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Foro

Synergism between GAP and MVP analyses

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RESUMEN: Hoy en día los biólogos de la conservación reconocen que una red de reservas debe preservar especies, poblaciones y procesos evolutivos. Esto es esencial para la eficacia de una red de reservas. Existe una tendencia al aumento de estudios que exploran el análisis de laguna (*GAP analysis*) para determinar la efectividad de las reservas en el mantenimiento de especies. Este es un tipo de análisis importante y efectivo en términos de costos, pero es limitado debido a la falta de perspectiva temporal sobre la viabilidad de las poblaciones. El análisis de laguna puede estimar la cantidad de reservas dentro de la distribución geográfica de una especie. Sin embargo, otros análisis deben ser realizados con el fin de conocer la viabilidad de las poblaciones en tales reservas. Nuestro objetivo en este estudio es mostrar la necesidad de combinar los análisis de laguna y de Poblaciones Mínimas Viables (PMV) para determinar realmente la efectividad de una red de reservas. El diseño de redes de reservas debe ser realizado considerando la viabilidad de las poblaciones en las reservas.

PALABRAS CLAVE: diseño de redes de reserva, efectividad de las redes de reserva, extinción, área mínima viable, preservación de procesos evolutivos.

ABSTRACT: Nowadays conservation biologists recognize that a reserve network should preserve species, populations and evolutionary process. This is essential to the effectiveness of reserve network. There is an increasing tendency to studies exploring GAP analysis to test the effectiveness reserves to maintain species. This is an important and cost-effective analysis, but it is limited because lack a temporal perspective on the viability of populations. GAP analysis can estimate the amount of reserves inside geographic ranges of species. However, others analysis should be done to know on the viability of populations in these reserves. Here, we intend to show the necessity to blend GAP and minimum viable populations (MVP) analyses to really test the effectiveness of a reserve network. Design of reserve network should be done considering the viability of populations in reserves.

KEY WORDS: design of reserve network, effectiveness of reserve network, extinction, minimum viable areas, preservation of evolutionary processes.

INTRODUCTION

Extinction is the destiny of all species, and the other side of the same coin of speciation. Earth has already passed through many periods of mass extinction, and nowadays we witness the sixth event of mass extinctions with a rate of species loss never seen before (Pimm and Brooks 2000). What are the consequences of the extinction of so many species? The answer is hard to unravel, but there is evidence that such loss may cause catastrophic effects in natural systems (Balmford *et al.* 2002, Loureau *et al.* 2001), and that natural areas should be preserved (see a brief discussion in Grelle 2005). This, however, can be minimized if some suggestions of the discipline named conservation biology are taken into account.

Nowadays, ecologists and conservation biologists recognize the paramount importance of biodiversity preservation at all scales (genetic diversity, species diversity and ecosystem diversity) as well as

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ecological and evolutionary processes (Brooks *et al.* 2004, Pressey 2004). Therefore, to be considered effective, a reserve network must be capable of maintaining all levels of biodiversity and the ecological and evolutionary processes (Peres 2005). Eventually, we need megareserves to get these objectives (see Peres 2005). Thus, the focal point of this article is the effectiveness of reserves to conserve biodiversity.

GAP PLUS MVP ANALYSES

Following the work of Scott *et al.* (1993) some GAP analysis have been done to test the effectiveness of reserve network, based on the threshold of 10% as minimum area to preserve biodiversity of large geographical ranges (for example Rodrigues *et al.* 2004b). However, GAP analysis gives us static picture of the effectiveness of a reserve network in representing species diversity. GAP analysis provides us the amount of reserves within geographic range of a species, but it does not inform us if the reserve network is capable or not to harbours viable populations. Establishing a reserve does not ensure the retention of native biota (e.g. Newmark 1996 and references therein). Wide ranges of actions are needed to enhance long-term viability (Shafer 1999). Potential indexes of reserve biotic integrity for future prognosis have been proposed, which include the estimation of minimum viable population sizes (MVP) and minimum viable areas (May 1994, Shafer 1999). Therefore, a complementary approach to GAP analysis is search for viability of reserves within geographic range of species (for example Brito & Grelle 2004).

