Investigating the implementation of biodiversity mitigation in EIA in Chile

Abstract

Global loss of biodiversity has directly and indirectly been caused by human activities. Environmental Impact Assessment (EIA) attempts to address the loss of biodiversity caused by development projects through mitigation, including avoiding, reducing or compensating (through offsetting) the loss. However, evidence suggests that in practice the implementation of biodiversity mitigation, including monitoring its success, remains challenging. This study aims to evaluate whether EIA in Chile, in combination with other environmental decision-support tools, is achieving a reduction in biodiversity loss, and also to identify potential routes for improving biodiversity outcomes through EIA practice. To characterise current practice and identify opportunities for improving outcomes, a review of relevant documents (Environmental Impact Studies, authorisation documentation, and monitoring reports) was undertaken, supplemented by semi-structured interviews and a focus group with stakeholders involved in the EIA process. Results indicate limited attempts to quantify biodiversity outcomes along with a focus on monitoring to verify implementation rather than to measure biodiversity outcomes. Areas of weak practice, and opportunities for improving practice (in relation to the biodiversity outcomes delivered through EIA) were identified and are likely to have wider relevance to other jurisdictions.

1. Introduction

Biodiversity loss has become a global concern in recent years. Evidence indicates that biodiversity has been decreasing at a global scale (Cardinale et al., 2012; Bowler et al., 2020), and its loss rate does not appear to be declining (Butchart et al., 2010). Anthropogenic threats are mostly acting as drivers of biodiversity changes in many environments, such as agricultural activities, urbanisation, pollution, and invasion of alien species in terrestrial and marine ecosystems which appear to be the leading causes (Bowler et al., 2020), producing habitat loss and, consequently, biodiversity loss (Balmford & Bond, 2005). The main pressures on terrestrial ecosystems in Chile are degradation and fragmentation due to human activities, such as changes in the use of land, irregular logging of forests, and the creation of plantations with exotic species (Armesto & Arroyo, 1991; Lara et al., 2009; MMA, 2019). In terms of anthropic environmental impacts on biodiversity, the agricultural and forestry industry, urbanisation processes, and mining, produce the main pressures on fragile ecosystems through the clearing of native forests, the establishment of pastures and crops, the extraction of groundwater, and the contamination of aquifers (MMA, 2019).

In order to counter the adverse effects on biodiversity caused by development projects, adequate consideration of biodiversity should contemplate the introduction of biodiversity mitigation in the practice of environmental impact assessment (EIA) (Gardner et al., 2013). Biodiversity mitigation involves the use of the mitigation hierarchy, in order to address negative effects on biodiversity through avoiding, minimising, restoring or compensating biodiversity impacts on the ground, with the ultimate goal to achieve no net loss or net environmental gain, playing an essential role in having a net positive impact on biodiversity (McKenney & Kiesecker, 2010).

Despite this, several weaknesses in the implementation of the mitigation hierarchy have been described in the literature, including the failure to follow the hierarchy sequence and the lack of monitoring to evaluate the effectiveness of measures (Bull et al., 2016; Maron et al., 2016;

Bigard et al., 2017; Lindenmayer et al., 2017; Phalan et al., 2018). Given the introduction of national guidelines in 2014 (SEA, 2014) into the environmental legislation in Chile, this presents an opportunity to use Chile as a case study to answer the research question: "How can the EIA system in Chile help to achieve no net loss of biodiversity?". To answer this research question, two objectives were developed: 1) to evaluate Chilean practice in relation to national obligations, and 2) to analyse the opportunities for improving biodiversity outcomes in Chile through institutional (policy) and individual and organisational (practice) capacity development.

2. Methods

2.1. To evaluate Chilean practice

The Chilean practice was evaluated in a first stage through a case study selection. The case studies were selected to identify how the Chilean policy of biodiversity mitigation is being applied in practice. To this end, different investment projects subjected to the environmental impact assessment system (EIAS) in Chile were selected, to reflect a wide spectrum of the implementation of environmental regulations in terms of the mitigation hierarchy and monitoring. Once the case studies were selected, the available documents (EIS, authorisation documentation, and monitoring reports) were reviewed, to obtain the background information on the cases, regarding type of measures proposed, and details of monitoring such as indicators of biodiversity to be monitored.

Additionally, online semi-structured interviews were conducted with the stakeholders involved in the EIA process in Chile to complement the information gathered from the relevant documents from the case studies selected. The participants in the interviews were chosen from a subsample of the case studies selected and are shown in the Table 1.

