The Water Game

This game introduces students to the distribution of precipitation (rain and snow) and hydropower generation in the Northwest. It also orients them to the major watershed regions.

Set Up:

Hand out a Water Game map and Generation/Precipitation Record sheet to each student. The map displays 7 major watersheds in the Northwest. Students work in groups of three or four. Each group receives a pair of dice and an additional Record sheet.

Ask each group to guess which watershed receives the most precipitation, and which one gets the least. Have the groups also estimate which watersheds contribute the most and the least to hydropower generation. The group that gets the most correct guesses wins.

The Play:

Each throw of the dice represents a volume of water (about 240 billion gallons, or 900 million cubic meters) falling on a portion of the Northwest. Students take turns throwing a pair of dice. The number on the dice corresponds to a Northwest watershed. Use the legend on the Water Game map (p. A5) to find which watershed the number corresponds to. Find the name of that watershed on the Water Game map. The number beneath the watershed name on the map is the amount of electric power generated by the water falling in that basin.

For example, a dice throw of 11 corresponds to the Pend Oreille (pronounced "pond oray"). The map shows that water falling in the Pend Oreille watershed produces 100 MW (MW stands for megawatts. A megawatt is the equivalent of 1,000 hair dryers turned on at once.) 900 million cubic meters of water falling in the Pend Oreille watershed would produce an average of 100 megawatts over the course of a year.

Students record the generation on their generation sheets. Each student in the group records the generation they get on their own sheet. After every student has rolled the dice [redacted] times, the game ends. At that point students add up the total generation for each watershed in the space provided.

Students then add up the number of entries made in the generation record for each watershed. These numbers correspond to the number of times precipitation fell on each of the watersheds. After each student has added up their own numbers the group totals can be accumulated. Use the additional Record sheet in each group and have the students find the total generation and precipitation in the watersheds for their group.

enough times so that the classroom total is roughly 400 times

Concluding:

The group sheets can be collected and the grand total for the class computed in front of the entire class. Have students graph the amount of energy and precipitation coming from the each watershed.

Which region got the most precipitation? Ask students if they have any ideas about why the results came out the way they did? Which region received the least precipitation, why? Which region was responsible for contributing the most hydropower? The amount of energy produced depends on the amount of precipitation and the watershed elevation. The higher the elevation, the more dams the water goes through before returning to the sea. A good exercise is to have the class make bar charts of the generation by watershed. They can also make a graph of the precipitation by watershed.

The group coming closest to guessing the watersheds with the most and least precipitation and generation is the winner.

Notes:

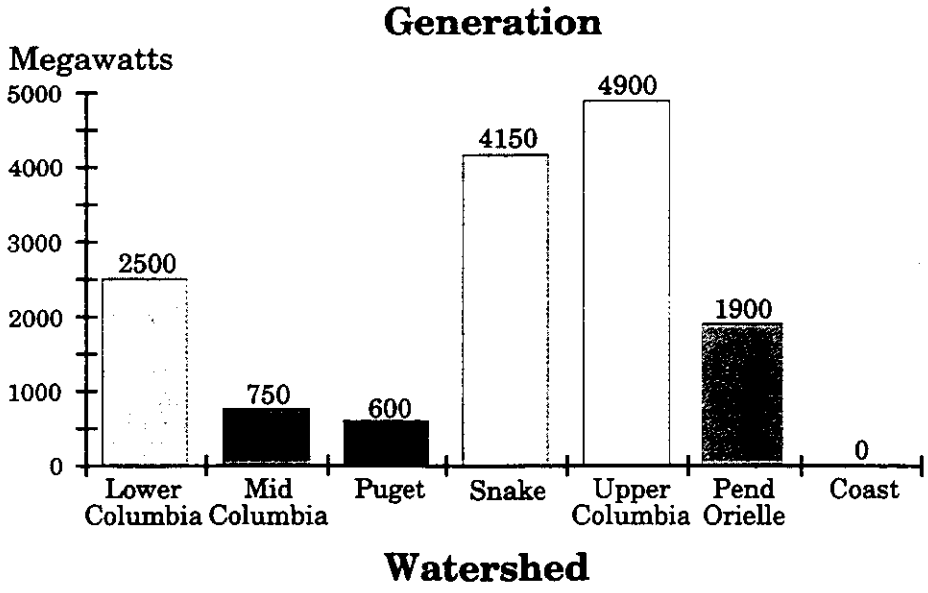
A total of 400 throws of the dice corresponds roughly to an average year's precipitation in the Northwest. You may want to adjust the number of throws each student makes so that the total throws made by the class is close to 400. For example, a class of 20 students might want to throw the dice 20 times each instead of the suggested 15.

