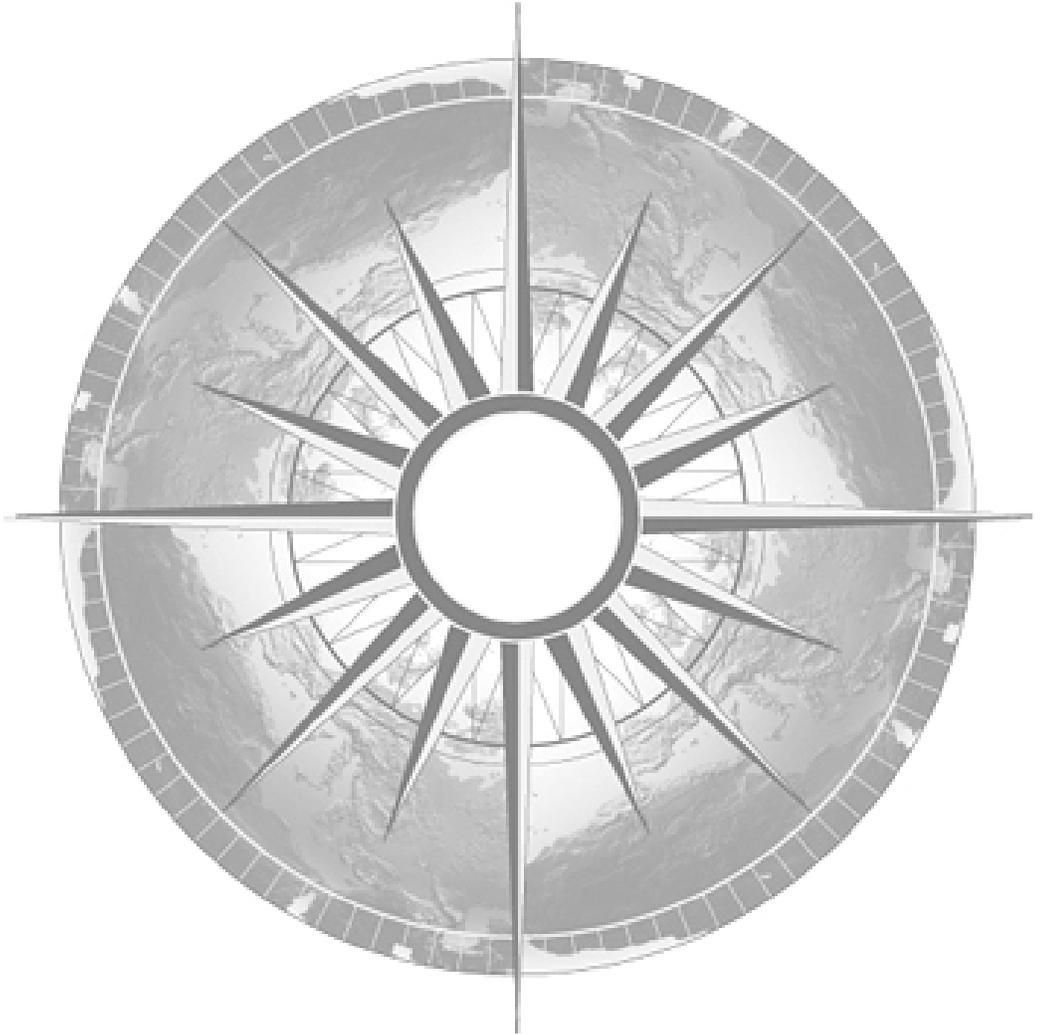


HEMISPHERES

People and Place Curriculum Resources on Human-Environmental Interactions

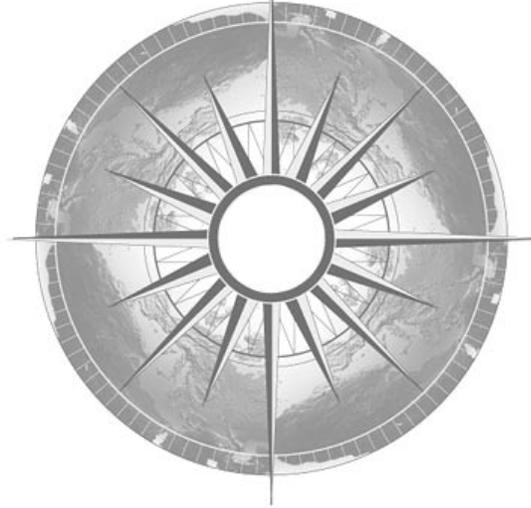


Hemispheres is a joint project of:
Teresa Lozano Long Institute of Latin American Studies
Center for Middle Eastern Studies
Center for Russian, East European & Eurasian Studies
South Asia Institute

in the College of Liberal Arts
at The University of Texas at Austin

People and Place

Curriculum Resources on
Human-Environmental Interactions



Primary Authors:

