2017 LiDAR Hillshade on Google Earth

Coquitlam River Watershed Roundtable

BRIEF GLACIAL HISTORY AND GEOMORPHOLOGY OF THE COQUITLAM RIVER WATERSHED

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metrovancouver

BRIEF GLACIAL HISTORY AND GEOMORPHOLOGY OF THE COQUITLAM RIVER WATERSHED

Data Sources

- Stephen Hicock M.Sc. Thesis (UBC). June 1976. *Quaternary Geology: Coquitlam – Port Moody Area, British Columbia*
- Mathews, W.H., Borden, C.E., Akrigg, G.P.V., & Gibbard, J.E. 1977. *The Fraser's History from Glaciers to Early Settlements*
- Hicock, S.R., and Armstrong, J.E. 1981. *Coquitlam Drift: a pre-Vashon Fraser glacial formation in the Fraser Lowland, British Columbia. In CJES, V.18 No. 9 pp. 1443-1451.*
- Clague, J.J. and Luternauer, J.L. 1983. *Field Trip Guidebook. Trip 6. Late Quaternary Geology of Southwestern British Columbia.*
- Cordilleran Geoscience. March 2022. *Geohazard Gap Analysis, Coquitlam Reservoir*

BRIEF GLACIAL HISTORY AND GEOMORPHOLOGY OF THE COQUITLAM RIVER WATERSHED

Ice Ages

- The Earth has experienced numerous ice ages during the Pleistocene (last 2.58 million years).
- In BC, the last major glaciation (Fraser Glaciation) reached its maximum extent around 15,000 year ago.
- Relative sea level was higher as ocean water was locked on land as glacial ice.

Maximum extent of Fraser Glaciation in BC (~15,000 YBP)

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Ice Ages

- Rapid deglaciation followed such that most of the Lower Mainland was ice free by around 11,000 year before present.
- As valley glaciers retreated most of the valleys on the North Shore (e.g., Capilano, Seymour, Coquitlam, Pitt) were submerged as fjords much like Indian Arm.
- Glacial unloading on land led to rapid relative sea level drop.

Deglaciation in BC (~11,000 YBP)

