MAKING SMART CONSERVATION DECISIONS HUGH P. POSSINGHAM . [ET AL.] pdf

1: Predicting species distributions for conservation decisions

Possingham et al. Conservation Decisions September Making Smart Conservation Decisions (To appear as a chapter in "Research priorities for nature conservation" in - a book sponsored by the Society for Conservation Biology and edited by Soule, Orians and Kohm) 1,2 H. P. Possingham, S. J. Andelman2, B. R. Noon3, 4 S. Trombulak, and H.R Pulliam5.

Show Context Citation Context Various definitions of adaptive management are available in literature e. The approach is grounded in the admission that issues involved in natural resour Acroptilon repens is an herbaceous perennial that propagates by seeds and vegetative means. Its natural range extends from Turkey throughout Central Asia to China. Our objective was to determine density and expanding Our objective was to determine density and expanding of A. The patche experiments were conducted for an 6 undisturbed meadow in Shoot density and height of A. In addition to this, the shoot density of A. The shoot density of A. The patches of A. Acroptilon repens is an invasive weed in NorthsAmerica but also causes problems in disturbed habitats in its native range in Asia. Thus, there is a need for more eVective and eYcient methods of risk analysis for biological control agents. We show how the pr We discuss the risks posed by weed biolog-ical control agents, and present a simple individual-based model of herbivorous insect movement and oviposition on two species of host plant, a target invasive plant species and a non-target native species, in simulated landscapes. The model shows that risks of non-target impacts may be inXuenced by the details of the movement behavior of biological control agents in heterogeneous land-scapes. The speciWc details of insect movement that appear to be relevant are readily measured in Weld trials and the general modeling approach is readily adapted to real landscapes. Current biological control risk assessments typically emphasize eVects analysis at the expense of exposure analysis; the modeling approach presented here provides a simple and feasible way to incorporate exposure analyses. We conclude that models such as ours should be given serious consideration as part of a comprehensive strategy of risk assessment for proposed weed biological control agents. Acknowledgments This research was performed under Cooperative Agreement No. Damage caused by capybaras in agroecossystems in Brazil has been frequently observed. The objective of this study was to describe and quantify the actual damage caused by capybaras in a corn field, aiming to get basic information on how, how much, and where these damage occur. Avoiding corn plantation in areas adjacent to forest fragments used by capybaras and, when possible, controlling capybara population may lead to a reduction of damage occurrence in agroecossystems. In wildlife management, the program of monitoring will depend on the management objective. If the objective is damage mitigation, then ideally it is damage that should be monitored. Alternatively, population size N can be used as a surrogate for damage, but the relationship between N and damage ob Alternatively, population size N can be used as a surrogate for damage, but the relationship between N and damage obviously needs to be known. If the management objective is a sustainable harvest, then the system of monitoring will depend on the harvesting strategy. In general, the harvest strategy in all states has been to offer a quota that is a constant proportion of population size. This strategy has a number of advantages over alternative strategies, including a low risk of over- or underharvest in a stochastic environment, simplicity, robustness to bias in population estimates and allowing harvest policy to be proactive rather than reactive. However, the strategy requires an estimate of absolute population size that needs to be made regularly for a fluctuating population. Trends in population size and in various harvest statistics, while of interest, are secondary. This explains the large research effort in further developing accurate estimation methods for kangaroo populations. Direct monitoring on a large scale is costly. Aerial surveys are conducted annually at best, and precision of population estimates declines with the area over which estimates are made. Management at a fine scale temporal or spatial therefore requires other monitoring tools. Indirect monitoring through harvest statistics and habitat models, that include rainfall or a greenness index from satellite imagery, may prove useful. Idels , " Fishery management typically involves many sources of uncertainty. Fish populations respond to variable events in nature, often unknown to fishery managers. The available data usually contain high levels of measurement error. Marine reserves offer a potential management tool for dealing with these u Marine reserves offer a potential management tool for dealing with these uncertainties. Protected populations in areas closed to all fishing could act as buffers that mitigate excessive fishing elsewhere. Furthermore, reserves could help maintain healthy ecosystems with natural levels of species and habitat diversity. As the world population grows, pressure increases to harvest unsustainable quantities of our marine resources. Marine reserves offer an alternative strategy that could supplement or even replace the attempt to define safe harvest limits. In this project we use mathematical models to examine management strategies associated with fully protected marine reserves. We consider two linked populations in adjacent areas, where one is exposed to fishing and the other is not. Our models allow us to explore the influence of a reserve on the levels of stock biomass and catch. Associated software would make it easy for students and researchers to investigate potential options for effective harvest management in the context of protected marine populations. Potential impacts of the research Powered by:

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2: Professor Hugh Possingham - School of Mathematics and Physics - University of Queensland

Making smart conservation decisions. Possingham et al. Conservation Decisions September 1. Hugh P Possingham; The Adriatic and Ionian Region (AIR) is an important area for both.

