

Supplementary Materials for
Risks of mining to salmonid-bearing watersheds

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Data sources for Figure 1.

Locations and numbers of past producing metal and coal mining projects were derived from three data sources:

1) Data for the states of Alaska, Idaho, Montana, Oregon, and Washington were downloaded from the United States Geological Survey's Mineral Resources Data System (MRDS), which is available at <https://mrdata.usgs.gov/mrds/>. We used the intersection of three attributes in the database to identify and map “past producing mines:”

- Development Status (dev_stat): ‘Past Producer’ and ‘Producer’ were included
- Commodity Type (com_type): Metallic commodity ‘M’ and commodity used in metallic and non-metallic forms ‘B’ were included
- Operation Type (oper_type): ‘Surface’, ‘Surface-Underground’, and ‘Underground’ were included

The final attribute query in ArcGIS was:

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("dev_stat" = 'Past Producer' OR "dev_stat" = 'Producer') AND  
("com_type" = 'M' OR "com_type" = 'B') AND  
("oper_type" = 'Surface' OR "oper_type" = 'Surface-Underground' OR "oper_type" =  
'Underground')
```

Within the MRDS, producers were defined as, “A mine in production at the time the data was entered. An intermittent producer that produces on demand or seasonally with variable lengths of inactivity is considered a producer.” Past producers were defined as, “A mine formerly operating that has closed, where the equipment or structures may have been removed or abandoned.” Additional data definitions and database details can be found at <https://mrdata.usgs.gov/metadata/mrds.faq.html>.

2) Data for the province of British Columbia were downloaded from the MINFILE Mineral Occurrence Database, which is available at <https://www2.gov.bc.ca/gov/content/industry/mineral-exploration-mining/british-columbia-geological-survey/mineralinventory>. To identify and map “past producing mines,” we used current (producers) and historical (past producers) listed in the status column (STATUS). Producers were defined as, “Currently producing mine. Occurrences from which ore containing one or more commodities is being mined for commercial gain or benefit. This does NOT include large bulk samples for testing purposes.” Past producers were defined as, “Past producing mine. Occurrences that are not currently being mined and have recorded production in the past. This does not include bulk samples for testing purposes.” Within each status, we counted only commodity types (COMDTY_DS1) listed as coal, copper, gold, iron, lead, molybdenum, nickel, silver, or zinc. Additional data definitions and database details can be found at <https://www2.gov.bc.ca/gov/content/industry/mineral-exploration-mining/british-columbia-geological-survey/mineralinventory/documentation/minfile-coding-manual>.

3) Data for the Yukon Territory were downloaded from the MINFILE Mineral Occurrence Database, which is available at <https://data.geology.gov.yk.ca/Compilation/24#InfoTab>. To identify and map “past producing mines,” we used current (producers) and historical (past producers) listed in the status column (DEP_STATUS). Producers and past producers were defined in the same manner as for British Columbia, described above. After narrowing down the database to producers and past producers, only 60 projects were listed. Caley and Lind mines were removed as the only projects not listing metallic or coal commodities.

Daily milling rates for the largest 26 operating projects in the study region were derived from the data sources listed in Table S1.

