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Preventing the Loss of Flamingos in the Atacama Desert

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Executive Summary

Flamingos are under threat from human activity in the Atacama Desert (figure 1). Mining, particularly copper and lithium, is causing flamingos to experience a loss in population and changes to their reproductive and migration patterns. The mineral rich brine so coveted by mining companies effects flamingos and as well as an abundance of other life that habits these brine pools. Flamingos depend on the conditions and availability of these pools and, as crucial species, their survival impacts the stability of this ecosystem. The ecosystem does not only hold environmental importance but also economic. Mining production is a key pillar of Chile's economy and continues to expand in the Atacama Desert as the demand for electric cars and technology booms. In the future, if action is not taken, economic exploitation could leave the Atacama Desert unable to support flamingo's life as well as human activity - meaning mining would have to stop all together. To prevent this, Chile must move away from privatisation and state control as it's proving ineffective. NGOs must become the prominent influencer regarding environmental action in the Atacama Desert. Ostrom's approach to the 'Tragedy of the Commons' should be adopted, and regular meeting's let by NGOs between the local community, mining companies, and relevant government figures should be held. Mining companies must prioritise sustainability and equally respect the three pillars of sustainability: economic, social, and environmental. Independent non-bias monitoring of mining companies and enforcing 'The Requirements' will ensure this. 'The Requirements' are a set of legally binding requirements that will

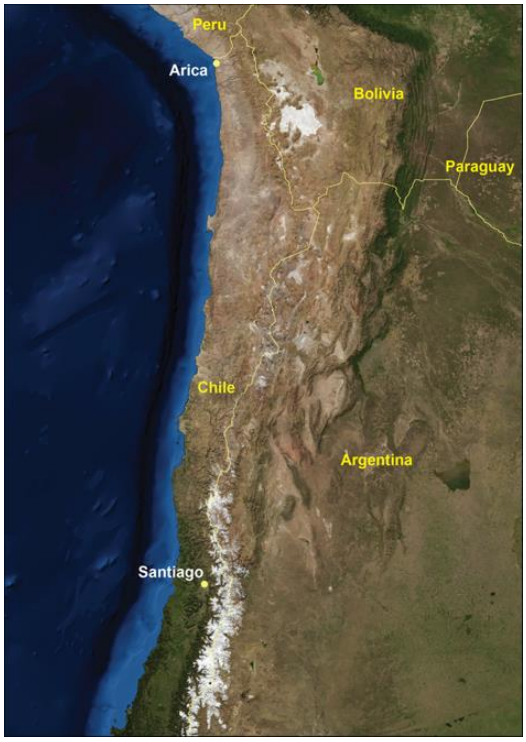

Figure 1 – Satellite image of the Atacama Desert in Northern Chile. Source: AGI/NASA

determine mining quotas will be a financial motivation for mining companies. Finally, to stop exploitation, brine must be classed as water rather than an economic good.

Foundational Science: Discussion & Analysis

In 2009, Rockström, et al. established nine planetary boundaries (PBs) (figure 2) that if overreached will cause irreversible damage to the earth systems and leave humans in an unsafe operating space. The PBs are interconnected meaning surpassing one threshold triggers increased risk in other PBs creating a domino effect of instability (Steffen et al., 2015). Therefore, the threats to flamingos intrinsically risk numerous PBs, such as Freshwater Use, Climate Change, and Land-system Change, but I will focus on Biosphere Integrity. This is because biodiversity is especially poor in Chile, with half of land ecosystems being classed as at least 'vulnerable' (United Nations, 2017:2). Globally, the situation is similar. Genetic diversity's threshold has been exceeded and is a 'high risk' (figure 2). Functional diversity's threshold is still unknown (figure 2) and could be as high as maintaining the Biodiversity Intactness Index at 90% (Steffen et al., 2015). Therefore, substantial action to preserve biodiversity must be taken urgently to provide a future where the earth is safely operating.

