

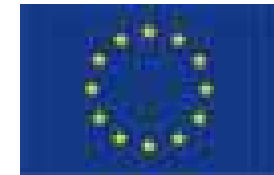
Landraces in Europe: an approach towards identifying landrace rich areas to be protected with priority

The results of the project AEGRO

(057_AGRIGENRES EC 870/2004)

Negri V, Barocco R, Pacicco L, Veronesi F, Venanzoni R

Department of Applied Biology, University of Perugia



“Towards the establishment of genetic reserve for crop wild relatives and landraces in Europe” Madeira 13 -16 Sept. 2010

Outline

1- LRs:

What is a LR?

Why landraces are important?

How many and Where are they?

2- CWRs:

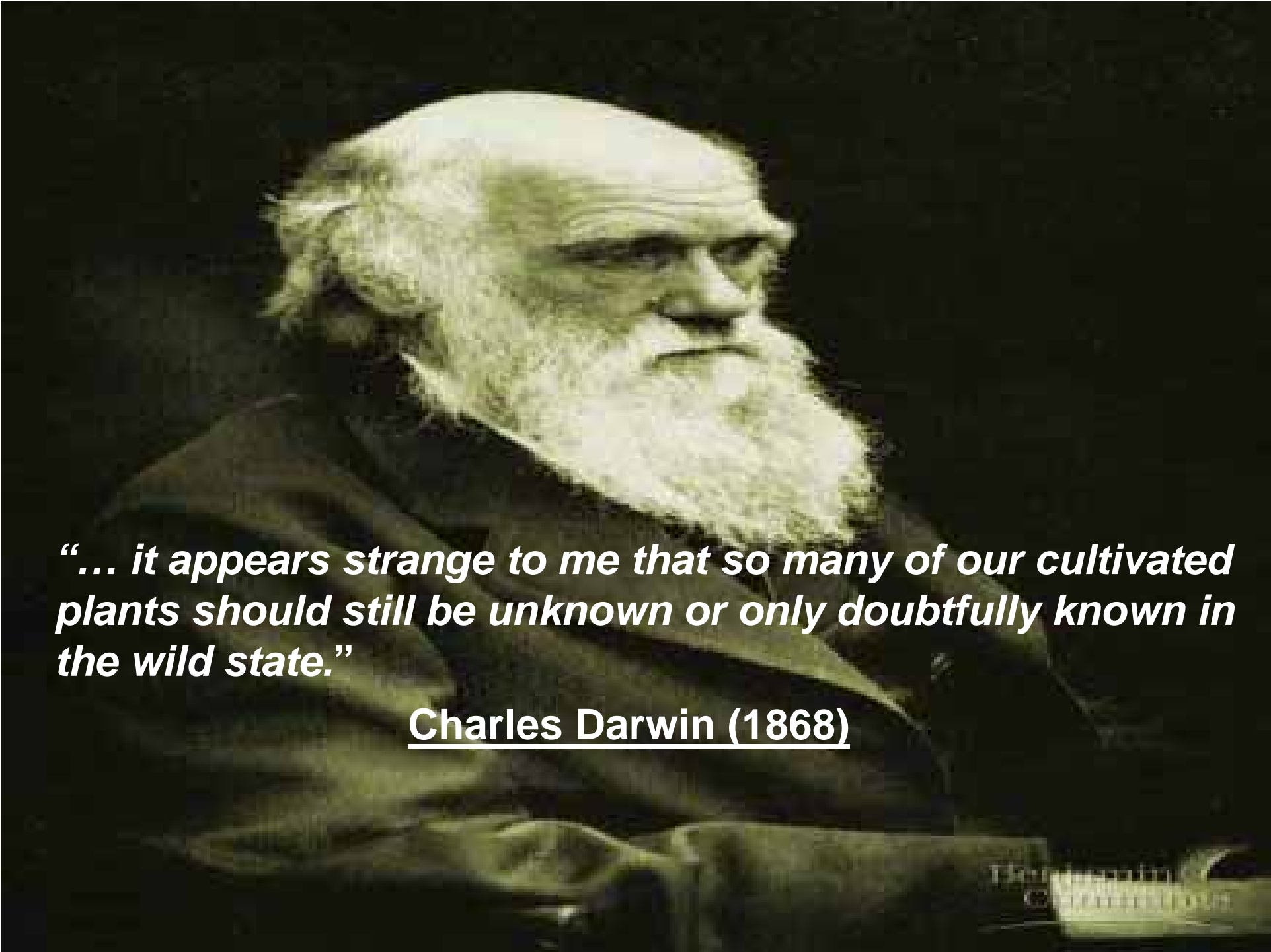
What is a CWR ?