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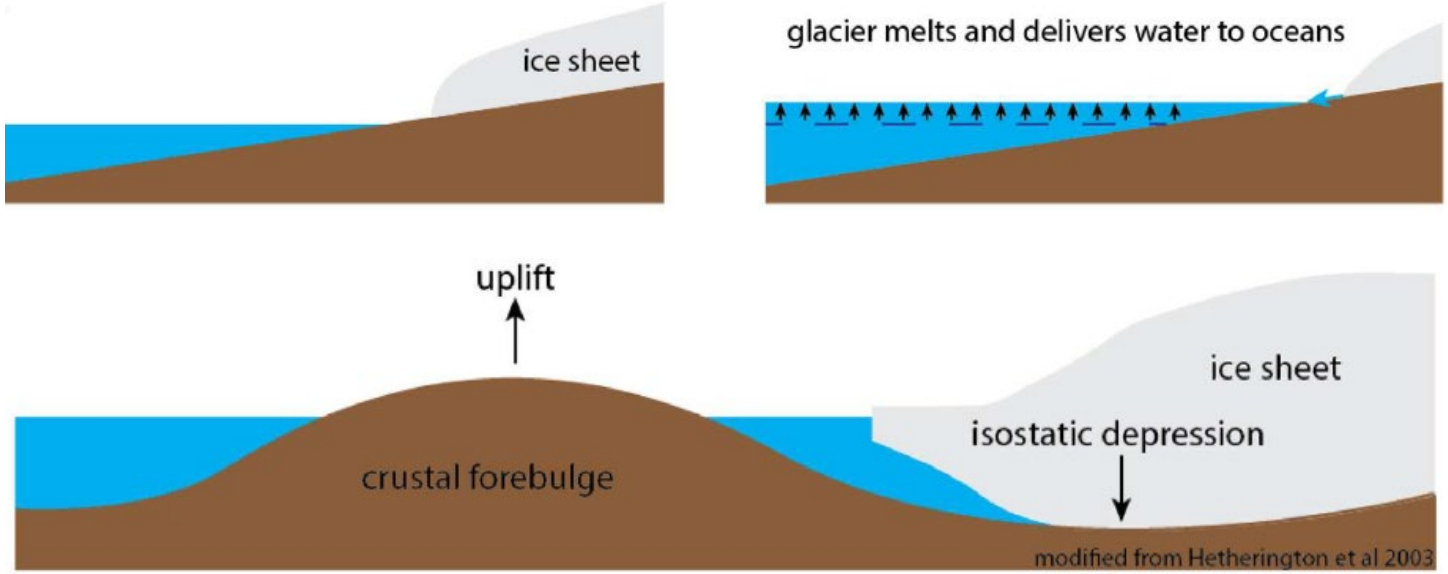
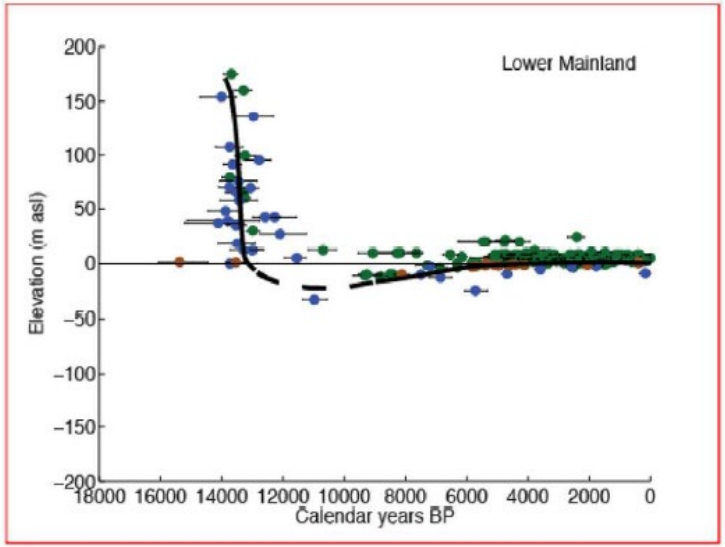
Relative Sea Level Change



Relative Sea Level Change

- Dan Shugar et al. 2014. Post-glacial sea-level change along the Pacific coast of North America. Quaternary Science Review 2014. p1-23.
- Marine shells deposited 13,000 YBP have been found around 200 meters above sea level (m asl) in the Lower Mainland.
- Radiocarbon dates of peat buried in post-glacial sediments allow geoscientists to develop sea-level curves for the Lower Mainland.
- Sediments exposed on the west slopes of Lower Coquitlam River valley have been dated as far back as ~26,000 YBP and aid in the interpretation of the Lower Coquitlam River's glacial and post-glacial history.



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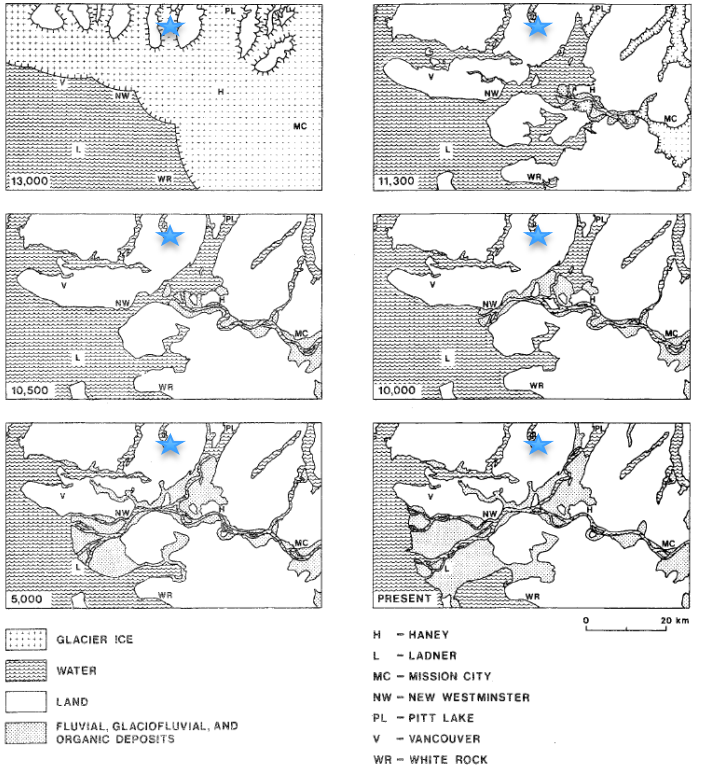
Evolution of the Fraser River floodplain and delta (Clague and Luternauer 1983)

