Aplicaciones

Teoría, método, herramientas y software

Deben tenerse en cuenta todas las formas de información pertinente, incluidos los conocimientos, las innovaciones y las prácticas de las comunidades científicas, indígenas y locales. Principio 11

Deben intervenir todos los sectores de la sociedad y las disciplinas científicas pertinentes. Principio 12

Enero 2010
Métodos de levantamiento y análisis de datos
Posgrado en Gestión de Áreas Protegidas y Desarrollo Ecorregional
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Tabla de contenido

1.GLOSARIO GENERAL

Análisis

Un Análisis en sentido amplio es la descomposición de un todo en partes para poder estudiar su estructura y/o sistemas operativos y/o funciones (http://es.wiktionary.org/wiki/).

La acción y el efecto de separar un todo en los elementos que lo componen con el objeto de estudiar su naturaleza, función o significado (http://es.wiktionary.org/wiki/).

La acción y el efecto de identificar, distinguir y clasificar diferentes aspectos integrantes de un campo de estudio, examinando qué relaciones guardan entre ellos y como quedaría modificado el conjunto si se eliminara o se añadiera algún aspecto a los previamente identificados (http://es.wiktionary.org/wiki/).

Documento que revisa, separa o hace un resumen de los elementos o principios de un tema o de una obra (http://es.wiktionary.org/wiki/).

Distinción y separación de las partes de un todo hasta llegar a conocer sus principios o elementos (http://www.rae.es/rae.html).

Ciencia

Conocimiento estructurado y sistemático de las cosas por sus principios y causas; Conjunto de conocimientos que constituyen una rama del saber humano (http://es.wiktionary.org/wiki/).

Conjunto de conocimientos obtenidos mediante la observación y el razonamiento, sistemáticamente estructurados y de los que se deducen principios y leyes generales (http://www.rae.es/rae.html).

Conocer

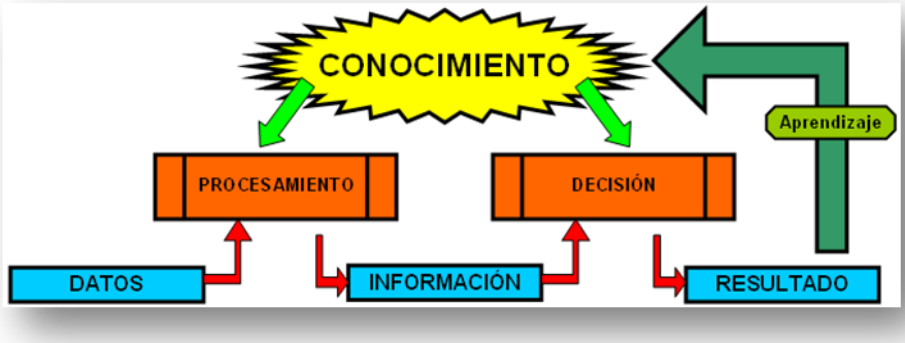
Saber de la existencia de una cosa (http://es.wiktionary.org/wiki/).

Averiguar por el ejercicio de las facultades intelectuales la naturaleza, cualidades y relaciones de las cosas (http://www.rae.es/rae.html).

Conocimiento

Resultado de la acción de conocer. Comprensión, entendimiento, inteligencia, razón (http://es.wiktionary.org/wiki/)

Acción y efecto de conocer; entendimiento, inteligencia, razón natural ello (http://www.rae.es/rae.html).



Esquema sobre el conocimiento desde el punto de vista de las ciencias de la información, como se genera y como se aplica. Fuente: http://es.wikipedia.org/wiki/Saber

Convicción

Acto o efecto de estar seguro sobre algo (http://es.wiktionary.org/wiki/).

Una convicción es una creencia de la que un cierto individuo opina que dispone de suficiente evidencia para considerarla cierta. La diferencia entre una simple creencia y una convicción, es que en el primer caso el individuo puede no tener evidencia suficiente para justificar su veracidad, mientras que en el segundo el individuo si la considera probada, con independencia de que exista evidencia científica o intersubjetiva incontrovertible de que dicha convicción es verdadera (http://es.wikipedia.org/wiki/Saber).

Idea religiosa, ética o política a la que se está fuertemente adherido.

(http://www.rae.es/rae.html).

Creencia

Algo en lo que se cree, confianza en que algo existe o que es cierto.

(http://es.wiktionary.org/wiki/).

Una creencia es una proposición o conjunto de ellas, que un cierto individuo considera ciertas, pero para la que en general no existe evidencia intersubjetiva suficiente para considerarla conocimiento propiamente dicho. Una creencia puede ser acertada o equivocada. Sin embargo, aunque en el uso contidiano al oponer "creencia" y "conocimiento", el primero se usa frecuentemente con el sentido de proposiciones que alguien considera ciertas, pero de la que existe evidencia de estar equivocadas o ser indemostrables(http://es.wikipedia.org/wiki/Saber).

Firme asentimiento y conformidad con algo; completo crédito que se presta a un hecho o noticia como seguros o ciertos; religión, doctrina (http://www.rae.es/rae.html).

Criterio

Norma para conocer la verdad (http://www.rae.es/rae.html).

Juicio o discernimiento (http://www.rae.es/rae.html).

Evaluar

Señalar el valor de algo (http://www.rae.es/rae.html).

Estimar, apreciar, calcular el valor de algo (http://www.rae.es/rae.html).

Estimar los conocimientos, aptitudes y rendimiento de los alumno (http://www.rae.es/rae.html).

Evaluación

Valoración de los conocimientos que se da sobre una persona o situación basándose en una evidencia constatable (http://es.wiktionary.org/wiki/).

Evidencia

Certeza clara y manifiesta de la que no se puede dudar (http://www.rae.es/rae.html).

Prueba determinante en un proceso (http://www.rae.es/rae.html).