Why CWR are important?

3- Landraces (LRs) and Crop Wild Relatives (CWRs) in Italy - A case study of a LR growing near a CWR

4- the AEGRO project achievements for planning *in situ* conservation of LRs and their CWRs



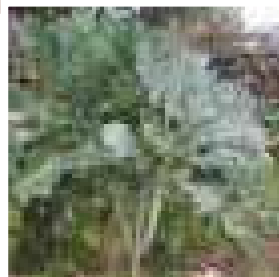
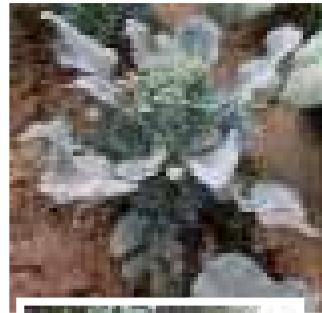
A portrait of Charles Darwin, an elderly man with a long, full white beard and hair, wearing a dark suit jacket. He is looking slightly to the right of the frame. The background is dark and indistinct.

“... it appears strange to me that so many of our cultivated plants should still be unknown or only doubtfully known in the wild state.”

Charles Darwin (1868)

What is a landrace?

*“A variable population, which is identifiable and usually has a local name. It lacks “formal” crop improvement, is characterized by a specific adaptation to the environmental conditions of the area of cultivation and is associated with the traditional uses, knowledge, habits, dialects, and celebrations of the people who developed and continue to grow it” (Negri 2007) **



It is propagation material that cannot be found in seed shops, but only in farmer’s fields or homegardens.

* Negri (2007) combining other definitions (Negri 2005; Camacho Villa et al. 2006; Asfaw2000; louette2000, Brush 1992; Papa 1996); ECPGR on fam group definition; AEGro obj 1



Why landraces are important?

They are:

- **widely used in breeding**
- **used in developing typical products**
- **useful in developing new farming systems**
(e.g. environmentally friendly)
- **and maintaining local traditions**

They may exchange genes with their CWRs, as such they represent case studies for assessing:

- **the level of gene flow**
- **the role of introgression in maintaining adaptation**



How many and Where are they?

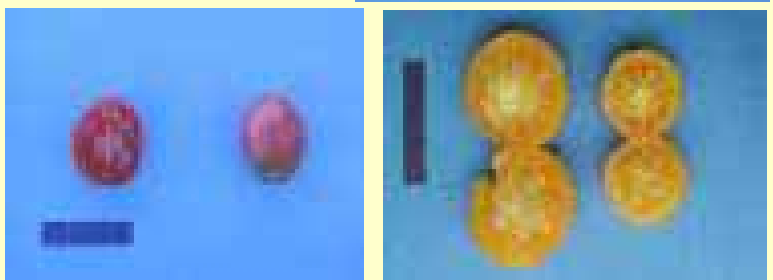
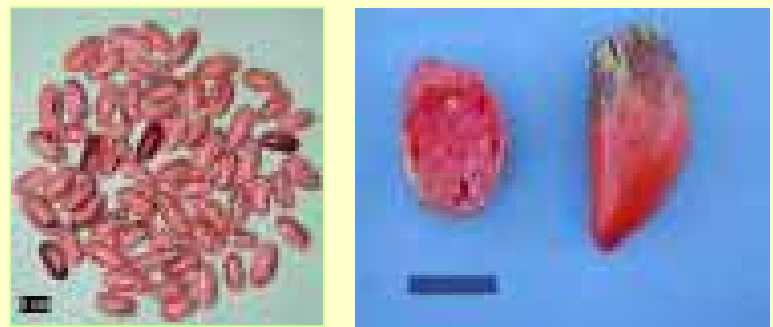
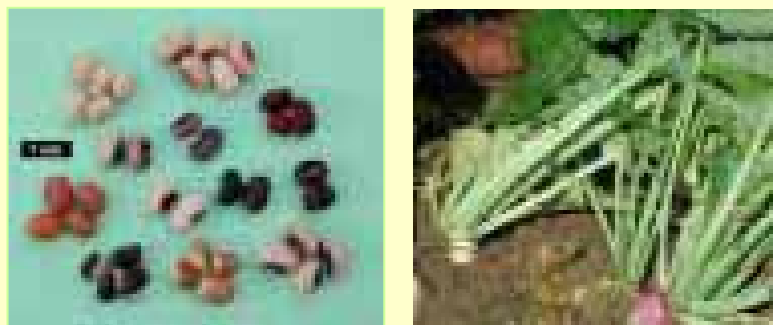
We do not know exactly! But we know that...

