Forest Sciences

Prince Rupert Forest Region

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The Next Big Storm or Flood

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When will the next big storm or flood occur? When did the last flood occur? How big should we design our culverts and bridges? Is it safe to build my house next to this stream—it's so peaceful? These are common questions we have when trying to determine the climatic hazard associated with forestry activities on steep unstable slopes, or when building bridges or houses. But, should you build your dream house next to that quiet babbling brook (Figure 1)?

If you ask your friendly forest hydrologist, geomorphologist or climatologist, he/she might start talking about return periods, return intervals or time intervals of major storms, which have occurred over the past few years. He might call the storm a 5-year, 10-year, 50-year, or 100-year storm. Really, all he is trying to do is express the size of a storm in terms of a probability statement. If he calls the storm a 50-year storm, this does not mean your home beside the river is safe for another 50 years or that the storm will not occur again for another 50 years. Rather, it means that there is a 2% chance that the storm will occur within the next year (that day could be tomorrow); about a 20% chance that the storm will occur within the next 10 years; a 65% chance that the storm will occur in the next 50 years; and a 90% chance that the storm will occur in the next 100-year period (Table 1).

Figure 1. Skeena River in flood, Usk, B.C., June 1936.

Table 1. Probability (in percentage) of occurance of various storms[a].

Type of Storm (T)	Time Interval in Years(r) 1	2	5	10	15	20	25	50	100
2 years	50	75	97	99	--	--	--	--	--
5 years	20	36	67	89	96	99	--	--	--
10 years	10	19	41	65	79	88	93	99	--
15 years	7	13	29	50	65	75	82	97	100
20 years	5	10	23	40	54	64	72	92	99
25 years	4	9	18	34	46	56	64	87	98
50 years	2	4	10	18	26	33	40	64	87
100 years	1	2	5	10	14	18	22	39	63

[a]The cell under the 5-year time interval and opposite the 5-year storm show that there is a 67% chance that the 5-year storm will occur in the 5-year time period. Similarly, there is a 10% chance that a 50-year storm will occur. Probability calculated by $1-(1-1/T)^{r}$.

The hydrologist makes predictions about future storms or floods based on the past occurrence of similar events. The frequency with which a given storm/flood event may be exceeded in the future is based upon a study of the frequency with which the event has been exceeded in the past. However, in order to complete this type of probability prediction, the hydrologist must have a historical record of past events (precipitation and stream flow). In the Prince Rupert Forest Region, our weather and stream flow records are very short and discontinuous. The oldest weather records are from Port Simpson, extending from 1886 to 1910, and from Kitimat Mission, extending from 1902 to 1945. The Skeena River at Usk has the longest running stream flow gauging station; it commenced operation in 1928. Stations on smaller streams in the region were only installed in the 1960s, and many have since been abandoned.

The lack of historical data on precipitation and stream flow prevents a simple ranking of storm size and the prediction of the recurrence of big storms. However, we know that heavy rainfall is the dominant environmental factor contributing to rapid debris slides-avalanches-flows and torrents on the B.C. North Coast. Hence, landslides provide a legacy to date large storm events. Evidence of debris slides-avalanches-flows and torrents are easily recognized on air photographs, as long linear tracks in forested terrain, either bare or covered in forest vegetation of an age or species differing from the surrounding forest matrix (Figure 2).

Landslide ages can be determined by counting the rings dating the scar damage and growth response of trees along the slide path (Figure 3). Dating of landslide events has thus enabled us to extend our storm data for big rainstorms back into the 1800s. The results indicate years when a large number of debris slides-avalanches-flows occurred. It appears that big rain storms or a series of large storms occurred in six years between 1875 and 1990. The years are 1875, 1891, 1917,

Figure 2. Historic debris avalanches showing different age and species composition of the slide-track vegetation.

Figure 3. Tree disk shows scar from impact damage. Ring count dates the scar damage to 1875.

1935, 1957, and 1978 (Figure 4 - see last page). The years between 1980 and 2000 have been relatively benign although some hillslope failures do occur almost every year.

Early newspapers also contain useful historical information on dates of hillslope failures, and about damage and deaths caused by the storms:

- In 1891, fifty people were killed when debris flows crashed through fish canneries along Inverness Passage, Prince Rupert;

- November 1917, Swanson Bay set the Canadian record for the greatest precipitation in one month—the majority falling over a 20-day period;

- Seven people were killed in 1957 when a debris avalanche from Mount Oldfield, Prince Rupert, swept over three houses;

- The 1978 storm was the largest storm in recent history. It caused considerable destruction and loss of life in a path from the Queen Charlotte Islands to Terrace.

