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Ecosystem Services A Challenge and Opportunity in Mining Industry Investment

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Abstract. **Abstract**. Understanding ecosystem services was initially developed to define the advantage natural ecosystems produce for society and raise awareness for biodiversity and ecosystem conservation. Ecosystems are capital assets, feasible of attention and investment given to other forms of capital. Recently, the trend of investment through a capital loan for the development of the mining and metal industry has increased. Several financing agencies have incorporated ecosystem services into industrial operations' risk and impact assessment systems to fulfil their standards. This study aims to identify significant challenges and opportunities for ecologists or environmentalists involved in research or modelling ecosystem services, especially in the mining industry. To reveal the relationship between ecosystem services challenge and opportunity in investment, a paper review related to ecosystem services was conducted. The challenge is to discover meaningful and robust indicators to quantify ecosystem services. Biodiversity manages the capacity of the environment to present ecosystem services, can be directly gathered to meet the material requirements of individuals and is valued by social orders for its intangible commitment to prosperity.

Keywords: *Biodiversity manages, mining ecosystem, ecosystem services.*

1. Introduction

Ecosystem services are the benefits people obtain from ecosystems and are co-produced by the interactions between ecosystems and societies (Balvanera, et. Al., 2016). Biodiversity manages the capacity of the environment to present ecosystem services, can be directly gathered to meet the material requirements of individuals and is valued by social orders for its intangible commitment to prosperity. The Millennium Ecosystem Assessment (MA) – the formal international effort to elevate awareness and understanding of societal dependence on ecosystems – has suggested four categories: provisioning, regulating, cultural, and supporting services (Brauman and Daily, 2014). The various kinds of ecosystem services and their various elements (supply, conveyance, commitment to prosperity, and value) can be observed locally to globally.

Recently, the trend of investment through a capital loan for the development of the mining and metal industry has increased. Several financing agencies have incorporated ecosystem services into industrial operations' risk and impact assessment systems to fulfil their standards. However, ecosystem services are intangible commitments. Subsequently, the regard for the significance of ecosystem services in the satisfaction of funding principles is frequently undefined or unreadable. However, compared with physical, monetary, human, and social capital, biological system capital is perceived as ineffective, barely observed, and often goes through fast debasement and consumption.

This study aims to identify significant challenges and opportunities for ecologists or environmentalists associated with research in ecosystem services, particularly in the mining business. The challenge is to track down significant and vigorous markers to evaluate ecosystem services. Biodiversity controls the capacity of the environment to present ecosystem services, can be directly reaped to meet individuals' material necessities and is valued by social orders for its intangible commitments to prosperity.

Recent research related to the same theme has never been specifically conducted, especially in Indonesia. Several similar studies have been conducted in the hydrology sector (Guswa, et. al., 2014; McIntyre, et. al., 2014) as well as research related to Ecosystem services—current challenges and opportunities for ecological research conducted by Bikhofer *et al*. in 2014 (Birkhofer, 2015). Research in the mining sector related to ecosystem services, so far, has mainly focused on assessing ecosystem services (McIntyre, et. al., 2014) and managing ecosystem services (Handayani, et. al., 2018). This research was carried out to increase information on challenges and opportunities for ecosystem services in the mining sector.

2. Metods

A paper review related to ecosystem services was conducted to find out the relationship between ecosystem services challenges and opportunities in investment. Understanding interactions between ecosystem properties and processes is a fundamental domain of ecology and is crucial to map and manage final ecosystem services.

In addition, the development of investment instruments through environmental and social standards has also entered the mining industry. Understanding the development of the mining industry using investment instruments must be able to include ecosystem services in it. The results of the interaction will lead to the interrelation of ecosystem services and investment in the mining industry.

The term “ecosystem services” was originally intended to highlight both direct and indirect benefits humans obtained from nature (Daily, 1997). Ecosystem services are the circumstances and cycles through which environments and the biodiversity that make them up, support, and satisfy human existence. The Millennium Ecosystem Assessment (MA) - the conventional global work to lift mindfulness and comprehension of cultural reliance on biological systems - has proposed four classes (Balvanera, et. Al., 2016). MA 2005 unequivocally viewed as a supporting ecosystem service and a basic environmental capability of other ecosystem services, including provisioning, regulatory, cultural, and supporting services (Balvanera, et. Al., 2016).

Provisioning services are the products that can be extricated and drunk from environments and are many times valued in business sectors: for instance, water, food, wood, and biofuels. *Regulating services* are the advantages obtained from biological system processes that balance the circumstances we experience: such as the guideline of environment, soil richness, or floods. They only occasionally have advertisements and should be valued in a roundabout way. *Cultural services* are the genuine yet not physical ('intangible') benefits that arise from connections among people and ecosystems, for example, work, feeling of character, profound worth, stylish worth, and mental improvement (Chan, et. al., 2012). A few cultural services, such as diversion, have markets, while others do not. The fourth classification is *supporting services*, the key ecosystem cycles such as photosynthesis, supplement cycling, and evolution, which license the conveyance of the initial three classifications, and in this way, track down cultural advantage through them (Balvanera, et. Al., 2016).

