Fitosociologia vol. 48 (2) suppl. 1: 137-143, 2011

Between global priorities and local urgencies: the Important Plant Areas programme in Italy.

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Abstract
Global priorities for the conservation of biodiversity assume a key role in determining the national priorities and the research agenda. The "Important Plant Areas in Italy" project, promoted by the Italian Ministry for the Environment, Nature Protection Directorate through a programme aimed at mapping the IPAs, represents an important contribution to the planning of strategies designed to enhance biodiversity conservation. The national working group, co-ordinated by the Inter-university research centre for "Biodiversity, Plant sociology and Landscape ecology" of the "Sapienza" University of Rome and composed of a network of 100 botanical experts was set up to obtain original information and draw up a detailed, nationwide picture of the situation in Italy.
Important Plant Areas were identified on the basis of a range of taxonomic groups (such as vascular plants, bryophytes, freshwater algae, lichens and fungi) and habitats in order to promote an integrated model of knowledge for the conservation of plant diversity. Each of the selected vascular plants and habitats was assigned a conservation value on a regional basis. An approach based on the overlapping of the species and habitat maps was used to identify the most important areas for plant diversity and to pinpoint any "hotspots" of richness and diversity.
Hence, polygons were defined within the cells of high conservation value and/or containing high vascular species and habitat richness (grid approach). A total of 320 IPAs were identified in Italy (including 8 fresh water algae community sites), covering approximately 15% of the country. Regional results highlighted the extreme heterogeneity of available data and the need for new basic research projects designed to integrate and update the information currently available on the distribution of plant species (vascular plants, bryophytes, freshwater algae, lichens), fungi and habitats in our country. Considering the global emerging issues but acting at local level, the results yielded by this project may be exploited for interventions of various kinds, ranging from the choice of protected areas to urban planning.

Key words: expert-based approach, Global Strategy for Plant Conservation, hotspots of botanical diversity, multi-taxa approach.

Riassunto
Gli obiettivi globali per la conservazione della biodiversità assumono un ruolo chiave nel definire le priorità nazionali e dei programmi di ricerca. Il progetto Important Plant Areas in Italia, promosso dal Ministero dell'Ambiente e della Tutela del Territorio e del Mare e dalla Direzione Protezione della Natura con un programma volto alla individuazione cartografica delle IPAs, rappresenta a livello nazionale un importante contributo per poter intraprendere azioni mirate alla conservazione della biodiversità. Il gruppo di lavoro nazionale, coordinato dal Centro di Ricerca Interuniversitario "Biodiversità, Fitosociologia ed Ecologia del paesaggio" della "Sapienza" Università di Roma e composto da una rete di oltre 100 esperti botanici, provenienti dalle università, da istituzioni pubbliche e private e dal mondo delle professioni, è stato costituito al fine di ottenere dati originali ed al fine di redigere un quadro esaustivo della situazione nazionale attuale.
Le Important Plant Areas sono state individuate sulla base della distribuzione di diversi gruppi tassonomici (piante vascolari, briofite, alghe d'acqua dolce, licheni e funghi) e habitat al fine di promuovere un modello di integrazione delle conoscenze per la conservazione della diversità vegetale. Alle specie di piante vascolari e agli habitat selezionati per il progetto IPA è stato assegnato un valore conservazionistico su base regionale. Per individuare le aree più importanti per la diversità vegetale e per evidenziare gli "hotspots" di ricchezza e diversità, è stato utilizzato un approccio basato sulla sovrapposizione delle cartografie distributive di specie e di habitat.
I poligoni delle IPAs sono stati definiti, a seguito di un'analisi su griglia, in corrispondenza delle celle caratterizzate da un elevato valore conservazionistico e/o da un'elevata ricchezza di specie e/o di habitat. Le IPAs individuate attualmente in Italia sono 312 più 8 siti puntiformi (selezionati per le comunità algali) e coprono un'area pari a circa il 15% del territorio nazionale. I risultati regionali evidenziano un'estrema eterogeneità dei dati disponibili e la necessità di promuovere nuove ricerche di base per integrare ed aggiornare le informazioni attualmente disponibili sulla distribuzione reale di specie vegetali (piante vascolari, briofite, alghe d'acqua dolce, licheni), funghi e habitat nel nostro paese. Tenendo conto delle emergenze globali ma operando a scala locale, i risultati ottenuti possono essere utilizzati per la progettazione di diverse azioni di pianificazione, dalla gestione e zonizzazione delle aree protette alla redazione di piani urbanistici.

Parole chiave: approccio multi-taxa, hotspots per la diversità vegetale, metodo fondato sul parere degli esperti, Strategia Globale per la Conservazione delle Piante.