Table 1. Number of participants in the interviews.

Stakeholders	**Definition**	**Resulting interviews**
Project Proponent	The person that is responsible for carrying out a project and has the legal right to do so.	3
Environmental Consultants	Professional practitioners (also known as experts, specialists) who provides advice or services in the preparation of the EIS	3
Decision makers	People involved in approving, rejecting, or conditioning the execution of a project or activity and its modification.	4
In charge of monitoring	People involve in the monitoring of the mitigation measures after the authorisation is granted.	1

2.2. To analyse the opportunities for improving biodiversity outcomes

An in-person focus group was held to explore the results obtained from the interviews, identifying opportunities to improve the biodiversity outcomes in light of the findings from the interviews. The participants were selected based on judgement sampling, including stakeholders who participated in the interviews from the case study selection and those that were identified by these interviewees. Due to a number of last-minute withdrawals from the

focus group (only two stakeholders attended), supplementary interviews were held with five stakeholders who could not attended were conducted.

3. Ethical considerations

Ethical approval for conducting the research was gained from the University of East Anglia (UEA) Research Ethics Committee.

4. Results

For the 31 EISs analysed in this study, a total of 215 measures were proposed at the various levels of the mitigation hierarchy: mitigation (140), repair (11), and compensation (64). To investigate if the measures had been correctly allocated to the right category of the mitigation hierarchy, all the activities involved in each measure proposed were checked and occasionally (in 17% of cases) reclassified by the researcher following the definitions of the national guideline (SEA, 2014, SEA 2022).

Chile has a simplified mitigation hierarchy when compared to international models (e.g., Glasson and Therivel, 2019). Figure 1 indicates how the Chilean system (in which 'avoid' and 'minimise' are included together in a single category of 'mitigation') aligns with international understanding of the mitigation hierarchy (Figures 1a and 1b), and then details the categorisation of mitigation measures identified from the sample of Chilean EISs (Figure 1c) using 'avoidance', 'minimisation', 'restoration' and 'offsets' from the international hierarchy (and including 'enhancements' in the category of 'offsets' in line with the Chilean hierarchy).

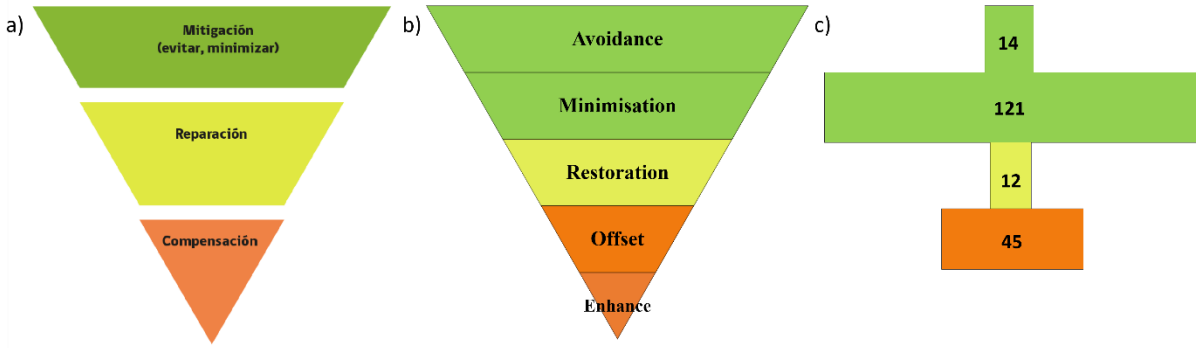

Figure 1. Representation of the mitigation hierarchy in the national guidelines (a), international models (b) and the mitigation hierarchy found in this study (c).

Out of 215 monitoring reports required from the total of 31 projects (those that should be presented to the authority as a requirement for construction permission), 100 reports were available for examination (47%). The type of monitoring and the indicator that is being monitored was extracted from each monitoring report. Overall, out of 100 reports, 69 aimed to monitor some biodiversity-related indicator, recording some element of biodiversity outcome. However, 31 reports included other types of indicators derived from visual inspections and studies, which were considered to be implementation indicators (Table 2). Most of these relied on visual inspection-based monitoring (29%) where the activity is recorded through photographs or against a checklist (being the most common indicators of success of the measures), followed by the verification of the installation of devices such as bird-flight diverters or signage. However, these monitoring reports do not provide quantitative

information on biodiversity outcomes as the results are based on the implementation of the measure, rather that monitoring what it has achieved (in terms of biodiversity outcome).

