Professional Development: Ethnobotany cCurse for Teachers
Case Studies

1. Jatropha: fighting Deforestation and Poverty with Biofuel

Environmental activists and development agencies are applauding Jatropha curcas, a plant native to Central America, as the answer to deforestation, poverty, and environmental pollution in Haiti. Scientists have discovered that the plant is a useful source of material for producing biofuel, as the seeds are 60% oil that can be converted into biodeisel.

There are two common strategies of producing biofuels. One is to grow crops high in sugar (sugar cane, sugar beet, and sweet sorghum) or starch (corn/maize), and then use yeast fermentation to produce ethyl alcohol (ethanol). The second is to grow plants that contain high amounts of vegetable oil, such as oil palm, soybean, algae, or jatropha. When these oils are heated, their viscosity is reduced, and they can be burned directly in a diesel engine, or they can be chemically processed to produce fuels such as biodiesel. Wood and its byproducts can also be converted into biofuels such as woodgas, methanol or ethanol fuel. It is also possible to make cellulosic ethanol from non-edible plant parts, but this can be difficult to accomplish economically.

Jatropha is special in that it is drought resitsant and can easily grow in poor soil and marginal areas, where conditions do not allow for crop production. Planting on such land is especially important in Haiti, where much of the country has bene deforested in order to attain wood for cooking charcoal, resulting in the increased severity of natural disasters. In addition, people have found additional medicinal, economic, and practical uses for the plant, including glycerine for making soap, natural fertilizer, livestock feed, wax from the bark, natural dye from the roots, medicinal tea from the flowers, and medicine for snakebites, paralysis, skin diseases, and more. However, some point out that the plant's production levels are unreliable, harvesting is too intensive (as each fruit ripens at different times and must be harvested separately), and the nuts and leaves are toxic.

Questions: How would the production and export of Jatropha help or hurt Haiti? What questions might this raise concerning workers' rights? How does Western demand influence the global environment and local politics? Who seems to be in power to make decisions about which local resources are used and how?

Sources: http://uk.reuters.com/article/oilRpt/idUKHKG7593720070912
http://www.jatrophabiodiesel.org/
http://en.wikipedia.org/wiki/Biodeisel

2. The Use of Plants in Religion and its Effect on Conservation Efforts

The Casamance is located in the Southern region of Senegal, West Africa, and is home to the Diola (pronounced Jōla) people. The Diola are actually composed of many, different ethnic groups that were conglomerated during colonialism. In contrast to the predominantly Muslim Wolof in the north of the country, many of the Diola in the South retain traditional practices and beliefs, one of which is the "sacred forest cult". This particular group is led by traditional, local priests and priestesses, who believe that sacred spirits live in the forest and rely on these wild forests to conduct coming-of-age and purification ceremonies. This latter ceremony is becoming particularly important, as the conflict between the north and south of the country escalates, resulting in increased violence, as this cult has been called upon by various peacekeeping and international agencies to restore and maintain peace between rebel forces and national government.

The sacred forest cult also works to preserve natural, wild lands by outlawing the harvest of trees from these wild areas. It is said that if someone is found cutting the trees they will be punished by the spirits residing in the forest. The preservation of such a traditional value and practice is especially important in an age of environmental destruction and climate change, however, the Diola continue to undergo pressure, both from globalization as well as the dominant Wolof culture, to assimilate and forgo such traditions.

Questions: How do various cultures use plants or nature for religious/spiritual purposes? How does this intersect with development and politics? How does the religious use of plants influence the conservation of nature or particular plants? How could this ethnobotanical use of plants benefit environmental conservation? On the flip side, what challenges could it present to the economy or development?

3. Sacrificing Biodiversity for Western Desires

The British began extracting and producing rubber from wild rubber trees in the Amazon Rainforest in the mid 18th century. Foreign interest in this product led to increased development in this otherwise natural landscape. This area of Brazil experienced a rise in wealth during the rubber trade: cities and roads were created to support the rubber trade from the Amazon, and rubber tappers amassed wealth. The high price of rubber, however, began to cause problems. The British then smuggled rubber tree seeds to Asia, where rubber was produced and exported more cheaply, resulting in an economic collapse in the Amazon.

As we hear more about acai, a tree native to the Amazon that produces fruit high in antioxidants and touted as the "wonder berry", many worry that history may repeat itself. With the increasing Western demand for foods marketed as "cancer-fighting", "age-defying", and "weight loss" products, it seems the biodiversity of the Amazon is already being threatened, as traditional cultivators plant more acai trees at the expense of other, native trees.

In addition, in the age of globalization, the transport of items from one continent to another contributes to climate change, as massive amounts of fuel are required to fly these products from one country to another each day.
Questions: How do Western cultures use rubber and acai? Why did these particular plants become so valuable, and what social forces led to the increased production and trade of these plants? How does global trade of local products influence local economies, biodiversity, the environment, and cultural preservation?