Introduction

Facing the 2010 target, the global priorities for the conservation of biodiversity assume a key role in determining the research agenda. In many global initiatives, biodiversity has different, but always significant, roles (WCMC, 1992; MEA, 2005): for example, the Millennium Development Goals focuses on goods and services delivered by biodiversity (ecosystem services, Naidoo *et al*., 2008), while the Common Agricultural Policy (CAP) concentrates on the controversial relationship among agriculture and biodiversity conservation (Henle *et al*., 2008).
On the other hand, one of the main debates in the field of conservation biology is the assessment of results obtained by conservation targets fixed by international treaties (Soutullo *et al*., 2008), evaluating the efficiency of existing protected areas (Vellak *et al*., 2009; Jackson *et al*., 2009) and developing new site selection techniques (Abèllan *et al*., 2005).
The need for a global partnership has been underlined by many agencies (Plantlife International, the European

program of Plantlife International - Planta Europa, Botanic Gardens Conservation International) in order to increase the positive outcomes derived from the science/policy interface (Tallis *et al*., 2008; see also Syracuse chart developed during the G8 environment in 2009).

In 2001, at the 3rd Planta Europa Conference, more than 150 delegates developed the European Plant Conservation Strategy (EPCS), a framework for plant conservation in Europe (Società Botanica Italiana, 2004). At international level, this initiative was immediately considered as a step forward the conservation of plants. In fact, one year later, the EPSC was endorsed by the Convention on Biological Diversity as part of and a contribution to the Global Strategy for Plants Conservation (GSPC) adopted during the Sixth Conference of the Parties (COP) of the CBD (2002). The Strategy's ultimate and long-term objective is to halt the current and continuing loss of plant diversity. The Strategy also considers issues of sustainable use and benefit-sharing, and aims to contribute to poverty alleviation and sustainable development.

The Important Plant Areas (IPAs) program was proposed by Planta Europa (1st conference in Hyères, France, 1995) and developed successively (Palmer & Smart, 2001) to achieve one of the preliminary aim of GSPC, i.e the identification of the most important sites of botanical diversity. In the last Report on the Global Strategy's application, IPAs program was confirmed as the best tool adopted at global level (GPPC, 2008). For this reason, the new version of the European Strategy for Plant Conservation (ESPC) establishes that IPA identification programs shall be completed in 100% of European countries by 2014 (Planta Europa, 2008). The aim of the IPAs program is to identify a network of sites that are essential to guarantee the long-term viability of natural populations of threatened and/or important wild plant species and their habitats.

The word "plant" encompasses bryophytes, algae, lichens, fungi and wild vascular plants. In addition to populations of species, the program also investigates the contribution of habitats (*sensu* plant communities). The IPAs program refers in particular to threatened, restricted range and/or rare species and habitats. The original definition of IPA is indeed: "an IPA is a natural or semi-natural site exhibiting exceptional botanical richness and/or supporting an outstanding assemblage of rare, threatened and/or endemic plant species and/or vegetation of high botanic value" (Anderson, 2002). But the IPAs are not a type of protected area nor are automatically a form of designation with legal value. They represent the instrument to highlight the most important sites for plant diversity, providing the framework to support and guide the existing initiatives for conservation and management.

Furthermore, identification of IPAs must strengthen, not duplicate, the efforts already existing in terms of policies for the conservation of biodiversity, for example those required by the Habitats Directive for the identification of Special Areas for Conservation (SAC, or ZSC in Italy) and the Natura 2000 network (Plantlife International, 2003). The IPAs program aims to localize sites for which conservation action is more urgent and essential and helps to make a gap analysis to check whether these sites has been guaranteed the best protection necessary; however it is not necessary that the IPAs become a protected area (Palmer & Smart, 2001).

At national level, we are urged to shift to a site based conservation, beyond the protected areas concept, using a multi scale approach, i.e considering the global emerging issues but acting at a local level. Accordingly, we need to harmonize data available at national level and adopt common conservation criteria, to fulfill the measurable target agreed at the international level.
Objectives of the Important Plant Areas program in Italy were to i) gather information on different *taxa* and habitats through a network of expertise at national level ii) harmonize obtained data iii) develop a prior method to create an IPAs map, using the proposed international criteria and considering existing protected areas.

Material and Methods

A working group composed of national experts of the 5 *taxa* considered (plants, bryophytes, fresh water algae, fungi and lichens) has been constituted, together with a regional network, involving more than 100 botanical experts (who work in universities, public and private institutions and on a freelance basis) to contribute to the knowledge on vascular plant species and habitats at the regional scale.

