



European crop wild relative diversity
assessment and conservation forum



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Crop wild relative

Issue 1 October 2003



Conserving Europe's plant genetic resources

for use now and in the future



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NGB Jubileum Poster 1999.
Flowering chives (*Allium
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Courtesy of the Nordic Gene
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Welcome to Issue 1 of *Crop wild relative*. This inaugural newsletter is brought to you by the European Community funded project, European crop wild relative diversity assessment and conservation forum (PGR Forum).

Crop wild relative provides a medium to publicise information about the conservation and use of wild relatives of crop plants, including updates on the activities of PGR Forum. We anticipate that anyone with an interest in crop wild relatives, whether conservationist, breeder, taxonomist, policy-maker or educator will benefit from this publication, both by spreading news about their activities and by learning about other initiatives.

This introductory issue provides information about the aims and objectives of PGR Forum, explaining the rationale for the initiation of the project. It serves to highlight the importance of crop wild relatives as vital ecosystem components, as a source of nutrition from the wild, for their medicinal and cultural values, as well as a critical resource for the improvement of crops.

While the focus of PGR Forum is on the conservation of crop wild relatives in Europe, it is expected that the content of *Crop wild relative* will not be limited to the region. Common experiences can be shared and similar lessons learned, whether the focus of the research or news item is a taxon of socio-economic importance in Europe or elsewhere in the world. The scene is set with a feature article on the use of GIS analysis for planning *in situ* conservation of wild relatives of *Lupinus* in Spain, which highlights the need for specific attention to be paid to the inclusion and management of crop wild relative populations within existing protected areas.

We foresee that this publication will continue to be produced beyond the end date of PGR Forum (December 2005); therefore, we expect that this is the first of many more issues of *Crop wild relative* to come. Whatever profession or interest group you belong to, we would like to hear from you with your ideas for the content of future issues. You will find a call for contributions on page 12.

We look forward to your feedback and to your contributions.

Editorial



Gert Poulsen

Above: NGB Jubileum Poster 1999. Root Crops, Oil Plants & Pulses. From a large collection of flax the Nordic material is being characterised and evaluated for fatty acid composition

Introducing PGR Forum

PGR Forum (European crop wild relative diversity assessment and conservation forum) is a Thematic Network funded under the EC Framework 5 Programme for Research, Key action 2 'Global change, climate and biodiversity', 2.2.3 'Assessing and conserving biodiversity'. PGR Forum provides a platform for the assessment of taxonomic and genetic diversity of European crop wild relatives and the development of appropriate conservation methodologies.

The project brings together 23 partners from 21 countries: Belgium, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, the Netherlands, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Romania, Russia, and the United Kingdom, with the addition of partners representing IUCN -The World Conservation Union and the International Plant Genetic Resources Institute (IPGRI). Advisory and Stakeholder Panels provide additional input and feedback on project activities and deliverables. A broad cross-section of the professional European PGR community is represented, and the project therefore provides a unique opportunity to enhance dialogue between national and regional crop wild

relative conservationists, policy makers and end-users, and to promote discourse with the broader international stakeholder communities.

PGR Forum aims to build an information system providing access to European crop wild relative data. The database will include all socio-economically important species native to Europe and their wild relatives; including food, fodder and forage, medicinal plants, condiments, ornamentals, forestry species, as well as plants used for industrial purposes, such as oils and fibres. One of the primary outputs of PGR Forum will be a conservation gap analysis and recommendations for *in situ* and *ex situ* conservation of European crop wild relatives. The development of methodologies, particu-

“PGR Forum provides a European forum for the assessment of taxonomic and genetic diversity of European crop wild relatives and the development of appropriate conservation methodologies”

larly for *in situ* conservation is also a major component of the project.

PGR Forum's work programme is implemented through a series of five inter-related work packages and associated workshops: 1) European crop wild relative assessment, 2) threat and conservation assessment, 3) *in situ* data management methodologies, 4) population management methodologies, and 5) genetic erosion and genetic pollution methodologies. An additional work package coordinates thematic network product dissemination and exploitation, and the final dissemination conference.

