14.4.5. Measuring Mining-Driven Sediment Contamination From Rivers to the Coast

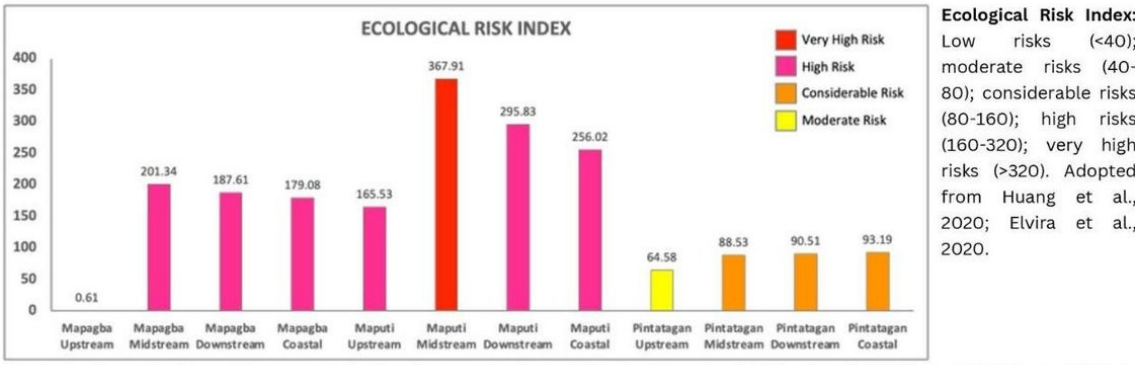
Introduction

Land-based pollution reaches the sea through rivers, and few sources make that connection as visible as a discolored river discharging toward the coast. Following river discoloration incidents caused by overflowing mining catchment ponds in Banaybanay, Davao Oriental, most controversially in the Mapagba, Maputi, and Pintatagan rivers in January 2022, researchers at Davao Oriental State University (DOrSU) carried out the project 'Evaluation of Sediment and Water Quality of Silted River-Marine Systems in Banaybanay, Davao Oriental: Initial Steps towards Regenerative Mining,' with funding support from the Department of Science and Technology through the National Research Council of the Philippines Science and Technology Experts Pool. The findings and policy recommendations are published as Katigaman Policy Brief Series No. 3, s. 2024, 'Banaybanay Orange River: Why mining companies should be environmentally accountable?' of the university's Center for Futures Thinking and Regenerative Development.

The account below documents the study's measured findings as reported in the policy brief, which presents the underlying project as unpublished research documentation. It does not claim that any of the brief's policy recommendations have been adopted as regulation, nor that water quality in the affected systems has improved; those would require separate evidence of consultation, adoption, or follow-up monitoring.

What the Sediment and Water Samples Showed

Surveys across the Mapagba, Maputi, and Pintatagan river systems found river beds filled with orange fine-grained sediments called laterite, the origin of the water's distinctive color. Sediment samples revealed heavy-metal concentrations far above baseline levels measured at the rivers' headwaters, where no mining occurs: chromium of 919 to 12,401 ppm against a baseline of 0.01 ppm, and nickel of 739 to 4,037 ppm against a baseline of 4.00 ppm. As the water flowed downstream, contamination levels decreased through dilution but remained high at the river mouth and coastal area, posing elevated ecological risks to riverine and coastal ecosystems, including the nursery grounds of economically important fish and invertebrates.



Ecological Risk Index: Low risks (<40); moderate risks (40-80); considerable risks (80-160); high risks (160-320); very high risks (>320). Adopted from Huang et al., 2020; Elvira et al., 2020.

Figure 2. Concentration of heavy metals (ppm) per sampling station in Mapagba (MPB), Maputi (MPT) and Pintatagan (PTG) in

Figure 1. Ecological Risk Index (ERI) per sampling station in the Mapagba, Maputi, and Pintatagan river systems, Banaybanay, Davao Oriental, indicating moderate to very high ecological threats particularly in midstream and downstream areas. Source: Katigaman Policy Brief Series No. 3, s. 2024, DOrSU.

From Ecological Risk to Policy Recommendations

The Ecological Risk Index computed from the samples confirmed the pattern: moderate to very high ecological threats at various sampling stations, particularly in the midstream and downstream areas, with the midstream station of the Maputi river showing the single highest risk value. The team also conducted perception surveys with residents, which found no direct social benefits perceived from mining in the area, disrupted livelihoods among those not employed by the mining company, concerns about deforestation, habitat destruction, biodiversity loss, and water pollution, and a generally negative attitude toward mining accompanied by willingness to participate in regenerative mining advocacy.

On the strength of this combined empirical and perception evidence, the brief advances concrete policy recommendations: involving the academe as a third-party member in periodic reviews of existing mineral reservations; keeping Davao Oriental's protected landscapes and seascapes clear of the direct and indirect impacts of mining; optimizing socio-economic benefits for local and indigenous communities and intensifying public education on mining; involving local government units and indigenous governance systems in the issuance of mining permits; requiring mining companies to rehabilitate, regenerate, revegetate, and reforest mined-out areas; and providing for the permanent cancellation of mining permits against companies proven to have caused irreparable environmental damage.

For the indicator, this study supplies what water-quality monitoring is meant to supply: a quantified, source-to-sea record of contamination, from headwater baselines through river beds to the river mouth and coastal receiving waters. It gives management bodies and communities in Banaybanay and the wider province a documented scientific basis for accountability conversations, and it complements the university's other water-quality evidence by covering mining-derived sediment contamination, a land-based pressure pathway distinct from aquaculture effluent and household waste.

References

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Antonio, E. S., Regino, R. V., Tayone, J. C., Leal, I. A., Villegas, J. P., Garcia, M. M., Asaias, V. E., Verzosa, R. C., Villarubia, G. S., Maxey, E. A., & Jimenez, L. A. (2024). Evaluation of sediment and water quality of silted river-marine systems in Banaybanay, Davao Oriental: Initial step towards regenerative mining [Unpublished research project documentation]. Davao Oriental State University.

Conclusion

The Banaybanay study gives DOrSU and the province a quantified, source-to-sea record of mining-driven contamination: laterite-choked river beds, chromium and nickel concentrations orders of magnitude above headwater baselines, continued elevated levels at river mouths and coastal areas, and ecological risk indices confirming moderate to very high threats midstream and downstream. Paired with community perception evidence, these findings anchor concrete policy recommendations on environmental accountability and regenerative mining. The documented contribution is the measured evidence base and its publication as a policy input; adoption of the recommendations and measurable recovery of the affected systems remain outcomes to be verified through follow-up monitoring and policy tracking.