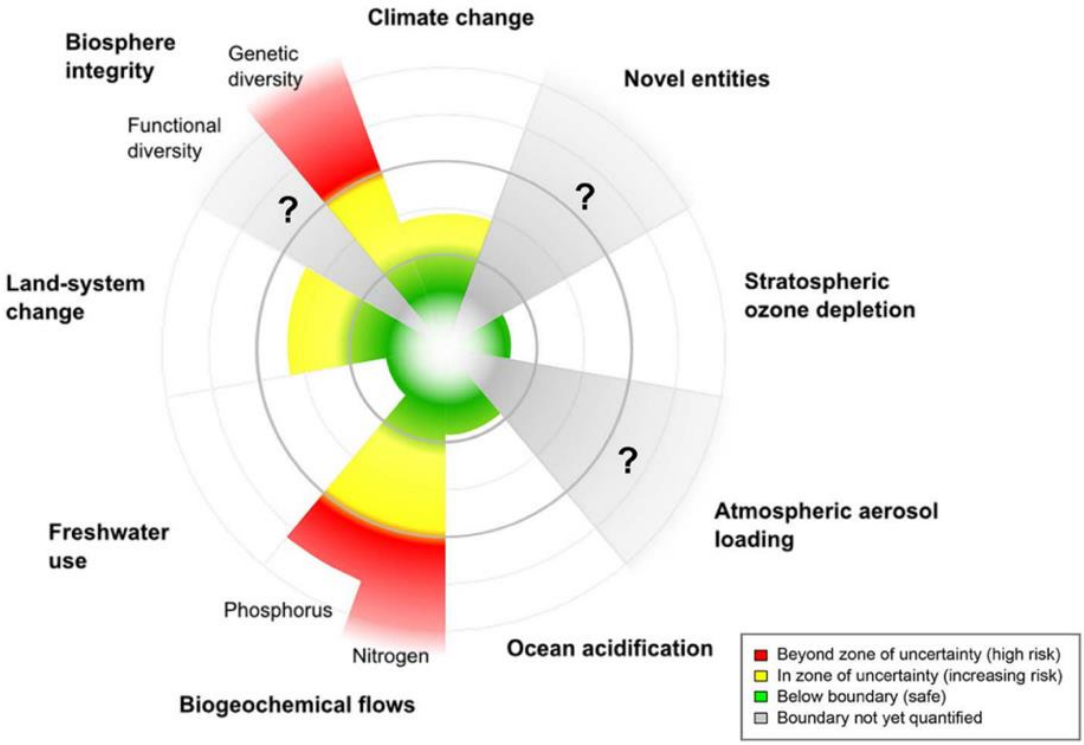

Figure 2 - Status of PBs in 2015. Source: Rockström, et al., 2015.

Strong biodiversity creates redundancy and resistance to human impact in the Atacama Desert. However, human impacts in the Atacama Desert are causing biodiversity loss, multiplying the effects of the impact. Biodiversity must be improved to continue human activity in the Atacama Desert. Improving biodiversity also aids in achieving the United Nation's Sustainable Development Goals. Not only does it directly support the environmental goals but improving biodiversity correlates with improvements in other targets, such as education and equality (Blicharska, 2019).

Flamingos, the Andean (Phoenicoparrus andinus), Chilean (Phoenicopterus chilensis) and James's (Phoenicoparrus jamesi), are important organisms to the Atacama Desert's biodiversity yet they are amongst the most threatened. All species of flamingo are targeted in this policy brief as all species must be protected to best prevent the loss of functional diversity. Functional diversity is crucial for the maintenance of the ecosystem. Flamingos impact their community as they disburse and control the populations of flora and fauna in lagoons (Gajardo and Redon, 2019). This is one of flamingo's niches as no other animal sufficiently does this function. Flamingos also provide prey for other animals (ibid). Moreover, flamingos are migratory birds and are responsible for this function throughout countries of South America (ibid).

Ending the human threats towards flamingos in the Atacama Desert is not only important to sustaining biodiversity, flamingos and the stability of the earth's systems. It also means the economic service the desert provides, with mining contributing 10% of Chile's GDP, can be sustained (International Trade Administration, 2021). Despite this, the mining industry in Chile has side-lined the preservation of the ecosystem it depends on. Lithium mining (figure 3), pumps saline groundwater and freshwater from the Andes, diverting water from brine pools where the flamingo's live and feed (Heuble, 2019). Copper mining (figure 4) is the most water intensive, requiring additional desalinated water, an energy intensive process contributing to climate change (Rüttinger, et al., 2020). The mining process also contributes to climate change which is causing brine pool levels to decrease and disrupting flamingo migration and reproductive patterns (Dorador, et al., 2020). Additionally, localised climate heating is being caused by lithium mining (Ozren,

2014). Mining is also causing fluctuation in the salinity of the lagoons which is harming the fitness and reproductivity of its flora and fauna, flamingo's food source (Garjardo and Redón, 2018). As this provides the flamingos' pink colour, these changes are turning some flamingos white, triggering them to be ostracised by the colony (Butcher, 2017).