Instrumento

Objeto o aparato, normalmente artificial, que se emplea para facilitar o posibilitar un trabajo, ampliando las capacidades naturales del cuerpo humano. Sinónimos: herramienta, utensilio, útil (http://es.wiktionary.org/wiki/).

Aquello que sirve de medio para hacer algo o conseguir un fin; Conjunto de diversas piezas combinadas adecuadamente para que sirva con determinado objeto en el ejercicio de las artes y oficios (http://www.rae.es/rae.html).

Información

Comunicación o adquisición de conocimientos que permiten ampliar o precisar los que se poseen sobre una materia determinada (http://www.rae.es/rae.html).

Conocimientos así comunicados o adquiridos (http://www.rae.es/rae.html).

La información es un fenómeno que proporciona significado o sentido a las cosas. En sentido general, la información es un conjunto organizado de datos procesados, que constituyen un mensaje sobre un determinado ente o fenómeno. Los datos se perciben, se integran y generan la información necesaria para producir el conocimiento que es el que finalmente permite tomar decisiones para realizar las acciones cotidianas que aseguran la existencia. La sabiduría consiste en determinar correctamente cuándo, cómo, dónde y con qué objetivo emplear el conocimiento adquirido (http://es.wikipedia.org/wiki/Informaci%C3%B3n).

Principales características de la información

Significado (semántica)

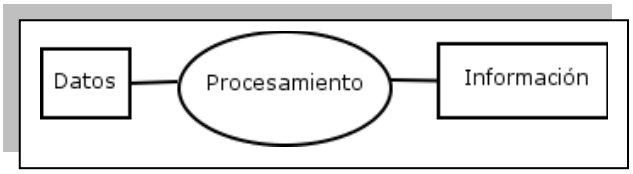
Importancia (relativa al receptor)

Vigencia (en la dimensión espacio-tiempo)

Validez (relativa al emisor)

Valor (activo intangible volátil)

Polimorfismo



Herramienta

Objeto o aparato, normalmente artificial, que se emplea para facilitar o posibilitar un trabajo, ampliando las capacidades naturales del cuerpo humano. Sinónimos: instrumento, utensilio (http://es.wiktionary.org/wiki/).

Instrumento, por lo común de hierro o acero, con que trabajan los artesanos (http://www.rae.es/rae.html).

Método

Procedimiento, técnica o manera de hacer algo, en especial si se hace siguiendo un plan, o de forma sistemática, ordenada y lógica. (http://es.wiktionary.org/wiki/).

Lista ordenada de partes o pasos (avance logrado para la consecución de una tarea.) para lograr un fin (http://es.wiktionary.org/wiki/).

Procedimientos y técnicas característicos de una disciplina o rama del saber (http://es.wiktionary.org/wiki/).

Procedimiento que se sigue en las ciencias para hallar la verdad y enseñarla (http://www.rae.es/rae.html).

Percepción

La percepción es la función psíquica que permite al organismo, a través de los sentidos, recibir, elaborar e interpretar la información proveniente de su entorno (http://es.wikipedia.org/wiki/Percepci%C3%B3n).

Acción y efecto de percibir (http://www.rae.es/rae.html).

Sensación interior que resulta de una impresión material hecha en nuestros sentidos (http://www.rae.es/rae.html).

Conocimiento, idea (http://www.rae.es/rae.html).

Procedimiento

El o un procedimiento es el modo de ejecutar determinadas acciones que suelen realizarse de la misma forma, con una serie común de pasos claramente definidos, que permiten realizar una ocupación o trabajo correctamente. (http://es.wiktionary.org/wiki/)

Método de ejecutar algunas cosas (http://www.rae.es/rae.html).

Saber

Conjunto de conocimientos, adquiridos mediante el estudio o la experiencia, sobre alguna materia, ciencia o arte. Sinónimo: sabiduría, erudición (http://es.wiktionary.org/wiki/).

Conocer algo, o tener noticia o conocimiento de ello (http://www.rae.es/rae.html)

Sabiduría

Conocimiento de las ciencias y artes (http://es.wiktionary.org/wiki/).

Prudencia en la forma de actuar (http://es.wiktionary.org/wiki/).

Grado más alto del conocimiento; conducta prudente en la vida o en los negocios; conocimiento profundo en ciencias, letras o artes (http://www.rae.es/rae.html).

Técnica

Conjunto de habilidades para aplicar determinados conocimientos (http://es.wiktionary.org/wiki/).

Conjunto de procedimientos y recursos de que se sirve una ciencia o un arte (http://www.rae.es/rae.html).

Teoría

Conocimiento especulativo considerado con independencia de toda aplicación (http://www.rae.es/rae.html).

Serie de las leyes que sirven para relacionar determinado orden de fenómenos (http://www.rae.es/rae.html).

Hipótesis cuyas consecuencias se aplican a toda una ciencia o a parte muy importante de ella (http://www.rae.es/rae.html).

Una teoría es un sistema lógico compuesto de observaciones, axiomas y postulados, así como predicciones y reglas de inferencia que tienen sirven para explicar de manera económica cierto conjunto de datos e incluso hacer predicciones, sobre que hechos serán observables bajo ciertas condiciones. Las teorías además permiten ser ampliadas a partir de sus propias predicciones, e incluso ser corregidas, mediante ciertas reglas o razonamientos, siendo capaces de explicar otros posibles hechos diferentes de los hechos de partida de la teoría (http://es.wikipedia.org/wiki/Teor%C3%ADa?

En ciencia, se llama teoría también a un modelo para el entendimiento de un conjunto de hechos empíricos. En física, el término teoría generalmente significa una infraestructura matemática derivada de un pequeño conjunto de principios básicos capaz de producir predicciones experimentales para una categoría dada de sistemas físicos. Un ejemplo sería la "teoría electromagnética", que es habitualmente tomada como sinónimo del electromagnetismo clásico, cuyos resultados específicos pueden derivarse de las ecuaciones de Maxwell.