Find articles by Tara G. Marra Find articles by Peter P. Possingham Find articles by Hugh P. Discussion of results and editing of manuscript: Received Mar 20; Accepted Jun Copyright Martin et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are properly credited. This article has been cited by other articles in PMC. Abstract Background Migratory animals comprise a significant portion of biodiversity worldwide with annual investment for their conservation exceeding several billion dollars. Designing effective conservation plans presents enormous challenges. Migratory species are influenced by multiple events across land and seaâ€"regions that are often separated by thousands of kilometres and span international borders. To date, conservation strategies for migratory species fail to take into account how migratory animals are spatially connected between different periods of the annual cycle i. Employing a decision theoretic approach using dynamic optimization, we address the problem of how to allocate resources for habitat conservation for a Neotropical-Nearctic migratory bird, the American redstart Setophaga ruticilla, whose winter habitat is under threat. Our first conservation strategy used the acquisition of winter habitat based on land cost, relative bird density, and the rate of habitat loss to maximize the abundance of birds on the wintering grounds. Our second strategy maximized bird abundance across the entire range of the species by adding the constraint of maintaining a minimum percentage of birds within each breeding region in North America using information on migratory connectivity as estimated from stable-hydrogen isotopes in feathers. We show that failure to take into account migratory connectivity may doom some regional populations to extinction, whereas including information on migratory connectivity results in the protection of the species across its entire range. Our framework can be used to identify efficient conservation strategies for migratory taxa worldwide, including insects, birds, mammals, and marine organisms. Protecting these species presents a unique conservation challenge because population abundance is influenced by geographically separated events that occur during different periods of the year [2]. If maximizing population persistence is a central goal of species conservation [3] , then the optimal allocation of resources for conserving migratory species should consider population dynamics throughout the annual cycle, not just during a single period of the year. However, the lack of information on how populations are geographically linked between periods of the annual cycle i. Global estimates for this same fiscal year are likely to be several billion if all migratory species are considered [6]. Current strategies used to allocate funds are ad-hoc or based on ranking methods [7] and fail to incorporate both migratory connectivity and the cost of implementing the conservation action. Several recent studies addressing cost-effectiveness in conservation planning provide guidance on how to estimate where, when and how much to invest for the conservation of non-migratory species [7] â€" [10]. We build upon these approaches using a unique dataset from a long-distance migratory songbird, the American redstart Setophaga ruticilla , to examine whether incorporating migratory connectivity into habitat protection schemes influences decisions designed to maximize the persistence of populations. We demonstrate for migratory species how failure to include estimates of migratory connectivity leads to the improper formulation of the problem and could doom regional populations to near extinction. Results Following a decision theoretic framework [7] , [11] , [12] , we employed an optimal search algorithm Dijkstra [13] to find optimal resource allocation strategies for two problems; first, to maximize the number of birds protected across the wintering range, and second, to maximize the number of birds protected across the entire range of the species by adding the constraint of maintaining a minimum population size within each of five temperate breeding regions see Materials and Methods. To solve the first problem, we developed an optimization model where sequential decisions to acquire parcels of wintering habitat, within a fixed budget and time period, were based on rates of winter habitat loss, land value, and the relative density of birds in each wintering region Table 1 ; see Supporting Information, Text S1 i, ii. This information allowed us to estimate the relative change in abundance of breeding populations as a result of habitat conservation on the wintering grounds. Although we used land acquisition as our mechanism to preserve populations, our models can readily incorporate ongoing management costs [15] and other conservation strategies such as easements or active management [10].

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Using decision theory, conservation triage can be illustrated as a process of resource allocation. Decision theory guides decision makers in achieving explicitly stated objectives while acknowledging the constraints of the system (e.g. money, time and capacity) involved with the decision process.

