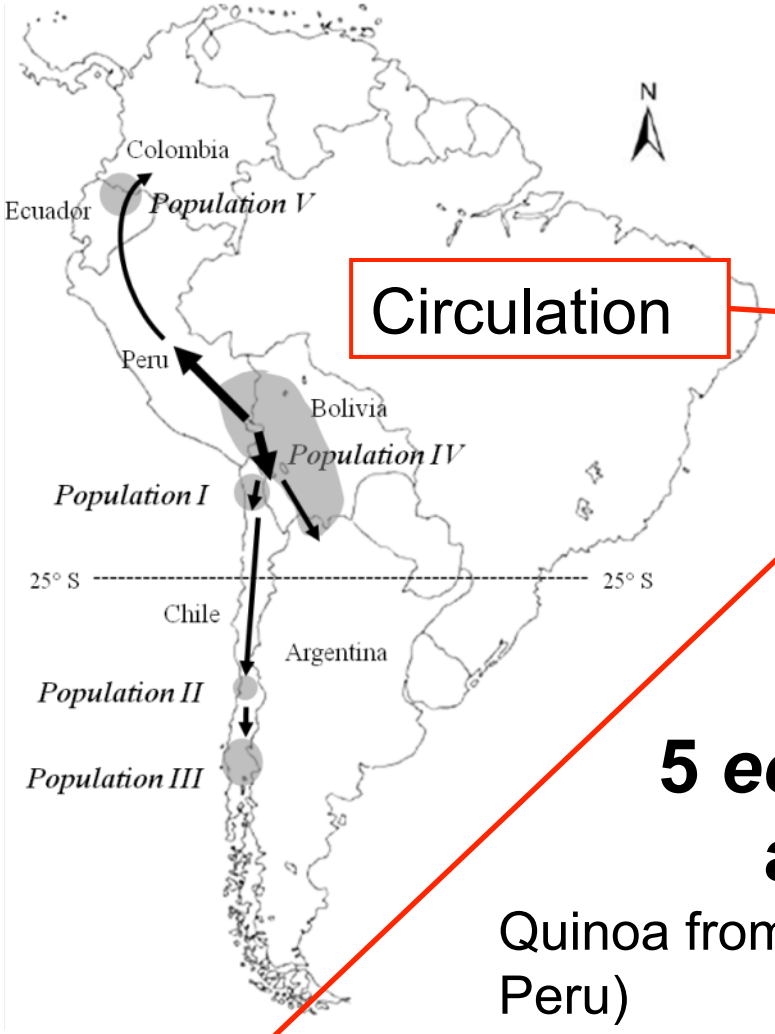
Diversity of ecotypes of quinoa
(genetic diversity)

Several types of farms
(diversity of cropping systems)



Characteristics of the varieties

Introduction and seed exchanges



Circulation

Adaptation

Utilization

5 *ecotypes* asociated eachone to a *diversity sub-center* :

Quinoa from Inter Andean Valleys (Colombia, Ecuador y Peru)

Quinoa from the Highlands (Peru y Bolivia)

Quinoa from the Y*ungas* (Bolivia)

Quinoa de los *Salares* (Bolivia, Chile y Argentina)

Quinoa from Sea level (Chile)

Quinoa
rejected by the
Spanish

a) Since colonization until the late XX = "Indian Food".
b) Its use as a religious drink (eg *Mudai* for *Nguillatun*), was rejected by the Church.
c) Schooling changed eating patterns
e) Policies for Agricultural Modernization
    i) Structure of Land Tenure
    ii) Forms of production

High diversity *In Sit*

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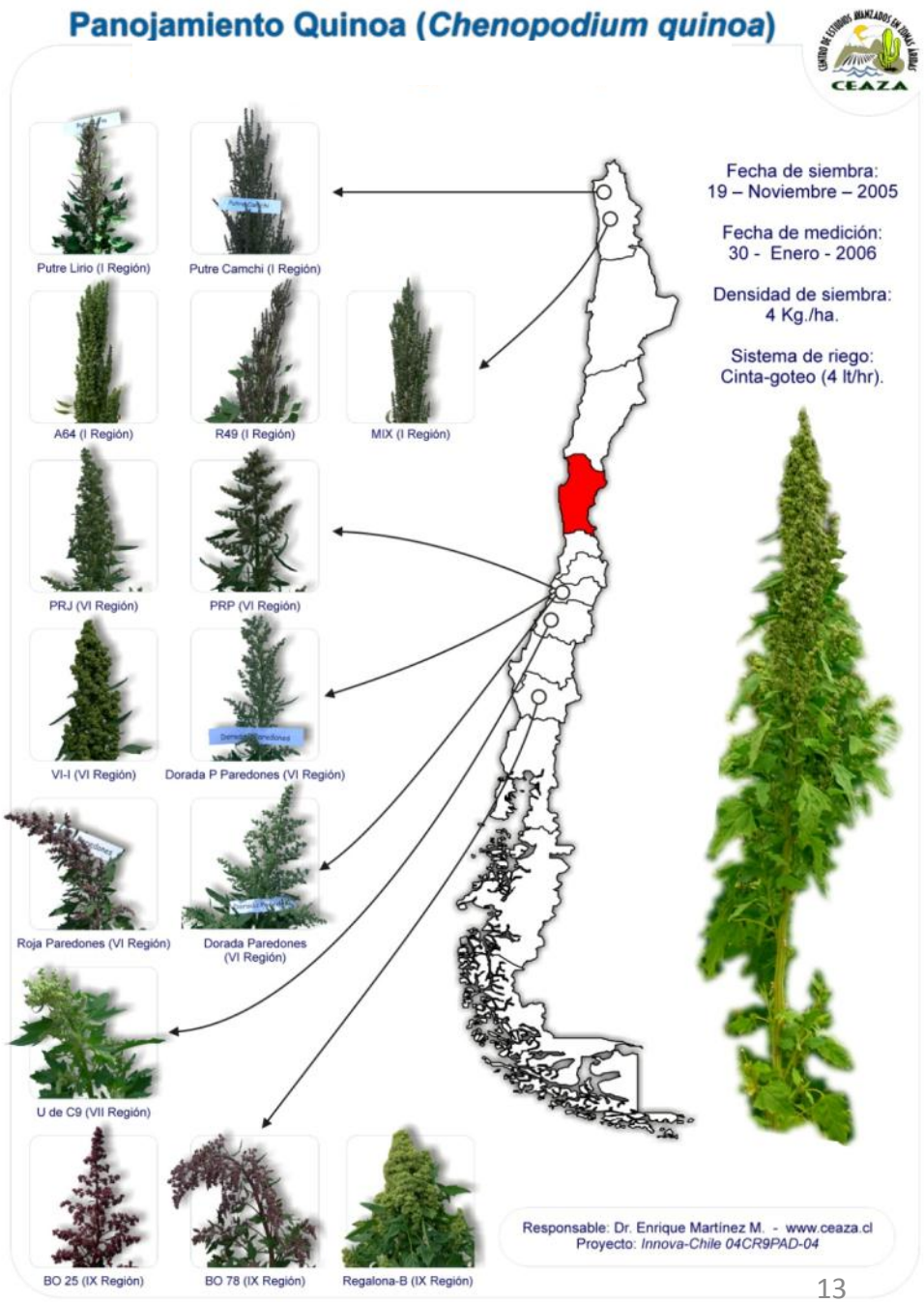
The high diversity of quinoa can be seen in the field