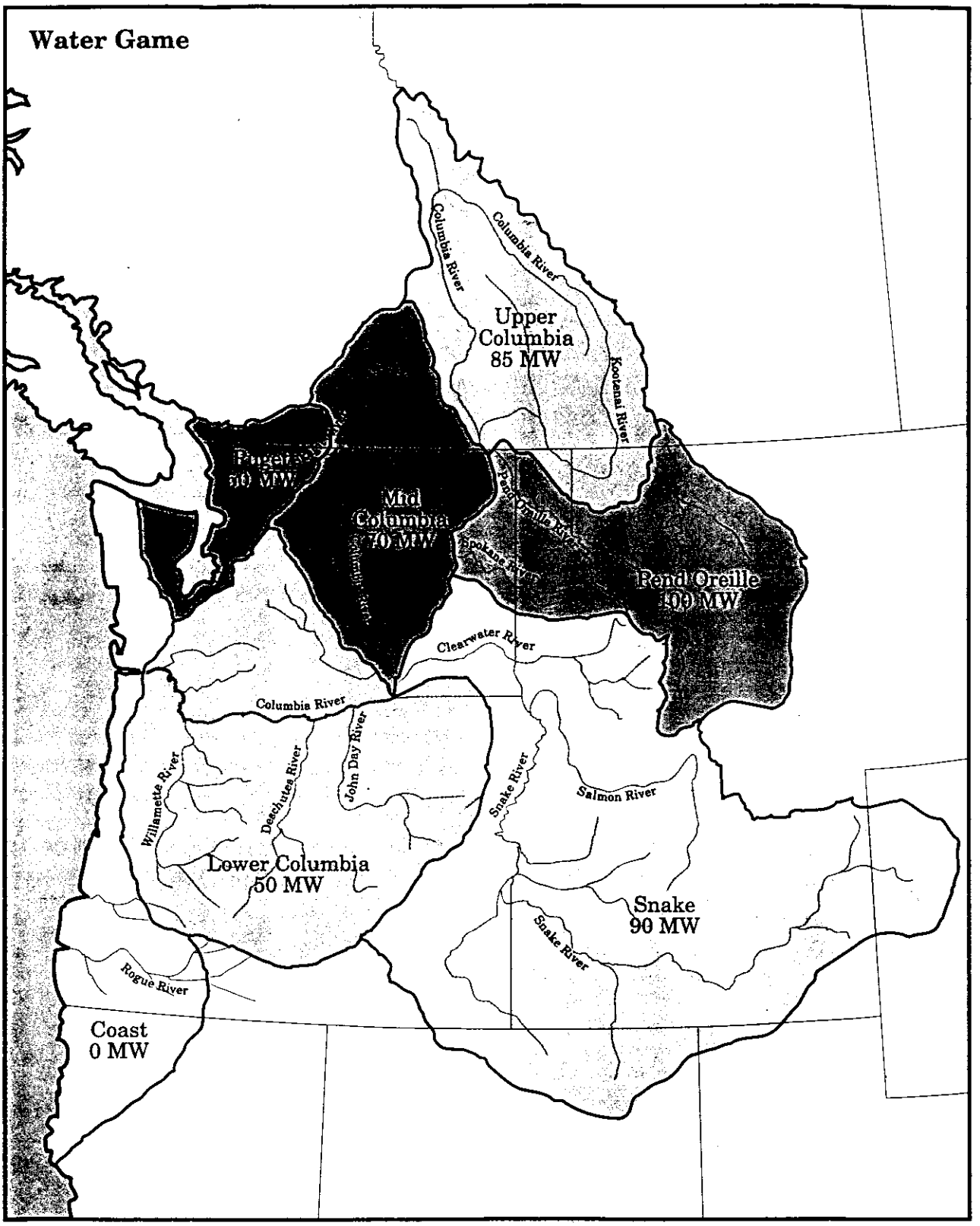
Because of the statistical nature of this exercise, the results may come out slightly different from time to time. The important things for students to note are:

The coastal area receives about half of all precipitation, but no energy is produced because of the short distances the water falls, and the absence of dams.

About a third of the hydropower generated in the US comes from rain and snow falling in the Canadian Rockies.

One other thing to note is that the generation listed for the Upper Columbia (85 MW) represents the US energy value of that precipitation. If Canadian energy is included, the figure would be significantly higher.





Number on Dice	Watershed	Number on Dice	Watershed
2	Puget Sound	7, 8, 9, or 10	Coast
3 or 4	Lower Columbia	11	Pend Oreille
5	Snake River	12	Mid Columbia
6	Upper Columbia		

FIRST:
Roll the dice and make a tally mark on the Precipitation Record (below) in the watershed represented by the number rolled. This is how many times it rained or snowed in each watershed.

Precipitation Record

Coast	Lower Columbia	Mid Columbia	Pend Oreille	Puget Sound	Snake	Upper Columbia

THEN:
1. Count the tally marks in each watershed on the Precipitation Record and write the total in the top, dark-framed box of the corresponding watershed on the Generation Record (below).
2. For each watershed, multiply the number of times it rained or snowed [the number you just wrote in the top boxes] by the amount of energy generated in each watershed when that amount of water falls [the number printed with a MW in the middle boxes].
3. Write the products in the bottom boxes for each watershed. This is how much power was generated in the watersheds.

Generation Record

Coast	Lower Columbia	Mid Columbia	Pend Oreille	Puget Sound	Snake	Upper Columbia	TOTAL
							= times
x 0 MW	x 50 MW	x 70 MW	x 100 MW	x 50 MW	x 90 MW	x 85 MW	
MW	MW	MW	MW	MW	MW	MW	= MW

CLASS TOTALS:
1. In the TOTAL column on the right, sum how many times precipitation fell in all watersheds. Then sum how many total megawatts (MW) of power were generated.
2. Transfer the numbers from the bottom (MW) row of your record to a row of the large Classroom Generation Record.

Example: Rough equivalent of an average year's precipitation in the Northwest

Generation Record

Coast	Lower Columbia	Mid Columbia	Pend Oreille	Puget Sound	Snake	Upper Columbia	TOTAL
204	50	11	19	12	46	58	=400 times
x 0 MW	x 50 MW	x 70 MW	x 100 MW	x 50 MW	x 90 MW	x 85 MW	
0 MW	2500 MW	750 MW	1900 MW	600 MW	4150 MW	4900 MW	= 14800 MW