Growing biodiversity banking Bekessy, Sarah A. Planning for persistence in a changing world Fuller, Richard A. Planning for persistence in a changing world. Ladle and Robert J. Past, present and future Watson, James E. Past, present and future. Prioritizing trade-offs in conservation. Adams and Robert J. Deciding what to save pp. Reassessing the spatial and temporal dynamics of kangaroo populations. The biology of kangaroos, wallabies and rat-kangaroos pp. Trade-offs in identifying global conservation priority areas. A mathematical classification of conservation prioritization problems. In Atte Moilanen, Kerrie A. Wilson and Hugh P. Accounting for habitat dynamics in conservation planning Possingham, Hugh P. Accounting for habitat dynamics in conservation planning. From theory to practice: Designing and situating spatial prioritization approaches to better implement conservation action. Designing and situating spatial prioritization approaches to better implement conservation action.. Software for spatial conservation prioritization Ball, Ian R. Software for spatial conservation prioritization.

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4: CiteSeerX â€” Citation Query State-dependent decision analysis for conservation biology. In

Making smart conservation decisions.: Springer, ; Google Scholar If costs are considered in planning, decision makers are aware of the opportunity cost of funds that are directed away from particular conservation actions, leading to greater returns on investment [.

Master and David A. Keith Abstract Threatened species lists are designed primarily to provide an easily understood qualitative estimate of risk of extinction. Although these estimates of risk can be accurate, the lists have inevitably become linked to several decision-making processes. There are four ways in which such lists are commonly used: The lists were not designed for any one of these purposes, and consequently perform some of them poorly. We discuss why, if and how they should be used to achieve these purposes. Governments and nongovernmental organizations produce threatened species lists for three main reasons: Moreover, in many countries there is a direct connection between threatened species lists and legislation e. The ideal characteristics of these lists, and the protocols for generating them, will depend on the specific objectives. Regardless of who generated the list, there are three classes of user group: All protocols result in an assessment of threat, couched in words that reflect the probability of decline or loss of a taxon at different regional scales [3]. Some are designed to apply within a local region or state [4â€"6], whereas others have national [7â€"9], or international status [10,11], or are used at multiple political scales [12â€"14]. Some have also been developed for specific taxonomic groups [15â€"17]. These protocols share many attributes and use similar information, such as population size, extent, number of populations and trends in at least some of these variables. Because of the variety of objectives and users, the interpretation of lists is variable, and most are used for more than one purpose, regardless of their original intent. Here, we critically assess four ways in which threatened species lists are commonly used. We argue that they are used for purposes beyond their original intent; furthermore, they perform some of these uses poorly. The protocols used to generate lists differ in the extent to which they consider management variables, taxonomic status, recoverability and assessments of past or future trends. In addition, they employ different logical systems to interpret data, treat missing data differently, and apply different weights to the variables. As a result, the level of correspondence among classifications resulting from different methods can be low, even when using the same data [18]. Given the widespread use of such lists to allocate scarce conservation resources, before application, users need to ask the question: Should lists of species at risk guide resource allocation for species recovery? Threatened species classification systems provide a method for highlighting those species under higher extinction risk, so as to focus attention on conservation measures designed to protect them [10]. Most of the lists in Table 1 are used to prioritize species recovery and habitat protection activities with the aim of minimizing future extinctions [12,17,19]. Agencies in most countries must decide how to allocate resources among species, and often the only metric guiding these decisions is species conservation status. As a rule of thumb, more funding is allotted to species in the highest threat categories within a taxonomic group. For example, of the 18 completed Australian national recovery plans for plants, 17 were for species in the highest risk category [19]. It is inappropriate to use threatened species lists for resource allocation. Resources for conservation are limited. Spending the most money on species with the highest extinction probabilities is not the most efficient way of promoting recovery or minimizing global extinction rates, because some of the most highly ranked species require huge recovery efforts with a small chance of success, whereas other, less threatened taxa might be secured for relatively little cost. To minimize overall species loss, we should allocate resources to recovery actions such that the marginal rate of increase in viability is equalized across all threatened species. Status is only part of the information required for resource allocation, and this approach to threatened species recovery has been acknowledged in discussions of triage [20]. Figure 1 provides two examples of how optimal allocation of resources for threatened species leads to allocations that are very different to those based solely on threatened species rank. The examples show that the optimal allocation of funds does not mean that the most threatened species receive the most funding, although they rely on a crude understanding of how recovery actions influence probability of extinction. Should lists of species at risk be used to set priorities for reserve selection? Reserve selection algorithms seek to conserve biodiversity as efficiently and completely as possible [21,22]. Conserving populations of threatened species often drives and simplifies reserve system planning. For example, Ceballos et al. Given the social and legal importance of threatened species, protecting such species might take precedence over other criteria. Although simplifying complex problems makes sense, there is no biological justification for using threatened species alone as an umbrella group for all biodiversity. The use of threatened species as surrogates for biodiversity is limited, because most invertebrate animals and nonvascular plants do not appear on any threatened species lists. The use of single threatened species as umbrella species for biodiversity conservation is particularly problematic [25â€”27]. For example, in southern California, the presence of the California gnatcatcher Polioptila c. However, Rubinoff [27] found that the presence of the gnatcatchers was a poor indicator of habitat value for coastal sage scrub biota, and prioritizing acquisition based on patch size protected more biodiversity. Furthermore, not all listed species will benefit from inclusion in a reserve system. Such species, regardless of their status, should not influence reserve design. Using listed species to design reserve systems runs into the same logical flaws as the use of lists to set resource allocation priorities. A high risk of extinction does not imply a high priority for an action, in this case reserve dedication. We need to set priorities for reserve selection using a decision theory approach so that the reserve system maximizes a specific objective, such as securing as many species as possible within socioeconomic constraints [28]. For example, Araujo and Williams [29] maximize the probability of persistence across species to identify networks of conservation areas. The intended purpose and actual uses of some threatened species list protocols Should threatened species lists be used to constrain development or exploitation? In most countries, environmental impact processes evaluate the likelihood that development will affect any threatened species. Most environmental regulations are implemented in a way that assumes development activities are benign, until proven otherwise. This policy places the burden of proof on stakeholders who seek to protect public good or public values [30]. Threatened species lists are one of the few tools at the disposal of regulatory agencies and the public to limit adverse environmental impacts of development. When a proposed development action is judged to increase risks to threatened species, that activity might be modified or postponed. If there is no evidence that listed species are present, or impacts are negligible, development can proceed. There are many examples in which the presence of a threatened species has been a serious impediment to some human activity e. The pros and cons of endangered species legislation have been extensively debated, and we add only three points. First, the binary nature of lists can lead to the illogical outcome that developments with small impacts might be curtailed by a listed species, but developments with large impacts on one or more nonlisted species proceed with no mitigation requirements. An alternative approach is to consider the impact of developments on a much wider array of elements of biodiversity at a site and ask the question: This would disentangle the listing process from the Environmental Impact Assessment process. Second, the high-profile application of threatened species lists to constrain development affects the listing process itself. Even in instances where listing decisions are purported to be based on criteria of extinction risk, economic or social criteria can override scientifically based criteria S. This can lead to subjectivity in the lists. Third, listing might increase threats to a species. When the presence of a threatened species in an area is viewed as an impediment to a particular land use, land managers might destroy habitat, deny the presence of the species or deny access to the area for researchers or government officials. This is an unintended consequence of a threatened species list when incentives for landowners to conserve threatened species on their properties are lacking. Two solutions to the problem of allocating resources to recover threatened species. The lines represent the way in which the risk of extinction declines for each species as money is spent on that species in this simple example, actions are assumed to affect species independently. With no allocation of resources to any species, the CE species has a higher extinction probability than does the E species, which, in turn, has a higher extinction probability than does the V species.