Natalie Arsenault, Outreach Coordinator
Teresa Lozano Long Institute of Latin American Studies

Christopher Rose, Outreach Coordinator
Center for Middle Eastern Studies

Allegra Azulay, Outreach Coordinator
Center for Russian, East European & Eurasian Studies

Jordan Phillips, Outreach Coordinator
South Asia Institute



People and Place
Curriculum Resources on
Human-Environmental Interactions

Final Version

Original Compilation Date: June 2005

Final Publication Date: April 2007

Permission is granted to reproduce this unit for classroom use only.

Please do not redistribute this unit without prior permission.

For more information, please see:

<http://www.utexas.edu/cola/orgs/hemispheres/>

Permission to include copyrighted materials in this unit is indicated in citations.

TEACHER NOTES

GOALS

This case study will help students think about environmental policy-making. Students will read about water conservation in rural India in order to formulate their own opinions on this issue. The case study will compare how people adapted locally to the environment in ways that met their specific needs and how the Indian government handled the same natural resources. They will also examine environmental interrelatedness: how clear-cutting leads to erosion and water table loss and, subsequently, to economic hardship. Students will begin to understand how an environmental policy decision can lead to unforeseen consequences and, conversely, how an improved policy that takes local factors into consideration can bring about great change in local society.

ASSESSMENT EVIDENCE

There are two assessment activities included with this case study:

- *Water Dilemma*: This activity is designed to help your students examine the different points of view in an issue as fundamental to life as water. Students play the roles of various people who live in the Arvari River area. You can have students summarize their ideas in a presentation or through a role play activity. To fulfill their roles successfully, students will demonstrate their understanding of this case study by incorporating information from the reading, activities, and tables.
- *Controlled Debate*: Students consider the pros and cons of both big and small dam construction in India. This activity should be conducted after students have worked through both case studies: **Big Dam Construction in India** and *Johad Construction in India*. To fulfill their roles successfully, students will demonstrate their understanding of these case studies by incorporating information from the readings, maps, and tables.

LEARNING ACTIVITIES

- The *Anticipation Guide* introduces the case study to your students. It was designed to be used before the reading to prompt students to think and to make predictions about the reading content. Students are motivated to read more closely to discover the answers to topics in the guide.
- The *Arvari River: Photo Analysis* motivates students to think about the topics of the reading by providing a visual stimulus for brainstorming and discussion.
- *Timber* teaches about non-renewable resource depletion and its potential social consequences, using “everything is connected” as a central concept. In this activity, students observe what happens to a forest when the demand for wood is greater than the supply. Students begin to learn about the impact of deforestation in the world, whether in the U.S., the original context for the activity, or in rural India.
- The *Building Small Dams in Rajasthan, India* reading introduces the situation in Rajasthan and the impact that *johads*, small dams built by locals, have had in the area.
- The *Groundwater Level and Wheat Production* worksheets ask students to analyze information from the preceding tables. They will use the information from these tables in the final activities of the unit.

Source: Much of the information for this case study came from a presentation at Hemispheres’ 2004 Summer Teachers’ Institute, *People and Place: Human-Geographic Relations*. Information found elsewhere has been cited.

Anticipation Guide

To begin, put the Anticipation Guide statements on an overhead or the chalkboard. Have students copy them into their notebooks and fill in the “Before the Reading” column. You can have a class or small group discussion on their responses, or have them write their reasons as homework. However the guide is reviewed, it is important to get students’ opinions but not to answer any of their questions.

After the reading, during class or as homework, students highlight the ideas in the reading that address the statements. Students should compare their initial thoughts and their post-reading thoughts in writing, a class discussion, or a debate.

Before the Reading		After the Reading
True/False		True/False
_____	1. Deforestation has a negative economic impact on local citizens.	_____
_____	2. The national government can make the most informed decisions about how to use natural resources in all parts of the country.	_____
_____	3. A flowing river can affect literacy rates.	_____
_____	4. Local citizens know best how to use an area’s natural resources.	_____

Anticipation Guide modified from: 2004. *A Link to the Past*. Silver Spring, MD: National Council for the Social Studies. 30-31.