Table 2. Types of monitoring that projects have implemented and the indicator that is being monitored.

	Type of monitoring	Indicators	Number of reports
Biodiversity-related indicator	Systematic fauna surveys	Richness and abundance	18
		Presence of individuals	6
		Number of individuals	2
	Wildlife observations	Presence of individuals	9
		Number of individuals	1
	Systematic flora surveys	Survival of individuals	18
		Number of individuals	5
		Richness and abundance	2
		Plant cover	2
		Number of seeds	1
		Germination and flowering	1
		Plant density	1
		Presence of individuals	1
	Systematic flora and fauna surveys	Richness and abundance	1
		Biodiversity offset	1
Implementation indicator	Visual inspection	Activity recorded	19
		Installation of equipment	8
		Attendance record	2
	Studies	Report delivered	2
Total			100

Source: Cares et al., 2023.

Overall, despite the system agree mitigation measures should follow the mitigation hierarchy, and then monitoring should confirm the effective implementation of the measures, this review showed projects have a tendency to use more compensation measures than would be expected from the implementation of the mitigation hierarchy, stating a bias towards compensation with poor use of the mitigation hierarchy, followed by less than optimal selection and measurement of monitoring indicators, where some measures were being claimed as successful based purely on implementation (the verification of the activity being conducted), rather than on evaluation of biodiversity outcomes.

Therefore, the questions for the interviews were designed to gain a better understanding of the current implementation of biodiversity mitigation in Chile in the practice, considering the issues identified from the documentary review. From the analysis of the interviews, four themes were identifying as main issues for the interviewees:

i. Tendency to favouring compensation measures rather than follow mitigation hierarchy.
ii. Issues on effective implementation of proposed mitigation measures in practice.
iii. Uncertainty surrounding the achievement of no net loss.
iv. Recommendations by the agencies sometimes incompatible or inconsistent with the biodiversity compensation guidelines.

The issues above were discussed at the focus group and at the supplementary interviews with the stakeholders, and some suggestions derived from the conversations with the stakeholders are show in the Figure *2*.

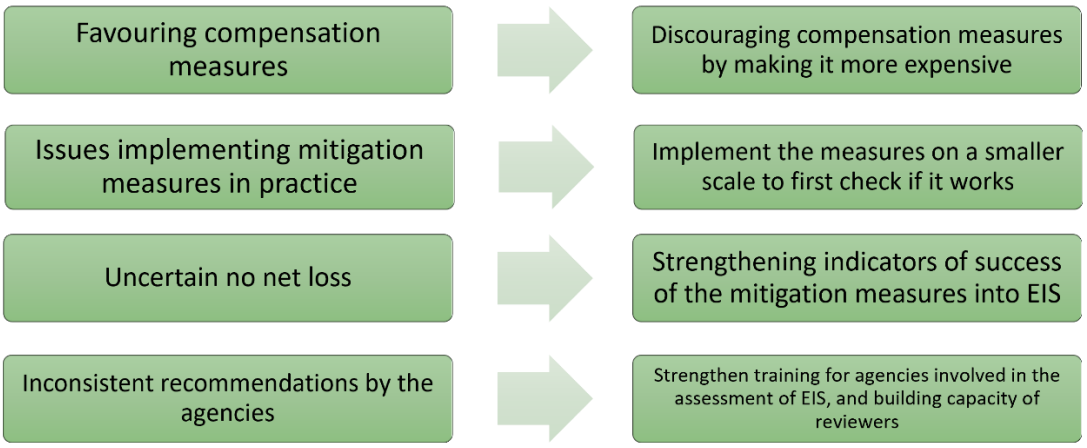

Figure 2. Suggestions made from the stakeholders at the Focus Group and supplementary interviews.

5. Discussion and conclusions

Considering all the progress that has been made in the field of biodiversity mitigation since the introduction of the national guidelines in 2014 in Chile, some issues were identified in terms of the implementation of the mitigation hierarchy and associated monitoring, and opportunities for improvement were discussed with the stakeholders involved in the process.