The project duration is 36 months, with a start date of November 1 2002, and is coordinated by the University of Birmingham, UK.

Project themes

In situ data management

A critical aspect of *in situ* conservation is data management, and the ability to exchange data in a standardised format. Standards for exchange of *ex situ* data already exist, but there is a need to develop standards for the collation, analysis and exchange of *in situ* data, both for genetic reserve and on farm conservation. PGR Forum's objectives in this context are to:

- define appropriate *in situ* genetic conservation data types;
- design appropriate database structures and data visualisation tools;
- design *in situ* genetic conservation data management and analysis techniques;
- publish an *in situ* data management methodology.

Population management

PGR Forum will propose population management and monitoring methodologies appropriate for the *in situ* genetic conservation of crop wild relatives. Specifically, the forum is assessing:

- the minimum baseline information and standards required for generation of protected area management plans for population management of crop wild relatives;
- how existing management plans



Above: Participants at the PGR Forum Workshop on *In Situ* Data Management Methodologies, held in Prague, Czech Republic, September 2003

can be adapted for the genetic conservation of crop wild relative populations;

- the most appropriate means of monitoring crop wild relative populations.

Genetic erosion and pollution assessment

Genetic erosion and pollution are major threats to the diversity of European crop wild relatives. PGR Forum is tackling the critical issue of how plant genetic erosion and pollution can be predicted and assessed. The forum will build upon and refine existing methodologies for the prediction of genetic erosion; however, there are currently no established methodologies for assessing plant genetic pollution. The threat of genetic pollution or introgression, either from genetically modified organisms (GMOs) or from conventionally bred

crops, to wild species has become an increasing risk to the *in situ* genetic conservation of crop wild relatives. PGR Forum's objectives in this context are to:

- provide a forum to debate genetic erosion and pollution assessment and prediction for crop wild relatives;
- establish methodologies for the assessment and prediction of genetic erosion and pollution.

Threat and conservation assessment

PGR Forum will carry out threat assessments for the taxa listed in the European crop wild relative database using the IUCN Red List Categories and Criteria. Although some countries have published "Red Lists" of threatened species, the current lists do not adequately address European crop wild relatives and a more systematic ap-

proach is required. Existing *in situ* and *ex situ* conservation actions for the taxa will also be reviewed. This information will be used to help prioritise future conservation action for European crop wild relatives. Specifically, PGR Forum's objectives in this context are to:

- assess threat for all or a selected subset of European crop wild relatives;
- review the *in situ* and *ex situ* conservation status of the taxa;
- conduct a gap analysis of conservation needs;
- produce a list of priority species for conservation action.

For more information about PGR Forum, visit <http://www.pgrforum.org/> or contact the Project Officer, s.p.kell@bham.ac.uk

Why are crop wild relatives important?

Crop wild relatives may be defined as taxa related to species of direct socio-economic importance. Crop wild relatives are essential components of natural and semi-natural habitats, as well as agricultural systems, and are critical for maintaining ecosystem health. Their conservation and sustainable use is vital for improving agricultural production and increasing food security, as well as maintaining the environment.

“Europe is an important centre for crop wild relative diversity”

N.I. Vavilov realised the importance of crop wild relatives in the early years of the 20th century, particularly in their ability to exchange genes with the crops themselves. Crop wild relative germplasm (genetic material) has been utilised by humankind for thousands of years to improve the quality and yield of crops. Natural crosses between crops and their wild relatives have occurred since the beginnings of agriculture. Farmers have used traditional breeding methods for millennia, and

more recently, plant breeders have utilised crop wild relative genes to improve a wide range of crops, including wheat (*Triticum cereale*), maize (*Zea mays*), rice (*Oryza sativa*), barley (*Hordeum vulgare*), potato (*Solanum tuberosum*), cassava (*Manihot esculenta*), and grain legumes such as *Phaseolus*, *Vicia*, *Vigna*, *Lens*, *Lathyrus*, and *Cicer*. Improvements include resistance to pests and diseases, and abiotic stresses, such as drought and salinity. Other uses include increased protein and vitamin content, and the improvement of medicinal plants and pharmaceuticals. In many countries, crop wild relatives are also harvested directly from the wild and are an important source of nutrition.