- Blue star = Coquitlam Dam
- ~13,000 YBP: valley glaciers from the North Shore Mountains and the Fraser River valley covered the Fraser Lowland and retreated north and east.
- ~11,300 YBP: much of the Fraser Lowland had emerged from the sea (e.g., Burnaby Uplands and Mary Hill). Indian Arm and Pitt River valley were still connected to the sea.
- ~10,500 YBP: meltwater deposits filled the Fraser River valley from Mission to Surrey to form a prograding delta.
- ~10,000 YBP: Prograding Fraser River delta built across and up Pitt fjord to form Pitt Lake; coalescing with the Coquitlam River and continuing west past New Westminster and into the ancestral Salish Sea.
- Buried peat dated around 7300-8350 YBP, located near the Port Mann bridge, was found at -11 m elevation suggesting sea level was at least 12m lower than present around this period.
- ~5000 YBP: Fraser River delta rapidly expanding southwest and Burns Bog began to form. Point Roberts was an island.



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Deglaciation of the Lower Mainland (Mathews et al 1977)

- Blue star = Coquitlam Dam
- Figure 1. ~12,500 YBP the Lower Coquitlam River valley was ice-free and open to the sea (fjord-like)
- Figure 2. ~12,000 YBP as relative sea level drops, glacial meltwater from the Coquitlam River valley glacier deposits thick sequences of sand and gravel (marine delta).
- Figure 3. ~11,500 YBP short-lived marine incursion and wave-action re-worked gravel and sand containing marine shells up to 175 masl.
- Figure 4. ~11,000 YBP Lower Mainland was ice-free and ancestral Coquitlam River incised its valley sediments and redeposited sand and gravel along its lower course from Coquitlam Lake to the Fraser River.