Current Governance Concerning Flamingos in the Atacama Desert

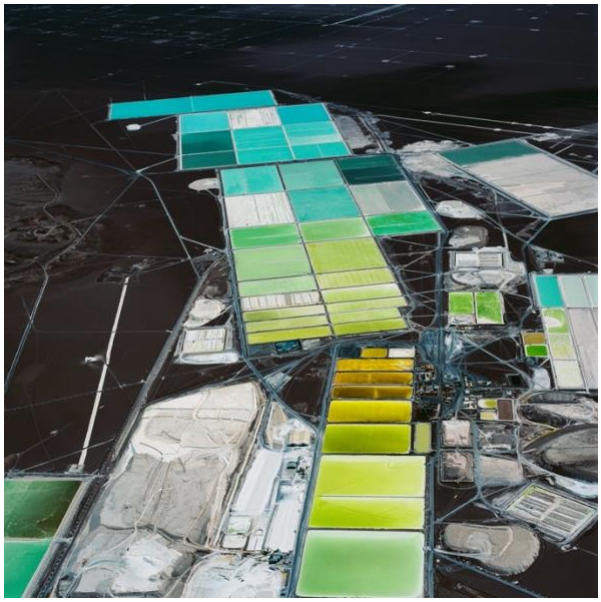

Figure 3 - Lithium mine in the Atacama Desert, 2018. Credit: David Maisel.

Figure 4 - Copper mine in the Atacama Desert, 2018. Credit: David Maisel.

Royalties

In 2004, after heated debate, Chile implemented low mining royalties (González, 2004). Between 2015 and 2018, Chile regained its focus on mining royalties, increasing them and addressing scandals where mining companies had issued fake invoices and paid off politicians (Barandiarán, 2019). The royalties, which progress with production, are intended to provide compensation for the negative social externalities of mining and somewhat regulate mining companies. Recently, a new royalty bill that would increase royalties, was called 'unconstitutional' by Chile's Mining Minister (Sherwood and Cambero, 2021: para1). He added: "we believe the best way to increase government revenue from mining is to increase production and improve competitiveness" (ibid: para4). This shows the governments prioritisation of increased productivity and economic growth. Increased productivity would amplify the negative environmental and social externalities

therefore, increased government revenue would be required anyway. This is a reactive policy that only benefits mining companies and the government.

Monitoring

Current governance does not ensure reliable monitoring of mining companies. Mining companies are permitted to monitor themselves, from their action towards sustainability, or lack thereof, to their extraction and production rates. This privilege is being exploited. For example, one of the most significant mining companies, Soquimich (SQM) was found to be concealing overdrawing brine in 2019 (Heubl, 2019). An online system has been established to monitor extraction rates and freshwater use. This technical solution has not been effective and there has been no policy changes to combat this (ibid).

Chilean Government's Relationship with Mining Companies

The Chilean government's Production Development Corporation (CORFO) is responsible for promoting economic growth in Chile. Despite, SQM committing a 'grave non-compliance' with its contract with CORFO that 'severely risk the stability of the ecosystem of the Salar de Atacama, of its brine and its reserves', CORFO has granted SQM's lithium production quotas increase until 2030 (CORFO, 2017:3)(Soquimich S.A, 2020). In return, SQM must increase payments to CORFO (Soquimich S.A, 2020). Although a portion of these finances go towards CORFO's flamingo monitoring and reproductive programme, this is not a sustainable decision and clearly prioritises immediate economic growth to the detriment of the environment, threatening flamingos and biodiversity (Soquimich S.A, 2021). The alliance between CORFO and mining companies is powerful, combing the strength of Chile's government and global billion-dollar mining companies.