Europe is an important centre for crop wild relative diversity. Major crops such as oats (*Avena sativa*), sugar beet (*Beta vulgaris*), apple (*Malus domestica*), annual meadow grass (*Festuca pratensis*), and white clover (*Trifolium*

repens), have wild relatives in Europe. Many minor crops have also been developed and domesticated in the region; such as arnica (*Arnica montana*), asparagus (*Asparagus officinalis*), lettuce (*Lactuca sativa*), and sage (*Salvia officinalis*).

Although it is acknowledged that populations of crop wild relatives throughout Europe are under threat from habitat alteration and loss, their conservation across the region has received relatively little systematic attention. There are a number of initiatives to inventory European crop wild relative species at the individual country level, but there has not been a coordinated effort focusing on the production of a comprehensive European catalogue. And while some European crop wild relative material is conserved *ex situ*, their conservation *in situ* has not been the subject of significant debate.

“Although it is acknowledged that populations of crop wild relatives throughout Europe are under threat from habitat alteration and loss, their conservation across the region has received relatively little systematic attention”

PGR Forum activities: in brief

The activities of PGR Forum are centred around a series of five interrelated workshops. PGR Forum is a Thematic Network, which means that funding has been granted to hold meetings and workshops, during which presentations are given and concentrated discussion sessions take place. PGR Forum is tackling some new and unexplored areas, with the final goal being the development of methodologies for the conservation and sustainable use of wild relatives of crop plants. The diversity of professional expertise amongst the participants makes for some dynamic and productive brainstorming sessions, leading to a set of clear-cut resolutions at the end of each workshop, which are then reviewed and developed at subsequent meetings. In order to maintain a continuous dialogue between workshops, participants have an opportunity to discuss issues and make collaborative decisions via the project e-mailing list and web site bulletin board.

PGR Forum has held two workshops to date. Workshop 1, European crop wild relative assessment, the project's inaugural meeting, was held in Véria, Greece in February 2003, in the foothills of the Olympus mountains. Hosted by the Greek Gene Bank based in Thessaloníki, the objectives of this workshop included:

- Agreement on a methodology for compiling a list of European crop wild relative taxa;

“PGR Forum is tackling some new and unexplored areas, with the final goal being the development of methodologies for the conservation and sustainable use of wild relatives of crop plants”

- Preliminary discussions regarding the minimum dataset required per taxon for their effective conservation;
- Initial investigation into data standards, sources of data, access and acquisition;
- Review of available data management tools;
- Exploration of existing European PGR projects, lessons learned, and opportunities for collaboration.

One of the major outcomes of this workshop was the decision to produce a preliminary list of European crop wild relative taxa through a process of data harmonisation between Mansfeld's World Database of Agricultural and Horticultural Crops (<http://mansfeld.ipk-gatersleben.de/>) and Euro+Med PlantBase (<http://www.euromed.org.uk/>). This process has been assisted by two members of the project's Advisory Board, Dr. Helmut Knüpfner (The Institute of Plant Genetics and Crop Plant Research, Gatersleben, Germany) and Dr. Stephen Jury (University of Reading, UK). The initial “rough” list of taxa contains 23,072 records, which consists of 838 genera, 15,031 species, and 8,421 infra-specific taxa. Forestry and ornamental species have yet to be incorporated from other sources, which will clearly increase this number of taxa significantly. Further steps are also underway to refine this list through a process of harmonisation with Euro+Med PlantBase, which is continuously updated by a network of taxonomic experts, and by circulating the list to national focal points for review.