Allocation of funds is assumed to reduce extinction probabilities differently. If the objective is to minimize loss of species then the optimal allocation of funds is found when the marginal rate of gain for each species is the same. With a small allocation of funds circle the optimal strategy allocates most funding to the V species, less to the CE and none to the E species. With a larger budget square most of the money should be spent on the CE species, some on the V species and little on the E species. Should threatened species lists be used to indicate changes in the status of biodiversity? Threatened species lists are used to report on the state of the environment, based on statistics derived from: There are many examples of the application of these statistics. At an international level, they include the Montreal criteria [31], Article 7 of the Convention on Biological Diversity, and the global assessments of impact provided by organizations such as the World Resources Institute [32]. At the national level, in the USA, the US Fish and Wildlife Service, the National Marine Fisheries Service and the Heinz Center provide annual reports on the status of species or ecosystems based on these lists [33]; and, in Australia, the State of the Environment Report used them to provide an assessment of human impacts on the environment [1]. Such measures influence public awareness of conservation objectives. In theory, they provide a benchmark for the extent and severity of human impacts, and a basis for comparing impacts between places, between taxa, and over time. In reality, threatened species lists might have limited value as indicators of changes in the state of the environment because of: Almost all lists, both official and unofficial, substantially under-represent some taxa, particularly insects and fungi. In Australian, US Federal and international lists, there is significant bias towards large species and those that are close to humans in evolutionary terms [35,36]. Any biases resulting from the personal interests of the experts making the decisions might result in inflated lists of species at risk for a few taxa, eroding the credibility of the entire list, and of changes in those lists from one period to another. However, in groups that are thoroughly evaluated, the relative differences in number among taxa might actually reflect differences in threat. Comparisons of lists among areas, among taxa, or through time are also compromised by differences in survey intensity. For example, the list of threatened species in South Africa is much longer than that from any other African nation, in part, because the survey effort in that country has been higher than in its neighbors [38]. To eliminate survey effort bias, metrics from threatened species lists should be scaled to account for the number of species that have been assessed, and for the number for which there are sufficient data to make an assessment. Most changes in the composition of threatened species represent changes in knowledge. When the causes of status change are not apparent, changes in knowledge and taxonomy mask true changes in conservation status. For example Master et al. The primary cause of the increase was the addition of numerous plants, reflecting backlogs in processing information through formal channels. The number of species listed at risk in Australia increased from in to in , most of which were due to the increasing numbers of assessments [19,39]. BirdLife International noted a total of bird species threatened with global extinction in [40]. This figure increased to in , most of which was attributed to taxonomic changes and improved knowledge. We do not generally recommend using threatened species lists as they are currently constructed for indicating changes in the state of the environment, except where comprehensive data are maintained on well-studies groups e. Conclusions There is no doubt that threatened species lists fulfil important political, social and scientific needs.

5: Altmetric â€“ Is conservation triage just smart decision making?

Is Conservation Triage Just Smart Decision Making? Conservation efforts and emergency medicine face comparable problems: how to use scarce resources wisely to conserve valuable assets. In both fields, the process of prioritising actions is known as triage.

