Teacher Notes

Water Budgets in Mesopotamia

(adapted from ARGWorld Activity L – Association of American Geographers)

Overview

Four countries, Turkey (T on the map), Syria (S), Iran (western I), and Iraq (eastern I), share the waters of the Tigris and Euphrates Rivers in Southwest Asia. The Euphrates is the longer western branch of the river system – it starts in Turkey and flows through Syria and Iraq. The Tigris, to the east, has some tributaries in Iran. In this activity, students calculate the water budgets for these two rivers at present and about 30 years in the future. With these and other data, students can role-play representatives of the three countries in an international conference trying to promote cooperation in the distribution of scarce water resources. NOTE: This dire water situation, coupled with a major drought for the past ten years, is a key part of the background for the Gulf Wars and the current ISIS uprising. The fact is that Syria had half a million refugees from failed farms even before ISIS came along – potential recruits for ISIS.

Learner outcomes and standards

After doing this Activity, students will be able to:

1) use thematic maps to describe the physical and human characteristics of the Tigris-Euphrates region (Standard 1: use of different kinds of maps, globes, graphs, charts, databases, and models; Standard 4: the physical and human characteristics of places);

2) explain how international rivers can both unite and divide countries (Standard 13: why people cooperate but also engage in conflict to control Earth's surface);

3) discuss several uses that humans make of rivers (Standard 15: how physical environments affect human activities);

This Activity fits a unit on world geography, the regional geography of Southwest Asia, environmental studies, economic geography, or modern history; its budget framework is an example of applied mathematics, and presentations can fit a focus on writing.

Resources

Time: One class period to develop the idea of a water budget, and one or two classes for role-play, depending on whether students gather additional information and/or prepare visual aids for presentations

Clickable mini-Atlas on SW Asia; Multimedia units on Water Budgets, Battle Creek (consequences of altering the water budget in an urban area), Three Gorges (a large water project in China)

Classroom procedures

1. Using a wall map, the clickable mini-atlas, or the attached map, have students identify the countries and trace the course of the Tigris and Euphrates rivers.

2. Hand out the Student Activity and have students read the Background. Review the meaning of the terms *inflow*, *addition*, *withdrawal*, and *outflow*. Have students fill in the blanks on the Response Sheet and identify any areas where water shortages are predicted.

3. If you wish, run a role-play, with groups representing Turkey, Syria, Iraq, and the UN. Their task is to decide how to allocate the water from the rivers among the four countries, in order to prevent the rivers from running completely out of water before they reach the Persian Gulf.

Evaluation

Collect the Response Sheets and evaluate (or have students evaluate each other); answers are underlined:

	Euphrates River	Tigris River	Combined Rivers	Predicted flow (combined rivers) in 2040
Turkey				
Addition	+23	+15	+38	+38
Withdrawal	-2	-2	-4	-26
Outflow	21	**13**	**34**	**12**
Syria				
Inflow	21	13	**34**	12
Addition	+1	+0	+1	+1
Withdrawal	-5	-2	**-7**	-18
Outflow	17	**11**	**28**	**-5**
Iran				
Inflow	0	0	0	0
Addition	+0	+33	**+33**	+33
Withdrawal	-0	-4	-4	-8
Outflow	0	29	**29**	**25**
Iraq				
Inflow from Syria	17	**11**	28	**-5**
Inflow from Iran	0	**29**	29	**25**
Addition	+0	+1	**+1**	+1
Withdrawal	-12	-26	-38	-47
Outflow	5	**15**	**20**	**-26**
Persian Gulf				
Inflow	5	15	**20**	**-26**

Points worth making:

By 2040: Turkey's withdrawals are estimated to increase from 4 maf to 26 maf, reducing outflow to Syria from 34 maf to 12 maf.

This 12 maf (plus 1 MAF addition) would still be enough to meet Syria's 2000 withdrawals of 7 maf, but by 2040, Syria's water demands could grow to 18 maf, 5 maf more than the available water.

But since a river cannot have an outflow less than zero, Syria would be able to withdraw only 13 maf, 5 maf less than its demand.

Iraq, the country downstream from Syria, would face even greater shortages, which could occur before 2020. At first, the country may be able to move water from one river to the other to meet demand.

Extension and Enrichment

Examine other case studies of conflict and/or cooperation over river water, such as the Colorado and Rio Grande, the Danube and Rhine, and the Nile.

Study conflict and/or cooperation over groundwater, lakes, and other kinds of water resources.

Look at examples of conflict and/or cooperation over other renewable and nonrenewable resources.

Conduct further study of Turkey, Syria, and Iraq and their relationships (e.g. ISIS and terrorism).

