Shock Tracker

Example case study submission

SHOCK TRACKER
The database of social-ecological shocks

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1. Introduction

How would you like to contribute to Shock Tracker?

- ☐ Contribute a new case

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2. Update a Case

Fill in all sections you would like to update information in. For unchanged sections add "N/A".

What is the unique case ID of the case you would like to update?

N/A (because in this example case I am adding a new case. But if you do update a case, you must pick the ID that looks something like this → ID_27092024115307)

Your name (update)
Name Surname

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3. Metadata

This section collects metadata about your case contribution

Short title of case study
Brumadinho tailings dam collapse

Your name
Name Surname

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4. The Shock Event

This section contains information about the shock event.

Describe the shock event
On 25th January 2019, the tailings dam of the Brumadinho iron mine operated by Vale S/A collapsed catastrophically. The liquified toxic tailings spread from the top of a hill down into the valley (up to 10km), in the Paraopeba River, onto mining infrastructure and people. The death toll stood at 259 and 11 people remained missing as of January 2020.

GPS location of shock event
-20.102049832172078, -44.11412863011199

Country, region, municipality of shock event
Brazil, Minas Gerais, Brumadinho, Córrego do Feijão iron ore mine

Date of shock event
25-01-2019

Scale of shock impact

- ☐ Local/landscape (sub-national)

Did you only want to flag a case and end the submission here?

- ☐ No, I wish to contribute a complete entry.

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5. Drivers of the Shock

This section collects information about the drivers that led to the shock event to happen the way it did.

Describe the drivers of the shock event

The lack of drainage at the rear part of the dam caused the creation of underground ponds. The accumulated water gradually infiltrated through the fill, causing seepage erosion that led to the liquefaction of the tailing, the increase in weight of the material and the rupture of the dam from which a mudslide of material flowed out into the valley, rivers and crop fields. The mudslide started to push from the rear of the dam, where the water table gradient had reached the crest of the dam several years before the collapse, but no one had noticed due to a lack of monitoring and remote sensing evaluations. Algae blooms discovered after the shock event demonstrated that the stagnant condition of the ponds had been persistent over time. By being saturated with water for a long period of time, the solid materials lost their mechanical resistance and presented fluidal behaviour until reaching liquefaction. The high-pressure generated by the liquefied materials at the back side of the dam caused the flow of mud to proceed fast even down a relatively small slope, enhancing the impact on human infrastructure and natural capital.

Categorize the drivers of the shock event

- ☐ Waste management: Mine tailings

Did the event have a single or multiple drivers?

- ☐ Multiple drivers

Were the drivers social, natural or both?

- ☐ Both

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6. Impacts of the Shock

This section collects information about the impacts of the shock event.

Describe the impacts of the shock event

The dam rupture directly impacted the ecosystem by destroying hectares of forest and habitat for flora and fauna, polluting the river and soil up to 10km and indirectly decreasing freshwater biodiversity. It also affected human health mainly due to the toxic composition of the mud and the velocity of the mudflow that was released and engulfed habited areas, with no chances of survival during the event. Moreover it killed mining workers on site. The infrastructure in the

area also collapsed (bridges, railway). Impacted were also grass areas for grazing and crops – one of the most relevant livelihood streams for local inhabitants.

Categorize who and/or what was impacted

- ☐ Humans/Individuals (mortalities and/or physical injuries)
- ☐ Ecosystems
- ☐ Economy (local, regional or global)
- ☐ Built infrastructure (e.g. homes, buildings, roads)
- ☐ Other: Water resources for local communities – as the river became polluted

Were the impacts social, natural or both?

- ☐ Both

Quantify the impact of the shock event

Lives lost: 259, 11 missing

Economic impact: 7 million dollars, loss of $19 billion in market capitalization, $3 billion of Vale's assets frozen

Number of ha of habitat impacted: 3.13 × 106 m2 of land: 49 % of forested area, 24% grass and agriculture, and 10km+ of surface water

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7. Preventative and Mitigating Actions

This section collects data on which actions could have prevented or mitigated the event or its impacts. This whole section is appreciated but optional.

Which actions (if any) would have prevented the shock event from happening?

Drainage of ponds, field inspections, remote sensing exercises to observe water retention or algal blooms in the mine tailings storage area

Which actions would have mitigated/reduced the impact of the shock event?

Drainage of ponds, strengthening of the dam structure through iterative maintenance

Who had the mandate to drive the actions you describe above?

Vale S/A, owned by the Brazilian government and administered by CEO Fabio Schvartsman at the time

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8. References and additional information

Include references (required) and contact information to you (optional).

Add References

Rotta, L. H. S., Alcantara, E., Park, E., Negri, R. G., Lin, Y. N., Bernardo, N., ... & Souza Filho, C. R. (2020). The 2019 Brumadinho tailings dam collapse: Possible cause and impacts of the worst human and environmental disaster in Brazil. International Journal of Applied Earth Observation and Geoinformation, 90, 102119.

Grebby, S., Sowter, A., Gluyas, J., Toll, D., Gee, D., Athab, A., & Girindran, R. (2021). Advanced analysis of satellite data reveals ground deformation precursors to the Brumadinho Tailings Dam collapse. Communications Earth & Environment, 2(1), 2.

Cambridge, M., & Shaw, D. (2019). Preliminary reflections on the failure of the Brumadinho tailings dam in January 2019. Dams and Reservoirs, 29(3), 113-123.

Your case addition was:

- ☐ AI supported (synthesis, extraction of quantitative data points)

Your contact information

yourname.surname@gmail.com

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9. Self-check-out

Before you go, validate your case.

(All the questions were answered positively, which means that most likely the case will pass review!)