

HYDROLOGICAL ANALYSIS OF THE HUDSON AND AROOSTOOK RIVERS: FLOOD VS. DROUGHT, AND TRADITIONAL ECOLOGICAL KNOWLEDGE (TEK) OF THE MOHICAN AND MI'KMAQ NATIONS

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BACKGROUND

Traditional Ecological Knowledge (TEK) is defined as Indigenous peoples' intergenerational knowledge and practices that predate modern science and are based on cultural memory, oral tradition, and reciprocity.

Hudson River (The Mohicans):

- The 315 mile-long Hudson River stretches from the Adirondack Mountains into the New York Harbor. In Colonial times, the river supported a lucrative fur trade and transported wheat and timber from Hudson Valley to New York City.
- The name "Mohican" translates to "The people of the waters that are never still." Their land consists of the entire Hudson River valley of New York. They hunted deer and relied on fish from the Hudson Valley's waterways to survive but were ultimately forced off of their lands by the Dutch.

Aroostook River (Mi'kmaq Nation):

- It's the largest sub-basin of the St. John River, lying almost entirely within the state of Maine
- The Mi'kmaq = First Nations people indigenous to the Atlantic coast of Canada and the northeastern United States, one of the largest indigenous tribes, with a population of over 150,000
- Mi'kmaq culture = the relationship with nature is one of deep respect and interdependence

RESEARCH OBJECTIVES

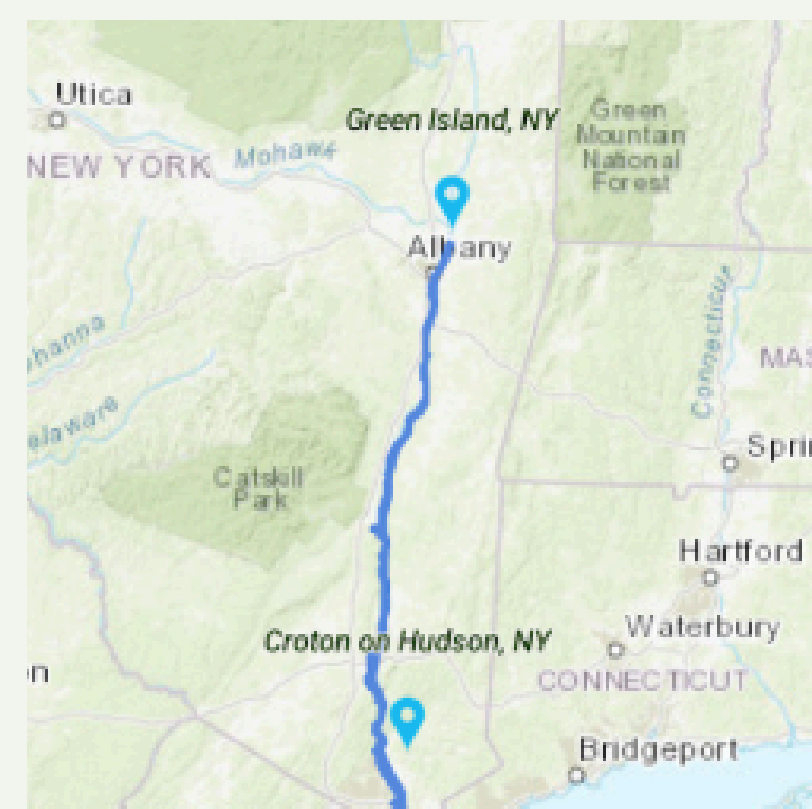
Motivations:

- Learn about water conservation from locals
- Examine changes in land and water using data and maps
- Contrast scientific results with Indigenous knowledge
- Establish better suggestions for sustainable water management