Projects should still make a greater effort to include measures that avoid impacts on biodiversity following the mitigation hierarchy, and evaluators must ensure that the promises are properly implemented. The quantification of impacts should be made explicit in the EIS, allowing the monitoring of biodiversity losses and gains post authorisation. Additionally, indicators of success must be based on the effectiveness of the mitigation measures, in terms of biodiversity outcomes, rather than on the implementation of the measures.

Regarding the role of the environmental institutions, inter-agency work should be reinforced and the capacity of stakeholders to fulfil their roles in relation to the mitigation hierarchy need to be developed.

Although a new guideline on methodology was published lately in Chile (SEA, 2023), there is still uncertainty over the extent to which it will help to resolves some of the issues identified in this research.

6. References

Armesto JJ & MTK Arroyo (1991) El estudio y la conservación de la biodiversidad: Una tarea urgente para Chile. Creces (Chile) 11: 54-60.

Balmford, A., & Bond, W. (2005). Trends in the state of nature and their implications for human well-being. Ecology letters, 8(11), 1218-1234.

Bigard, C., Pioch, S., Thompson, J.D., 2017. The inclusion of biodiversity in environmental impact assessment: policy-related progress limited by gaps and semantic confusion. J. Environ. Manag. 200, 35–4.

Bowler, D. E., Bjorkman, A. D., Dornelas, M., Myers-Smith, I. H., Navarro, L. M., Niamir, A., ... & Bates, A. E. (2020). Mapping human pressures on biodiversity across the planet uncovers anthropogenic threat complexes. People and Nature, 2(2), 380-394.

Bull, J.W., Gordon, A., Watson, J.E., Maron, M., 2016. Seeking convergence on the key concepts in 'no net loss' policy. J. Appl. Ecol. 53 (6), 1686–1693.

Butchart, S.H., Walpole, M., Collen, B., Van Strien, A., Scharlemann, J.P., Almond, R.E., ... & Carpenter, K.E. (2010). Global biodiversity: indicators of recent declines. Science, 328, 1164-1168.

Cares, R. A., Franco, A. M., & Bond, A. (2023). Investigating the implementation of the mitigation hierarchy approach in environmental impact assessment in relation to biodiversity impacts. *Environmental Impact Assessment Review*, *102*, 107214.

Cardinale, B.J., Duffy, J.E., Gonzalez, A., Hooper, D.U., Perrings, C., Venail, P., ... & Kinzig, A. P. (2012). Biodiversity loss and its impact on humanity. Nature, 486, 59.

Gardner, T. A., Von Hase, A., Brownlie, S., Ekstrom, J. M., Pilgrim, J. D., Savy, C. E., ... & Ten Kate, K. (2013). Biodiversity offsets and the challenge of achieving no net loss. Conservation biology, 27(6), 1254-1264.

Glasson, J., Therivel, R., 2019. Introduction to Environmental Impact Assessment. Routledge, London. IPBES. 2019.

Lara, A., Little, C., Urrutia, R., McPhee, J., Álvarez-Garretón, C., Oyarzún, C., ... & Arismendi, I. (2009). Assessment of ecosystem services as an opportunity for the conservation and management of native forests in Chile. Forest Ecology and Management, 258(4), 415-424.

Lindenmayer, D.B., Crane, M., Evans, M.C., Maron, M., Gibbons, P., Bekessy, S., Blanchard, W., 2017. The anatomy of a failed offset. Biol. Conserv. 210, 286–29.

Maron, M., Ives, C.D., Kujala, H., Bull, J.W., Maseyk, F.J., Bekessy, S., Gordon, A., Watson, J.E., Lentini, P.E., Gibbons, P., Possingham, H.P., Hobbs, R.J., Keith, D.A., Wintle, B.A., Evans, M.C., 2016. Taming a wicked problem: resolving controversies in biodiversity offsetting. Bioscience 66, 489–49.

McKenney, B. A., & Kiesecker, J. M. (2010). Policy development for biodiversity offsets: a review of offset frameworks. Environmental management, 45(1), 165-176.

Phalan, B., Hayes, G., Brooks, S., Marsh, D., Howard, P., Costelloe, B., ... & Whitaker, S. (2018). Avoiding impacts on biodiversity through strengthening the first stage of the mitigation hierarchy. Oryx, 52(2), 316-324.

SEA, 2014. Guía para la compensación de la biodiversidad en el SEIA. Santiago, Chile.

SEA, 2022. Guía para la compensación de la biodiversidad en el SEIA. Santiago, Chile.