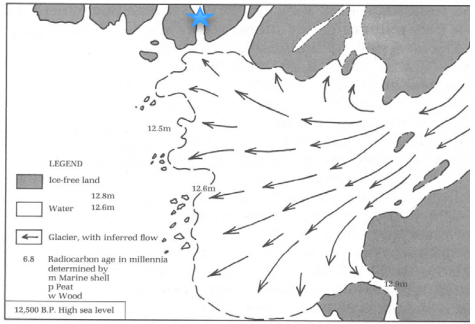

figure 1

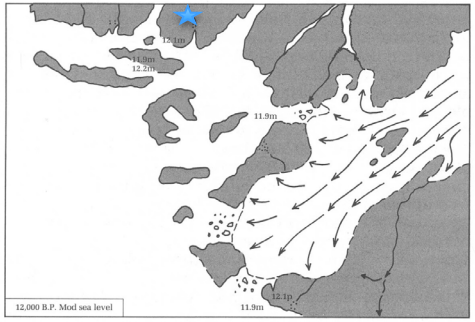

figure 2

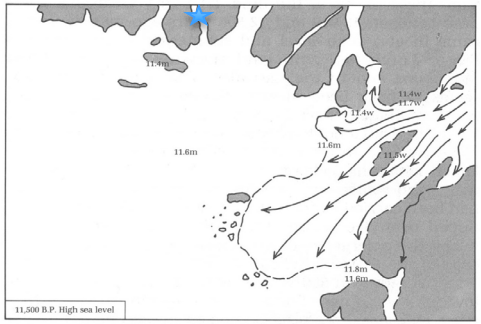

figure 3

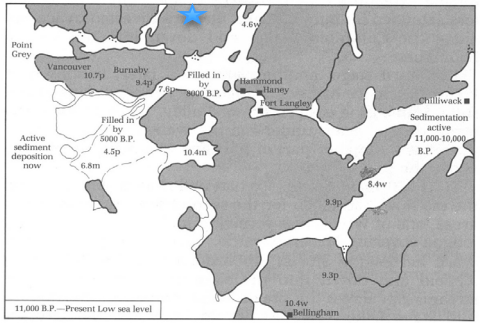

figure 4

Post-glacial Coquitlam River valley (last 10,000 years)

- The Coquitlam River valley glacier and its tributary glaciers likely retreated into their respective headwater valleys as the climate warmed.
- Steep, unvegetated slopes were subject to rapid mass wasting (landslides, snow avalanches, stream erosion).
- Debris flow cones and fans form at the mouth of steep gullies and mountain streams.
- Sediment supply soon decreased as valley slopes were stabilized by vegetation.
- Wetlands and organics deposits form on floodplains and lowlands.
- In recent times, human activity (logging, roads, urbanization, dam, aggregate extraction) also affect erosion and deposition of sediments.

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Post-glacial Processes (Geohazards aka Natural Hazards)

- Landslides (debris avalanches, debris flows, debris floods, rock falls, rockslides)
- Snow avalanche
- Hydrotechnical hazards (flooding, bank erosion, avulsions)

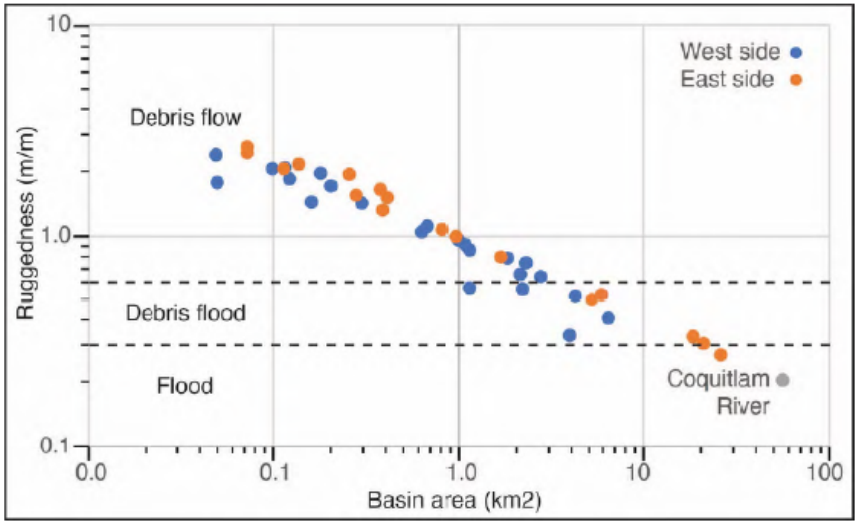
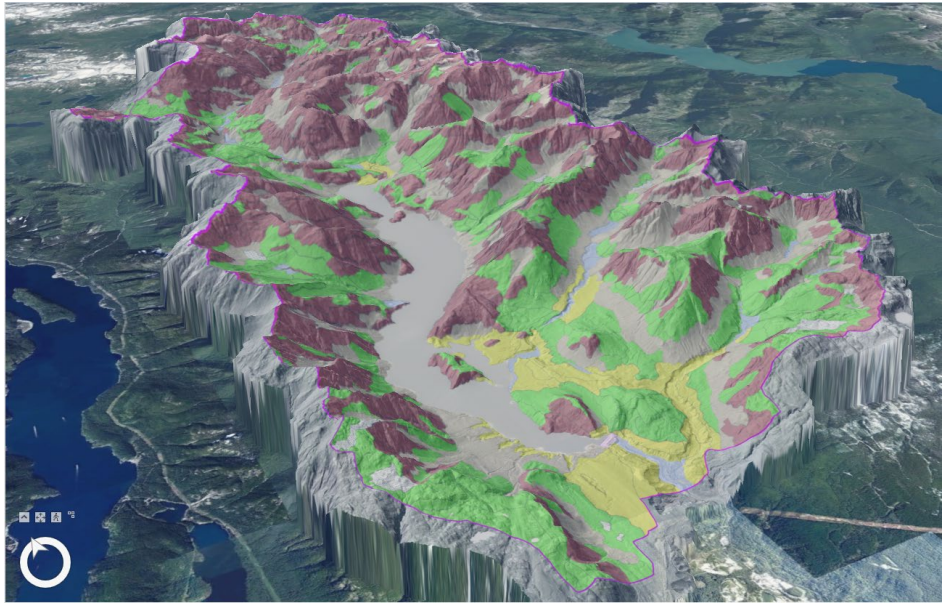