2. PLANIFICACIÓN ECOREGIONAL

A conservation planning tool is defined as software with the following two characteristics:

It can be used to guide decisions about conservation action for biodiversity, although it may also be used to plan for other natural values such as scenery or ecosystem services.

At the very minimum, it can identify either (a) sets of complementary sites needed to achieve quantitative targets for biodiversity features or (b) the complementary contribution that individual sites make to biodiversity conservation within a region. (Sarkar, Sahotra, et.al., 2006)

2.1.Systematic Conservation Planning Primer

M1: Introduction to Conservation Area Networks

Learning Objectives: This module is an introduction to the key concepts of biodiversity, conservation areas, systematic conservation planning, and to the software used for planning. Learners will draw on some previous knowledge of ecology and conservation biology. http://consnet.org/primer/M1.php

M2: Systematic Conservation Planning Overview

Learning Objectives: This module describes, with an overview, the stages of systematic conservation planning and tools that support conservation planning. This is meant to help the learner understand the larger picture for the in-depth material provided in later modules. **http://consnet.org/primer/M2.php**

M3: Stakeholder Identification and Involvement

Learning Objectives: This module describes the identification of stakeholders within the systematic conservation planning process and explains the complex relationships between stakeholder roles within this process. The module presents examples of negotiations with stakeholders in Baja California (Mexico), the California Channel Islands, Guyana, Madagascar, Namibia, the Philippines, and South Africa. **http://consnet.org/primer/M3.php**

M4: Data Compilation, Assessment, and Treatment

Learning Objectives: This module explains proper data collection, assessment, and treatment of the data in systematic conservation planning. The learner is able to conceptualize the theoretical and practical issues that are part of the data collection, assessment, and treatment process. **http://consnet.org/primer/M4.php**

M5: Surrogacy Identification and Analysis

Learning Objectives: This module explains how to assess the effectiveness of surrogates within systematic conservation planning. In addition, using the Québec and Queensland data sets, this module explains the concepts of true and estimator surrogates and gives examples of the output of the Surrogacy software package. http://consnet.org/primer/M5.php

M6: Conservation Targets and Goals

Learning Objectives: At the completion of this module, learners should be able to asses the general concepts of setting conservation area network targets and goals within the general framework of systematic conservation planning. **http://consnet.org/primer/M6.php**

M7: Review of Existing Conservation Areas

Learning Objectives: This module allows the learner to gain knowledge of the importance of reviewing existing conservation areas within systematic conservation planning. Case studies are also presented to demonstrate the review process. **http://consnet.org/primer/M7.php**

M8: Place Prioritization

Learning Objectives: This module describes the process of prioritizing areas on the basis of what they contribute to the biodiversity representation targets for a region. **http://consnet.org/primer/M8.php**

M9: Vulnerability and Persistence Analysis

Learning Objectives: This module describes how to incorporate persistence and vulnerability into systematic conservation planning. Learners will conceptualize the importance of persistence and vulnerability with new examples as well as some used in previous modules. **http://consnet.org/primer/M9.php**

M10: Network Refinement Protocol

Learning Objectives: This module develops a protocol for refining conservation area networks selected at stage 6 (see M8: Place Prioritization). Learners will draw from what was learned in previous stages and be asked to reflect on how to utilize these methods in the process of refining a conservation network plan. **http://consnet.org/primer/M10.php**

M11: Multi-Criteria Analysis

Learning Objectives: This module demonstrates the use of the multi-criteria analysis in systematic conservation planning. Learners should acquire an understanding of different criteria used during conservation planning and of alternative approaches to incorporating these criteria in conservation decision-making. **http://consnet.org/primer/M11.php**

M12: Implementation of Conservation Plan

Learning Objectives: This module discusses the practical implementation of conservation plans. In previous modules, systematic conservation planning has been described as the steps and strategies of planning for a conservation area network. Learners will draw from different real-life examples of conservation plan implementation and be asked to synthesize learning in a manner which critically compares and contrasts different plans and their utilization of systematic conservation planning strategies. **http://consnet.org/primer/M12.php**

M13: Periodic Network Reassessment

Learning Objectives: This module discusses the importance of periodic network reassessment in systematic conservation planning. Learners will be introduced to the dynamic aspects of this

process and the complexity involved in reassessing a conservation plan after its implementation. **http://consnet.org/primer/M13.php**

M14: Conclusion and Review - Future Directions

Learning Objectives: This module will focus on several areas which require more attention from both developers and practitioners of systematic conservation planning tools and protocols. Rather than summarize the previous modules, this module will discuss the stages of systematic conservation planning that require further research. Learners will be asked to reflect on the concepts learned in previous modules. **http://consnet.org/primer/M14.php**

Glosario http://consnet.org/primer/Glossary.php

Abundance of a surrogate (such as a species) is the number of individuals present in a given area.

Adaptive Management involves the identification and subsequent procurement of areas for conservation purposes followed by the adoption of management procedures so as to guarantee the indefinite persistence of those biological units located on the procured areas. The current consensus framework for conservation biology takes adaptive management to be the subject of conservation biology.

Allometric relationships are mathematically well defined relationships that have been found to hold between some properties of organisms. An example of an allometric relationship is the relationship between the body mass of an organism and its basal metabolic rate.

Biodiversity is the variety of living features and processes at all levels of structural, taxonomic, and functional organization. Biodiversity does not include ecosystem services (e.g., nutrient cycling, the movement of water or energy) or culturally-based categories (e.g., cultural, spiritual, or aesthetic objects).

Biogeographical theory holds that conservation areas are analogous to oceanic islands. The theory thus calls for the design of conservation area networks as large circular reserves located closely to one another and connected by corridors.