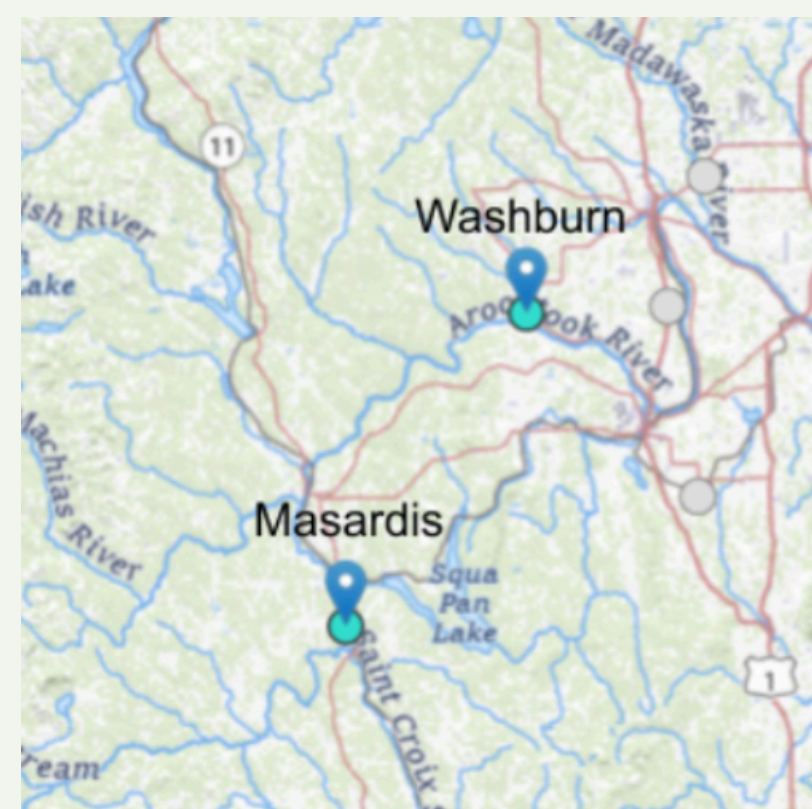
Culturally sensitive approaches to sustainable water management resulting from the integration of scientific data and traditional ecological knowledge (TEK), providing a more thorough understanding of changes in the targeted water ecosystem.

STUDY AREA

The two study area for Hudson River are Green Island (USGS 01358000) and Croton (USGS 01375000).