Figure 4. The relationship between ruggedness and basin size is log-log linear, with the distribution of all basins showing a good fit. Basins on the west side range between 0.1-10 km^2; while basin size on the east side is somewhat bimodal with five basins larger than 40 km^2 and the rest less than 2 km^2. Source: Cordilleran Geoscience 2022

Mid 1990s – GVWD Baseline Ecological Inventory Mapping

- Terrestrial ecosystem mapping is based on terrain mapping
  - site series,
  - vegetation development
- Terrain mapping
  - surficial material,
  - material texture,
  - material thickness & landform,
  - geomorphological processes
  - soil drainage
- 1:20,000 scale
  - resource planning level



Coquitlam River Watershed Terrain Map

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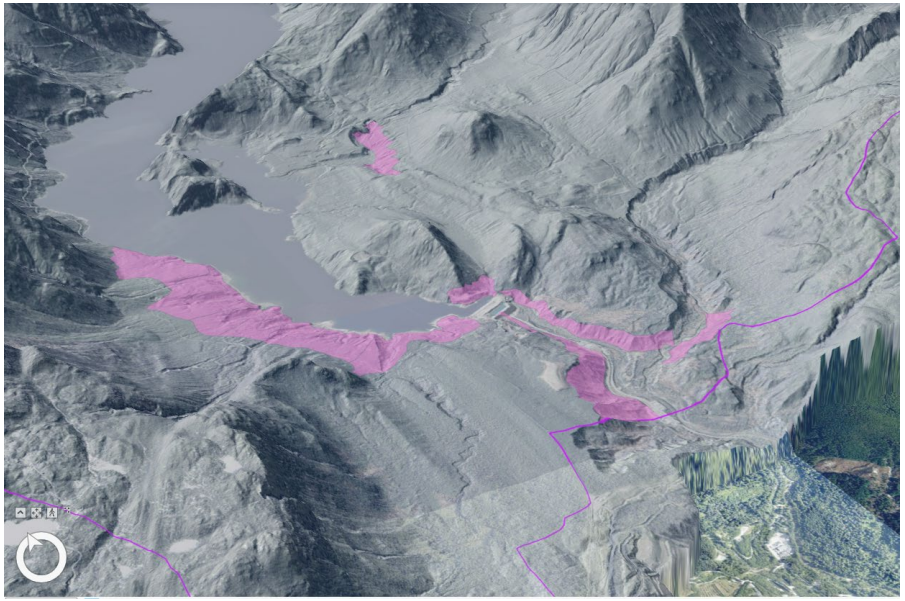
Mid 1990s – Terrain Mapping & Derivate Mapping (Acres Int'l & JMRATA)

- Bedrock
- Till
- Glaciolacustrine (pink)
- Glaciofluvial
- Colluvium
- Fluvial
- Organics
- Anthropogenic