3. Result and Discussion

3.1. Challenges and Opportunities

Ecosystem service research aims at developing more sustainably managed ecosystems by understanding the links between natural and social systems (Daily, et. al., 2009). In the next part, we discuss difficulties for environmentalists in ecosystem services research when managing anthropogenic adjustments of the ecosystem and evaluating administrations, including measurable traps and issues of causality while dissecting connections between different ecosystem services.

Challenge 1: Understanding Anthropogenic Modified Systems

The idea of ecosystem services is valuable to comprehend what managing a human-reorganized landscape means for both the creation of products and ecological externalities. The challenges emerge in anthropogenically changed frameworks (e.g., agrarian scenes, creation woodlands, or municipal regions) comprising of:

(i) the recognizable proof of humans' impact on assistance-giving units and related ecosystem services,
(ii) considering the impacts of landscape perimeter area units that give ecosystem services.

Selected challenges and sub-challenges are discussed in this article, with opportunities for ecologists to contribute to improved recommendations regarding the management of ecosystem services presented in Table 1 (Birkhofer, 2015).

Table 1. Challenges and Opportunities of ecosystem services management

Challenges	Sub-challenges	Opportunities
Understanding anthropogenically modified systems	(i) Identifying human impact on service-providing units and ecosystem services	Consideration of the relationship between the provision of ecosystem services and biodiversity and management interventions
	(ii) Impact matrix consideration in modified landscapes	Identifying effects of anthropogenic interventions on service-providing units at different spatial scales
Assessing ecosystem services	(i) Assessing relationships between services and measures usually quantified in ecological studies	Identifying ecological measures that are reliable indicators of ecosystem service provision
	(ii) Accounting for dynamics and uncertainties in models of service provision	Evaluation of uncertainty, integration of evolutionary aspects and human impacts into process-based models and socio-economic models
Improving the next-stage ecosystem services research	(i) Assessing the biodiversity baseline, biodiversity action plan, and ecosystem management plan	Cooperation between ecological researchers and investors provides the best solution for the conservation of ecosystem services
	(ii) Providing the direct benefits of ecosystem services based on ecosystem management plant	Planning sustainable company management to improve the conservation of ecosystem services

Challenge 2: Assessing Ecosystem Services

According to the viewpoint of a biologist, challenges in surveying ecosystem services emerge from the need

(i) to assess connections among services and the sort of measures generally gathered in environmental examinations (e.g., species richness),
(ii) to represent the qualities of environmental cycles (e.g., elements, response, and doubtfulness) in quantitative models focusing on service provision.

This incorporates the assessment of the commitment of moderate ecosystem services and how they are impacted by management. In many cases, the evaluation of halfway administrations is more exorbitant and tedious than for conclusive services.

Challenge 3: Improving the next-stage ecosystem services research, especially in the mining industry

More in-depth and advanced research and utilization of ecosystem services can be carried out because it includes stakeholders, not just biologists who have been worried about biological systems and biodiversity but also investors, local people, NGOs and the public authority. Advanced research and utilization that can be completed include:

(i) Ecological and biodiversity research is not restricted to species diversity and richness, however, to the level of management and substantial activities for biodiversity preservation.
(ii) The application of ecosystem services research in the mining area is not simply restricted to addressing the requirements of ecological archives for mining business exercises yet additionally gives direct advantages to the mining business.

In appraisal mining projects, especially the transition from the exploration to exploitation stage, the company must prepare or analyze the impacts and risks of business activities on the environment. Environmental and social impact analysis is an impact mitigation instrument and part of the permitting documents. Another challenge is that companies must be able to develop biodiversity studies and ecosystem services to address public concerns about environmental degradation in mining activities. As the initial step to obtaining minerals, land or forest clearing is often accused of causing environmental damage. For this reason, the company needs to have good mine planning and understanding of the ecosystem services in every development stage of the mine.

Ecologists or environmentalists in the company must understand all categories of ecosystem services by understanding anthropogenic modified systems and conducting assessments for ecology services. The company can develop appropriate studies or models to fulfil ecosystem services in mining operations by understanding both.

For instance, land clearing programs, arranged mineral extraction, rehabilitations or reforestation, and appropriate mine closure plans. Rehabilitation or reforestation has both present-moment and medium-term influences on the environment. Forest might, in specific conditions at any point, likewise impact precipitation, and forests assume a part in carbon cycling and sequestration on a more extended timescale. Forests in a watershed, on the hillslopes channelled into a stream, impact the water quality in that stream. Forests themselves additionally diminish dregs and supplement overflow (Chan, et. al., 2012).

With that assessment, research and planned modelling, the company can answer ecosystem and biodiversity challenges, such as restoring modified landscapes to become natural and ultimately balancing the fulfilment of human and natural needs, sustaining and fulfilling human life.

3.2Mining Investment

The mining industry and its downstream industries, such as smelters and refineries, have been developing rapidly. This is due to technological developments and innovative discoveries worldwide that require raw materials or mining products. The company's expansion in terms of exploitation requires substantial capital, where the tendency is not only to mine but also to develop its downstream industry.