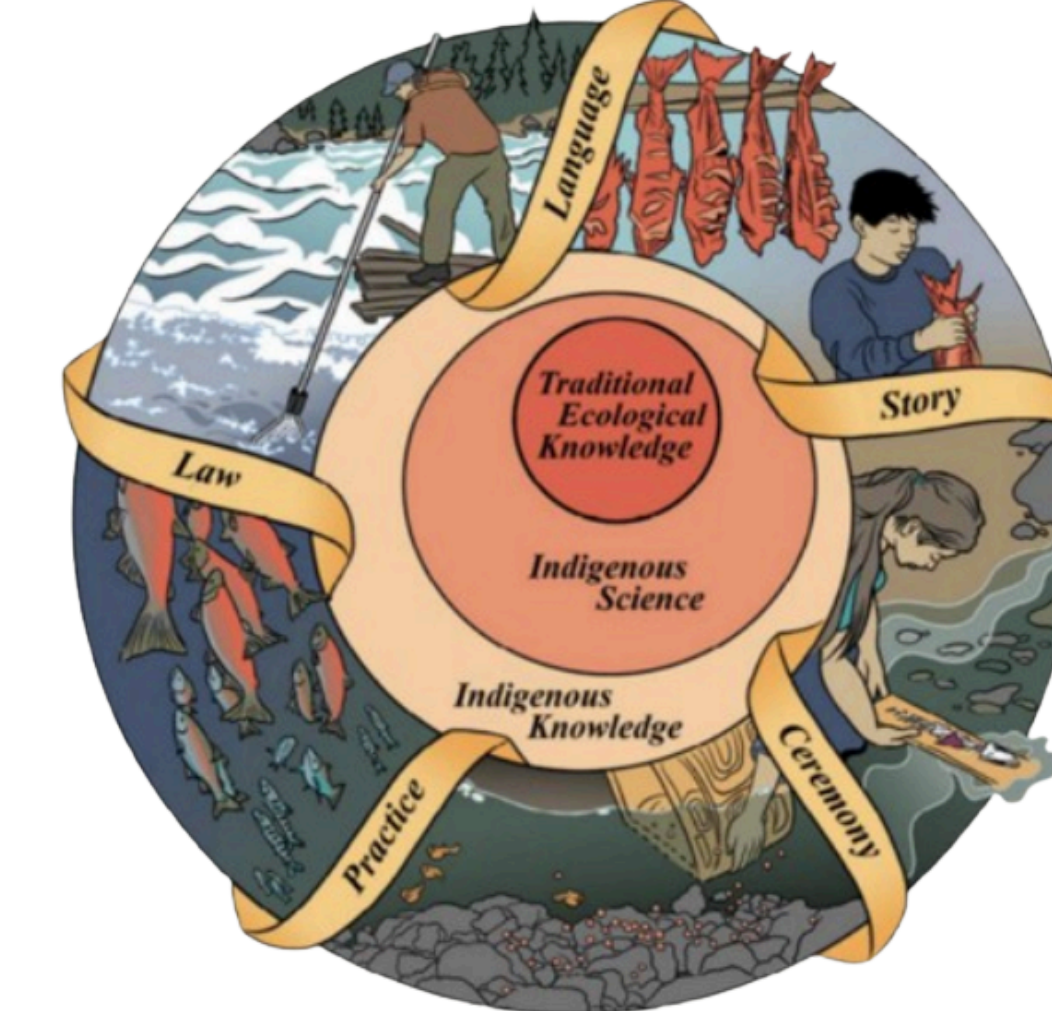


And the two study area for Aroostook River are Masardis (USGS 01015800) and Washburn (USGS 01017000).



METHODOLOGY

- Literature Review & Compilation - research and reading paper
 - "Integrating indigenous ecological and scientific hydro-geological knowledge using a Bayesian Network in the context of water resource development" - A.C. Liedloff
 - "Resource Management & the Mi'kmaq Nation" - S. Berneshawi
- Data Collection from USGS (United States Geological Survey)
- Flood and drought analysis by R, Python, Google Sheets, Excel