Arvari River: Photo Analysis

Show the two pictures (Arvari River, February 1993 and Arvari River, February 2003) to the class. Stir class discussion by asking students what differences they see and what they think may have caused these differences. Do not provide answers.

Arvari River, February 1993



Arvari River, February 2003



Timber

Introduction: People rely on wood from trees to heat their homes, cook their food, and provide building materials and paper for homes, schools, and businesses. The more people there are, the greater the demand for wood. While it takes only seconds to cut down a tree, it takes years to grow a new one. We also depend upon forests to regulate climate, clean air and water, conserve precious soil, and provide homes for many birds and animals. In almost every part of the world, trees are being cut down at a faster rate than they are being replaced.

Materials: For each group of four, you will need: 120 craft (Popsicle) sticks in a coffee can with a rubber band around them; 32 craft sticks in a rubber band; a stopwatch or a clock with a second hand.

Procedure

- (1) Divide the class into groups of four. For each group assign the roles of: lumberjack, forest, forest manager, timer.
- (2) Give 120 craft sticks to each student representing the forest. These sticks represent the supply of trees available to the lumberjack for cutting.
- (3) Give 32 craft sticks to the students representing the forest managers. These sticks represent trees that will grow during the game.
- (4) The lumberjack records the transfer of trees each minute on the chart provided.
- (5) Begin the game when the timer gives the signal. After 15 seconds, the timer tells the forest manager to give the forest one tree. Every 15 seconds, the forest manager adds another tree to the forest. In doing so, the forest manager simulates the average rate at which trees grow to maturity and become timber in the real world.
- (6) Stop at the end of the first minute and let the lumberjack remove one tree from the forest. The tree represents the amount of wood the world needs for heating, cooking, and building materials at its present population.
- (7) Continue the game. At the end of each succeeding minute, the world's demand for wood doubles as a result of the growing population. At the end of the second minute, the lumberjack takes two trees; at the end of the third minute, the lumberjack takes four trees, and so on.
- (8) End the game when the wood reserves in the forest can no longer meet the demands of the lumberjack.

Comprehension Questions

- (1) How many minutes did it take for the lumberjack to cut all the trees in the forest?
Just over 7 minutes. At 7 minutes there should be only 21 trees left.
- (2) Was the forest always shrinking?
No. After the first minute, the forest increased by two trees and stabilized for another minute. After the third minute, the doubling of forest use led to the end of the forest.
- (3) If the forest manager could develop a tree that grows at the rate of one tree per second, would tree growth keep up with timber demand? Why, or why not?
No. The doubling of forest use due to increased population size would still lead to the demise of the forest. If the simulation was done with 60 sticks given to the forest each minute, it would only increase the life of the forest by two more minutes.
- (4) What could be done to prevent the demise of the forest?
The forest can only be maintained if we cut down what can be replaced and no more. This means conserving our use of tree products such as paper and lumber. However, if the human population continues to grow, so will the demand for these items.

Minute	Number of trees at beginning of minute	Number of new trees	Number of trees cut	Number of trees at end of minute
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Minute	Number of trees at beginning of minute	Number of new trees	Number of trees cut	Number of trees at end of minute
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Source: 1996. *People and the Planet: Lessons for a Sustainable Future*. Washington, DC: Zero Population Growth, Inc. 74-75.

Building Small Dams in Rajasthan, India

Until the 1930s, the Aravali Hills, near the Arvari River in Rajasthan, a desert state in western India, had abundant forest cover. Despite extremely low annual rainfall (on average 4 inches per year), traditional water conservation allowed for an adequate supply of water all year. In the 1930s the government abolished communal rights to the forest and gave tree-harvesting permits to timber companies. As the forest was cut down, the soil eroded, rivers dried up, ground water levels dropped, vegetation died, and agriculture was seriously affected. Each year, 4% of the Aravali Hills became a wasteland. Men had to leave their homes to move to the cities to find work. Women, left at home in the villages, had to spend hours walking to collect water. Instead of going to school, children had to stay at home to do the work their mothers were not home to do. Literacy rates dropped, affecting the locals' ability to find work with a livable wage. Deforestation was affecting the entire community.