Example of Chile

north to south

Rainfall (mm/y)

Height (m)



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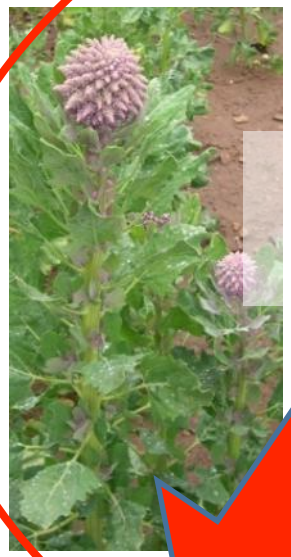
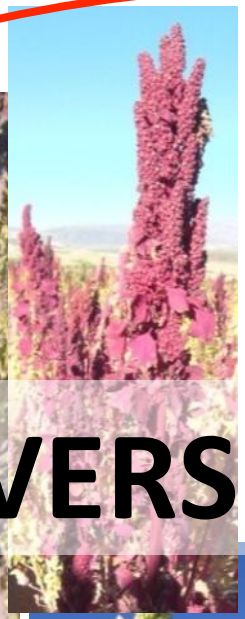
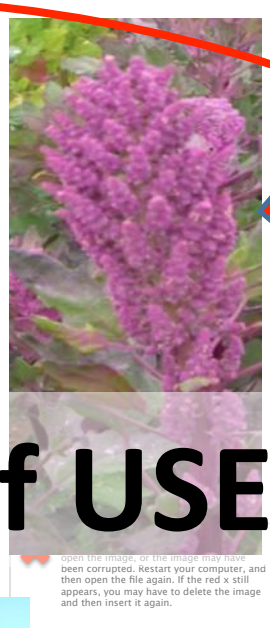
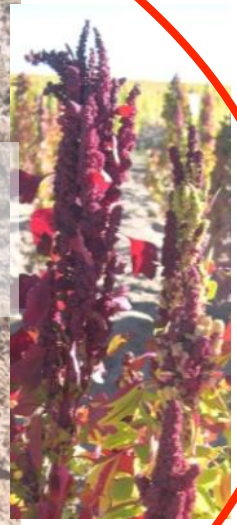
DIVERSITY of USES

