Ice Jams: How will they change? And how can we prepare?

What is an ice jam and how does it cause flooding?

Ice jams are caused when pieces of river ice that are moving downstream with the current build up against an obstruction, like a more solid sheet of ice. That ice builds up then grows or thickens enough to slow the flow of water. As a result, water levels upstream of the jam increase.

These events, which can occur during freeze up, break up, or mid-winter thaws, can lead to major flooding, either through the rise of water upstream of the jam, or from the surge of water when the jam lets go. Ice jam floods can be particularity dangerous since water levels can rise quickly and large pieces of ice can cause additional damage.

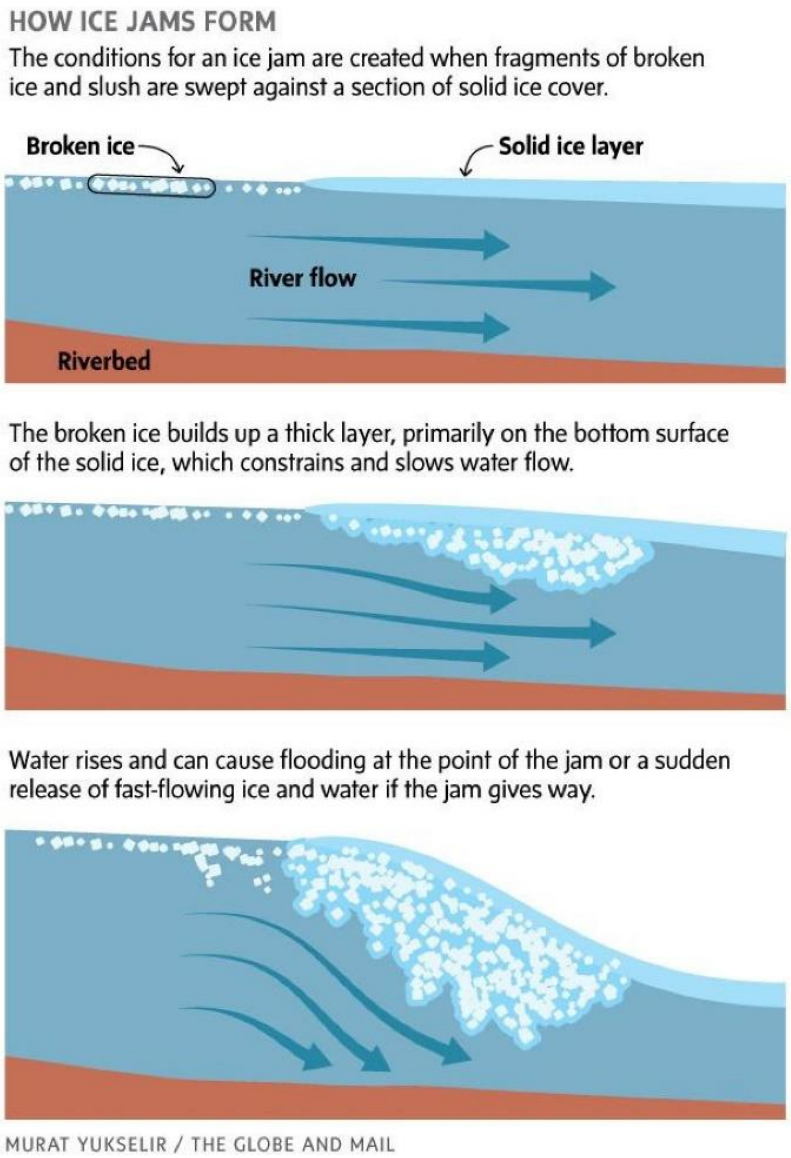

Image from https://www.theglobeandmail.com/technology/science/winter-flooding-risk-in-canada-expected-to-increase-as-climate-warms/article38078061/

How will climate change impact ice jam flooding?

The formation of an ice jam depends on a number of factors, including the thickness of the ice, the flow of the water, and the shape of the river channel. Because these factors are site-specific, it's difficult to make a single statement about how the frequency of ice jams will change with climate. Scientists do know that climate factors, such as temperature, amount of precipitation, and type of precipitation (whether it falls as rain or snow) are a big influence on ice break up and jam formation.

The impact of climate change on ice jam formation will likely vary depending on where you are, and from season to season. For example, warmer regions might have thinner ice and more mid-winter break ups. In more northern areas, temperatures and ice thickness might allow for only small mid-winter thaws, but these small thaws could cause broken ice to be swept downstream against patches of thicker ice which can then freeze together, thickening the ice increase the risk of jams in the spring. This is especially true of the large rivers that begin in the south and drain into Hudson and James Bay.

How can we prepare?

Monitor

Monitor river conditions, especially during break up. This could be particularly important for rivers that have had ice jams in the past. Traditional Ecological Knowledge (TEK) could be an important component for determining if ice jams have happened in the area and where they might have occurred.

Land use planning

Knowledge of flood plains and past high-water levels can help identify areas of communities that may be vulnerable to flooding. These areas should be avoided when new development is considered. In some cases, communities may want to consider relocating structures built in areas prone to flooding.

It should be noted that ice jam flooding can result in even higher water levels than other open-water flooding events. Knowledge of past ice jam flooding from TEK or local memory can be helpful in determining the extent of flooding that could be expected.

Promote ice decay

In areas where jams are common, reducing the quality of the ice to promote melting can prevent a jam or reduce its severity. Some examples of this include ice cutting (slots cut into large sections of ice), hole drilling (drilling holes into the ice at equal intervals) and ice dusting (spreading dark material across the ice to absorb sunlight). On some rivers, like the Red River in Manitoba, ice-breaking vessels are deployed to reduce the chance of large ice pieces causing jams.

Ice dusting can promote melting. Snow was covered with sticks and has melted about 30cm below the surrounding snow.

Amphibex machines (icebreakers) on the Red River in Manitoba, March 2019. Image from https://www.cbc.ca/news/canada/manitoba/amphibex-ice-breaker-manitoba-flood-1.5072933

Fixed structures

Structures for ice jam prevention can be quite effective but are also more expensive and not always feasible for remote areas. Structures can include dykes (for holding back flood water), ice booms (man-made barriers with floating sections installed across the channel to control the movement of ice), and ice-retention structures (such as rows of concrete piers to stop the downstream movement of ice).

Dyke along the Albany River, South Channel [1]

Ice boom on the Rupert River, James Bay region [1]

Erindale Park ice retention structure on the Lower Credit River[2]

[1] Abdelnour, R. Albany River 2008 Ice breakup: forecasting the Flood Event, Observations of the River during the Spring breakup and the Potential for mitigating the Flooding Risk of the Kashechewan and Fort Albany First Nation. Proc. 17th Work. River Ice 16 pages (2013). [2] https://cvc.ca/news/story/cvc-clears-debris-in-river-to-help-prevent-future-flooding/

Although it is difficult to predict if ice jams will happen more often because of climate change, we know that the climate will change. Northern rivers may be at higher risk of ice jams because they begin in the south where ice melts more quickly than it does where communities are located along the Hudson and James bays.

Want to know more?

Read this paper: https://www.sciencedirect.com/science/article/pii/S0165232X07001796

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