In 1985, a group of volunteers with Tarun Bharat Sangh (TBS, or Young India Association) decided to help. They understood that life in rural Rajasthan revolves around water. They identified the main cause of poverty as the lack of water. TBS volunteers talked to village elders to discover what life was like before deforestation. They learned how villages used to construct *johads* to collect water. A *johad* is a small crescent-shaped pond approximately 15-feet deep, with three sides formed by the natural slope of a hill and a fourth side formed of a short wall built to hold back the monsoon runoff water. These structures allow the water to trickle down slowly into the ground, which recharges the groundwater and then supplies water to the plants that provide groundcover. Adequate groundcover stops erosion. This has many benefits to humans and animals. In the past 20 years, the villagers have built over 7,500 *johads*, which have proven to be extremely valuable to them. In 36 villages the water table has risen by six feet. The forest cover in the Aravali Hills has risen to 40%, an increase of 34% in 15 years. Stopping erosion and increasing the water table has allowed some seasonal rivers to flow year-round. Having adequate local water has allowed villagers to breed more buffalo, increasing the regional milk supply by 10% and providing excess milk products that can be sold. Five times more land is cultivated than in 1995. Grain production has increased and many villages are able to sell excess grain and grain products when just a few years ago they had to import grain to prevent starvation.

Besides a guaranteed supply of drinking water, there are many economic and social benefits to the *johads*. An increase in the percentage of land that is producing food has led to economic improvements. Costs for irrigation water have dropped because villagers now have a ready supply of local water. The increase in agricultural production and decrease in water costs have led to an increase in the number



Johad.

Source: Inde Sauvage, <http://perso.orange.fr/alainjoly1/ecologie03.htm>

of livestock a family can own. This, in turn, has led to higher overall prosperity because villagers can sell livestock and livestock products such as milk. Nutrition has improved as agricultural production and diversity have increased. Social changes were possible because of the improved economic health of the region. Men no longer need to go to cities to find work. Women do not have to spend their time searching for water, firewood, and food for their livestock, so they are able to participate in the communal life of the village. Literacy rates have risen because children can go to school instead of staying and working at home.

An important part of TBS's plan was to involve the villagers. By being involved in all stages of water harvesting, they came to believe that their futures were linked to building *johads*. Both men and women participate in the local river parliaments that manage the rivers and create rules that benefit the entire community. This increased the role for women in the decision-making processes related to their lives. More involvement in their villages and with their livelihoods has led to an increase in levels of school enrollment and literacy rates among girls and women.

The river parliaments not only establish and enforce rules, but they divide up all the necessary work. When asked about the benefits of the *johads*, one villager said, "Forests were cleared for the urban people. I lost my agriculture and had to slave for the same people who destroyed it. The freedom of the country doesn't mean anything to us. I became free in 1995, when I cultivated my land again for the first time. For villagers, freedom means freedom from poverty. This comes from self-sufficiency."

Sources:

Arvari River: Rajasthan State, India, <http://www.riverfestival.com/au/2003/files/symposium/Arvari%20River.pdf>

Soma Basu. *Check-dams perform a miracle*. The Hindu, <http://www.narmada.org/archive/hindu/files/hindu.20000330.0430221p.htm>

Shree Padre. *Harvesting the monsoon: livelihoods reborn*. LEISA Magazine 16(1): 14-15.

Class Discussion Questions

- (1) What was the reason for the lack of water in Rajasthan? What were the effects?
- (2) What is a *johad*? Describe three benefits of building the *johads*.
- (3) How has the building of the *johads* affected women and children in the community?

Groundwater Level and Wheat Production Tables

Table 1

Groundwater level in wells of the village Buja before and after Johad			
No.	Total depth of well (in feet) 1988	Water level before Johad	Water level of well after Johad, 1994 (in feet)
1.	81	Dry completely	44.5
2.	73	Dry completely	37
3.	67	3 feet	40.5
4.	55½	4 feet (dry most of the time)	27
5.	81	10 feet	66
6.	69	20 feet	50
7.	43	15 feet	35
8.	83	20 feet	58
9.	80½	19 feet	55
10.	66½	Dry completely	25

Table 2

Wheat production before and after the construction of Johad			
Village Name	Wheat / bigha (in quintal)		Wasteland brought under cultivation (in Acres)
	Before	After	
K K Dhani	–	–	5
Buja	7	15	30
Pathroda	5	10	50
Kalad Natata	8	17	50
Banta	6	15	40
Debri	7	15	70

Note: Bigha is a Hindi word for a unit of land approximately the same size as an acre. Quintal is a unit of weight measurement equal to 100 kilograms.