Mineral tenure polygons displayed within the inset of Figure 1 were downloaded from the British Columbia Data Catalogue’s Mineral, Placer, and Coal Tenure Spatial View, which is available at <https://catalogue.data.gov.bc.ca/dataset/mta-mineral-placer-and-coal-tenure-spatial-view>. Information regarding mine location and regulatory status within the inset of Figure 1 was retrieved from the British Columbia Environmental Assessment Office Project Information Centre, which is found at <https://projects.eao.gov.bc.ca/>.

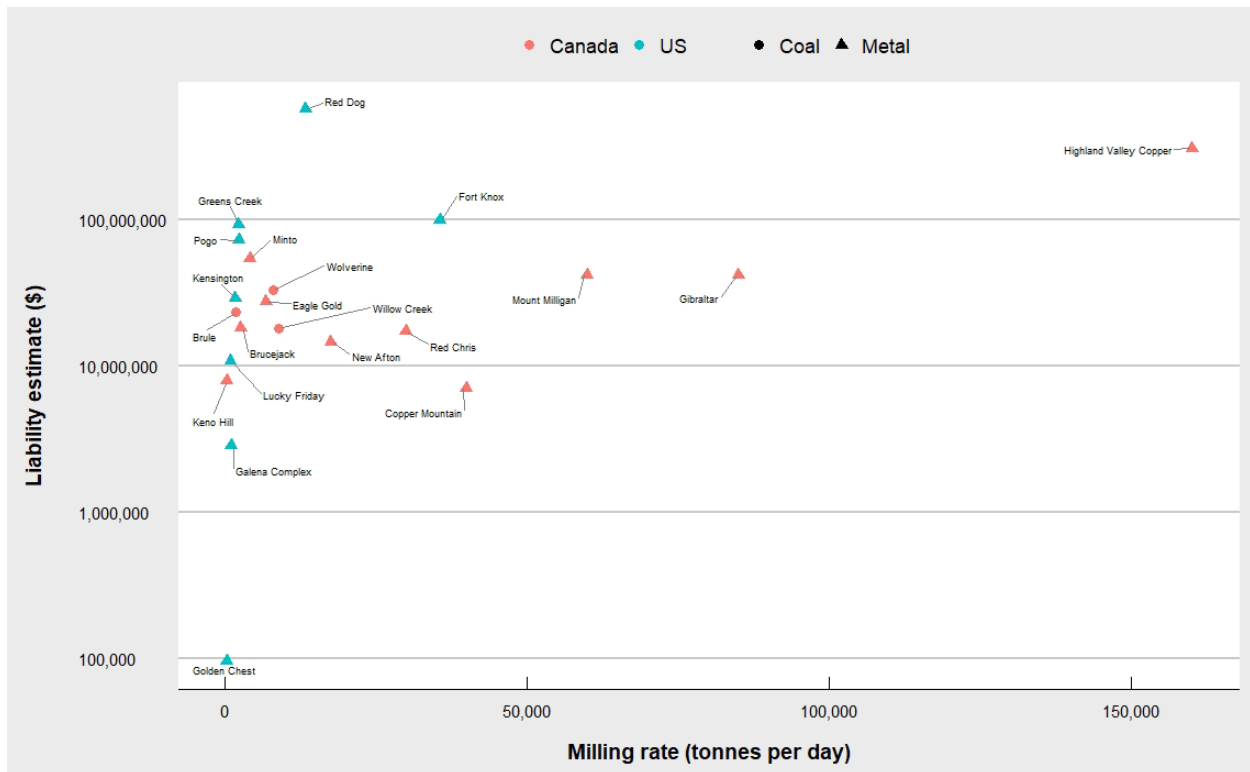


Fig. S1.

Relationship between milling rate and liability estimate for individual mines in northwestern North America (summarized in Table S1). The currency for individual liability estimates match the country of origin (Canada = red, US = teal). Shapes represent the type of commodity mined (circle = coal, triangle = metal). Note that the y-axis is log scale.

Table S1.

Summary of primary resources, liability estimate, and milling capacity for the largest 26 operating mining projects in northwestern North America.

Mining project name	State/prov/territory	Primary resource(s)	Liability estimate	Milling capacity (tonnes per day) ²	Milling capacity data source
Highland Valley Copper	BC	Copper, molybdenum	\$303,416,000 (188)	160,000	2017 Annual Reclamation Report, Table 3.3-2
Gibraltar	BC	Copper, molybdenum	\$41,300,000 (188)	85,000	2017 Annual Reclamation Report, Table 2-8
Mount Milligan	BC	Copper, gold	\$41,868,000 (188)	60,000	2017 Annual Reclamation Report, Table 5
Copper Mountain	BC	Copper, gold, silver	\$7,040,000 (188)	40,000	2017 Annual Reclamation Report, Table 2.1
Fort Knox	AK	Gold	\$99,231,393 (189)	35,606	Athey and Werdon 2019 (200)
Greenhills	BC	Coal	Unavailable ¹	35,000	2017 Annual Reclamation Report, Table 2-3
Fording River	BC	Coal	Unavailable ¹	30,000	2017 Annual Reclamation Report, Table 2-3
Red Chris	BC	Copper, gold	\$17,055,921 (188)	30,000	2017 Annual Reclamation Report, Table 2-4
New Afton	BC	Copper, gold	\$14,361,702 (188)	17,600	2017 Annual Reclamation Report, Table 2.6-1
Elkview	BC	Coal	Unavailable ¹	17,226	2017 Annual Reclamation Report, Table 2-4
Usibelli	AK	Coal	Unavailable	16,800 ³	Project web page, Mining Equipment (201)
Red Dog	AK	Lead, silver, zinc	\$585,662,000 (190)	13,376	Athey and Werdon 2019 (200)
Line Creek	BC	Coal	Unavailable ¹	11,512	2017 Annual Reclamation Report, Table 2-3
Willow Creek	BC	Coal	\$17,951,375 (188)	9,000	2019 Annual Reclamation Report, Table 3
Wolverine	BC	Coal	\$33,018,177 (188)	8,000	2019 Annual Reclamation Report, Tables 3, 4
Eagle Gold	YT	Gold	\$27,406,539 (191)	6,849	2019 Annual Report, Page 24
Minto	YT	Copper, gold	\$53,627,572 (192)	4,200	2019 Annual Report. Page 1
Brucejack	BC	Gold, silver	\$17,993,224 (188)	2,700	2017 Annual Reclamation Report, Table 2.1-1
Pogo	AK	Gold	\$71,908,000 (193)	2,411	Athey and Werdon 2019 (200)
Greens Creek	AK	Gold, lead, silver, zinc	\$92,176,539 (194)	2,316	Athey and Werdon 2019 (200)
Brule (Dillon)	BC	Coal	\$23,148,811 (188)	1,945	2019 Annual Reclamation Report, Table 2
Kensington	AK	Gold	\$30,704,008 (195)	1,756	Athey and Werdon 2019 (200)
Galena Complex	ID	Lead, silver	2,840,000 (196)	1,080	2019 Annual Report, Page 13
Lucky Friday	ID	Lead, silver, zinc	10,700,000 (197)	1,000	2019 Annual Report, Page 23
Keno Hill	YT	Lead, silver, zinc	7,871,492 (198)	400	Project web page (202)
Golden Chest	ID	Gold	95,000 (199)	360	Project web page (203)

¹ The total liability estimate for Teck Coal Elk Valley complex of five mines (Elkview, Fording River, Line Creek, Coal Mountain, and Greenhills) equals \$1,404,810,000 CAD

² For coal operations, “milling capacity” was calculated as the tonnes per day of ore crushed and washed

³ Usibelli coal milling capacity interpreted as crusher capacity (700 tons per hour according to project website); website also states that no washing takes place

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