Recommended Governance Concerning Flamingos in the Atacama Desert

The Requirements

The current evidence provided by NGOs on flamingos in the Atacama Desert is enough to justify and direct action towards their protection. This action must be preventative and unavoidable which means a legally binding policy is necessary. This policy should be simplified into 'The Requirements' (figure 6). It is a policy that

provides legal requirements expected of mining companies that if achieved will enable them to submit an application to increase their quota. If ‘The Requirements’ are not achieved, and a lack of progression is shown by a mining company, their quotas will get reduced. If adequate progress is shown quotas will be maintained. Though, note that ‘The Requirements’ are not targets or goals and they must be fully accomplished for the permittance of increasing quotas. Through this policy there will be a strong incentive for mining companies to change and ensure that the only human action in the Atacama desert in the future is sustainable.

The Requirements:

1) Sustainable Water Use
    a. Stop using freshwater from within the Atacama Desert (groundwater, brine pools, etc)
    b. Implement solar-powered desalination
    c. Recycle water
2) Sustainable Energy Use
    a. Use renewable energy (solar, hydropower, etc.)
    b. Progress to achieve being carbon neutral by at least 2030
3) Sustainable Waste
    a. Cut air, water, and soil pollution
    b. Responsibly dispose of waste product

Figure 6 - 'The Requirements' for mining companies that will determine their quotas and motivate action.

Royalties

According to Hardin’s ‘Tragedy of the Commons’, the Atacama Desert is a common pool resource meaning it’s benefits should be shared between everyone in the common (Hardin, 1968). Its minerals are rival goods as they are non-renewable (Barandiarán, 2019). Currently, mining companies are still free riders, benefiting more than others through excessive exploitation of resources and providing inadequate compensation (Heubl, 2019). Royalties are therefore, proving to be an ineffective solution.

Elinor Ostrom’s approach to a ‘Tragedy of the Commons’ is bottom-up as top-down approaches tend to oversimplify and exclude the environment and local

community (Ostrom, 1991). Ostrom emphasises the importance of the solution being situational and polycentric, including excellent communication, providing an effective set of rules, and creating a system of monitoring and sanctioning (ibid). Applying this to Chile, control must be decentralised with NGOs bearing the most control. Communication between mining companies, the government, the local community and NGOs will be ensured through meetings, organised and lead by NGOs. They will be open to all and obligatory for mining companies and relevant government members. These meetings will discuss the needs of all and consider the pillars of sustainability equally: economic, social, and environmental. Solutions, which can be put forward by anyone, will be discussed and then considered by NGOs. Preventative solutions will be prioritised over reactive solutions. Additionally, discussion concerning 'The Requirements', which creates rules and a monitoring and sanctioning system, will make up a portion of the meeting. Mining companies progress will be made public, and the effectiveness of 'The Requirements' and possible improvements will be shared. To begin with meetings should be held every two weeks and then can be adjusted appropriately. Accessibility for all will be ensured by the meetings take place in person in local communities with online attendance available.

Monitoring

It is imperative that NGOs continue independent monitoring of flamingos (Robinson et al, 2018). They should also be responsible for monitoring mining companies' and the government's actions and the effects of these action upon flamingos and biodiversity. For this to be carried out, mining companies and the Chilean government must financially support NGOs. This non-bias monitoring is critical for guaranteeing accountability and positive action, but to ensure efficiency there must be incentives and consequences for non-compliance. 'The Requirements' will provide this. NGOs will be responsible for monitoring the mining companies' status according to 'The Requirements'. Any assessments, monitoring or research should not be performed on a schedule to ensure it is unexpected by mining companies, promoting quick and consistent action.

Chilean Government's Relationship with Mining Companies

The relationship between the Chilean government and mining companies must be diluted to install a balance between the pillars of sustainability and stop the threat towards flamingos and biodiversity in the Atacama Desert. Through increasing the participation and control of NGOs this can be done. ‘The Requirements’ will not only fulfil this but also give leadership to the NGOs as they will dictate the actions of mining companies cutting off government interference.

Currently, the Chilean government classes brine as a mineral meaning it is an economic device owned by the government who permits the usage of mining companies (Heubl, 2019). Brine should be classed as water as it is 70% water and home to invisible world of artemia, bacteria and phytoplankton which should not be sacrificed for economic gain due to their importance to the ecosystem (ibid). By ignoring brine’s water identity, the exploitation of brine will risk the stability of the PBs in the Atacama Desert as well as the availability of freshwater for indigenous communities (Gajardo and Redon, 2019). Brine must be legally recognised as water so that it can equally serve its multiple purposes - environmental, social and economic.

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