Catchments are areas of land drained by a creek or river system; or a place set aside for collecting water which runs off the surface of the land.

Charismatic/Iconic species are species that are either well liked by people or in some way firmly associated with a particular geographic locale. As a consequence of their popularity charismatic and iconic species have often been used as surrogates for biodiversity.

Commercial importance is an importance attributed to those species that possess either existing or potential commercial value. Species possessing commercial importance are often afforded increased priority in conservation planning.

Complementarity is what new biodiversity features a new area brings relative to a group of already selected areas; complementarity is thus a measure of beta diversity, measuring what is *different* about the new area. Complementarity is a measure of the contribution an area in a planning region makes to the full complement of biodiversity features (e.g., species). In systematic conservation planning, it refers to the relative contribution an individual area within a larger region makes toward a particular conservation goal. For example, if a particular area has few species that do not occur widely in the planning region, it may have higher complementarity than an area with many species that are widespread throughout the planning region. In other words, high complementarity is an area with high numbers of unrepresented species relative to other areas in the planning region. Complementarity supersedes (replaces) other measures of biodiversity in systematic conservation planning. The use of complementarity typically allows the representation of all species in as few areas as possible.

Complementary (see Complementarity).

Conservation Area Networks (CANs) are a network of geographically delineated terrestrial or marine regions (places) managed for the persistence of biodiversity features (taxa, communities, habitats, etc.) and processes. Each network consists of several conservation areas.

Conservation assessment is a term used to refer only to the assessment of the potential value of conservation areas. Such assessment is a necessary stage for the selection of CANs.

Conservation planning tools are software packages used for conservation planning purposes that: (i) can be used to guide decisions about conservation action for biodiversity (although they may also be used to plan for the conservation of other values such as scenery or ecosystem services); and (ii) at the very minimum can identify either (a) sets of complementary sites needed to achieve quantitative targets for biodiversity surrogates, or (b) the complementary contribution that individual sites make to biodiversity conservation within a planning region.

Conspicuous species are species used as surrogates for biodiversity representation due to the availability of records indicating their distribution. Mammal, bird, butterfly, and vascular plant species are often conspicuous.

Ecological communities are defined by groups of different species living together in a shared environment.

Effective population size is the size of an idealized population that would behave the same as an actual population. The ideal population is one in which there is random mating and no selection. The effective size of a population is typically smaller than its actual size.

Effects of habitat modification are the consequences of the modification of a given area for the organisms that reside with it. Habitat modification often requires the adoption of special management processes so as to so safeguard the persistence of biodiversity within the modified area.

Empirical studies are studies that have been performed in the field. They must be used to determine whether or not a particular management option is adequate for the persistence of biodiversity at a site.

Endemicity is the property of being uniquely located in a given place or region and not naturally located elsewhere.

Environmental classes are land classifications based on physical and climactic variables. Environmental classes may or may not incorporate biotic variables.

Environmental nomenclature is the naming system describing environmental characteristics, used by stakeholders that may not always be the same for each participant in a group of stakeholders.

Exact or Optimal algorithms are algorithms that are guaranteed to produce the optimal solution to a given problem.

GARP is a software package that allows for the prediction of the distribution of a species on the basis of geographically referenced records of its presence. GARP uses a genetic algorithm.

Geo-referencing or geographically referenced records/cells are geographically located records, with the longitude and latitude for each record being explicitly recorded.

Grid cells are regularly-shaped cells used to divide a geographical area (the conservation planning region) so as to cover it uniformly.

Habitat remnants are areas of untransformed original habitat types remaining in a landscape that have otherwise been changed, almost always due to human activities.

Habitat types are different classes of the environment in which species reside. In systematic conservation planning habitat types are often used as surrogates for biodiversity.

Herbaria are places devoted to the observation and study of plants and the maintenance of plant material collections.

Heuristic algorithms are algorithms that tradeoff optimality for speed. Heuristic algorithms are not guaranteed to produce the optimal solution to a given problem. However, they can be expected to produce a reasonable solution within an adequate period of time.

Iterative planning procedures, in conservation area network selection, are those in which the potential conservation value of all areas are reevaluated after each area is selected. The most important criterion for such a reevaluation is the complementarity value of the areas.

Keystone species are species critical to the continued persistence of a community.

Life zone diversity is the diversity of different ecological habitat types defined using a variety of features; especially, vegetation types and climatic variables such as patterns of temperature, precipitation, and humidity.

Lithographical data or lithography (in the systematic conservation planning context) are data from maps, posters, and other visual media produced through the use of photographs.

Maxent is a software package that allows for the prediction of the distribution of a species on the basis of geographically referenced records of its presence. Maxent uses a maximum entropy method.

Metaheuristic algorithms are algorithms used to improve the results produced by a heuristic algorithm. Examples of metaheuristic algorithms include simulated annealing and Tabu search.

Metapopulation dynamics are changes in species that have been distributed across a landscape in discrete clusters marked by the presence of suitable habitat. The consideration of metapopulation dynamics results in the realization that targets must be set so as to guarantee the persistence of spatially separated populations.

Multiple Criteria Analysis or Multi-criteria analysis is a method to make decisions when multiple, potentially conflicting, criteria (for instance, cost, biodiversity content, and water quality) must be taken into account.

Niche modeling is a way to predict the geographic range of a species from occurrence (presence or presence/absence) data and information on the environmental characteristics of the individual areas in a region.

Non-iterative planning procedures in conservation area network selection are those which select all features that are going to be included in the network in one step.

Null models are models that do not assume the presence of a given biological phenomenon. When testing for the presence of a biological phenomenon null models are often considered first so as to guarantee that the proposed phenomenon is not merely stochastic.

Operationalize is to define a scientific concept in such a way that it can be quantitatively measured in the field.