The implementation of ecological and environmental research in the industrial sector only focused on fulfilling environmental permits. Ecological research at this scale is limited to complete data colleciton and initial data collection on the existence of ecosystem services and biodiversity. Currently, there are several regulations in the mining and plantation industry related to the further increase in the role of investors in environmental conservation. Several financial investment regulations in mining and plantations require sustainable management of biodiversity.

Ecosystem service research in the mining industry is starting to shift not only to meet the needs of national environmental documents, which are limited to collecting complete and initial data on ecology and biodiversity using the IFC Performance Standards on Environmental and Social Sustainability standards. IFC's environmental services research standards require more detailed planning of conservation actions at the ecosystem and landscape scale, including studies of threatened species and populations. IFC has eight standards called Performance Standards (PS). Guarantee banks use the IFC Performance Standard (IFC, 2012) for various industrial activities, including mining and mineral refining. The eight performance standards are:

PS 1 assessment and management of environmental and social risks and impacts
PS 2 Labor and Working Conditions
PS 3 Resource Efficiency and Pollution Prevention
PS 4 Community Health, Safety and Security
PS 5 Land Acquisition and Involuntary Resettlement
PS 6 Biodiversity Conservation and Sustainable Management of Living Natural Resources
PS 7 Indigenous People
PS 8 Cultural Heritage

A further challenge from research and utilization of ecosystem services in the mining industry is how to develop a broad research framework because ecosystems are a broad entity, while research conducted in this industry is only limited to the business permit area of each of these companies.

In carrying out these challenges, several opportunities can be used as supporters. Among the opportunities obtained are the costs of ecological research, which have been challenging to obtain and become more accessible through a cooperation system between ecological researchers and investors.

Referring to the challenges and opportunities of ecosystem services that have been discussed previously, it is necessary to examine further what categories of ecosystem services are related to the IFC Performance Standard. By knowing the relationship between the two, companies involved in IFC Performance Standards can meet challenges and opportunities through risk analysis or environmental and social assessments. Fulfilling this will ensure a balance between investment and sustainable mining operations in the environmental and social fields. Table 2 below describes the interrelationships between IFC Performance Standards and Ecology Services.

Table 2: Ecosystem services challenge and opportunity in IFC Performance Standard

IFC Performance Standard	Ecosystem Services Category	Challenge and Opportunity
PS1	Supporting Services	identify all risks and impacts related to ecosystem services/environment directly/indirectly for affected areas such as livelihoods/community livelihoods and those related to human rights.
PS 4	Regulating Services	management of HSE risks for communities due to the project by managing ecosystems such as buffer zones (e.g. swamps/wetlands, upland forest mangroves, etc.)
PS 5	Supporting Services	assess the risk of losing the provision of ecosystem services due to land acquisition and involuntary resettlement (if any), including the livelihood restoration plan
PS6	Regulating Services	conduct a systematic review (including affected communities) for all ecosystems that will be affected by the project to identify priority ecosystem services (biodiversity action plan) and to avoid minimizing ecosystem/environmental impacts that have significant impacts/that can be controlled by the client
PS7	Cultural Services	assessing ecosystem services when assessing projects that affect Indigenous People (study of Indigenous people must be carried out, and if there are indigenous people, IP assessment is required)
PS8	Cultural Services	maintain or restore ecosystem processes when there is a transfer/replication of cultural heritage (need to prove cultural heritage through a Cultural Heritage study and conduct transfer guidelines if the results of the study show that there is a cultural heritage site)

4. Conclusions

Theoretically, ecosystem services are corresponding connections among environments and networks in which there are benefits for people. Ecosystem services are the circumstances and cycles that environments go through and the biodiversity that shapes, continues, and satisfies human existence. Understanding the connections between environmental properties and cycles is a basic space for biology and is basic for planning and overseeing end ecosystem services.

In mining projects, particularly the progress from the exploration to exploitations stage, the business should get ready or examine the impacts of business activities on the ecology. Ecological and social impact investigation is an effect alleviation instrument and a piece of the licensed document. Another challenge is that businesses should have the option to serve biodiversity concentrates and ecosystem services to address public thoughtfulness about the ecological reduction in mining exercises. There are significant challenges and opportunities for biologists engaged with research ecosystem services, particularly in the mining industry. The challenge is tracking down significant and influential markers to measure ecosystem services. Biologists should see all classifications of ecosystem services, specifically by understanding anthropogenically altered frameworks and directing appraisals for ecosystem services. By understanding both, the business can build suitable examinations or displays to satisfy ecosystem services in mining activities.

Referring to the challenges and opportunities of ecosystem services, it is crucial to inspect what ecosystem services classes are connected with the IFC Performance Standard. Businesses associated with IFC performance Guidelines can address challenges and opportunities such as chance investigation or natural and social appraisals by knowing the connection between the two. Fulfilling this will guarantee harmony among ventures and feasible mining tasks in the natural and social fields.

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