Hugh Possingham Possingham et al. Conservation Decisions September Introduction In little more than a decade, conservation biology has generated a large and growing body of theory aimed at predicting and managing the impacts of anthropogenic activities on populations, species and ecosystems e. However, to succeed in its mission, conservation biology must do more than generate theories and principles. Conservation biologists must use their theories to deliver effective, science-based decision tools for practical use by managers and policy makers. Furthermore, to demonstrate the efficacy of conservation biology theory and applications to skeptical managers, conservation biologists must also establish feasible yet reliable monitoring programs to detect key trends and effects and determine the effectiveness of decisions Kareiva et al. Transforming pure science - whether theoretical or empirical - into information that can actually be used by managers and decision-makers to address the sorts of conservation problems outlined throughout this volume remains a major challenge in conservation biology. To meet this challenge, the next generation of conservation biologists will need to embrace more economics, more management science, more decision theory and more operations research. This chapter has two broad objectives. First, we outline the key elements for how to make smart conservation decisions and measure their benefits â€” an outline that is applicable to the sorts of conservation problems discussed in this book. With this framework in mind, we then highlight priorities and directions for future research. We begin by discussing some specific problems generic to species and ecosystem management that have resisted rational, science-based solutions. These examples illustrate some of the gaps in traditional approaches to conservation biology research and provide a platform to illustrate the benefits of decision-theory approaches. Next we give examples of the application of decision theory to solving conservation problems. While decision- making methods can account for uncertainty and errors, monitoring the results of conservation actions is essential for improved decision-making in the future. Ultimately our objective is to encourage the development of active adaptive management programs on real conservation problems Parma et al. Within an adaptive management framework, once an action has been initiated, a monitoring program must be implemented that evaluates and measures the performance of that action. The performance evaluation then informs the decision-making process by reducing uncertainty and ignorance. In this paper we use the term monitoring to refer to a repeated assessment of some environmental attribute for the purpose of detecting change within a defined area over time Thompson et al. That is monitoring explicitly designed to assist decision-making and management. We conclude with an overview of research opportunities for monitoring and decision-making, emphasizing the challenge of developing robust rules of thumb for making decisions. Two common conservation decisions where conservation biology has failed to provide useful advice Where in space should habitat be protected from destruction, and where should it be restored? This first question is fundamental to conservation and conservation biology should provide the answer. Let us see what answers these theories provide to this question. Island biogeography theory generated a series of rules, most notably: Metapopulation theory tells us that there are several ways to increase the likelihood that a metapopulation will persist: Sourceâ€”sink theory emphasizes the importance of identifying habitat where population growth rates are consistently positive hence the rule: We also have the empirically derived rule: All these rules have been useful in providing general conservation principles, but their use is more limited for dealing with specific conservation and management problems. To provide useful practical advice, conservation biologists must have a clear understanding of the questions that managers want answered. For example, consider the question of where it is best to restore habitat. A land manager interested in habitat restoration will typically have a finite set of resources and financial constraints. The question for conservation biologists is: Let us assume there are two existing patches of native vegetation on the site, one larger than the other. The specific question then is: Make the existing bigger patch bigger; 2. Make the existing smaller patch bigger; 3. Connect the two existing patches with a broad corridor; 4. Make one new large patch; or 5. Make many new small patches evenly scattered over the property. Conservation Decisions September Island biogeography theory and metapopulation theory provide few insights to help us choose amongst these options, except, perhaps, ruling out option 5. Although without further information about the distribution of species and communities across the property, we might not want to eliminate this option. The reason these conservation biology theories have limited utility for such practical decisions is that the general principles have not been couched within a decision-making framework. The question of where to focus restoration efforts raises the immediate question of what biodiversity is the land manager trying to maintain or recover? What is the objective? A simple question that is rarely answered. Even when an explicit objective is specified, none of our theories provide explicit predictions as to how the objective is most likely to be met. If the biodiversity objective is to minimize the likelihood a species becomes extinct, we may test alternative habitat reconstruction scenarios in a population viability model something which is rarely done given the lack of data and the demands on the time of managers. If the biodiversity objective were to restore a representative sample of habitats, then information on soil types and topography would