Probabilistic expectations or abundances are the expected average number of individuals of a biodiversity surrogate (e.g., average number of individuals in a species) in an area.

ResNet is a software package used to select conservation area networks using rarity and complementarity.

Sites are places or areas being analyzed for potential conservation action.

Source habitat is a small percentage of habitat that provides the most recruits for other habitat sites.

Source-sink population structures are structures in which a small percentage of habitat provides the origin of most individuals while a small percentage of habitat provides the locale in which most individuals are lost.

Spatial autoecological requirements are requirements that a species may have regarding the spatial arrangement of its habitat.

Species as evolutionary units can be used to increase biodiversity through the encouragement of speciation.

Species assemblages are classifications of co-occurring species at a place. They also represent various alternative combinations of species and the interactions between them. Assemblages are more ecologically complex than individual taxa.

Successional pathways are stages through which a community proceeds when changing from one form to another.

Surrogates are measurable components of biodiversity used to represent biodiversity for the purposes of conservation planning.

Tenure parcels are units of land that are owned or managed in a particular way (e.g., individually owned properties or communally managed pastures)

Time horizon is the period of time over which a plan is considered when evaluating it.

Umbrella species are species whose protection is thought to guarantee the protection of other species as well.

Unique identifiers are tags that allow each of a set of geographically specified cells to be located exactly.

Vulnerability assessment is an assessment of the vulnerability of a potential conservation area from external threats (using techniques such as risk analysis) to plan for the persistence of biodiversity in a conservation area network.

Weighted average is an average of multiple values produced by assigning a weight to each value, multiplying each value by its weight, and then adding the results.

2.2 Bibliografía

Systematic Conservation Action

(ver software en http://uts.cc.utexas.edu/~consbio/Cons/consnet_home.html)

1. Compile and assess biodiversity data for region: Compile available geographical distribution data on as many biotic and environmental parameters as possible at every level of organization; Collect relevant new data to the extent feasible within available time; remote sensing data should be easily accessible; systematic surveys at the level of species (or lower levels) will usually be impossible; Assess conservation status for biotic entities, for instance, their rarity, endemism, and endangerment; Assess the reliability of the data, formally and informally; in particular, critically analyze the process of data selection.
2. Identify biodiversity surrogates for region Choose true surrogate sets for biodiversity for part of the region; be explicit about criteria used for this choice; Choose alternate estimator-surrogate sets that can be (i) quantified; and (ii) easily assessed in the field (using insights from Stage 1); Prioritize places using true surrogate sets; Prioritize places using as many combinations of estimator-surrogate sets as feasible; • Assess which estimator-surrogate set is best on the basis of (i) efficiency and (ii) accuracy
3. Establish conservation targets and goals: Set quantitative targets for surrogate coverage; Set quantitative targets for total network area; Set quantitative targets for minimum size for population, unit area, etc.; • Set design criteria such as connectivity; • Set precise goals for criteria other than biodiversity.
4. Review existing conservation areas: • Estimate the extent to which conservation targets are met by the existing set of conservation areas.
5. Prioritize new places for potential conservation action Prioritize places for their biodiversity content to create a set of potential conservation area networks; Optionally, starting with the existing conservation area networks as a constraint, repeat the process of prioritizationn to compare results; • Incorporate design criteria such as minimum size and connectivity.
6. Assess prognosis for biodiversity for each potential targeted place: Perform population viability analysis for as many species using as many models as feasible; Perform the best feasible habitat-based viability analysis to obtain a general assessment of the prognosis for all species in a potential conservation area;

• Assess vulnerability of a potential conservation area from external threats, using techniques such as risk analysis.
7. Refine networks of places targeted for conservation action: Delete the presence of surrogates from potential conservation areas if the viability of that surrogate is not sufficiently high; Run the prioritization program again to prioritize potential conservation areas by biodiversity value; • Incorporate design criteria such as minimum size and connectivity.
8. Perform feasibility analysis using multiple criterion synchronization: Order each set of potential conservation areas by each of the criteria other than biodiversity; Find all best solutions; Discard all other solutions; • Select one of the best solutions.
9. Implement conservation plan: Decide on most appropriate legal mode of protection for each targeted place; Decide on most appropriate mode of management for persistence of each targeted surrogate; If implementation is impossible return to Stage 5; Decide on a time frame for implementation, depending on available resources.
10. Periodically reassess the network: Set management goals in an appropriate time-frame for each protected area; Decide on indicators that will show whether goals are met; Periodically measure these indicators; • Return to Stage 1.

Fuente: Sarkar, Sahotra. 2004.

Example Criteria and Methodologies for Prioritizing Indicators

(http://science.nature.nps.gov/monitor/docs/CriteriaExamples.doc)

This document includes a number of different examples of ho w various groups or programs have prioritized ecological indicators based on a set of criteria.

Incluye los siguientes documentos:

Section 1: Example criteria for evaluating ecological indicators

EPA's evaluation guidelines for ecological indicators (Jackson et al. 2000)

Considerations For The Development Of A Terrestrial Index Of Ecological Integrity (Andreasen et al. 2001)

Planning Approach For Developing Inventory And Monitoring Programs In National Parks (Analytical Hierarchy Process - Peterson et al. 1995)

Challenges In The Development And Use Of Ecological Indicators (Dale and Beyeler 2001)

Lake Mead National Recreation Area Vital Signs Workshop Summary (NPS 1999)

Conceptual basis for designing an effectiveness monitoring program (Noon et al. 1999)

Canada's Ecological Monitoring And Assessment Network's Proposed Core Monitoring Variables: An Early Warning Of Environmental Change (Tegler et al. 2001)

Section 2: Methodologies

Example of the Analytical Hierarchy Process for Olympic NP (Jenkins et al. 2002)