Based on the methodology proposed at international level (Palmer & Smart, 2001; Anderson, 2002) - which identifies 3 criteria: "threatened species" (Criterion A), "botanical richness" (criterion B) and "threatened habitats" (criterion C) - a list of species and habitats that contribute to the definition of IPAs was drawn up (alphanumeric database). For each *taxa* (vascular plants, bryophytes, lichens, algae and fungi) and for each habitat experts identified major criticality and

assigned a conservation value according to their regional value. Unlike standard methodology, the lists include species and habitats which do not strictly comply with the specifications of the criteria A and C, but considered of conservation interest by the experts. Data of presence have been associated to each species and habitats (georeferenced database).

In order to process data with different accuracy, Italy was subdivided into 3,504 square cells of 10x10 km and vascular plant species and habitats records were univocally assigned to one cell.

The IPA definition process comprised two successive steps: i) ranking of cells at the regional level and ii) definition of the IPA polygons within the top ranking cells.

The data for the other taxonomic groups were omitted from the ranking procedure because, if compared with those available for the vascular species and habitats, they were more limited and distributed less homogeneously throughout the country owing to information gaps.

Ranking was performed on the regional scale to take into account the heterogeneity on data availability in the different administrative units in Italy, in this way the evaluation was made on the basis of current knowledge and available data. The data for the other taxonomic groups were included in the subsequent polygon phase as a means of confirming the value of the IPAs and of integrating the description of the areas. For defining the polygons important for plants, we principally referred to the CORINE Land Cover 2000 map (scale 1:100,000) and matched natural and seminatural land cover classes with species and habitats. As additional information, we used the boundaries of protected areas, including Natura 2000 sites (Habitats Directive).

The described procedure was possible because of the availability of georeferenced data, largely derived specifically within this project. The identification of IPAs polygons was not automatic, but was made case by case for each polygon based on the available data (Blasi *et al*., 2009, 2011).

National results

Data gathered on species and habitats produced a substantial advance in knowledge of the national territory; in particular, the experts have enriched the database with unpublished records and to fulfill one of the objectives of the project, many resources were invested to increase georeferenced data (table 1), producing ad-hoc geo-database.

A total of 320 IPAs of national interest (312 polygons plus 8 sites of freshwater algae) were identified in Italy. They cover an area of 4,476,830 hectares, approximately 15% of the country. The mean area of the IPAs is 14,348 ha. The size of the IPAs, however, varies considerably, ranging from a maximum size of 243,738 ha for the transregional IPA coded ITA 12 (Dolomiti, Valli Talagona e Tovanella, Dolomiti Friulane, M. Coglians, Creta d'Aip, M. Corona), which straddles the three regions of Veneto, Friuli-Venezia-Giulia and Trentino-Alto Adige, to a minimum size of 8 ha for the Scogliera dei Rizzi, in Calabria (Figure 1). About 6,000 out of the 9,745 records of vascular plant are included in IPAs, and 300 out of the 395 species of vascular plant that have only one record (79 of these meet the criterion A) are included in IPAs.

It is interesting to point out that, excluding the eight IPAs important for freshwater algae, only four IPAs do not include any habitat record; of these four IPAs, one is important for fungi (Bosco di S'Agnese, Tuscany), one for lichens (Tusculum, Latium) and two for the vascular flora (Piana di Buddusò, in Sardinia, and Costa di Sampieri, in Sicily). On the other hand, 40 IPAs were selected for the conservation of other taxonomic group and not for vascular flora (38 out of 40 were also important for habitats). Moreover, about 9,000 out of the 14,000 records of habitat are included in IPAs (1,807 considered as "best sites" for their habitats and 288 characterized by original records); seven out of ten habitats listed throughout Italy with a single record are included in IPAs. Results highlighted and confirmed the essential role of habitats to achieve targets in the conservation of biodiversity.

Regional results

The analyses at regional level revealed the importance in terms of data of the Autonomous Province of Trento, which includes 18 IPAs, covering 42% of the regional territory. At the nationwide level, the administrative unit which contributes the most to the IPAs coverage is Sardinia, which has 34 IPAs that overall represent 10% of the national IPAs extent (Table 2).

Although the data collected represent an important contribution, the level of botanical knowledge in Italy varies greatly depending on administrative unit. The cells without species and habitats records are 1,046 (about 30% of the national territory) and they show a heterogeneous distribution on the territory. For example, Campania and Puglia show more than 40%

Taxonomic group	*number of species*	*georeferenced records*
Vascular plants		
Species selected according to International criteria (A)	320 (310)	3149
Species of National interest	257 (244)	3904
Species of Regional interest	839 (839)	2692
IPA sites for vascular plant		*172*
Total vascular plants	*1416*	*9917*
Bryophytes		
Mosses and liverworts	109 (78)	375
IPA sites for bryophytes		*19*
Total bryophytes	*109*	*394*
Fresh water algae		
Desmidiaceae	344	-
Diatomeae	56	-
Charophyceae	30	-
IPA sites for fresh water algae		*42*
Total fresh water algae	*430*	*42*
Lichens		
Species selected according to International criteria (A)	72 (68)	238
IPA sites for lichens		*21*
Total licheni	*72*	*259*
Fungi		
Macrofungi	42 (36)	394
IPA sites for fungi		*8*
Total fungi	*42*	*402*
Habitats		
Natura 2000 habitats	122	13731
Habitats of National interest	45	261
Total habitats	*167*	*13992*