- **Landraces are still found and used throughout Italy**
- **They are still present also across Europe** (Vetelainen et al, 2009)

However, a complete inventory for Italy and for other European countries is still lacking!



Most common food species for which LRs are found in central Italy:



Apium graveolens

Brassica rapa

Cicer arietinum

Lactuca sativa

Lathyrus sativus

Lens culinaris

Lycopersicon esculentum

Phaseolus vulgaris

Triticum aestivum

Triticum dicoccum

Vigna unguiculata

Zea mays

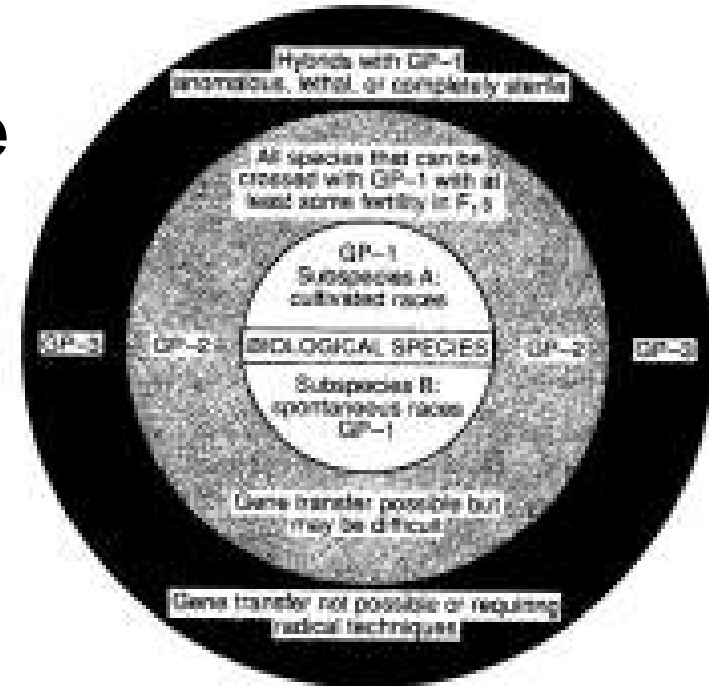
Most common forage species:

Medicago sativa

Onobrychis viciifolia



CWR = A crop wild relative is a wild plant taxon that has an use derived from its relatively close genetic relationship to a crop; this relationship is defined in terms of the CWR belonging to gene pools 1 or 2 (Maxted et al, 2006)



Following Harlan and de Wet

- Possible introgression, spontaneous or managed by man, of useful genes for adaptation to
 - changed environment conditions or
 - new biotic stress



Important components of ecosystems, also used directly by man, CWRs are

- Important socio-economic resources
- Important resources for plant breeding



Many CWRs are present in Italy

Avena sativa, *Allium* spp., *Apium graveolens*, *A. nodiflorum*, *Arnica montana*, *Asparagus officinalis*, *A. albus*, *A. acutifolius*, *Beta vulgaris*, *B. maritima*, *Brassica oleracea*, *B. fruticulosa*, *B. nigra* etc., *Capparis spinosa*, *Cynara scolimus*, *C. cardunculus*, *Crocus vernus*,



Dianthus spp., *Diploaxis* spp., *Daucus carota*, *Festuca pratensis*, *Eruca sativa*, *Lactuca sativa*, *Lolium perenne*, *Malus domestica*, *Mentha* spp., *Prunus* spp., *Pinus* spp., *Ribes rubrum*, *R. album*, *Rubus* spp., *Salvia officinalis*, *Sinapis arvensis*, *Trifolium repens*, *Viola* spp....etc



EXAMPLES of LR_s living next to their CWR_s:

**Black celery of Trevi (*Apium graveolens*)
A typical product of Umbria!**

Wild Crop Relative in the area: *Apium nodiflorum* (L.) Lag.