The estimation of MVPs and reserve sizes are fundamental contributions from the field of conservation biology (Shaffer 1981, Belovsky 1987). The MVP approach seeks to determine the minimum number of individuals a population needs to persist for a certain time period (Shaffer 1981, Gilpin and Soulé 1986, Soulé 1987). For instance, suppose a species that needs large reserves (more than 3500km2) to maintain viable populations, and compare the hypothetical reserve networks (area 1 and 2) of figure 1 and 2. Both figures have same total area, separated in two areas (area 1 with 4000km2 and area 2 with 3500km2), and consequently give us the same response in a GAP analysis. However, area 1 and 2 show different size per unit in figure 1 and 2 and, therefore, distinct viability of their populations. It is important to note that in this hypothetical reserves network the reserves are isolated on figure 2. Thus there are no possibilities of migrations among reserves. Unfortunately, this can be a tendency in tropical forests (Defries *et al.* 2005).

GAP analysis is a cost-effective strategy for conservationist decisions and important for selecting important areas for biodiversity preservation, but it lack a temporal perspective and therefore gives us a static picture of the populations in the areas being evaluated. The importance of temporal approach in conservation biology has been addressed (e.g Frankham and Brook 2004) and the issue addressed here is not entirely new (Allen *et al.* 2001, Gaston *et al.* 2002, Rodrigues *et al.* 2004a). However, rather few works has explored the potential synergism between GAP and MVP analysis.

In conclusion, a blend of GAP and MVP analysis can represent an avenue for more realistic frameworks testing the design and the effectiveness of reserve network.

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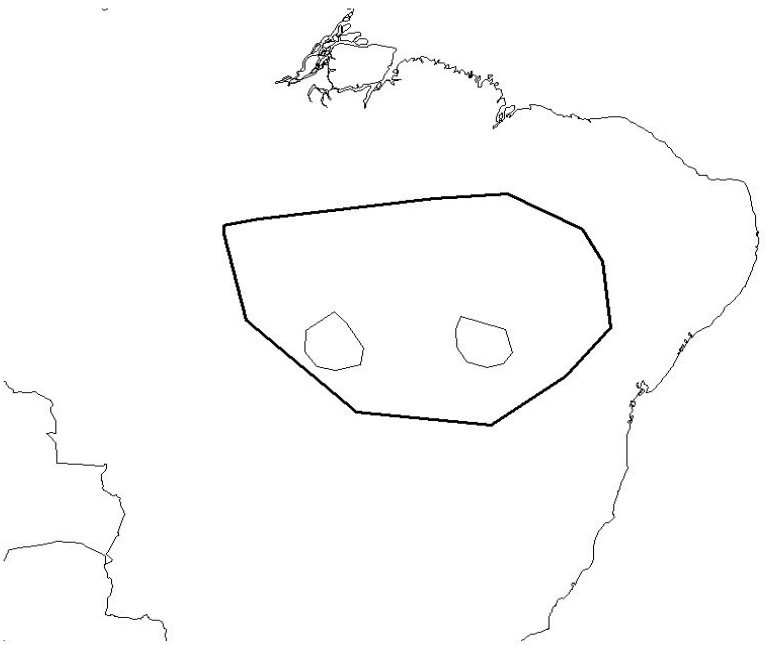

Figure 1. Hypothetical reserve network within geographic range of a species. Area 1 = 40000Km2 (leftt) and Area2 = 35000km2 (right).

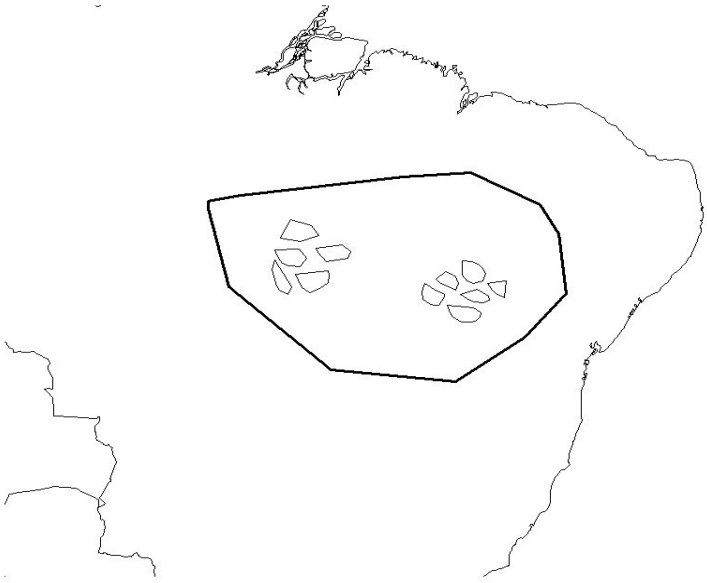

Figure 2. Hypothetical reserve network within geographic range of a species. Amount of Area 1 = 40000Km2 (left) and amount of Area 2 = 35000km2 (right).