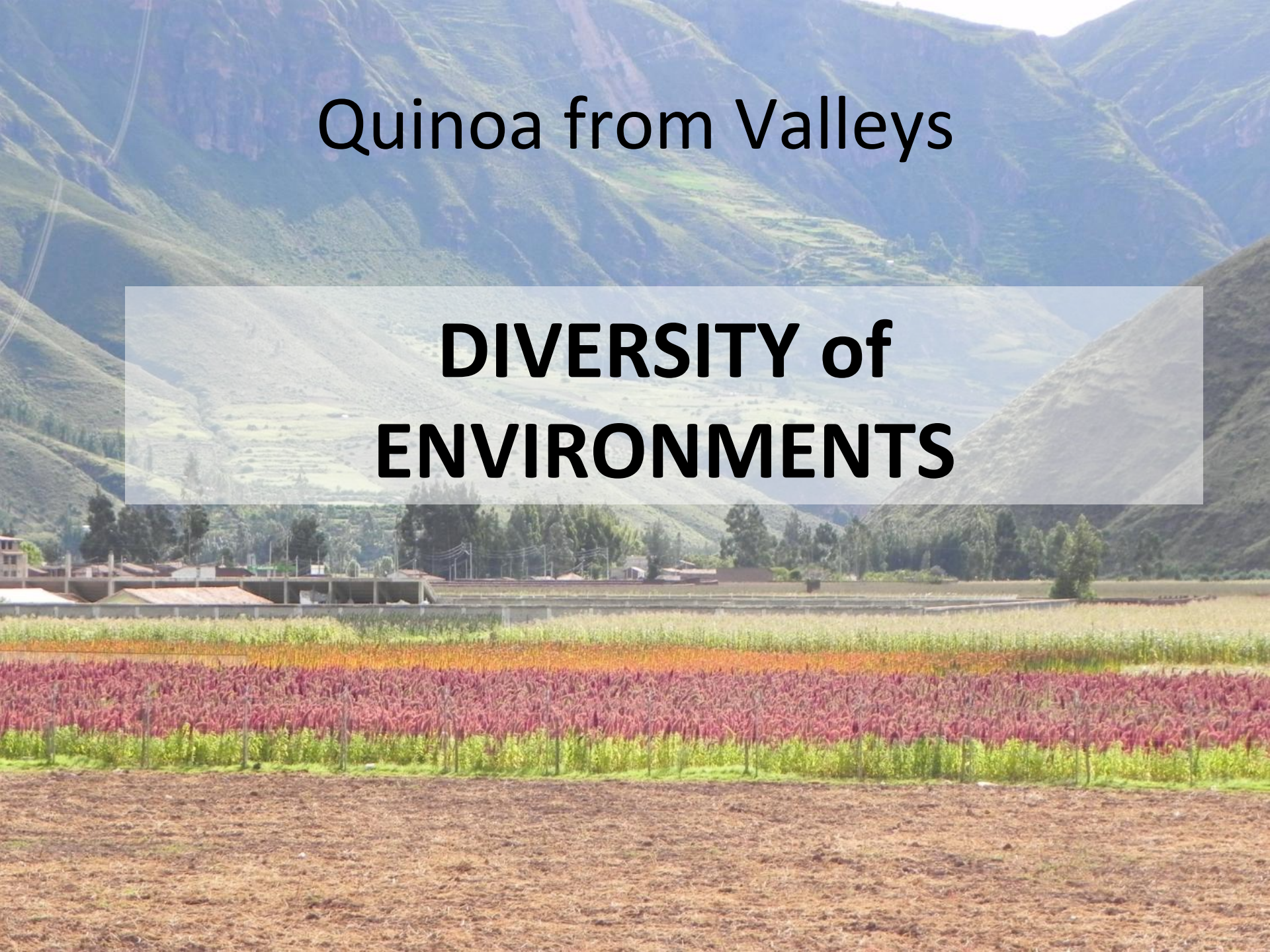








DIVERSITY of PRACTICES


Quinoa from Valleys
DIVERSITY of
ENVIRONMENTS


Quinoa from Salares (*altiplano sur*)
DIVERSITY of
ENVIRONMENTS

Quinoa from the Lowlands/ Sea level

DIVERSITY of ENVIRONMENTS

Quinoa, a wide diversity allowing it to adapt to different agro-ecological contexts and to tolerate extreme conditions (drought, salinity, frost, etc..)

=> *This shows the potential for cultivation in other parts of the world*

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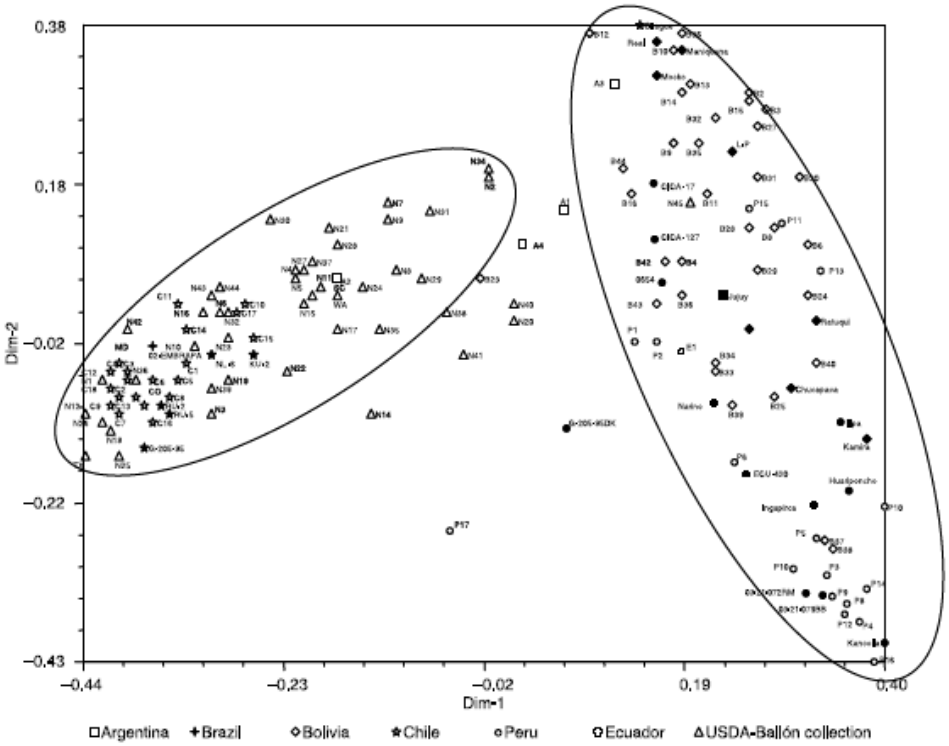
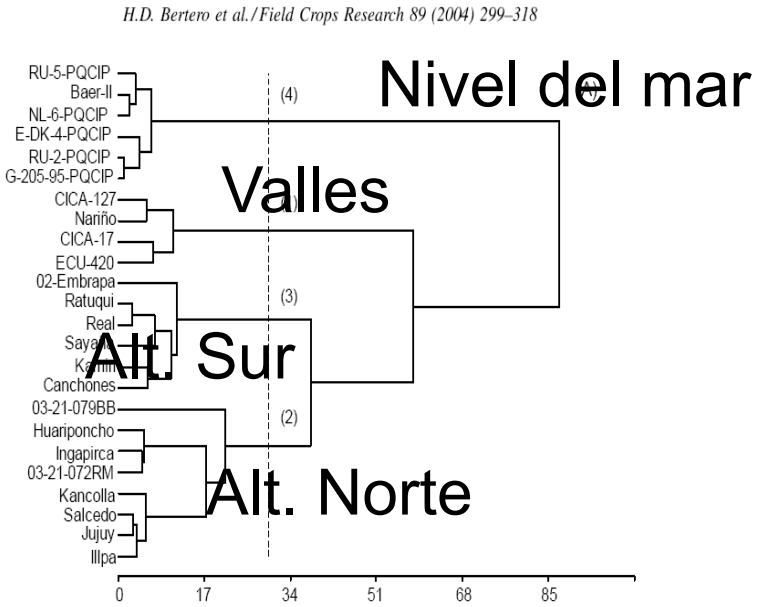
Salar Coipasa, lado chileno

Quinoa,
leaving from the Andes

What can be grown in temperate environments?





Christensen et al. 2007. Plant Genet. Res.
Bertero et al, 2004. Field Crop Research