Name: _____

Groundwater Level and Wheat Production Comprehension Exercises

(1) According to Table 1, which three wells had the least amount of water before the *johad* was built? By how much did each of these wells increase after the *johad* was built? What was the average amount by which these wells increased?

(2) Which three wells are the deepest? How much water did each have before the *johad* was built? Which well is the most shallow? How much water did it have before the *johad*? Does there seem to be a relationship between the depth of the well and the amount of water in it? Why or why not?

(3) What was the benefit of the *johad* in the village of Buja? Explain your answer, using data from Table 2.

(4) According to Table 2, which villages at least doubled their production of wheat after the *johad* was built? Which village did not? What information in the table helps to explain why wheat production did not increase there?

(5) Explain what “wasteland brought under cultivation” means, in your own words. What does this mean for the farmers in these villages?

(6) Would you argue that the building of the *johad* was a good thing for these villages? Why or why not?

Water Dilemma

In this activity, students assume the roles of various players involved in and affected by dam construction in the Arvari River area of Rajasthan, India. Each student will be given a dilemma card that outlines his/her role, the concerns associated with that role, and options for a course of action. After students receive their dilemma cards, allow a few minutes for them to think about which option they would choose and why. Then, each student should stand, read the dilemma card out loud, and present the option he/she would choose and the rationale for choosing that option.

As a variant to this activity, you can group students who were given the same dilemma card and have them prepare a group presentation. It is important to make certain that each student has an assigned role in their group to ensure that all students participate. Students would be graded not only on the presentation but also on their participation.

Source: Eco-Ethics: 1996. *People and the Planet: Lessons for a Sustainable Future*. Washington, DC: Zero Population Growth, Inc. 116-119.

DILEMMA CARD ONE

You are a farmer's child. You enjoy going to school and just began learning to read last year. It has not rained for a long time, and your family's wheat fields and vegetable garden have dried up. Your father had to leave home to find work. You know you are old enough to be able to help your mother by staying home and taking care of your younger siblings. But you really want to learn how to read. What would you do and why?

Would you:

- not offer to help so you could go back to school?
- offer to stay home to help and not go back to school?
- do nothing and wait for your parents to make the decision?
- other (specify)?

DILEMMA CARD TWO

You are a national government official. You think that this rural area of India should be developed to increase its food production. You think that the Arvari River could irrigate a lot of fields and produce food that is needed in other parts of India. The government studies you have read conclude that big dams would not only increase food production but could also be used to create electricity. On the other hand, you know that many families will need to be moved as the waters flood over the lands they live in now. What would you do and why?

Would you:

- decide that the government studies are correct and that big dams are the best option?
- hire a couple of local representatives to help you learn about the citizens' concerns?
- employ a non-governmental agency to conduct a study to see if the results are the same or different from the government studies you have read?
- other (specify)?

DILEMMA CARD THREE

You are a business investor. You want to put your money into some infrastructure development that would be a safe investment and also make money for you. You think that big dams are a good investment because they produce electricity, which can be sold to make a profit. On the other hand, you think that *johads* are a better way to irrigate the land and increase crop production. What would you do and why?

Would you:

- try to influence a government official to make sure *johads* are built on the Arvari River?
 - move to the area and run for local office so you could influence which dam is built?
 - hold meetings in the towns near the Arvari River to promote the idea of electricity production?
 - other (specify)?
-

DILEMMA CARD FOUR

You are a wheat farmer. Your crops have dried up because there hasn't been enough rain. You have moved to a big city to do manual labor. You return home once a month to bring your family money. Unfortunately, there aren't men in your town old enough to remember how to build *johads*, the traditional way to conserve water. You wish that you and your neighbors had a better way to conserve water to irrigate during the droughts. What would you do and why?

Would you:

- keep moving back and forth to the city because that is the way you have always had to live when there is a drought?
 - return home and find other local residents to work together to try to remember how to build a *johad*?
 - ask your friends in the city to help you find a government expert that has a solution?
 - other (specify)?
-

DILEMMA CARD FIVE

You are a local government official. You want to protect the citizens that have voted you into office, but you also have to keep your bosses in the national government happy. You think building a system of *johads* is the best solution for the local situation, but a big dam would generate lots of money for the government and investors. What would you do and why?