Building on the results of Workshop 1, the project's second workshop, *In Situ* Data Management Methodologies, concentrated on the development of a conceptual model of a crop wild relative information system that will serve all user communities. The list of taxa, with associated nomenclatural and utilisation data, lies at the core of this system, with links to any number of ancillary data sources managed by other organisations. These data sources may for instance include information on distribution, habitats, threat status, detailed

population data, breeding research, molecular data, and *ex situ* holdings. One such data source is EURISCO (European Internet Search Catalogue of *ex situ* PGR Accessions, <http://eurisco.ecpgr.org/>), established by the EC-funded project EPGRIS (European Plant Genetic Resources Information Infrastructure, <http://www.ecpgr.cgiar.org/epgris/>). In order to facilitate the exchange of data, PGR Forum will develop an XML schema (exchange mark-up language) for the core taxon database, and investigate other XML data sources that can be linked to.

The structure and precise components of the CWR information system rests on an analysis of user requirements. A survey of stakeholder needs is therefore being undertaken via the PGR Forum participants, while internal working groups will continue to investigate potential data sources and data standards.

A further component of the project is the formulation of taxon case studies, which will be presented via the project web site. These case studies will serve to illustrate the potential of the CWR information system. In addition, a methodology for assigning conservation priority to each taxon in the core database is to be proposed.

Planning is underway for the next two workshops, Population Management Methodologies and Genetic Erosion and Pollution Assessment Methodologies, which will take place during 2004.

For further information about PGR Forum activities, visit <http://www.pgrforum.org/> or contact the Project Officer, s.p.kell@bham.ac.uk.

PGR Forum participants

PGR Forum involves national and regional partner institutes from 21 countries across Europe, with the addition of partners representing IPGRI (International Plant Genetic Resources Institute) and IUCN -The World Conservation Union. Advisory and Stakeholder Panels representing a number of further national, European and international organisations provide additional input and feedback on project activities and deliverables. PGR Forum collaborates closely with other European projects, including EPGRIS (European Plant Genetic Resources Information Infrastructure) (<http://www.ecpgr.cgiar.org/epgris/>) and Euro+Med PlantBase (<http://www.euromed.org.uk/>).



Above: Participants at the PGR Forum Workshop, *In Situ* Data Management Methodologies, Prague, Czech Republic. Andy Jarvis, representing IPGRI, presents a paper on tools for spatial analysis of PGR distribution

Collaborating institutes

- Bureau des Ressources Génétiques, France
- Centre for Genetic Resources, The Netherlands
- Danish Institute of Agricultural Sciences
- European Association for Research on Plant Breeding, Germany
- European Commission
- European Topic Centre on Nature Protection and Biodiversity, France
- Gembloux Agricultural University, Belgium
- Genebank of Suceava, Romania
- German Centre for Documentation and Information in Agriculture
- Greek Gene Bank
- Institute for Agrobotany, Hungary
- Institute of Botany, Lithuania
- Instituto Nacional de Investigação Agrária e das Pescas, Portugal
- Instituto Sperimentale per la Frutticoltura, Italy
- International Plant Genetic Resources Institute
- IUCN-The World Conservation Union
- National Centre for Plant Genetic Resources, Poland
- N.I.Vavilov Research Institute of Plant Industry, Russia
- Nordic Gene Bank, Sweden
- Norwegian Crop Research Institute
- Planta Europa, United Kingdom
- Research Institute for Crop Production, Czech Republic
- Research Institute of Plant Production, Slovak Republic
- The Institute of Plant Genetics and Crop Plant Research, Germany
- Universidad Politécnica de Madrid, Spain
- University of Birmingham, United Kingdom
- University of Helsinki, Finland
- University of Latvia
- University of Reading, United Kingdom



The PGR Forum logo

The project logo represents the wild ancestor of the olive, *Olea Europaea* subsp. *oleaster*. Olives have been cultivated in Europe and the Mediterranean for centuries and are extremely important for the regional economy. The wild olive grows in maquis and woodland throughout the Mediterranean region, and is distinguished from the cultivated form by its shrubby habit, spiny stems, smaller leaves and small bitter fruits. In many countries, wild olives are sparse or even rare. The plant is therefore a potent symbol both as a highly important genetic resource and as a species of conservation concern.