Coquitlam River Watershed - Extent of Glaciolacustrine Silt and Clay

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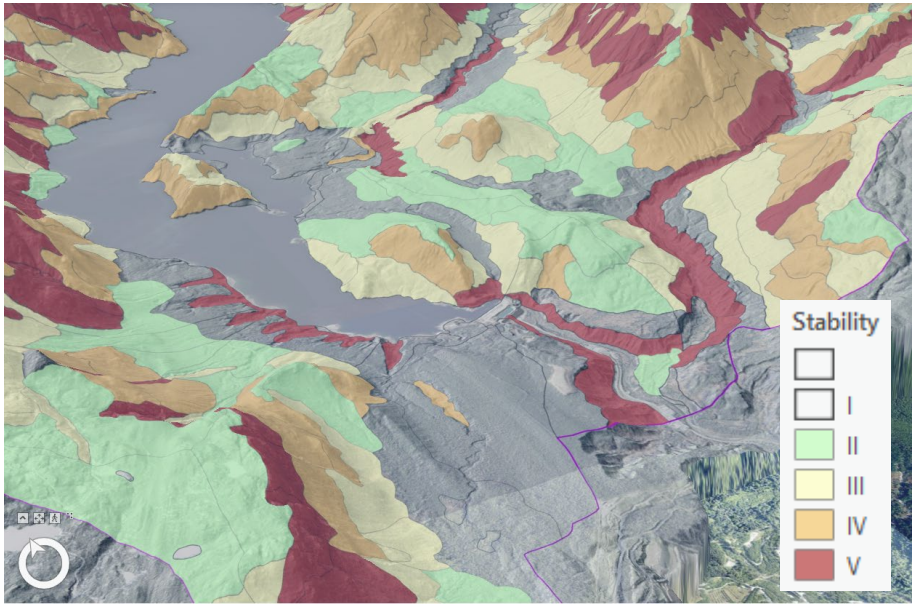
Mid 1990s – Terrain Stability Mapping

- Natural hazards (Geohazards)
  - Landslides
  - Snow avalanche
  - Hydrotechnical hazards (flooding, bank erosion, avulsions)
- 5 Terrain Stability Classes
  - I-V (stable → unstable)



Coquitlam River Watershed – Terrain Stability Map

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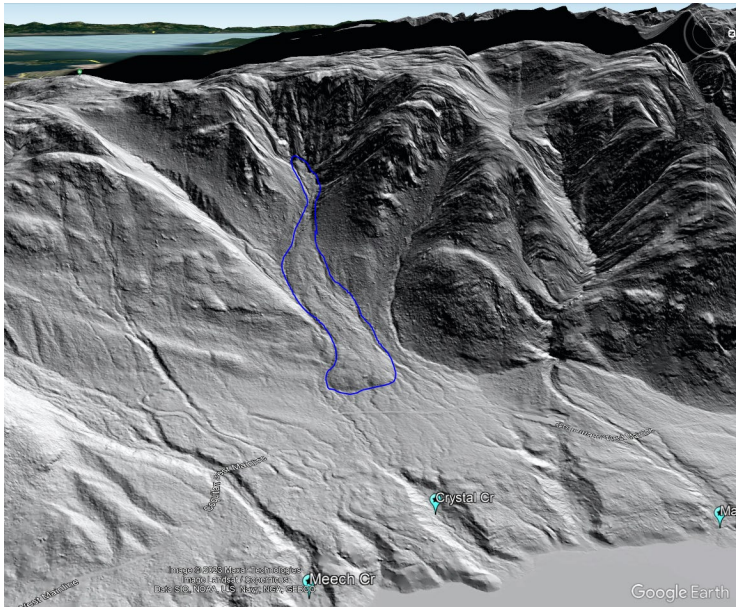
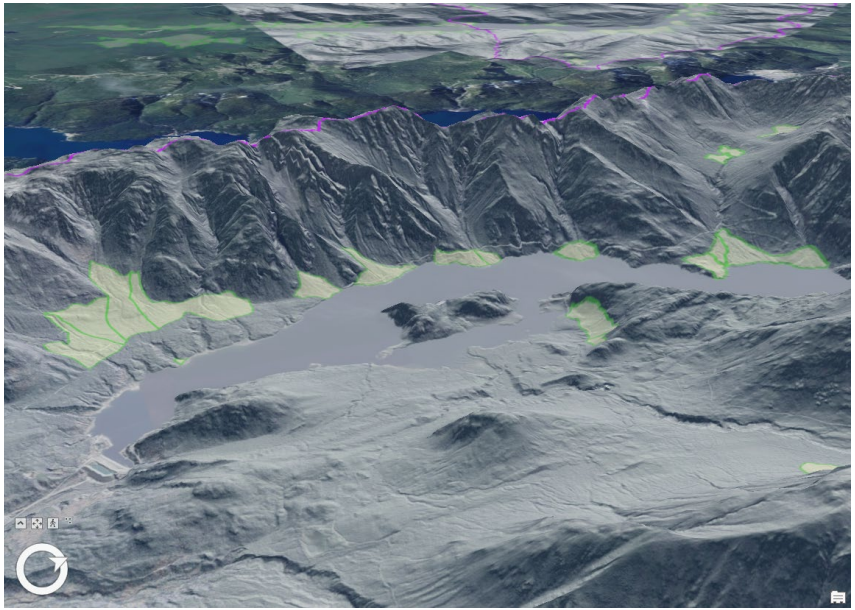
Example Images