Trevi: a little town of Umbria

LR Area: 2 ha

Production destination: local village fair (October)



Conservation activities are urgently needed for both LRs and CWRs!

LRs are rapidly disappearing because progressively replaced by modern varieties

CWRs are rapidly disappearing because of spoiling, fragmentation and excessive use of natural habitats



The EC funded 'AEGRO' project

**An Integrated European *In Situ* Management Work Plan:
Implementing Genetic Reserves and On Farm Concepts
aims for LRs:**

Obj 1- To work out criteria to be taken into account in delimitating areas which are rich in LRs.

Obj 2- To draft a model strategy for setting conservation areas in Central Italy.

Obj 3- To test the efficiency of the developed strategy in capturing the maximum of LR diversity



OBJECTIVE 1: definition of criteria to be taken into account in delimitating areas which are rich in LRs

- **A panel of experts (botanists, geneticists, naturalists and agronomists) was set, met several times and discussed what should be**
- **the most proper aim of a conservation action**
- **the criteria to be chosen in setting conservation actions**



OBJECTIVE 1: definition of criteria to be taken into account in delimitating areas which are rich in LRs

- **the most proper aim of a conservation action resulted to be:**

the conservation and valorisation of areas with high level of agro-biodiversity', i.e. areas rich in diversity for

- **landraces,**
- **agro-ecosystem types and**
- **crop wild relatives.**

- **The criteria (in order of importance) were:**

C1. Number and diversity of LRs in an area

C2. Agro-ecosystem diversity of the area

C3. Presence of nearby protected areas

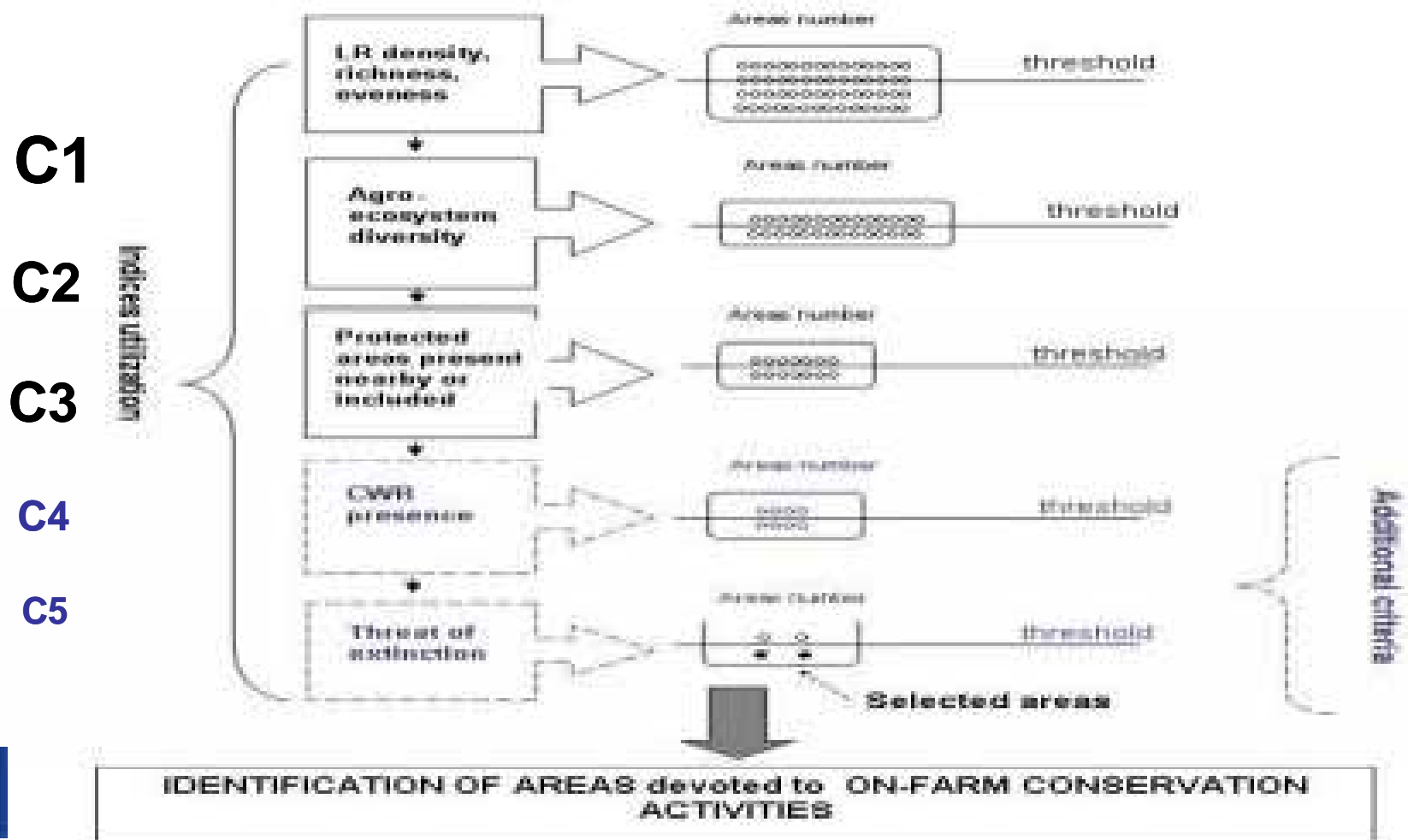
C4. Presence of CWRs in the area (additional criterium)