The logo was designed and produced by Margaret Chamberlain and Ian Dicks, graphic designers and illustrators.

Assessing *in situ* conservation of *Lupinus* spp. in Spain through GIS

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The genus *Lupinus* (Fabaceae) is comprised of approximately 200 to 500 species (Abdel-Kader and Randall, 1999), distributed all around the world. Only four species have been domesticated, three of which are native to the Mediterranean region. In Spain six native species occur: *Lupinus albus*, *Lupinus luteus*, *Lupinus angustifolius*, *Lupinus hispanicus*, *Lupinus consentinii* and *Lupinus micranthus* (Castroviejo and Pascual, 1999). The first three species can be found both as crops and in the wild, while the others are crop wild relatives.

The conservation of these crop wild relatives should preferably be carried out *in situ*, as this approach allows for their evolution within their ecological framework. In this context, it is important to know which populations occur in protected areas and whether they are subjected to some kind of active protection. In Spain, the Sites of Community Importance (SCI) from Natura 2000 Network (92/43/EEC Directive) group all kinds of protected areas, including those without administrative management. At present, protected areas do not take into account crop wild relative populations, unless they belong to an endangered species. As *Lupinus* species are not included in the Spanish Red Lists (VV.AA., 2000), they are not being considered in current conservation policies.

In this paper, we show how geographic information systems (GIS) can help to

“At present, protected areas do not take into account crop wild relative populations, unless they belong to an endangered species”

assess the possibilities of conserving crop wild relatives in protected areas. We used six *Lupinus* species as a model in the GIS assessment of crop wild relatives in Spain to answer the following questions: How many SCIs contain *Lupinus* species? How many *Lupinus* species are conserved in these SCIs? Which *Lupinus* populations are close to SCIs? Which SCIs should be studied more thoroughly to improve *Lupinus* conservation?

METHODOLOGY

Gathering information

Data on the geographic location of *Lupinus* populations in Spain was compiled from various sources. Initially, we used passport information from CRF-INIA (Centro de Recursos Fitogenéticos-Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria, Spain) and ausPGRIS (Australian Plant Genetic Resources Information System) seedbank accessions. In addition, *Lupinus* georeferenced data from herbarium specimens of the Real Jardín Botánico de Madrid (Spain) and from the ANTHOS project database (Spain) were collected. Thus, we compiled a total of 2501 records.

Layers and data management

Using the collected information, we created dot maps of the species occurrence. We then superimposed a UTM 1x1 km grid on the *Lupinus* dot maps in

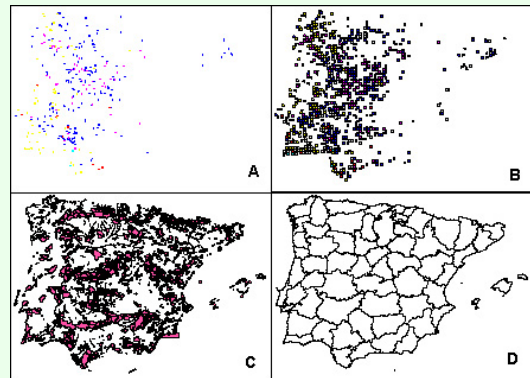


Fig. 1. Geographical information layers used in the GIS assessment of *Lupinus* species in Spain. A) UTM 1x1 km grids of *Lupinus* populations, different colours represent different species; B) UTM 10x10 grids of *Lupinus* populations, different colours represent different species; C) SCIs layer (Spanish Ministry of Environment, 2002); D) Flora Iberica regions.

order to produce a UTM 1x1 km *Lupinus* distribution map (Fig. 1-A). The same procedure was followed to obtain a UTM 10x10 *Lupinus* distribution map (Fig. 1-B). An SCI layer from Natura 2000 network (Spanish Ministry of Environment, 2002) (Fig. 1-C), was used to represent areas subjected to some degree of protection. For geographical reference we used a layer with the regions considered in *Flora Iberica* (Fig. 1-D).