be vital. Given the vast conservation literature on habitat fragmentation generated over the past decade, it is an embarrassment that so little of this research empirical or theoretical provides answers to the most basic practical questions concerning optimal habitat reconstruction for biodiversity conservation. The theories generate a list of generally useful things we might do, but they offer little insight into how best to choose among the alternative options Possingham The example provided is deliberately simple. Most conservation problems are more complex, and a land manager may envisage spending her conservation dollars in other nature conservation activities, such as control of introduced predators and weeds in the existing habitat patches. The question then becomes: What fraction of our conservation effort should be directed to each of several management activities: What conservation biology theory helps us juggle these alternatives? A second common question in conservation biology relates to the problem of reintroductions and captive breeding. There is a large amount of science focused on reintroduction and captive breeding Ralls and Ballou , but few protocols exist for answering basic questions like: Again, the existing theory provides general rules such as: Empirical reintroduction research yields essential data and experience, but provides only a limited framework for extending experience with a particular species or site to new species or uncertain circumstances. What is decision theory and how has it been used in conservation? Decision theory is a framework within which people responsible for management attempt to achieve explicitly stated objectives while acknowledging the levels of uncertainty involved with the decision process Clemen Other professionals, such as engineers Kulkarni et al. Specify the management objectives, or at least list the indicators of policy performance e. Where there are multiple objectives, utility theory Maguire and Servheen , Guikema and Milke is employed to deal with the problem of how to maximize multiple objectives that are measured in different currencies e. List the management options and express them as control variables e. Specify the variables that describe the state of the system e. Develop a conceptual model of the dynamics of the system being managed, and if possible develop equations to describe the dynamics of the state variables e. This step will often involve collaboration between a field biologist and ecological modeler. Specify constraints that bound the decision variables and state variables e. Specify the range of uncertainty for all the parameters. Find solutions to the problem. To illustrate how decision theory thinking might be integrated with traditional conservation biology approaches, we now present three examples. Optimal fire management for a large conservation park Managing disturbance processes in conservation areas is a contentious issue throughout the world. In many large and semi-natural terrestrial systems fire is the main 5 Possingham et al. Conservation Decisions September force that disturbs vegetation and it is often managed with fuel reduction burning, attempts to reduce ignition frequency, and prescribed burning to increase fire frequency. The fear of making the wrong decision invariably means we make the decision to do nothing. Here we summarize Richards et al. The description of the problem fits into the seven-point framework above. Statement of objective s. We set the broad objective of maintaining a balance of the different successional states. Specifically, Richards et al. This is a surrogate objective for the more fundamental objective of minimizing species loss. However there are so many species, and limited information on each, that the ecosystem-level objective is expedient and more likely to be implemented and monitored. List of management options. Each year the park manager has three options: The state of the system is the percentage of the park in each of the three successional states - early, mid and late. Using basic probability theory, we constructed transition probabilities that predicted the chance of the park moving from any one state to any other state in a single year, given that the manager had chosen a particular management option for that year. The two forces that drove the dynamics were fire and vegetation succession, and the final state dynamics model is a Markov chain model. We did not constrain the ability of the manager to enact any of the three management options, although we did assume that the fire suppression option would not be completely effective. We varied the definition of early, mid and late successional habitat, and the relationship between fire frequency and habitat state, to do a limited test of the robustness of our conclusions. For more detailed fire management a whole host of uncertainties regarding ability to control fire, risk to life and property, and even variability in the political climate, could be used to enhance the robustness of the results. We used Stochastic Dynamic Programming, a common mathematical programming method Intrilligator , to find the optimal solution. The main outcome is a state-dependent fire management diagram that tells a manager what to do given a particular state of the park see Fig. Where the resources to explore options for a particular park are limited, Figure 1 could be thought of as a rough rule of thumb for fire management in a large semi-natural park, although its robustness would require considerable further testing see point 6 above. The stochastic dynamic programming method is able to accurately integrate decisions in a stochastic world over a longer time frame than human intuition. There is no fixed optimal policy - it depends on the state of the park. One question raised by the work was the social and economic cost of adopting different policies. This was not dealt with in detail, yet may be important in some cases. This issue is discussed in the context of another example below.