RESULTS & OBSERVATIONS

Figure 1: Water Discharge of Green Island

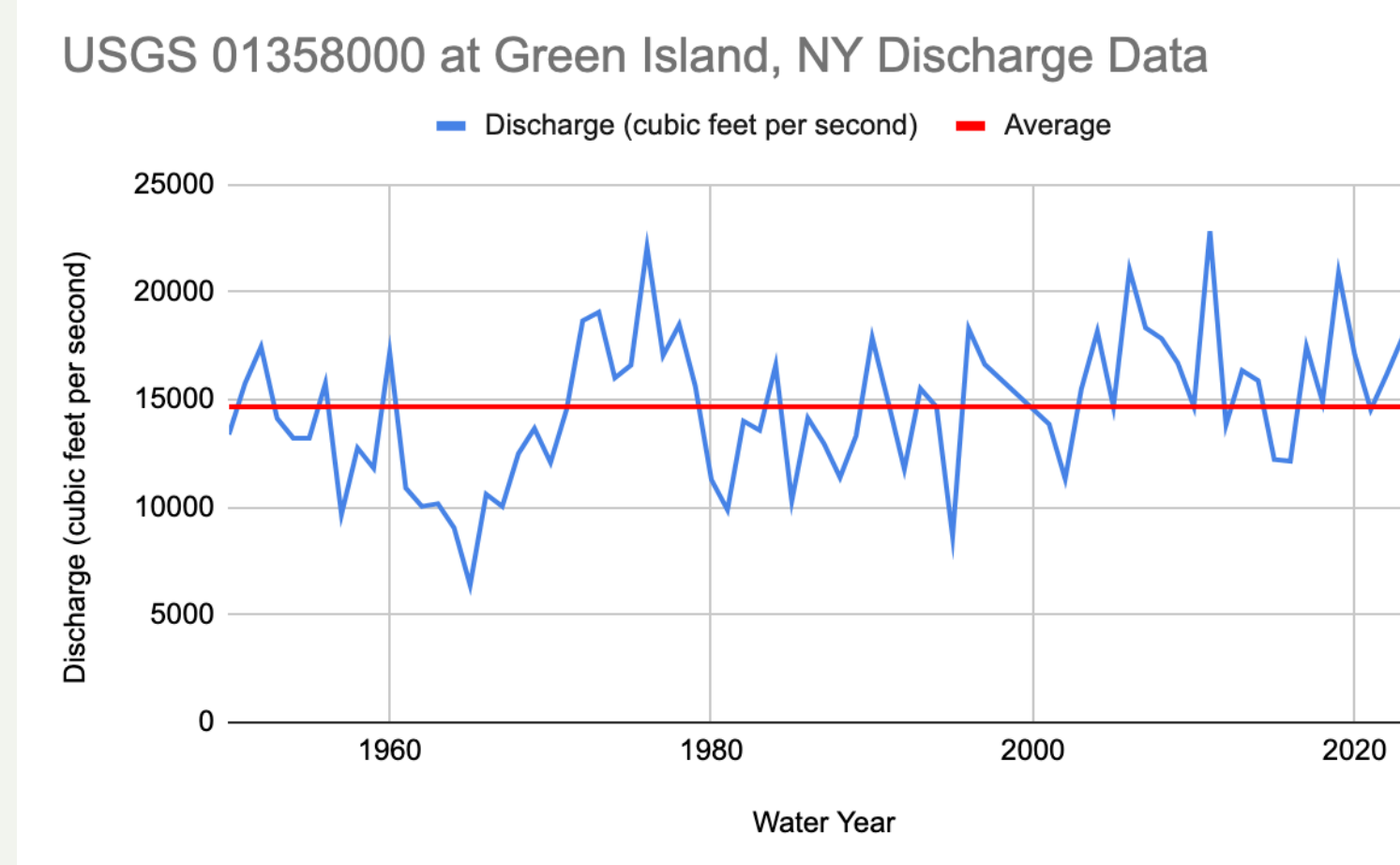
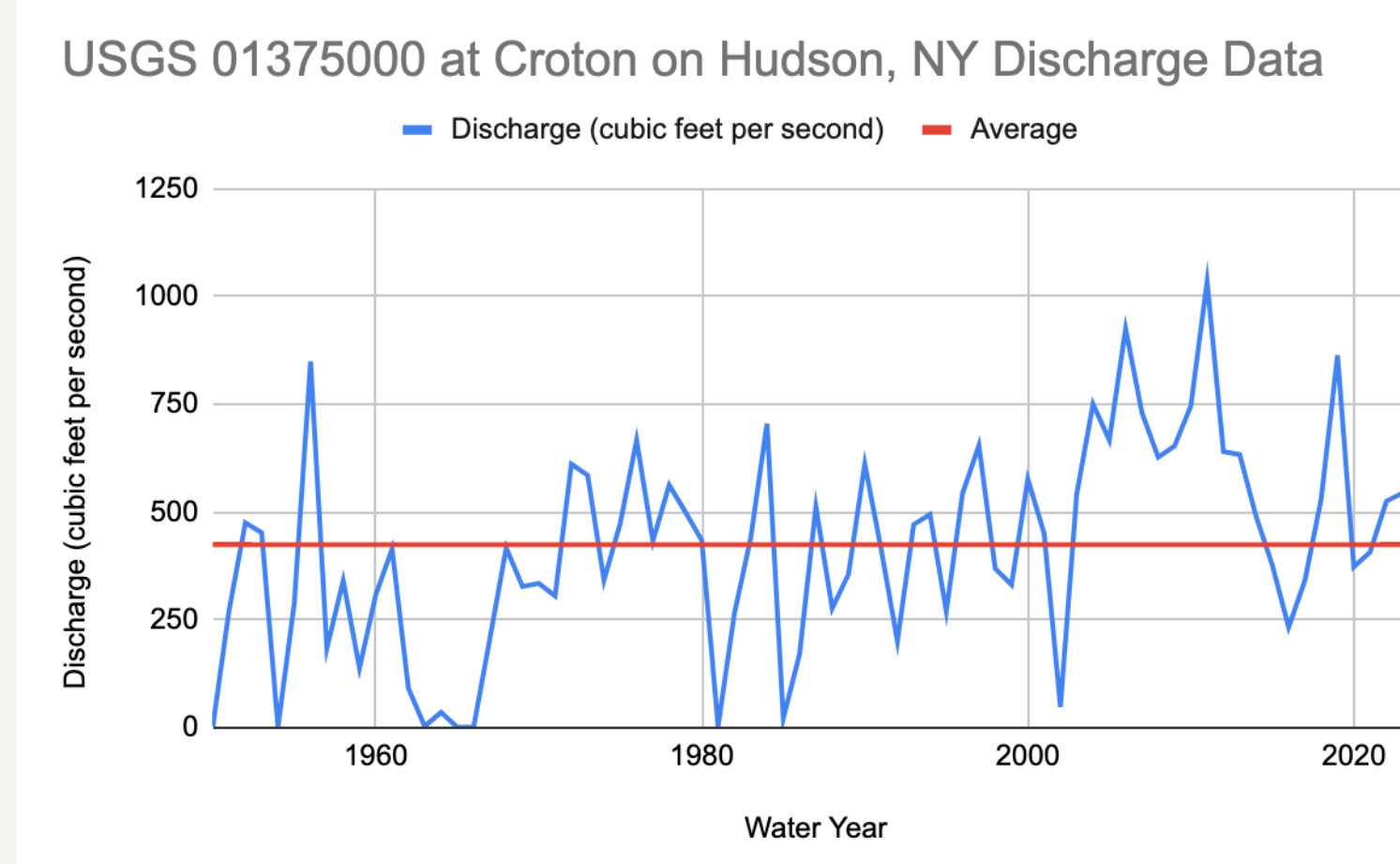