Tab. 1 - Species and habitats data used for the definition of the Important Plant Areas in Italy. In brackets the number of species with georeferenced data.

of cells without records, while Liguria, Piemonte, Valle D'Aosta, Trentino-Alto-Adige, Friuli-Venezia-Giulia, Umbria and Molise are characterized by a more homogeneous data distribution (less than 20% of cells without records).

The differences recognized at the administrative unit level can be attributed to various causes including the presence of extensive areas transformed by anthropogenic uses/exploitation and the consequent reduction of natural and semi-natural areas, or the focusing of data collection in particular/specific areas (e.g. only in protected areas) or simply, lack of information. For more information at regional level, please refer to Blasi *et al*. 2010.

Conclusions

With the Important Plant Areas program in Italy, we answered to the need of a quick assessment of the state of art of botanical knowledge on selected species of vascular plants, bryophytes, lichens, fungi, fresh water algae and habitats.

The IPAs program results are essential to meet the international requirements that have been signed by Italy. For example, achieving the target 5 of Global Strategy for Plant Conservation (ensure the protection of 50% of the most important areas for plant diversity within 2010) appeared feasible now, because more than 80% of the network of IPAs in Italy have some form of legal protection (protected areas and/or Natura 2000 sites).

One of the main results of the project refers to the conservation value assigned by the experts to vascular species and habitats: conservation values for both vascular plants and the habitats indicated the conservation priorities at the regional level, positively reassessing the value of species and habitats poorly

Fig.1 - Map of the Important Plant Areas (IPAs) in Italy. Regional IPAs fall within only one admistrative unit (dark grey). Transregional IPAs fall across two or more administrative units (light grey).

Administrative Regions	*Regional area (ha)*	*Number of IPAs*	*Area of IPAs (ha)*	*% of Regional area*	*Contribution to the National IPAs area (%)*
Sardegna	2,408,588	34	430,235	18	10
Puglia	1,953,816	8	377,340	19	8
Piemonte	2,538,853	18	314,430	12	7
Sicilia	2,583,214	29	312,428	12	7
Veneto	1,842,478	16	310,663	17	7
Toscana	2,298,646	29	285,053	12	6
Aut. prov. Trento	620,247	18	258,753	42	6
Abruzzo	1,083,004	6	218,038	20	5
Emilia-Rom.	2,212,514	16	217,309	10	5
Lazio	1,722,843	26	218,625	13	5
Lombardia	2,386,411	17	231,389	10	5
Aut. prov. Bolzano	739,855	14	199,015	27	4
Campania	1,367,068	14	171,034	13	4
Friuli V. G.	785,866	10	160,246	20	4
Calabria	1,522,316	17	155,869	10	3
Liguria	540,732	22	137,118	25	3
Umbria	846,505	22	153,643	18	3
Marche	972,860	12	103,227	11	2
Molise	446,107	9	74,841	17	2
Valle d'Aosta	326,086	10	88,943	27	2
Basilicata	1,007,341	10	66,666	7	1
ITALY	***30,205,350***	***357***	***4,484,865***	***15***	***100***

Tab. 2 - Regional contribution in terms of number and extent to the Important Plant Areas network in Italy. Regional IPAs straddling two or more regions were merged in transregional IPAs (see fig.1).

considered in the past and reconsidering the relative importance of others.

The IPA program highlighted the extreme heterogeneity of available data and the need for new basic research projects and field investigations.

Mapping IPAs represents another important task of the project, both in the processing of data (different from each other in origin, distribution, quality, etc...) and in the delimitation of polygons (with the complex identification of boundaries). This methodology can be applied at different scales: the application of the proposed method at detailed scale could identify other important but very small areas (e.g. marshes, peat bogs, coastal dunes, remnants of flood-plain woods, Rosati *et al*., 2008), that have a very high risk of extinction and that are not represented in the data processing at regional/national because of their small size. These small sites are crucial for local ecological networks and for the conservation of species characterized by very small and limited population (Rossi *et al*., 2008; IUCN, 2008), especially when threatened by strong human impact. The efforts we adopted to map IPAs as a site based policy can be useful for the future application such as KBAs (Eken *et al*., 2004), ecological networks and zonation of existing protected areas.

Acknowledgement

This project would not have been possible without the funding of the Italian Ministry for the Environment - Nature Protection Directorate and the work of the many experts involved.

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