6: Hugh Possingham - Wikipedia

Decisions about the management of threatened species are made in the face of considerable uncertainty. This uncertainty arises from a lack of knowledge about many aspects, for example; population dynamics, impacts of threatening processes, and the usefulness of conservation actions.

7: Optimal Conservation of Migratory Species

Conservation efforts and emergency medicine face comparable problems: how to use scarce resources wisely to conserve valuable assets. In both fields, the process of prioritising actions is known as triage.

8: Limits to the use of threatened species lists | Hugh Possingham - www.enganchecubano.com

) - could be used to support decision making in relation to clear conservation objectives (Possingham et al.). More practice-oriented assessments of the use of models to support conservation are urgently needed.

9: Professor Hugh Possingham - UQ Researchers

Professor Hugh Possingham's research interests are in conservation research, operations research and ecology. More specifically his lab works on problems to secure the world's biological diversity: efficient nature reserve design, habitat *reconstruction, monitoring, optimal management of populations for conservation, cost-effective conservation actions for threatened species, pest control and.*

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The Photographers Practical Handbook Dickens and the voices of time, by G.H. Ford. Turkish foreign policy and Turkish identity His eye on the sparrow : teaching and learning in an African American church Wendy L. Haight and Janet Ca Mindfulness and the therapeutic relationship Great Power Conflict After 1945 (Key History for GCSE) Jump (High Stakes Series Level a) Safety For Parents With School-Age Children Intrinsically conducting polymers Mine health and safety engineering Currency and contest in East Asia Watch out on your side Human Rights and the Politics of Agreement White Pine (Pinus strobus Linnaeus) On the track of the mail-coach Saudi Arabia and Its Royal Fam Successor to Hamilton Towards emancipation World Development Report, 1978-2005 Or five bad constitutions Simplifying radicals worksheet basic Philadelphia County, Pennsylvania, land records, 1706-1713 Terminological clarification Online shopping and buying The Soul of Malaya Rortys humanistic pragmatism On the Eastern Front Fundamentals of biostatistics 7th edition solutions The man in the Sopwith Camel Do the hokey pokey Practical Aspects of Ophthalmic Optics Part 2 : My 4-step program for creating change now. Aside on two dimensionalism Human Relationships Solitary Fibrous Tumor Cheniers practical math dictionary Reorientation in education Boyd H. Bode Human pharmacology Last loosening manifesto Walter Serner. Drug dictionary for nurses