CRITERIA FOR IMPLEMENTATION OF GREEN INFRASTRUCTURE IN COASTAL AREAS

Valeria Chávez, Instituto de Ingeniería UNAM, vchavezc@iingen.unam.mx
Debora Lithgow, Instituto de Ecología INECOL, debora.lithgow@inecol.mx
Rodolfo Silva, Instituto de Ingeniería UNAM, rsilvac@iingen.unam.mx

INTRODUCTION

Unlike traditional infrastructure, which only takes into account socio-economic and political factors, or ecological restoration which focuses on the recovery of ecosystem health, resistance and resilience, green infrastructure has multifunctional goals, determined by the ecological and socioeconomic conditions of each, specific site (Silva *et al.*, 2017).

Connectivity, multifunctionality, integration and a multiscale approach are the key concepts in green infrastructure projects. Coastal green infrastructure projects include broad and contrasting aspects such as: 1. Recovery of the structure and functionality of natural ecosystems, 2. Creation of artificial ecosystems, 3. Engineering structures that depend on the functioning of the surrounding ecosystems, 4. Traditional engineering projects, adapted to reduce their environmental impact and, 5. Corrective actions applied to structures and land uses which damage the environment and threaten socio-economic aspects.

The term green infrastructure is not necessarily synonymous with soft solutions, nor are rigid solutions synonymous with grey actions. For example, in some conditions dune stabilisation can lead to erosion on adjacent beaches. Often, beach nourishment efforts induce an increase in turbidity and sediment transport rates, particularly associated with the content of very fine material. When these nourishment actions are carried out near coral reefs, the increase in water turbidity and friction effects cause coral reef degradation. In these cases, a rigid infrastructure, such as an artificial reef, would be more suitable if it functions as a refuge for key species (e.g. larvae of coral species), thus offering conditions necessary for the establishment of a surrogate ecosystem.

GREEN INFRASTRUCTURE

Silva *et al.* (2017) defined five types of green infrastructure, based on the work of van der Nat et al. (2016). These five types are classified according to their degree of naturalness (Figure 1). This broad classification increases the feasibility of a green infrastructure project by incorporating the physical and ecological characteristics of the site, as well as the availability of local materials and human resources. The classification also highlights the relationship between the degree of naturalness, the time-space requirements and the level of economic investment needed. On the other hand, the classification also recognises that the degree of uncertainty of the results of the project increases with the degree of naturalness.

DETERMINING FACTORS FOR THE SUCCESS OF A COASTAL GREEN INFRASTRUCTURE PROJECT

From documented experiences, it is possible to identify the factors that have determined the success of some green infrastructure projects. These factors can be listed as follows: 1. Adequate diagnosis, 2. Conservation of mass and energy flows (connectivity), 3. Mimicry of natural functions, 4. Use of local resources, 5. Participation of local actors, 6. Designing a new site-specific solution or adaptation of previously tested alternatives to local conditions, 7. Resistance and resilience of the intervention, and 8. Adaptability potential of the solution. These factors are part of a cycle that must be continuously monitored.

The monitoring of green infrastructure projects is imperative; allowing evaluation of the success of the project, as well as identifying unexpected outcomes and permitting the timely implementation of corrective measures to solve any undesired consequences.

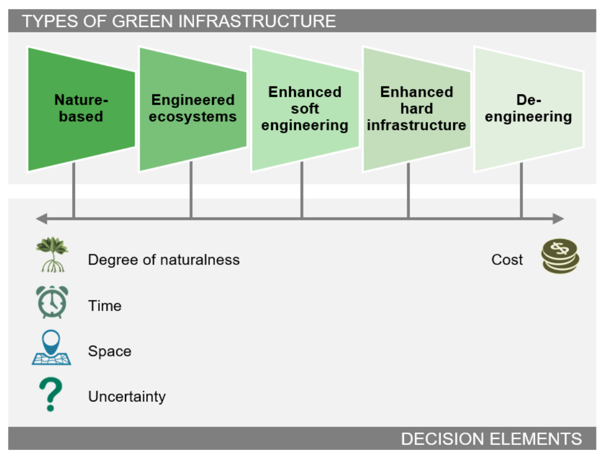

Figure 1 - General decision elements for selecting the type of green infrastructure

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REFERENCES

Silva, Lithgow, Esteves, Martínez, Moreno-Casasola, Martell, Pereira, Mendoza, Campos-Cascaredo, Winckler, & Osorio (2017): Coastal risk mitigation by green infrastructure in Latin America, In Proceedings of the Institution of Civil Engineers: Maritime Engineering, vol.

170, no. 2, pp. 39-54.
Silva, Chávez, Bouma, van Tussenborek, Arkema, Martínez, Oumeraci, Heymans, Osorio, Mendoza, Mancuso, Asmus, & Pereira (2019): The incorporation of biophysical and social components in coastal management, Estuaries and Coasts, vol. 42, no. 7, p. 1695-1708.
van der Nat, Vellinga, Leemans, & van Slobbe (2016): Ranking coastal flood protection designs from engineered to nature-based, Ecological Engineering, vol. 87, pp. 80-90.