Would you:

- set up citizens' meetings to gather information to write a report for your bosses?
- invite your bosses to come to see the results of the existing *johads*?
- let your bosses make the decision?
- other (specify)?

DILEMMA CARD SIX

You are a construction worker. If a big dam is built in your area, you know you will have work as an expert bricklayer. On the other hand, you could potentially find work for many years if a system of *johads* is built in your area. You would like to be employed close to home, but you need to make enough money to support your family. You can find work in the city, but that means you can only come home once a month. What would you do and why?

Would you:

- go the local government offices to meet with leaders to get their advice?
 - return to full-time work in the city?
 - try to find work with a local company that builds *johads* even though it may only be part-time right now?
 - other (specify)?
-

DILEMMA CARD SEVEN

You are the owner of a small general store. If a construction company comes into town to build a big dam, you know that your business would see an enormous increase in sales while the dam was being built. On the other hand, if the economy of your town were improved by building a system of *johads*, it would be a smaller increase in sales but would last much longer. What would you do and why?

Would you:

- meet with other local business owners to decide which dam would be best for the local economy and then try to persuade your customers which dam is better?
 - try to influence the government to build the big dam so that you can maximize your profit?
 - wait for the government to decide what is best?
 - other (specify)?
-

DILEMMA CARD EIGHT

You are a cow herder. You are watching your cows get sicker and sicker because of the drought. You must walk long distances every day to bring your cows to water, but they are still suffering. You wish that there were enough local water for your cows to drink and stay healthy. You know your town needs more water in order to meet its needs. What would you do and why?

Would you:

- try to persuade others in your town to take time away from their crops and animals to construct a *johad*?
- ask your son to care for your cows while you sit outside the local government offices and hope to catch an official to ask them to build a *johad* in the town?
- resign yourself to having to walk these long distances while there is a drought—why try to change the course of nature?
- other (specify)?

Controlled Debate

A controlled debate allows for complete class involvement. Unlike traditional class debates, which can become dominated by a few of the more vocal students, a controlled debate assigns roles. Every student is either a debater or a decision-maker. By setting up clear points with topics that have no right or wrong answer, the competition to persuade the decision-maker enhances student motivation.

This activity considers two sides of the complex issue of dam construction in India. Divide your students into three “teams”: a team for *johad* construction, a team for big dam construction, and a team of judges. The information the teams will use to prepare for this activity can be found in two case studies: this one—*Johad Construction in India*—and *Big Dam Construction in India*.

There are five phases in this activity:

(1) **Class Preparation:** Divide the students into three groups and assign each group a role: *johad* advocates, big dam advocates, and decision-makers. The two advocate groups need to be equal in size. If the class has an extra student, assign the role of decision-maker.

(2) **Individual Preparation:** Students should quietly prepare their argument points. Advocates prepare their arguments by finding relevant information in the unit that supports their position. Decision-makers prepare questions to ask the advocates to help them get the information they need to make their decision.

(3) **Group Preparation:** The students should meet in their peer-group teams to share information and to prepare their arguments. So, *johad* advocates should meet with the other *johad* advocates, and so on. The decision-makers should decide on the best questions to ask.

(4) **Timed Debate:** Re-group your students into small groups of three: one *johad* advocate, one big dam advocate, and one decision-maker. For the first three minutes, the *johad* advocates present their argument to the decision-maker, who may ask questions. However, the big dam advocates are not allowed to interject any comments. For the following three minutes, the big dam advocates present their argument. Again, the decision-makers can ask questions but the *johad* advocates are not allowed to interrupt. For the final five minutes, the decision-maker can ask questions and the two advocates can respond directly to each other. At the end of this activity, the decision-makers should make their decisions based on the facts each advocate presented.

(5) **Debriefing:** Decision-makers should present a summary of the debate to the class. They should discuss which arguments were most persuasive and supported and explain their decision and how they made it.

This activity was modified from one developed by John Rossi, School of Education, Virginia Commonwealth University. Revised by the Education Program of the United States Institute of Peace.