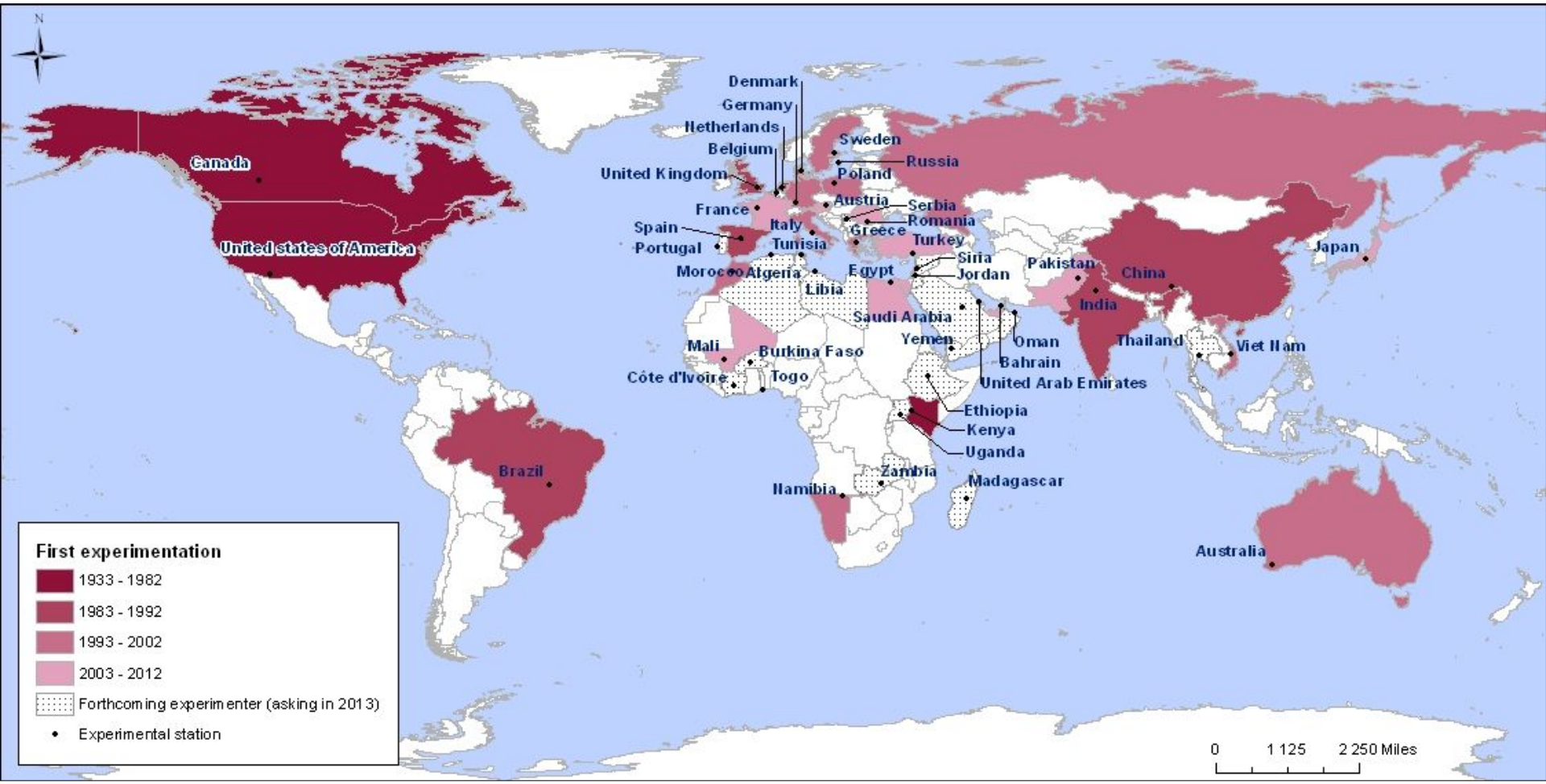
Quinoa worldwide development in 1973

Quinoa worldwide development in 1983

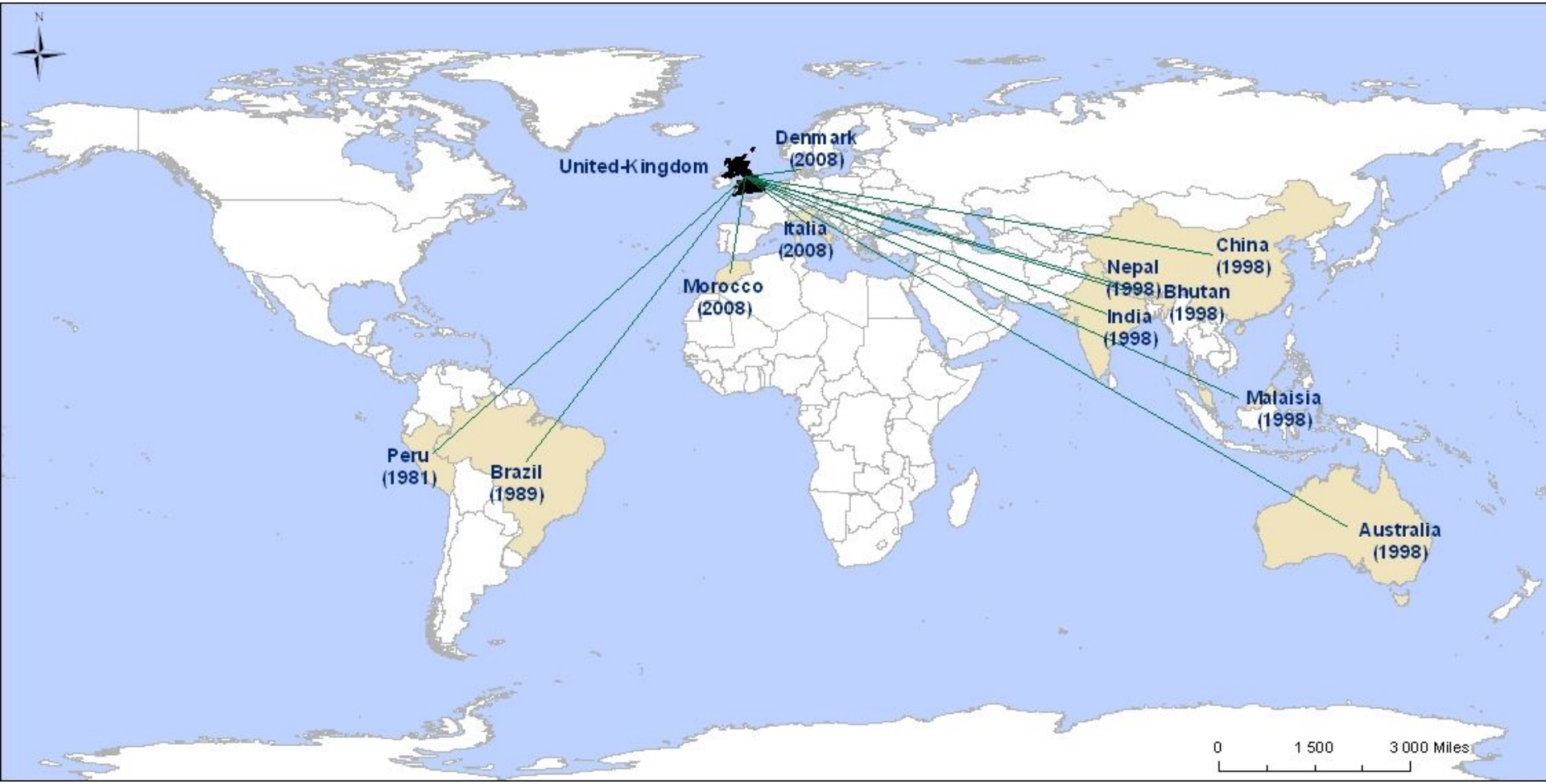
Quinoa worldwide development in 1993

Quinoa worldwide development in 2003

Quinoa worldwide development in 2013



First experimentation of quinoa in the country



Collaboration with University (England) for the first quinoa experimentation (since 1981)