Figure 2: Water Discharge of Croton



Observations:

- The red line on the graph is the average
- Lines below the red line = drought (not enough water discharge)
- Lines above the red line = flood (too much water discharge)
- Area under the curve:
 - Used the trapezoid approximation - find the area of each trapezoid and add them together
 - Used the SUM function and dragged it across all the connected years
 - To shows severity = the bigger the number
- Worst Flood for Masardis: 1990-2000
- Worst Drought for Masardis: 1984-1990
- Worst Flood for Washburn: 1999-2000
- Worst Drought for Washburn: 1964-1969

Observations:

- highest amount of discharge per second = Green Island, peaking at 22,840 ft³/s, compared to Croton on Hudson's highest at 1,035
- average amount at Green Island = 14,679; surpasses Croton's average = 424.37
- data point under average line = area suffered a drought
- area under average line = severity of the droughts
- Green Island:
 - 1950s - 1971: Drought in 16 of 20 years
 - 1972 - 1979: 8 drought-free years
 - 1979 - 1989: Drought in 8 of 10 years
 - Early 2000s - present: Rare droughts, frequent above-average discharge
- Croton-on-Hudson:
 - 1957 - 1971: 14 consecutive drought years
 - 1972 - 1980: Only 1 drought year
 - 1980s - early 2000s: Intermittent droughts, none lasting over 2 years
 - 2003 - present: Rare droughts (5 in 21 years)