Analytical Group Decision Making In Natural Resources: Methodology And Application (Schmoldt and Peterson 2000)

Northern Colorado Plateau Network's Summary of Criteria used to rank indicators, from ecological literature (from Mark Miller)

Articulos en PNAS sobre "systematic conservation planning"

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La infraestructura de datos espaciales de la comunidad valenciana (idecv) y el software de codigo abierto. dos caminos confluyentes.Gabriel Carrión Rico. Conselleria de Infraestructuras y Transporte Generalitat Valenciana Carrion_gab@gva.es

An Adaptive Ecosystem Approach to Monitoring: Developing policy performance indicators for Ontario Ministry of Natural Resources **by *Michelle Boyle*.** *The following document was written to fulfil academic requirements for a Master in Environmental Studies degree from the University of Waterloo, Canada (1998)*

4. SOFTWARE

La siguiente lista de software no pretende ser exhaustiva y su objetivo es ilustrar las herramientas tecnológicas disponibles para el análisis de datos y geodatos así como para el la planificación ecoregional.

Planificación para la conservación

Software	Descripción
ConsNet	Advanced Software for Systematic Conservation Planning. ConsNet is a comprehensive software package for the design and analysis of conservation area networks (CANs) to represent biodiversity. http://uts.cc.utexas.edu/~consbio/Cons/consnet_home.html
MultCSync-1.0	http://uts.cc.utexas.edu/~consbio/Cons/MultCSync-1.0.zip
LQGraph-1.0.zip	Análisis de conectividad http://uts.cc.utexas.edu/~consbio/Cons/LQGraph-1.0.zip http://groups.google.com/group/bbcl_software/files
The C-Plan Conservation Planning System	http://www.uq.edu.au/ecology/index.html?page=101951
Marxan	It provides decision support to a range of conservation planning problems, including: * the design of new reserve systems * reporting on the performance of existing reserve systems * developing multiple-use zoning plans for natural resource management This version is modified for compatability with the Zonae Cogito decision support system. It functions identically to version 2.0.2, although is around twice the speed as version 2.0.2. http://www.uq.edu.au/marxan/index.html?page=78412&pid=
Zonae Cogito	Zonae Cogito is designed as a simple and robust way to run Marxan analyses and view their results. http://www.uq.edu.au/marxan/index.html?page=106777&pid=
CLUZ	CLUZ (Conservation Land-Use Zoning software) is an ArcView GIS interface that allows users to design protected area networks and conservation landscapes. It can be used for on-screen planning and also acts as a link for the Marxan conservation planning software. http://www.kent.ac.uk/dice/cluz/

Software	Descripción
Habitat Priority Planner	This tool aids in making decisions about habitat conservation, restoration, and land use planning. Requiere ArcGis 9.2 ó 9.3 y analista especial. http://www.csc.noaa.gov/digitalcoast/tools/hpp/index.html Presentación PPT http://www.csc.noaa.gov/digitalcoast/tools/hpp/files/hpp.wmv
Indicators of Hydrologic Alteration IHA	The Indicators of Hydrologic Alteration (IHA) is a software program that provides useful information for those trying to understand the hydrologic impacts of human activities or trying to develop environmental flow recommendations for water managers. http://www.nature.org/initiatives/freshwater/conservationtools/art17004.html
Ecosystem-Based Management Tools	EBM tools are software or other highly documented methods that can help implement EBM by: -Providing models of ecosystems or key ecosystem processes. -Generating scenarios illustrating the consequences of different management decisions on natural resources and the economy. -Facilitating stakeholder involvement in planning processes. http://www.ebmtools.org/

Modelar distribución esperada de especies a partir de registros y requerimientos de hábitat

Software	Descripción
GARP	DesktopGarp is a software package for biodiversity and ecologic research that allows the user to predict and analyze wild species distributions. http://www.nhm.ku.edu/desktopgarp/
Maxent	Maxent software for species habitat modeling http://www.cs.princeton.edu/~schapire/maxent/
Opennlp.maxent	The opennlp.maxent package is a mature Java package for training and using maximum entropy models. http://maxent.sourceforge.net/
openModeller	OpenModeller is a fundamental niche modelling library, providing a uniform method for modelling distribution patterns using a variety of modelling algorithms. http://openmodeller.sourceforge.net/
Biomapper	GIS-toolkit to model ecological niche and habitat suitability http://www2.unil.ch/biomapper/

Sistemas de Información Geográfica Gratuitos

Software	Descripción
DIVA GIS	Sistema de Información Geográfico http://www.diva-gis.org/download
Quantum GIS	Sistema de Información Geográfico. Interfaz en español. Quantum GIS (QGIS) is a user friendly Open Source Geographic Information System (GIS) licensed under the GNU General Public License. QGIS is an official project of the Open Source Geospatial Foundation (OSGeo). It runs on Linux, Unix, Mac OSX, and Windows and supports numerous vector, raster, and database formats and functionalities. http://www.qgis.org/
GRASS	Sistema de Información Geográfico. Commonly referred to as GRASS, this is free Geographic Information System (GIS) software used for geospatial data management and analysis, image processing, graphics/maps production, spatial modeling, and visualization. GRASS is currently used in academic and commercial settings around the world, as well as by many governmental agencies and environmental consulting companies. http://grass.osgeo.org/
MapWindow GIS	Sistema de Información Geográfico. Interfaz en español. http://www.mapwindow.org/
gVSIG	Sistema de Información Geográfico. Interfaz en español. http://www.gvsig.gva.es/
Kosmo Desktop	La funcionalidad de Kosmo es similar a la de ArcView 3.x de ESRI. Interfaz en español. (http://www.opengis.es/)
SPRING	**SPRING** es un GIS (**S**istema de **I**nformación **G**eográfica) y al mismo tiempo un sistema de tratamiento de imágenes obtenidas mediante percepción remota que realiza la integración de las representaciones de datos matriciales ("estructura raster") y datos con estructura vectorial en un único ambiente. http://www.dpi.inpe.br/spring/espanol/index.html
SavGIS	SavGIS – Sistema de Información Geográfico. Programa gratuito, bajo MS Windows (98, 2000, XP, Vista). Gestión y uso de bases de datos geográficos, consultas por atributos y geoespaciales, diversos tipos de enlaces y uniones; numerosos métodos de clasificación, cartografía temática, estadística y geo-estadística, análisis espacial, interpolaciones, modelos numéricos de terreno, teledetección y tratamiento de imágenes, simulación, investigación operativa, cálculos métricos interactivos, digitalización, georeferenciación de imágenes, rectificación vectorial, simulación de vuelo, transformación de coordenadas (cambiando o no el sistema geodésico - *datum)*, gestión de macro-comandos, importación y exportación de datos (*Shapefile,*