Collaboration with CIP-DANIDA for quinoa experimentations

Prueba Americana y Europea de quinua (>1996-98)

Collaboration with the University of Copenhague (DK) for quinoa experimentations : *Project SWUP-MED (2008-2012)*

Quinoa Worldwide Genetic Resources Distribution (*ex situ* conservation)

Quinoa,
leaving from the Andes

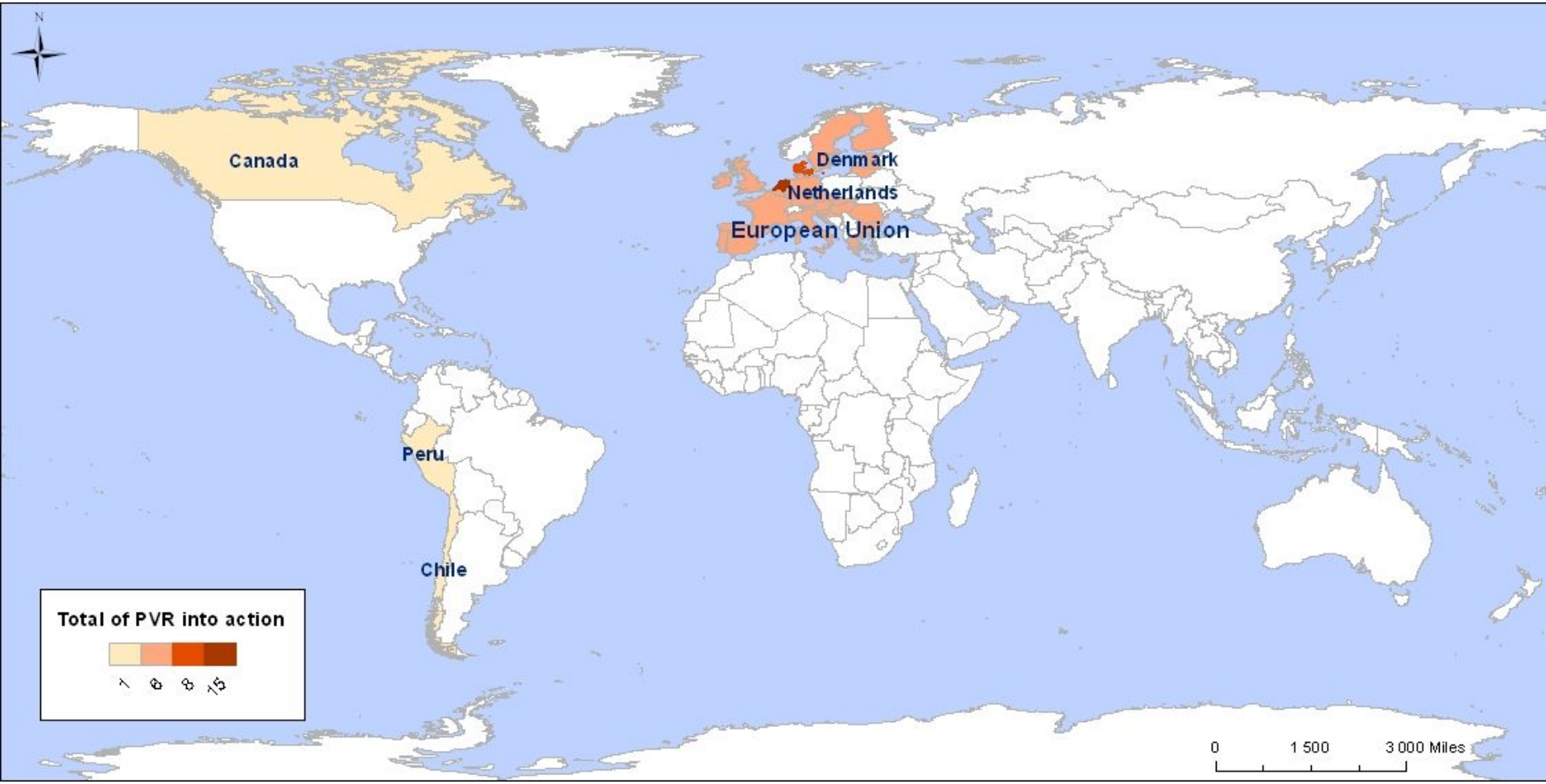
...

Expansion of the quinoa and future improvement and breeding?