Figure 3: Water Discharge of Washburn

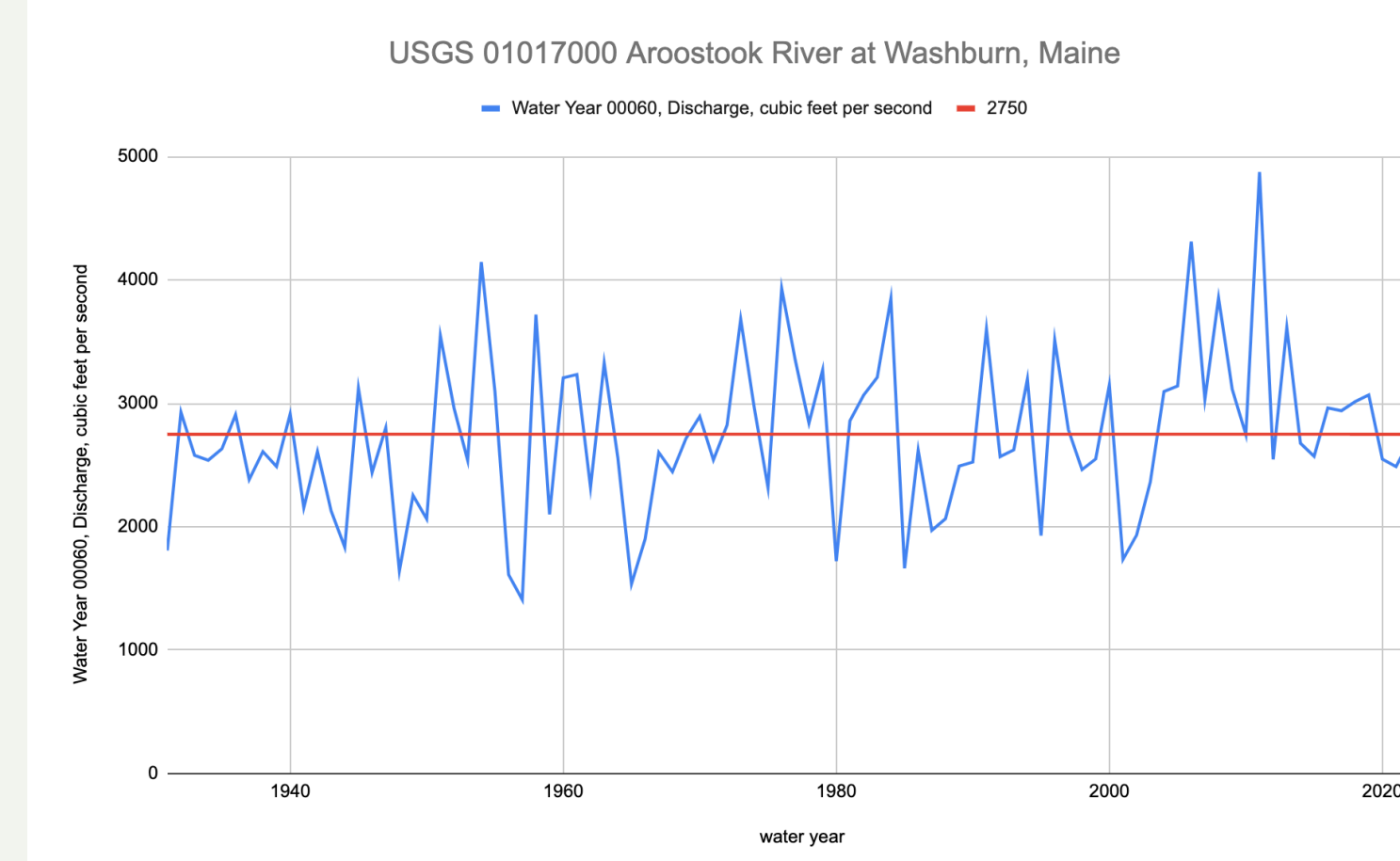
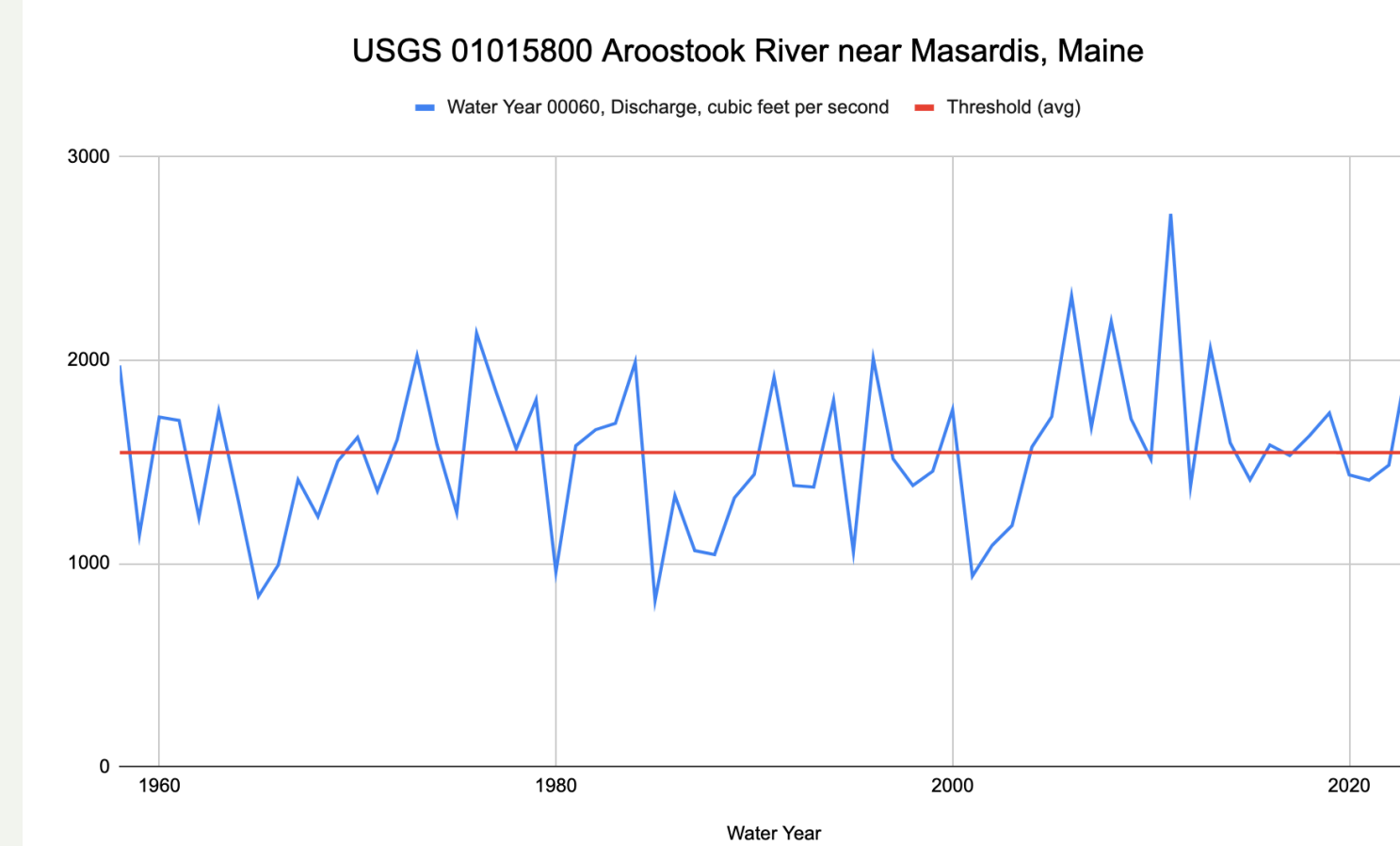


Figure 4: Water Discharge of Masardis



CONCLUSION & DISCUSSION

- Water data shows frequent occurrences of both floods and droughts. These events happen unpredictably, with no clear pattern
- Water levels and climate conditions are constantly changing
- Toward the end of the data, drought conditions rise and fall repeatedly. This instability makes it hard to predict future conditions. Overall, the constant shifts show that we can't be certain about what will happen next
- Green Island likely lies within a larger watershed with more precipitation, as shown by its higher discharge values.
- Drought has been rare in both Green Island and Croton-on-Hudson since the early 2000s, possibly due to increased precipitation or improved drought management
- Traditional Ecological Knowledge (TEK), though often overlooked by mainstream science, is deeply connected to Native American roles in discovering, settling, and preserving key rivers like the Hudson and Aroostook

FUTURE STUDIES



- A forested area that is at least 100 meters from the boundary with non-forested areas
- Different land cover colors represent different types of wetlands



Mohicans:

- Used to maintained big Pine Trees next to the river band to prevent the flood or drought
- 1746 clear cut the forests, tribal members landless
- Forest cover helps regulate streamflow (Croton is less impacted)
- Land use change impacts hydrology (Less forest = more surface runoff → higher flood peaks)
- Forests act as natural buffers and capture the water

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