C5. Threat of extinction of LRs (additional criterium)



OBJECTIVE 2: development of strategies for establishing on farm conservation area

Starting with a certain number of potentially suitable areas, reduce their number by applying criteria (C) in sequence



For each level a threshold has to be defined below which areas are not admitted to the following level (area discrimination).



These selected areas could be defined as the
'Most Appropriate Areas (MAA)'

To be *proposed* to the National or Regional authorities as areas where to set or enhance political and economic actions in favour of LR and agrobiodiversity conservation



In order to apply this strategy (Obj.3) LR preliminary information is needed:

- LR inventory,
- LR occurrence in standard areas and
- LR mapping

This information was worked out for the 'Central Italy' case study:

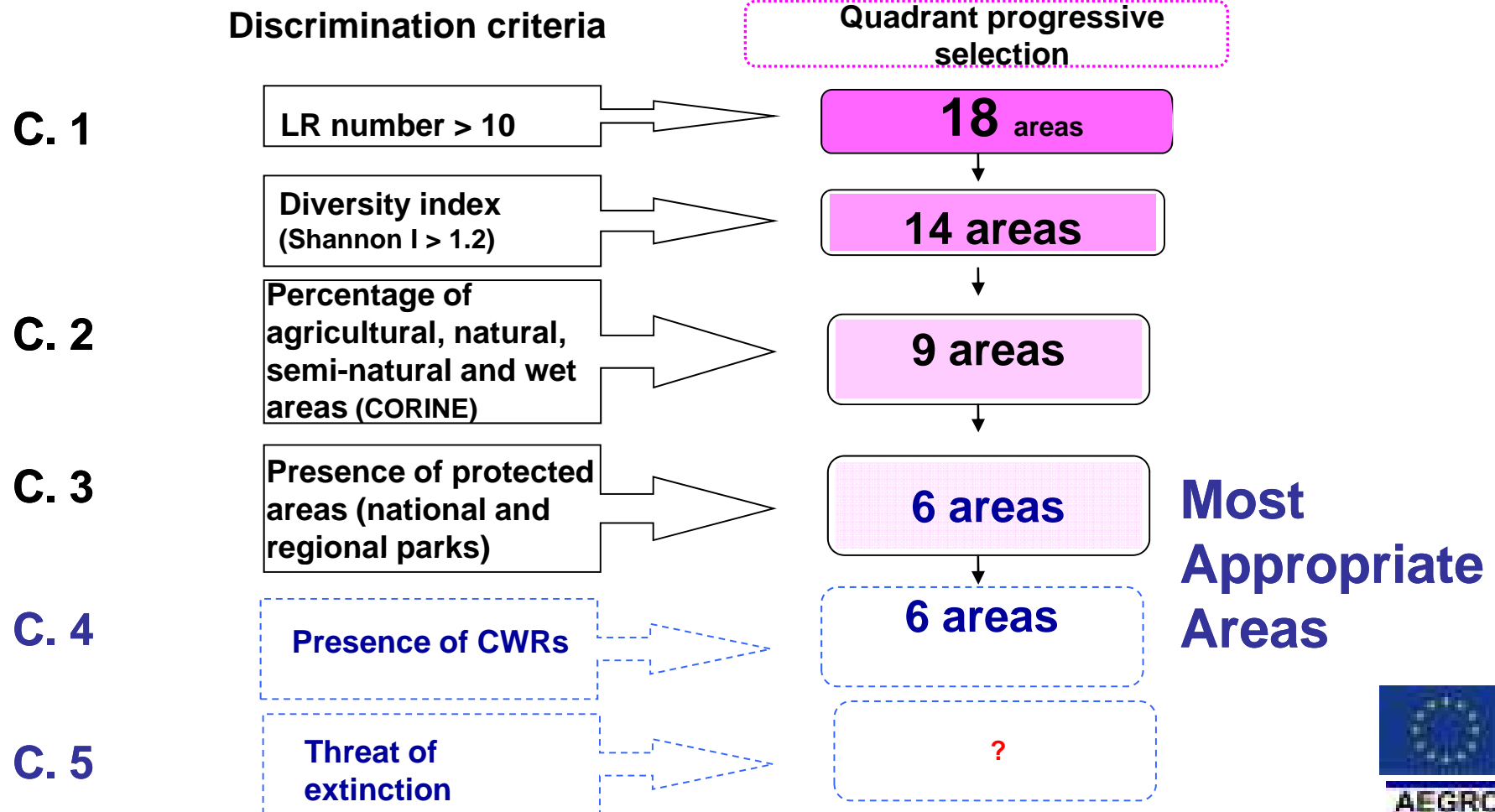
- An inventory of LRs was created (over 1300 LRs)
- LRs were mapped in standard areas