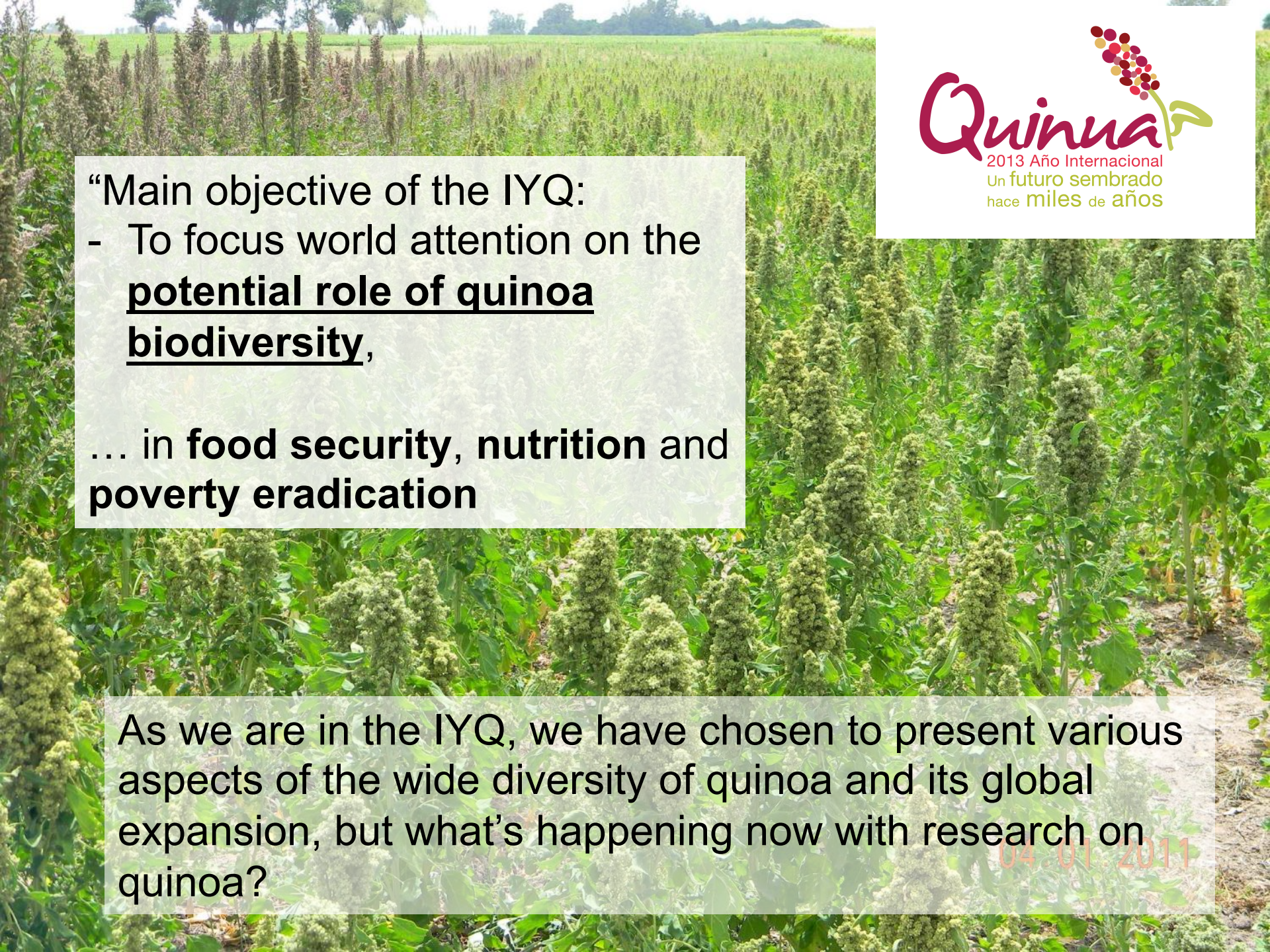
- Using molecular markers (SSR linkage map, marker-assisted selection).
- Improving feature selection based on genes of interest
- Adaptation to climate change and salinity using variability.

=> Imbalance technology access between the North and South

Number of varieties of quinoa under PVR enhancer by country (breeders)



Countries where a PVR protection for improved varieties is into action



"Main objective of the IYQ:

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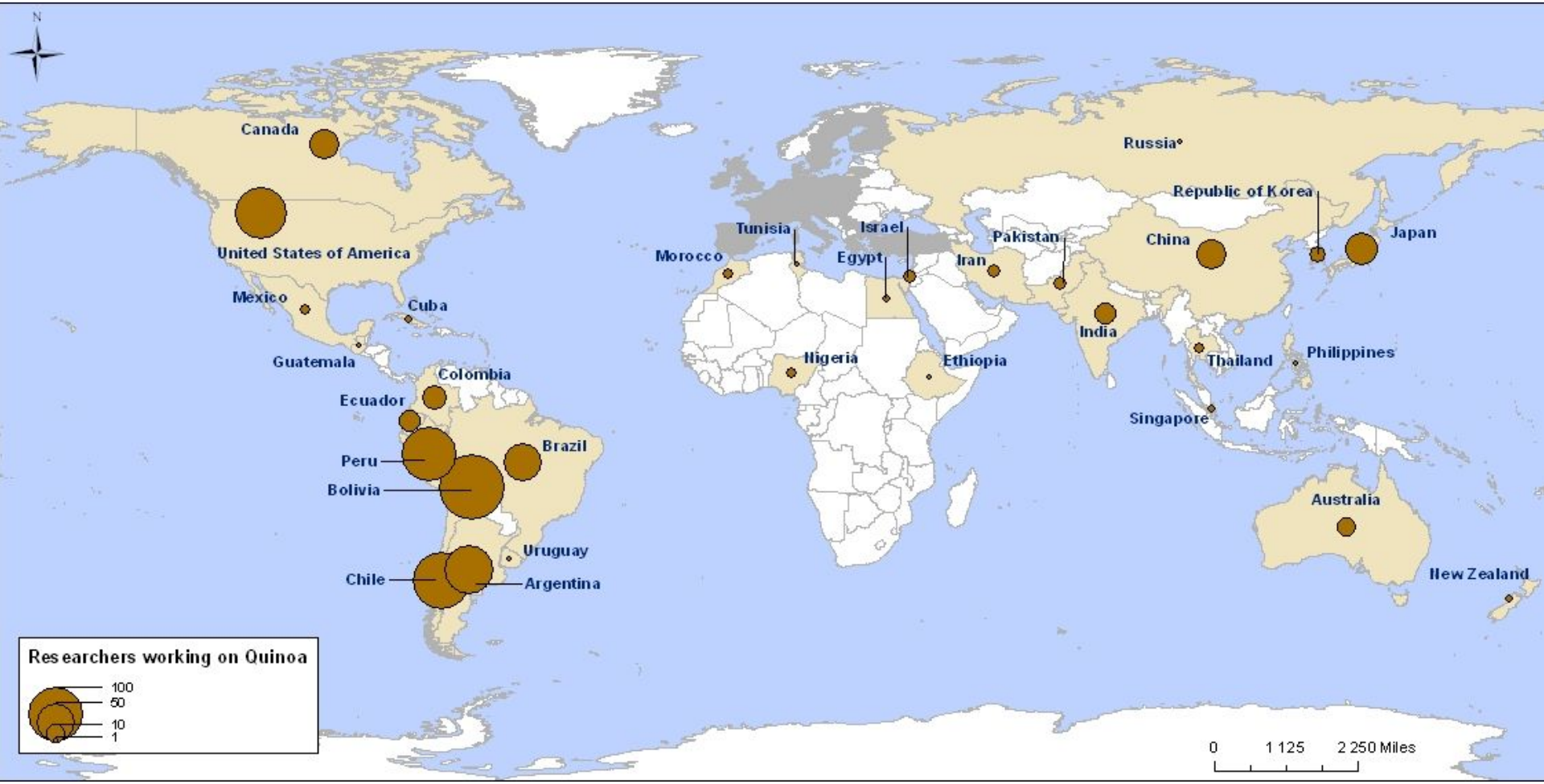
… in **food security**, **nutrition** and **poverty eradication**

As we are in the IYQ, we have chosen to present various aspects of the wide diversity of quinoa and its global expansion, but what's happening now with research on quinoa?