Old rockslide in Crystal Creek on the west side of Coquitlam Reservoir



Fans and cones (yellow areas) on the west side of Coquitlam Reservoir

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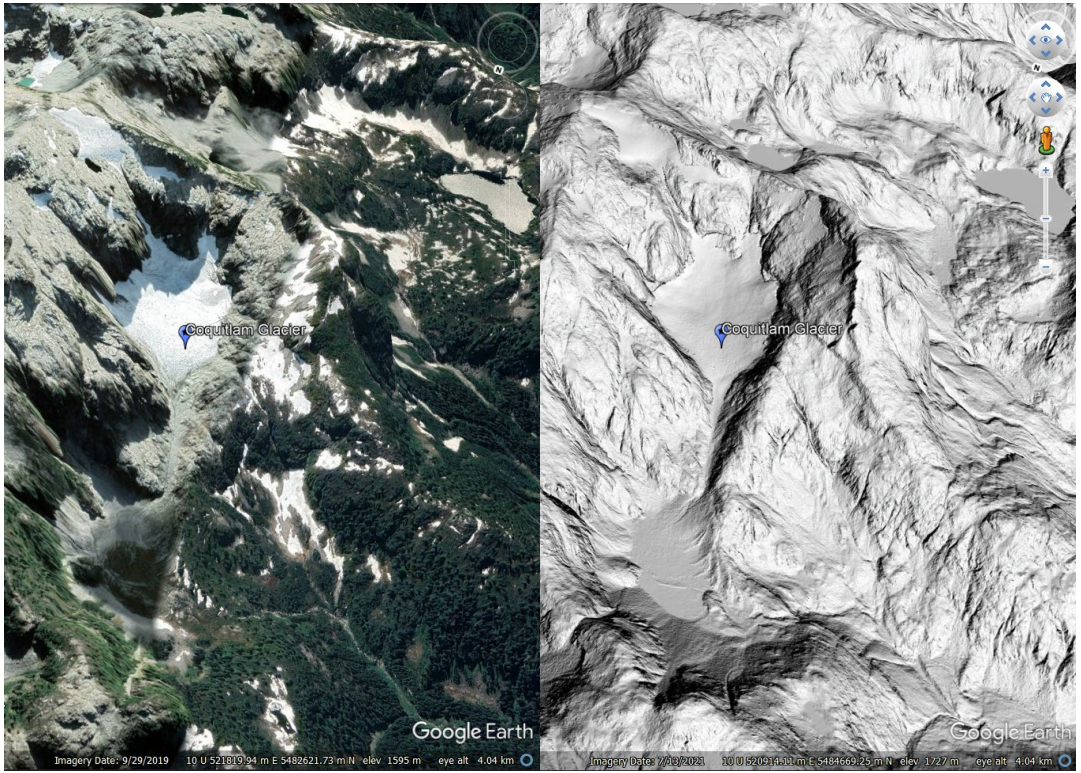
Example Images

- Coquitlam Glacier
  - Last glacier in Metro Vancouver watershed
  - Anticipated to disappear 2050-2100



THANK YOU