	GeoTIFF…), gestión optimizada del resultado de las consultas (no se duplica inútilmente los archivos), ventana Google Maps. Interfaz en español. http://www.savgis.org/es/
MultiSpec	MultiSpec results from an on-going multiyear research effort which is intended to define robust and fundamentally based technology for analyzing multispectral and hyperspectral image data, and to transfer this technology to the user community in as rapid a manner as possible. http://cobweb.ecn.purdue.edu/~biehl/MultiSpec/
Free and Open Source Desktop GIS	An Overview on Current Free and Open Source Desktop GIS Developments. (revised version from Sept. 2008; final 2009 version DOI: 10.1080/13658810802634956) http://www.geo.unizh.ch/publications/degen/sstein_foss_desktop_gis_overview.pdf
Sitios Web con listas de software de SIG gratuitos	The FreeGIS Project: Provides software overview on Free Geographic Information Systems (our web site). Communication on developments, plans, infos on Free GIS Software and Free Geo-Data. www.freegis.org MapTools.org: Hosts mapping related open source projects. http://www.maptools.org/ OSGeo.org: Hosts and supports various open source software projects related to remote sensing, GIS, mapping and advanced image processing. http://www.osgeo.org/ Open Source GIS: Attempt to build a complete index of Open Source / Free GIS related software projects. www.opensourcegis.org
Mapas e Internet	FlashIMS: Generic, fast and easy to customize Flash Macromedia client for ArcIMS (ESRI). Developed as open source coordinated by Jan Bliki (EEA). http://www.bliki.com/flashims/ Mapserver: MapServer is an OpenSource development environment for constructing spatially enabled Internet-web applications. http://mapserver.gis.umn.edu/ nMap: nMap is a simple-to-use map renderer that renders GIS vector data and WMS for use in web and desktop applications. Open source code written in #C. http://nmap.iter.dk/
Creación de paletas para mapas	Crear paletas de colores para diferentes usos (pantalla, imprimir a color, blanco y negro). http://colorbrewer2.org/
GPS Trackmaker	Software gratuito para descargar y carga datos a su receptor de GPS http://www.gpstm.com/index.php
DNRGarmin	Software gratuito para descargar y carga datos a su receptor Garmin de

	GPS http://www.dnr.state.mn.us/mis/gis/tools/arcview/extensions/DNRGarmin/DNRGarmin.html

gvSIG gvSIG: Software Libre para el manejo de : Software Libre para el manejo de Información Geoespacial Información Geoespacial Informe de Estado Informe de Estado. Gabriel Carrión Rico Gabriel Carrión Rico Director del Proyecto gvSIG. Conselleria de Infraestructuras y Transporte Generalitat Valenciana. II Jornadas de SIG Libre II Jornadas de SIG Libre Girona, 3, 4 y 5 de Marzo de 2008 Girona, 3, 4 y 5 de Marzo de 2008.

gvSIG gvSIG: Sistema de Información Geográfica. En: Sistema de Información Geográfica en Software Libre de la Generalitat Valenciana. Mario Carrera Rodríguez carrera_marrod@gva.es

gvSIG: El S.I.G. LIBRE DE LA GENERALITAT VALENCIANA. Francisco José Peñarrubia Martínez. IVER T.I. S.A fpenarru@iver.es

SPRING: Integrating remote sensing and GIS by object-oriented data modelling. Camara G, Souza RCM, Freitas UM, Garrido. J Computers & Graphics, 20: (3) 395-403, May-Jun 1996.

Análisis de biodiversidad

Software	Descripción
Species Diversity & Richness (SDR)	http://www.evri.ca/english/tour.htm. Programa comercial.
R Tools for Biologists (RT4Bio)	R Tools for Biologists (RT4Bio) is a multi-functional package writen in R language developed in the Laboratory of Behavioral and Computational Ecology at State University of Montes Claros - MG - Brazil. Formerly known as RRJ.
EstimateS	EstimateS 8.2 is a free software application for Windows and Macintosh operating systems that computes a variety of biodiversity functions, estimators, and indexes based on biotic sampling data. http://viceroy.eeb.uconn.edu/estimates
Biodiversity software Technical Bulletins series	http://www.irri.org/science/software/biodiversity.asp
BioDiversity Pro	http://www.sams.ac.uk/research/software/research/software/bdpro.zip
EcoSim	**EcoSim** is an interactive computer program for null model analysis in community ecology. **EcoSim** runs in the Windows 95 (or later) operating environment http://www.garyentsminger.com/ecosim/index.htm
SAM	SAM: Spatial Analysis in Macroecology. SAM, downloadable freeware developed by Thiago Rangel and colleagues, is a compact but robust computer program designed as a package of statistical tools for spatial analysis, mainly for applications in Macroecology and Biogeography. SAM runs under Microsoft Windows as as a user-friendly, menu-driven, graphical interface computational program. SAM offers a wide spectrum of statistical methods currently used in Surface Pattern Spatial Analysis. Sam fills most current scientific and analytical needs of Macroecologists, Biogeographers and Geographical Ecologists who study broad scale biological patterns and processes. http://www.ecoevol.ufg.br/sam/
vegan: R functions for vegetation ecologists	The VEGAN package is intended to help vegetation ecologists and other community ecologists to use *R*. It contains all major ordination methods, ecologically meaningful dissimilarity indices, tools to analysis of diversity, species richness and abundance models, plus numerous support functions. http://cc.oulu.fi/~jarioksa/softhelp/vegan.html
R Labs for Vegetation Ecologists	This section of the Laboratory for Dynamic Synthetic Vegephenonenology (LabDSV) includes tutorials and lab exercises for a course in quantitative analysis and multivariate statistics in vegetation ecology. http://ecology.msu.montana.edu/labdsv/R/labs/