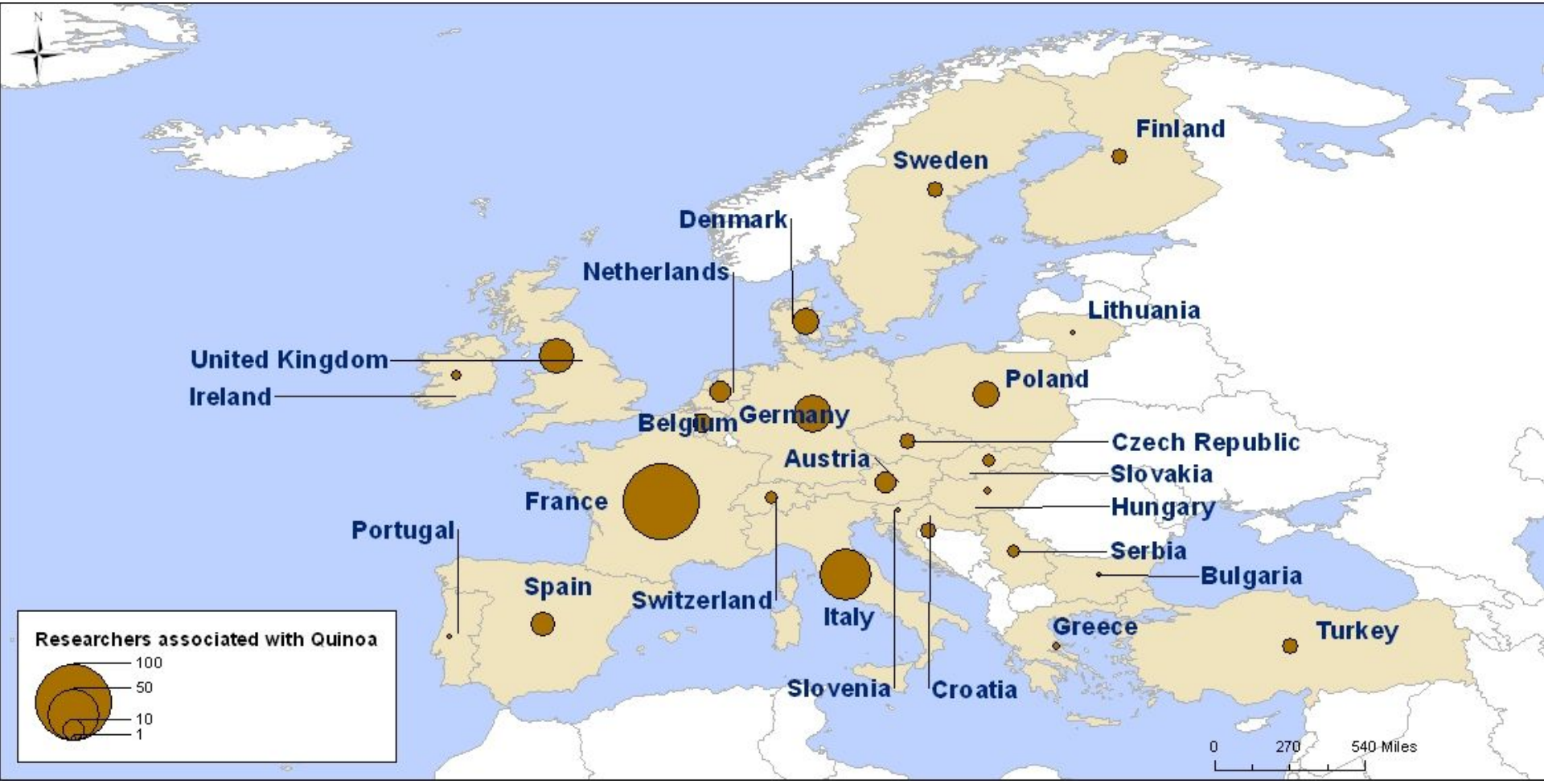
Expansion of the quinoa and actuality of research: who is working on quinoa?

- Review of 1228 references from:
  - Web of Science;
  - Scielo;
  - Personal database