Comparing the number and size of landslides along the North Coast dating to the storm(s) in 1917 for example to the number of slides that occurred during the 1978 event, for example, suggest that the 1978 storm was smaller. Unfortunately, insufficient historical climatological data prevent a clear understanding of factors or conditions that preceeded the large historical events in 1875, 1891, and 1917. This prevents meaningful calculations to determine return periods or recurrence probabilities for these events.

Age determination of historical landslides has shed some insight into the magnitude of historical storms that have occurred since 1875. This analysis suggests that the big storms similar to events in 1891 and 1917 have not occurred since the onset of forest management activity and larger population settlement along the British Columbia north coast. What sort of devastating impact will a truly big storm have on private property and forestry-fishery values? We must be very careful to avoid being lulled into a feeling of false security by a series of relatively benign years—the climatic hazard is always present.

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Sugessted Reading

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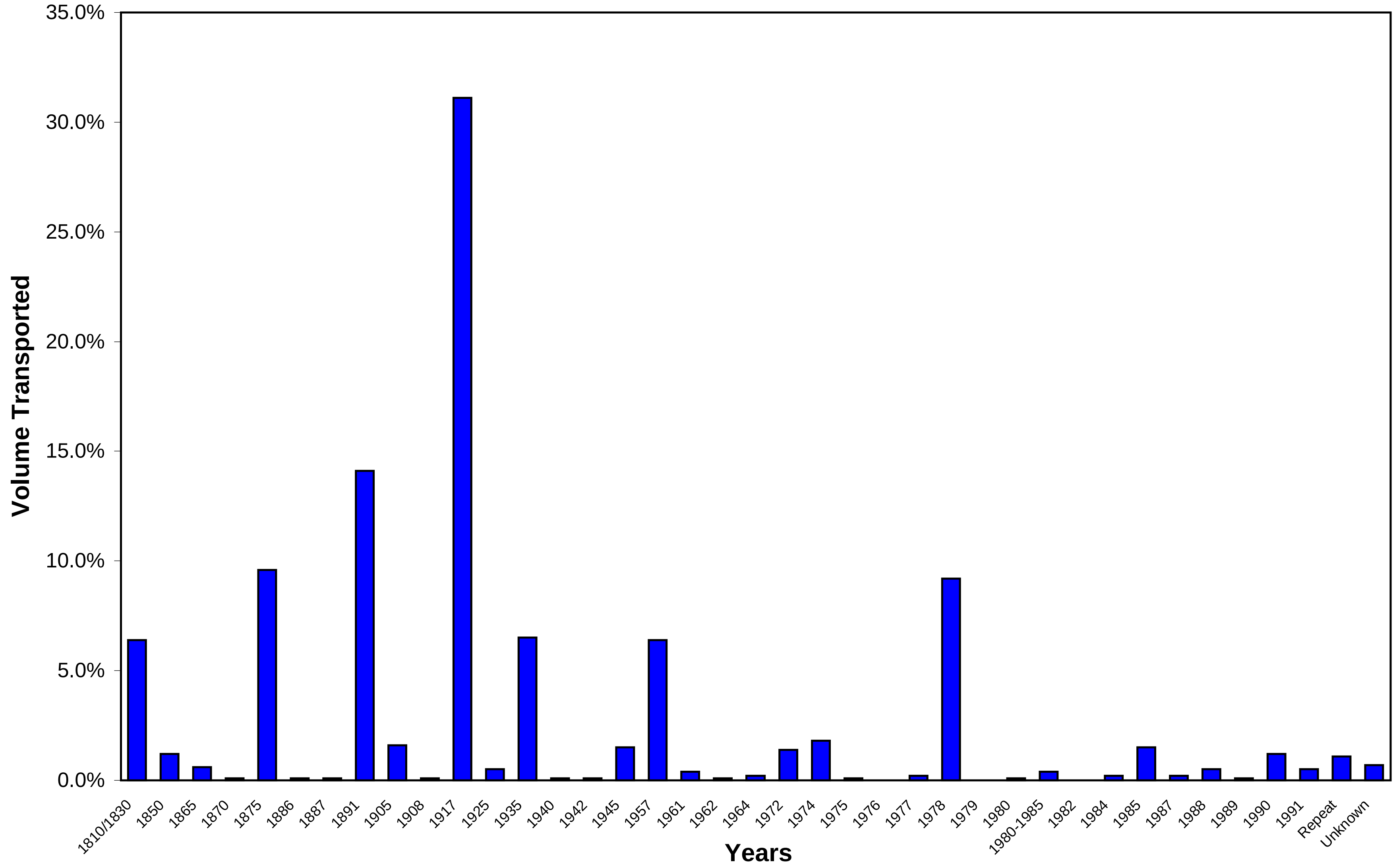

Figure 4. Percent volume transported per year by debris slides-avalanches-flows and torrents for study areas on Graham Island, Queen Charlotte Islands and in the Prince Rupert Area. Values are based on known, determined and estimated landslide failure dates, as shown.