Distance	Distance is a Windows-based computer package that allows you to design and analyze distance sampling surveys of wildlife populations. http://www.ruwpa.st-and.ac.uk/distance/index.html

Ecología del paisaje

Software	Descripción
Percent Edge Tool	The Percent Edge Tool is an ArcMap tool. The Percent Edge Tool performs the following calculations for each polygon in a polygonal GIS layer: area, compactness, perimeter, edge lengths with adjacent polygons, and percentage of edge with adjacent polygons. http://www.umesc.usgs.gov/management/dss/percent_edge_tool.html
Geographic Information Tools for Landscape Ecology	Free and Open Source Geographic Information Tools for Landscape Ecology. (revised version from July 2009; final version DOI: 10.1016/j.ecoinf.2009.07.004) http://www.geo.unizh.ch/publications/sstein/sstein_freegitools_ecoinf2009.pdf
LINK: ArcGIS Tools for Conservation Planning	LINK is a set of Environmental Systems Research Institute (ESRI) ArcGIS tools designed to analyze habitat patterns across a landscape. http://www.umesc.usgs.gov/management/dss/bird_conservation_tools_link.html
Fragstats	FRAGSTATS is a computer software program designed to compute a wide variety of landscape metrics for categorical map patterns. http://www.umass.edu/landeco/research/fragstats/fragstats.html
Landscape ecology Fragmentation Habitat Corridor Designer toolbox	Extensiones para ArcView y ArcGIS http://arcscripts.esri.com/
Conefor Sensinode 2.2	**Conefor Sensinode 2.2** (CS) is a new software package that allows quantifying the importance of habitat areas for the maintenance or improvement of landscape connectivity. It is conceived as a tool for decision-making support in landscape planning and habitat conservation, through the identification and prioritization of critical sites for ecological connectivity. http://www.conefor.org/
FocalPatch	The FocalPatch Extension runs Fragstats on a moving window basis within the ArcView 3.x environment. A sampling point theme is created from an existing grid. For each point, a circular group of cells is extracted from a landcover grid. The center is the sampling point, and the radius is user-defined. Fragstats is run on the extracted group of cells, and landscape metrics are calculated. Landscape metrics are then placed in an output table for eack point. Other functions: Utilization distribution intersection calculation.

	Utilization distribution calculation from a kernel grid. http://gis.washington.edu/phurvitz/av_devel/focalpatch/index.html
The **LMS** Analyst Extension	The LMS Analyst extension was created to update polygon-level landform attributes for forest stands. The analyst computes mean elevation, slope, and aspect on a stand-by-stand basis. The analyst needs an ArcInfo polygon coverage or ArcView shapefile representing forest stands (or other polygons) as well as an ArcInfo format grid representing elevation (or other Z-value). http://gis.washington.edu/phurvitz/av_devel/lms_analyst/index.html

Sitios de interés

Society for Conservation GIS	The Society for Conservation GIS (SCGIS) assists conservationists worldwide in using GIS through communication, networking, scholarships, and training. Membership is open to any individual seeking assistance in the achievement of personal or organizational conservation goals. http://www.scgis.org/
Environmental Valuation Reference Inventory	The Environmental Valuation Reference Inventory™. The EVRI is a searchable storehouse of empirical studies on the economic value of environmental benefits and human health effects. http://www.evri.ca/English/default.htm
The Millennium Ecosystem Assessment Current State & Trends Assessment Ecosystems and Human Well-being A Framework for Assessment Sub-Global Assessments	The Millennium Ecosystem Assessment assessed the consequences of ecosystem change for human well-being. From 2001 to 2005, the MA involved the work of more than 1,360 experts worldwide. Their findings provide a state-of-the-art scientific appraisal of the condition and trends in the world's ecosystems and the services they provide, as well as the scientific basis for action to conserve and use them sustainably. http://www.millenniumassessment.org/en/index.aspx http://www.millenniumassessment.org/en/Condition.aspx#download http://www.millenniumassessment.org/en/Framework.aspx http://www.millenniumassessment.org/en/Multiscale.aspx
GBIF	The Global Biodiversity Information Facility (GBIF) http://www.gbif.org/
Software for Biological Collection Management	Lista de programas utilizados para la gestión de colecciones biológicas. http://www.bgbm.fu-berlin.de/TDWG/acc/software.htm
AmphibiaWeb	AmphibiaWeb is an online system that provides access to information on amphibian declines, conservation, natural history, and taxonomy. http://amphibiaweb.org/
IUCN Red Lis	Lista de species amenazadas http://www.iucnredlist.org/

Biodiversity Informatics Facility	The Biodiversity Informatics Facility at the American Museum of Natural History's Center for Biodiversity and Conservation strives to utilize information technologies in biodiversity research and applications while developing and promoting the effective use of these technologies for biodiversity conservation around the world. This site provides a growing set of practical resources for those interested in using information technologies for biodiversity conservation. http://biodiversityinformatics.amnh.org/