We used MapInfo GIS software to find matches between the *Lupinus* UTM layers and the SCI map. Thus, we identified *Lupinus* populations occurring within protected areas and those occurring outside but less than 14.1 km (the maximum distance in a 10x10 km square) from their limits. In order to detect the latter, we selected populations which did not match with an SCI

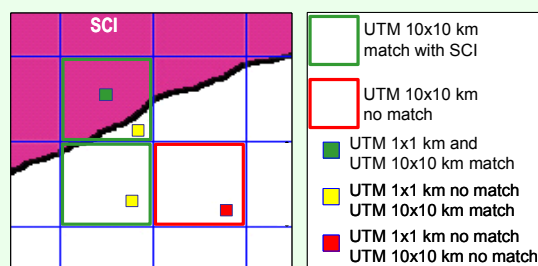


Fig. 2. Use of different scales to find the nearest populations of *Lupinus* species that are not included in SCIs. When a *Lupinus* population does not match with an SCI at the UTM 1x1 km grid level but does match at the UTM 10x10 km grid level, we know that this population lies within 14.1 km of the SCI border.

at the UTM 1x1 km grid level but did match with an SCI at the UTM 10x10 km grid level (Fig. 2). Finally, we classified the protected areas by the number of *Lupinus* species that they contained and the number of *Lupinus* species occurring nearby.

RESULTS

Georeferenced data included 519 records of *Lupinus albus*, 1257 records of *L. angustifolius*, 19 records of *L. consentinii*, 346 records of *L. hispanicus*, 316 records of *L. luteus* and 44 records of *L. micranthus*. The most common species was *L. angustifolius* with 50% of the data and the rarest species was *L. consentinii* with 2% of the data.

“a third of the *Lupinus* populations are potentially protected, although most SCIs do not presently provide effective protection due to a lack of specific management”

A map with the match between *Lupinus* locations at the UTM 1x1 km grid level and SCIs is shown in Figure 3. The colour of each SCI indicates the number of *Lupinus* species it holds. The total number of *Lupinus* populations occurring within SCIs was 743, equivalent to 30% of the records. This indicates that a third of the *Lupinus* populations are potentially protected, although most SCIs do not presently provide effective protection due to a lack of specific management. The least-favoured species is *L. consentinii* with only two populations occurring within SCIs (10% of the total *L. consentinii*

records) whereas the most-favoured species is *L. hispanicus* with 174 populations (50% of the total *L. hispanicus* records).

Figure 4-A shows a map with matches between *Lupinus* locations and SCIs. Just 1.47% of the existing SCIs (blue-coloured) matched with *Lupinus* locations at the UTM 1x1 km grid level. However, 21.6% of SCIs (red-coloured) matched with *Lupinus* locations only at the UTM 10x10 km grid level, indicating the presence of *Lupinus* populations within a 14.1 km distance. These SCIs were then classified by the number of different *Lupinus* species occurring within a 14.1 km distance (Fig. 4-B). Red and orange-coloured SCIs have a significant number of *Lupinus* species populations nearby. Field studies should be carried out to determine if these *Lupinus* species also occur within the SCIs (even though there are no current records). These SCIs represent only 1% of the total SCIs with populations within a 14.1

km distance from their border and 0.17% of the total SCIs. Should these populations be worth conserving, even if not present within the SCIs, specific proposals could be made to protected area managers to encompass these *Lupinus* populations within their management plans.