OBJECTIVE 3: application of developed strategies for the case study Central Italy, i.e. Testing the strategy

initial results

LRs are present in Central Italy in **105 square areas**



FINDING OUT THE MOST AGRO_BIODIVERSE AREAS (MAAs) TO BE PROTECTED *IN CENTRAL ITALY*

CRITERIUM n.1 : n. LR Number & Diversity index (Shannon)

LR Number
in 20x20 km AREAS **105**

THRESHOLD: > 10 LR's' **18**

Shannon Weaver index

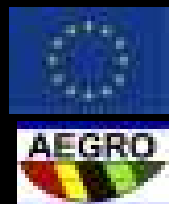
THRESHOLD:
Shannon index > 1.2 **14**



CRITERIUM n.2: AGROECOSYSTEM DIVERSITY

Corine Land Cover
classes 2+3+4 > 60%

THRESHOLD: > 60% **9**



CRITERIUM n. 3: presence nearby or within squares of protected areas

■ **Regional and National parks**

THRESHOLD:
presence/absence

6

■ **CRITERIUM n. 4: presence of CWRs**
CWR belonging to Genus *Avena*, *Beta*, *Brassica* and *Prunus* are present in all these quadrant

THRESHOLD:
presence/absence

6



All the 6 areas are of great agro-biodiversity value and can be recommended as areas where to promote conservation activities (Most Appropriate Areas)

This basic strategy was then further developed and tested, but substantially yielded the same results (see Barocco et al poster)



Avena, Beta, Brassica, Prunus CWRs inventoried and mapped in Umbria (central Italy)

AVENA

Avena barbata
Avena barbata atherantha
Avena barbata barbata
Avena barbata castellana
Avena barbata lusitanica
Avena byzantina
Avena brevis
Avena clauda
Avena fatua
Avena fatua fatua
Avena sativa
Avena sativa macrantha
Avena sterilis
Avena sterilis atherantha
Avena sterilis ludoviciana
Avena sterilis sterilis
Avena strigosa
Avena strigosa agraria
Avena strigosa strigosa
Avena wiestii

BETA

Beta macrocarpa
Beta trigyna
Beta vulgaris
Beta vulgaris maritima
Beta vulgaris vulgaris