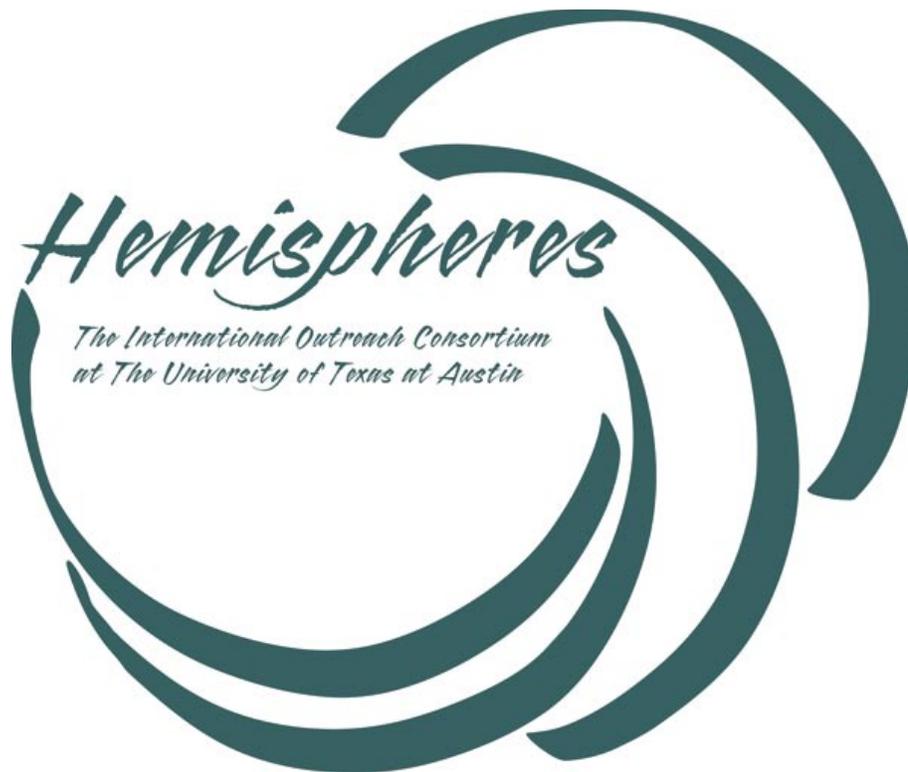
About Hemispheres

Created in 1996, Hemispheres is the international outreach consortium at the University of Texas at Austin. Hemispheres utilizes University resources to promote and assist with world studies education for K-12 and postsecondary schools, businesses, civic and non-profit organizations, the media, governmental agencies, and the general public.

Comprised of UT's four federally funded National Resource Centers (NRCs) dedicated to the study and teaching of Latin America; the Middle East; Russia, East Europe & Eurasia; and South Asia, Hemispheres offers a variety of free and low-cost services to these groups and more. Each center coordinates its own outreach programming, including management of its lending library, speakers bureau, public lectures, and conferences, all of which are reinforced by collaborative promotion of our resources to an ever-widening audience in the educational community and beyond.

Hemispheres fulfills its mission through: coordination of pre-service and in-service training and resource workshops for educators; promotion of outreach resources and activities via exhibits and presentations at appropriate state- and nation-wide educator conferences; participation in public outreach events as organized by the consortium as well as by other organizations; and consultation on appropriate methods for implementing world studies content in school, business, and community initiatives.

For more information, visit the Hemispheres Web site at:
<http://www.utexas.edu/cola/orgs/hemispheres/>
or e-mail: hemispheres@austin.utexas.edu



<http://www.utexas.edu/cola/orgs/hemispheres/>
hemispheres@austin.utexas.edu

**Teresa Lozano Long Institute of
Latin American Studies**
Natalie Arsenault, Outreach Director
The University of Texas at Austin
1 University Station D0800
SRH 1.310
Austin, TX 78712
(512) 232-2404
Fax (512) 471-3090
n.arsenault@mail.utexas.edu

**Center for Russian, East European
& Eurasian Studies**
Allegra Azulay, Outreach Coordinator
The University of Texas at Austin
1 University Station A1600
GRG 106
Austin, TX 78712
(512) 471-7782
Fax (512) 471-3368
aazulay@mail.utexas.edu

Center for Middle Eastern Studies
Christopher Rose, Assistant Director
The University of Texas at Austin
1 University Station F9400
WMB 6.102
Austin, TX 78712
(512) 471-3582
Fax (512) 471-7834
csrose@mail.utexas.edu

South Asia Institute
Rachel Meyer, Outreach Coordinator
The University of Texas at Austin
1 University Station G9300
WCH 4.134
Austin, TX 78712
(512) 475-6038
Fax (512) 471-3336
outreach@uts.cc.utexas.edu