GIS and systematic conservation planning in Chile

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Abstract
Introduction: The most important way to protect the biodiversity worldwide are the national protected areas systems. A modern design of these areas comprises their integration within a network of reserves, which harmonizes different intensities of use and hence the dissemination of conservation in the whole territory. One of the biggest challenges in this sense is to integrate public and private land into a common conservation objective. This is evident in Chile, as several evaluations demonstrate the uneven representation of ecosystems in the protected areas system (SNASPE). Paradoxically, regions with the lowest representation of protected areas and larger quantities of endangered species are the regions of central Chile, which concentrate most human population. That is why studies to prioritize areas are much needed. Sociopolitical constraints dictate that the prioritized sites represent biodiversity with minimum impact on human interests; therefore conservation planning problems can be formulated as optimization problems. Different algorithms have been developed in the search for the "best" solution, and planning tools are typically used to satisfy this while dealing with multiple criteria. This approach gets the name of "systematic conservation planning" defined as a structured approach with feedback and reiteration at any stage.

(3) Objectives
This investigation focused on the identification of the priority areas in the Valparaiso region, applying the concepts of systematic conservation planning. We analyzed the distribution of native flora and fauna target species, and used an optimization algorithm for the selection of areas. It also reviewed the level of representation that SNASPE provides for each of the considered elements and how this value varies under different scenarios.

(4) Methodology
The distributions of elements were obtained from three procedures involving the use of Geographic Information Systems (GIS). At this stage the distribution of 36 elements were mapped (27 elements of the flora and 9 elements of the fauna), together with 14 vegetational belts appearing in the research region. Identification of the priority areas was made by means of dividing the region in hexagons of five
km2 and were analyzed using the algorithm of efficient selection in the program SPOT.

(5) Results
The results showed 37 Priority Areas where all elements are represented, 34 of them can be justified by richness; 3 remaining elements are not present at all in other priority areas. 30% of the elements considered in this investigation are not
represented under the current scenario of conservation. Elements whose distributions do not coincide with areas corresponding to SNASPE are considered as groups with the higher conservation priorities. If a modelled scenario could include the 25 sites proposed in the investigation, all elements will be represented, but a good proportion of these will still not reach a 50% of their goals.

(6) Conclusions

The use of ecological niche modelling, algorithms for areas selection, GIS and the criteria of systematic conservation planning help diagnose current problems of existing networks of reserves in Chile and help the proposal of new solutions.