Water Budgets in Mesopotamia
Glossary of key terms

addition: in a water budget, water added to a river by precipitation or snowmelt in a country

budget: a plan for how to allocate or spend a limited resource; the term "budget" is often used with money, but can also be applied to natural resources, such as water

center-pivot irrigation: delivering water through sprinklers on a long pipe that moves slowly around a pivot point at one end; also called circle or pivot irrigation

desertification: a process in which grassland or shrubland is turned into desert by excessive wind erosion and/or salt accumulation in the soil

drip irrigation: delivering water to the bases of plants through holes in plastic tubes.

flood irrigation: spilling water directly onto the field.

groundwater: water in pore spaces between soil particles or in cracks in underlying rock

inflow: water in a river that flows into a country from another country

irrigation: artificial watering of land, using groundwater or water diverted from rivers and lakes.

maf: million acre-feet, about 350 billion gallons (an acre-foot is the amount of water needed to cover one acre to a depth of one foot; an acre is about the size of a football field)

Mesopotamia: literally means "between rivers;" usually refers to an area between the Tigris and Euphrates Rivers in Southwest Asia; due in part to easy-to-work and reasonably fertile floodplain soil, some of the world's earliest civilizations originated here.

outflow: water in a river as it flows out of a country

salinization: accumulation of salts in soil, often brought in irrigation water (see the CD unit on What Makes Land Rich?)

side agreement: treaty made between two or more countries without international supervision

surface irrigation: delivering water to a field directly from a canal, well, or ditch

surface-pipe irrigation: piping water to a field and distributing it via sprinklers or smaller pipes (see the CD unit on Farm Life in Namibia)

United Nations Environment Programme (UNEP): part of the United Nations that works on international environmental issues

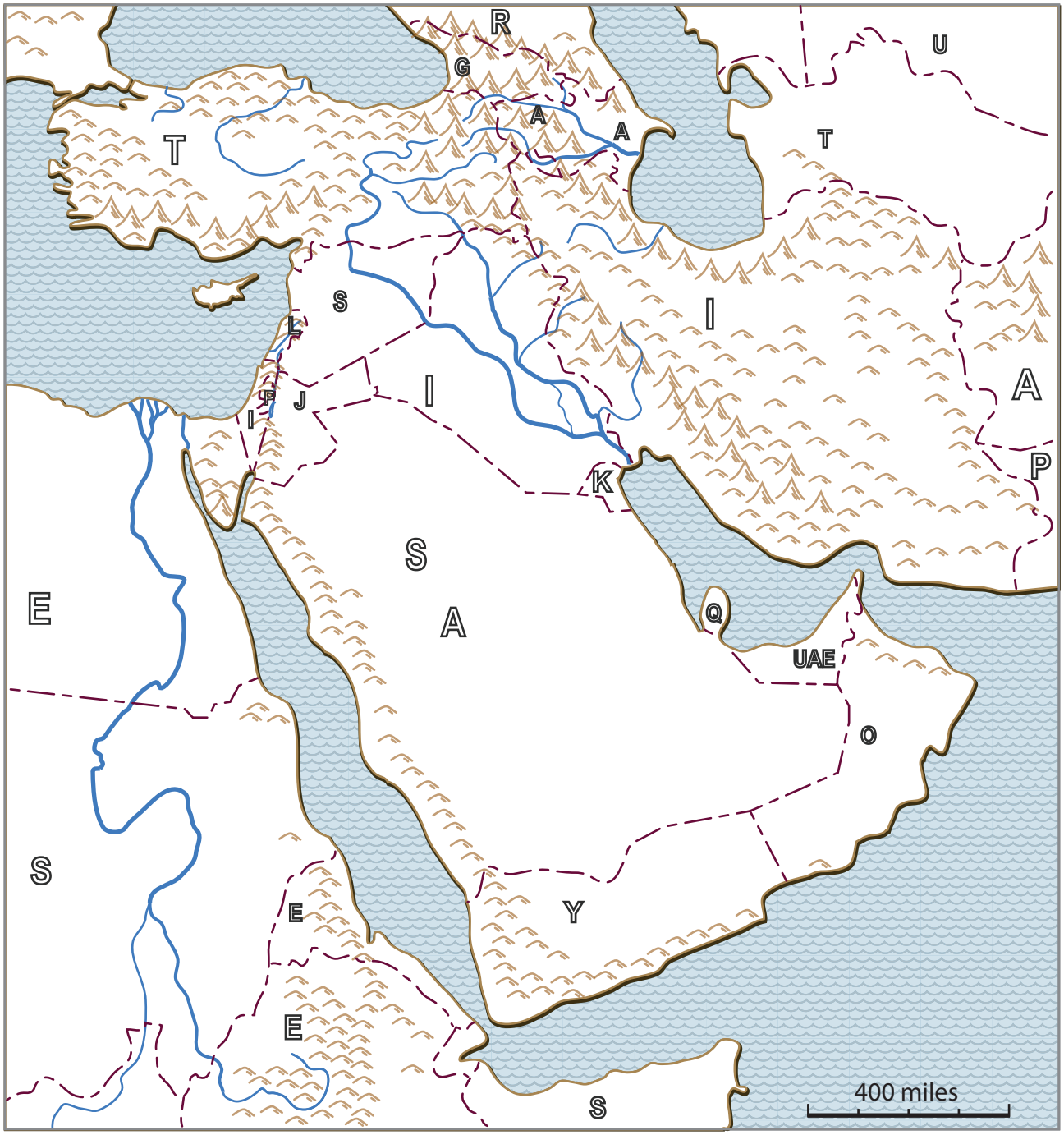
water budget: procedure for tracking the water in a river by measuring inflows, additions, and withdrawals in each country or state the river flows through.

water deficit: a situation in which there is less water than plants need; opposite of . . .

water surplus: a situation in which there is more water than is needed (see the CD units on Climagraphs and Battle Creek)

waterlogging: saturation of the soil as a result of inadequate drainage

withdrawal: in a water budget, this is water taken out of a river for irrigation or other purposes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