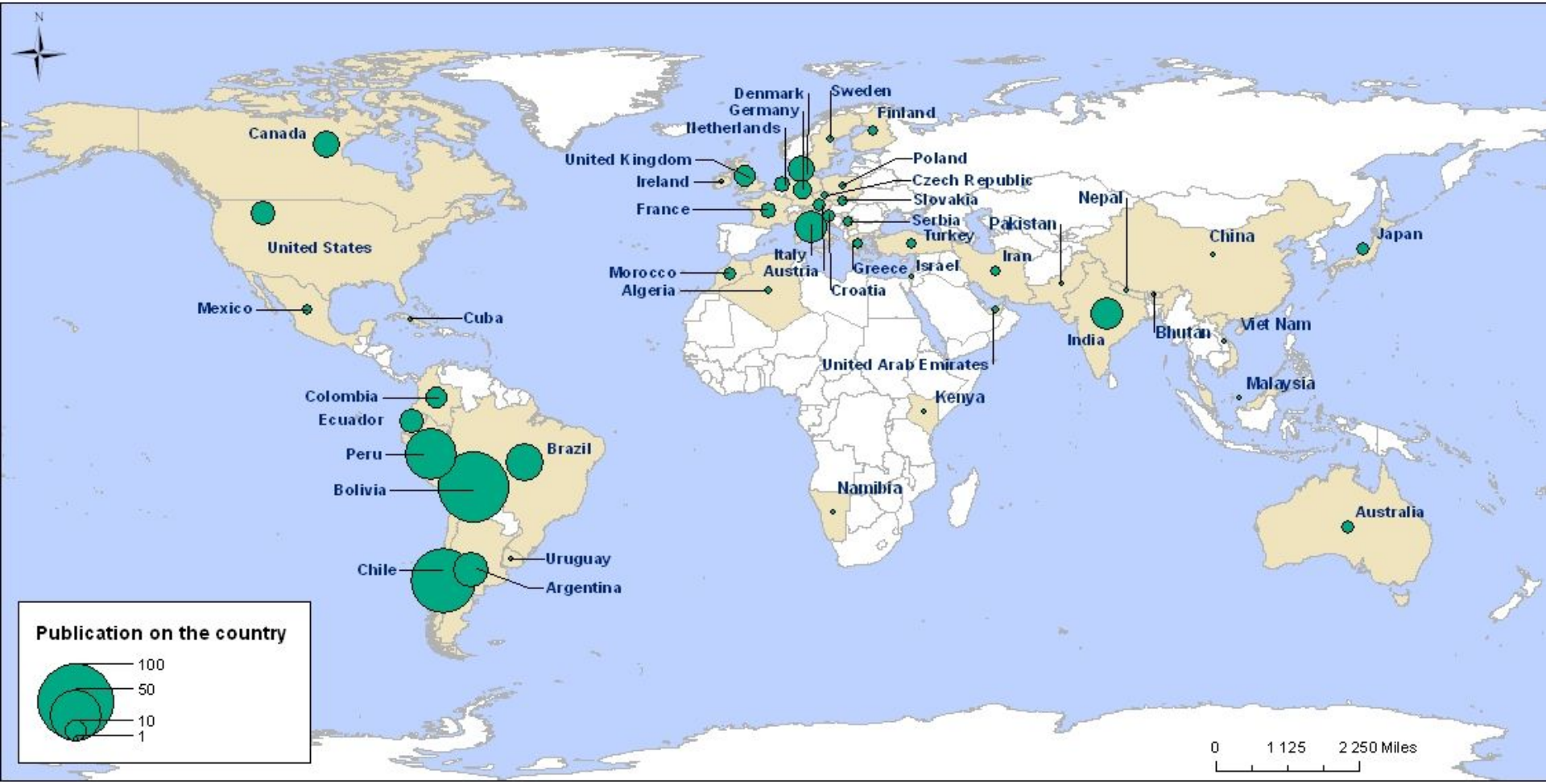
=> *1063 pertinent for treatment*



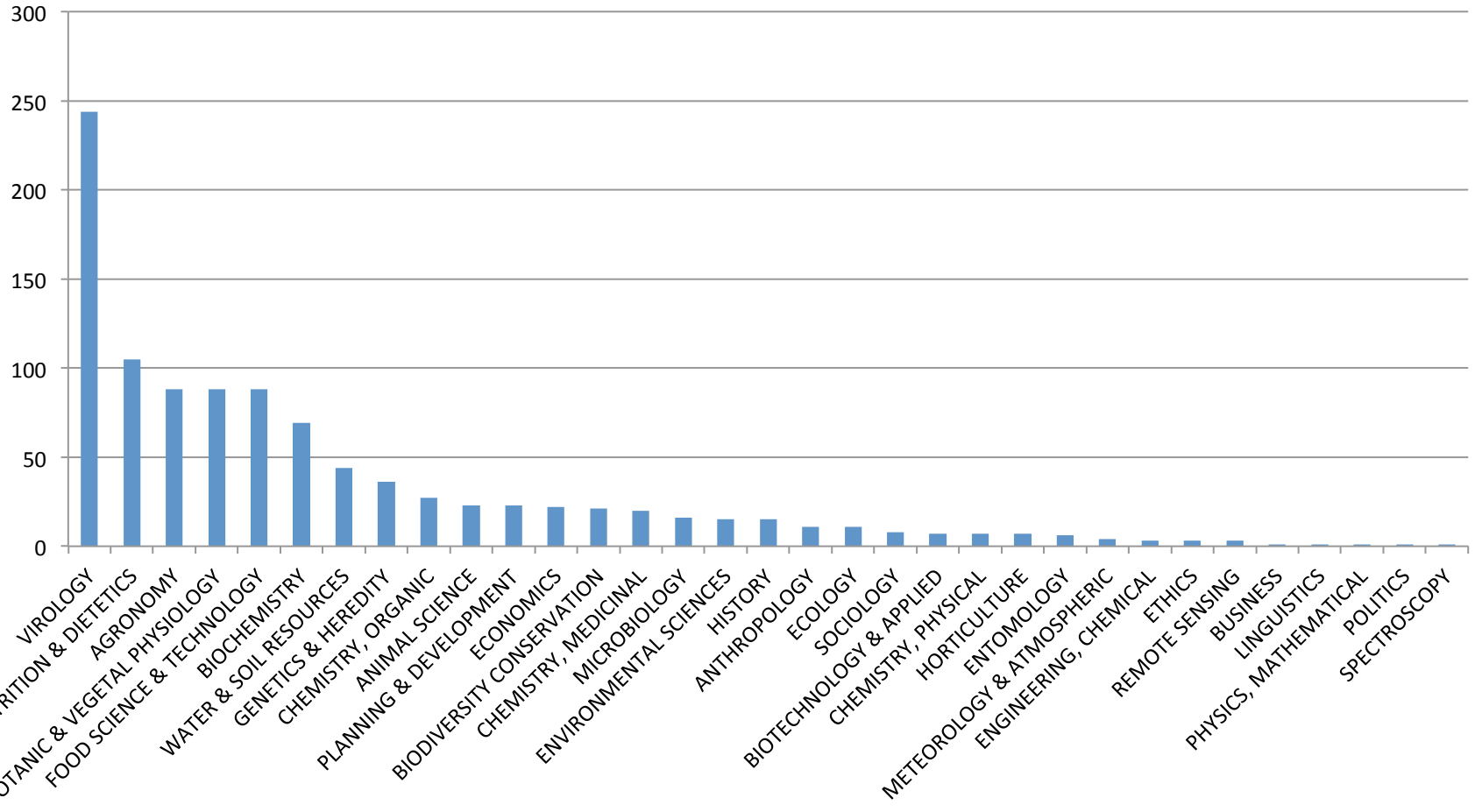
Researchers working on quinoa



Researchers working on quinoa: *zoom on Europe*



Number of publications on the country



Thematic of the publications

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We are in 2013, from Rio in 1992 several international treaties were signed that apply to the management of plant genetic resources (CBD, Nagoya, Upov, ITPGRFA, CAN, TLC, etc..).

There are many questions and also challenges for the future of quinoa and they need to be discussed in depth to associate all the actors and countries in the debate about benefits of quinoa ...


Territorio
Acción colectiva
Medio ambiente
Recursos genéticos
Salud

Thank you!