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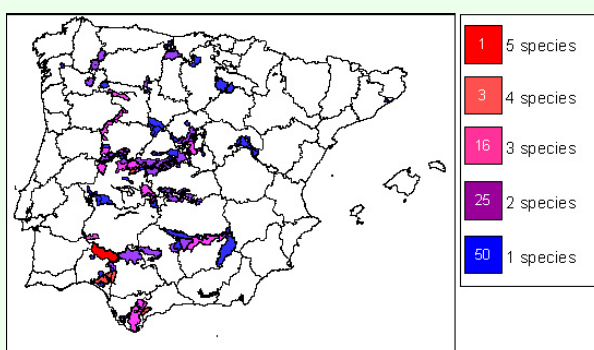


Fig. 3. Matches between SCIs and *Lupinus* locations at the UTM 1x1 km grid level. The colour of the SCIs indicates the number of *Lupinus* species that are found within. Each white number inside the legend's coloured squares represents the number of SCIs in each category.

Mauricio Parra-Quijano



Above: *Lupinus hispanicus*

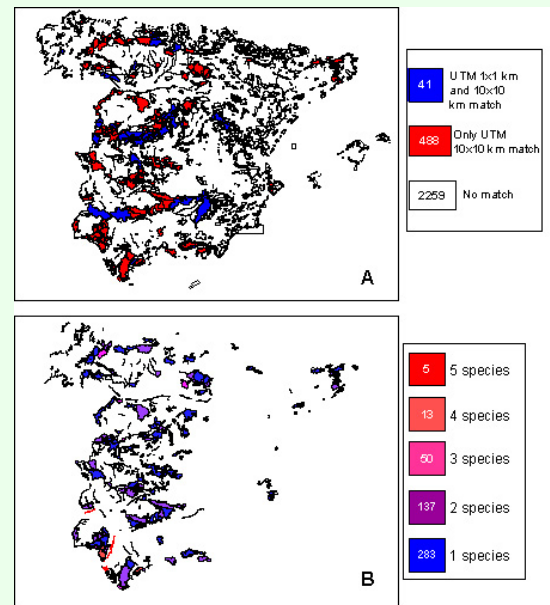


Fig. 4. Identification of *Lupinus* populations occurring near SCIs. A) Red SCIs match *Lupinus* locations only at the UTM 10x10 km grid level, indicating that they are situated within 14.1 km of the SCI; B) Classification of SCIs that match only at UTM 10x10 km grid level. The colour of the SCI indicates the number of *Lupinus* species occurring nearby. Each white number inside the legend's coloured squares represents the number of SCIs in each category.

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Above: Luigi Guarino, Plant Genetic Resources Advisor, Secretariat of the Pacific Community, and Advisor to PGR Forum presents "Spatial analysis methodologies for PGR data and the development of conservation strategies for crop wild relatives" at the workshop, *In Situ* Data Management Methodologies, Prague, Czech Republic

Call for contributions

We want to ensure that *Crop wild relative* provides the information you, the readers, want. We therefore want to hear from you with your ideas for the content of future issues. For instance, there could be pages dedicated to short news items and event announcements, news about recent publications, and feature articles about the conservation and use of crop wild relatives.

To reach as wide a readership as possible, *Crop wild relative* will be posted on the PGR Forum web site, circulated by email and a limited number printed for circulation by post. We would be grateful if you could spread the news about the availability of this new serial, and put us in touch with interested parties that would like to receive it.

Whatever profession or interest group you belong to, please send us your contributions for inclusion in future issues. We hope that this newsletter will be read by a wide audience; therefore, while we want to ensure a high standard in terms of scientific content, we would also like the serial to be available to those readers who are not directly involved in the genetic resources professions.

Articles should be a maximum 2000 words, and may contain good quality graphics and pictures. Please ensure that the appropriate caption and credit is included, and inform the editors if an article has previously been published elsewhere so that permission can be obtained for reproduction. Contributions should preferably be submitted in electronic format either by email attachment or on disc. *Crop wild relative* will be published twice yearly; the next issue will appear in early 2004. Please direct all correspondence to Shelagh Kell, s.p.kell@bham.ac.uk