**Beta trigyna,
Orvieto**

BRASSICA

Brassica elongata
Brassica elongata elongata
Brassica fruticulosa
Brassica fruticulosa fruticulosa
Brassica gravinae
Brassica incana
Brassica insularis
Brassica montana
Brassica napus
Brassica nigra
Brassica oleracea
Brassica procumbens
Brassica rapa
Brassica rapa campestris
Brassica repanda
Brassica repanda glabrescens
Brassica repanda repanda
Brassica tournefortii

PRUNUS

Prunus armeniaca
Prunus avium
Prunus brigantina
Prunus cerasifera
Prunus cerasifera cerasifera
~~*Prunus cerasus*~~
~~*Prunus coccomilia*~~
Prunus domestica
Prunus domestica domestica
Prunus domestica insititia
Prunus dulcis
~~*Prunus fruticosa*~~
Prunus laurocerasus
Prunus mahaleb
Prunus padus
Prunus padus padus
Prunus persica
Prunus spinosa
Prunus webbii

CONCLUSIONS

. Inventory and mapping of Landraces and CWRs in Central Italy

. Project goals reached:

- Criteria and methods defined
- Model strategy designed
- Model strategy tested
- High value conservation areas for LRs and CWRs in Central Italy identified

. This strategy may be useful to set *in situ-on farm* conservation areas for LRs and CWRs also in other European countries

(Because we used information systems and tools available all over)

Thank you for attention!





Thanks are due to:

- Prof. . Russi
- Dr. Renzo Torricelli
- Dr. Domizia Donnini
- Dr. Valeria Siciliano
- Dr. Alfredo Battistini
- Mr. Maurizio Cenci
- Ms. Laura Stigter
(visiting student)

Photo: S. Michahelles



Photo: S. Michahelles



Courtesy: Dr. L. Maggioni

UNIPG Personnel and students involved in WP3

- **Prof. Valeria Negri (permanent staff involved in AEGRO)**
 - **Prof. Fabio Veronesi (permanent staff involved in AEGRO)**
 - **Prof. Roberto Venanzoni (volunteer contributor)**
 - **Prof. Luigi Russi (permanent staff involved in AEGRO)**
 - **Dr. Domizia Donnini (researcher, volunteer contributor)**
 - **Dr. Renzo Torricelli (technician, volunteer contributor)**
 - **Dr. Valeria Siciliano (AEGRO hired staff)**
 - **Dr. Alfredo Battistini (volunteer contributor)**
 - **Dr. Luca Pacicco (AEGRO hired staff)**
 - **Mr. Raffaele Barocco (Ph.D. student, AEGRO hired staff)**
 - **Mr. Maurizio Cenci (MS student) and**
-
- **Ms. Laura Stigter (Columbia University, New York, visiting student)**

Avena, Beta, Brassica, Prunus CWRs mapped in Umbria (central Italy)

AVENA

Avena barbata
Avena barbata atherantha
Avena barbata barbata
Avena barbata castellana
Avena barbata lusitanica
Avena byzantina
Avena brevis
Avena clauda
Avena fatua
Avena fatua fatua
Avena sativa
Avena sativa macrantha
Avena sterilis
Avena sterilis atherantha
Avena sterilis ludoviciana
Avena sterilis sterilis
Avena strigosa
Avena strigosa agraria
Avena strigosa strigosa
Avena wiestii

BETA

Beta macrocarpa
Beta trigyna
Beta vulgaris
Beta vulgaris maritima
Beta vulgaris vulgaris

**Beta
 trigyna,
 Orvieto**

BRASSICA

Brassica elongata
Brassica elongata elongata
Brassica fruticulosa
Brassica fruticulosa fruticulosa
Brassica gravinae
Brassica incana
Brassica insularis
Brassica montana
Brassica napus
Brassica nigra
Brassica oleracea
Brassica procumbens
Brassica rapa
Brassica rapa campestris
Brassica repanda
Brassica repanda glabrescens
Brassica repanda repanda
Brassica tournefortii

PRUNUS

Prunus armeniaca
Prunus avium
Prunus brigantina
Prunus cerasifera
Prunus cerasifera cerasifera
Prunus cerasus
Prunus cocomilia
Prunus domestica
Prunus domestica domestica
Prunus domestica insititia
Prunus dulcis
Prunus fruticosa
Prunus laurocerasus
Prunus mahaleb
Prunus padus
Prunus padus padus
Prunus persica
Prunus spinosa
Prunus webbii