4. Genetically Modified Organisms

Humans have been manipulating plants for over 10,000 years since they began farming in the Middle East. Technology has led to the survival of some plants and the demise of others along with many, new hybridized species. More recently, capitalist forces and globalization have resulted in companies developing and using technology to genetically modify organisms, mainly food crops.

Genetic modification involves recombinant DNA technology, which identifies a particular, desired DNA and inserts it into another organism's genome. This technology is often used in food crops in order to produce crops that are resistant to disease and pests or to ensure higher and more successful crop yields. Over 50% of the world's GMO crops are grown in the US, and many everyday products, such as cotton and corn, have been genetically modified. There is currently no legislation that requires labeling of products containing GMOs.

Companies like Monsanto have used this technology to develop and patent sterile seeds that contain certain attributes. This then requires that farmers buy news seeds each year, rather than using seeds from the previous year's harvest. On a global scale, this secures a more powerful position for companies possessing this technology when they compete with smaller companies or companies based in other countries. Because GMO technology is so new, many worry about the long-lasting effects of using such technology on health and environment. Long-term studies of GMOs' impact on health have not been conducted, and GMO seeds could easily blow into neighboring farmers' fields, uncontrolled and unmonitored.

Questions: What are the benefits and disadvantages of using GMOs? How could such technology harm the environment? What effect does this technology have on the free market and the global economy?

Sources: http://www.engdahl.oilgeopolitics.net/GMO/Monsanto/monsanto.html
http://www.ornl.gov/sci/techresources/Human_Genome/elsi/gmfood.shtml

Stakeholder Analysis: Medicinal Rainforest Plants

Background

Rainforests are dense evergreen forests with an annual rainfall of at least 406 centimeters (160 inches). Rainforests are often, but not always, located in tropical regions.

Rainforests used to cover 14% of the earth's surface but now only occupy 6% of the earth's surface. Scientists estimate that 1.5 million species were lost and 50,000 more continue to be lost every year with the destruction of the rainforest to harvest timber or create space for farming and development. It is estimated that ten million Indians lived in the Amazonian Rainforest five centuries ago, but there are only 200,000 left today. (http://www.rain-tree.com/facts.htm)

Approximately 25% of pharmaceutical drugs are derived from plants found in the rainforest. (http://www.rain-tree.com/facts.htm) Many Western companies and scientists have gone to the Amazon to study plants that could be used to cure illness and disease. Up until recently, however, the indigenous people who knew how to use these plants and lived in the areas where these plants were found were not compensated in any way once these companies patented their "findings" and made a large profit from the sales of their plant-based products.

The lack of recognition or compensation for indigenous people in these circumstances led to a global conversation concerning "intellectual property rights", rights related to creations of the mind. This includes traditional knowledge, music, art, inventions; symbols, names, images, and designs used in commerce. In 1992, at the World Summit on Ecology in Rio, Brazil, 144 countries signed the Convention on Biological Diversity, a document establishing that communities or countries must be paid royalties when companies develop products based on their natural resources or indigenous knowledge. (http://www.brazil-brasil.com/cvrjul97.htm)

Case Study

Plant X is native to the Amazon rainforest. The indigenous Indians use the plant for both medicinal reasons and religious ceremonies. Recently, an American pharmaceutical company conducted studies on this plant and found that it suppresses the growth of cancer tumors in mice. This company would like to create a drug based on this plant and patent it for use in treating cancer. They have held a preliminary meeting with the local chief and an ethnobotanist but have disclosed very little information about their ideas and plans.

Directions

1. You may wish to ask students to conduct research on any or all of the following topics prior to this lesson: rainforest ecology, indigenous groups from rainforest areas, medicinal plants found in the rainforest, pharmaceutical medicines that have been derived from plants, threats to the survival of the rainforest, and "intellectual property rights".

2. Lead a discussion with the class concerning the rainforest and the use of plants from the rainforest. You may use the following questions as a guide:

- Where are rainforests located in the world? [close to the equator]
- Describe the environment [humid, hot, rains each day, very dense vegetation, high biodiversity]
- Who lives in the rainforest? [thousands of different species of plants and animals, various groups of indigenous Indians]
- What resources have been found in the rainforest? How have people used these resources? [many different plants that have been used for construction, creating materials we use each day, food, and medicine. Some examples include the rubber tree, acai berry, raffia]

3. Explain to students that they will conduct a stakeholder analysis, which is a process of gathering and analyzing information to determine whose interests should be taken into account when developing and/or implementing a policy or program. Stakeholders are people or groups that have a vested interest in the policy or program.

4. Read the students the case study (or write on board or on overhead projector).

5. Have students brainstorm who the stakeholders would be in this scenario. Answers could include: indigenous Amazon Indian groups, Western doctors, pharmaceutical companies, cancer patients, Brazilian and American governments, political activists, environmentalists, scientists, and ethnobotanists. Write all answers on the board.

6. Divide the class into smaller groups. Assign each group to a particular stakeholder (alternatively, the groups could choose which stakeholder they are). Have them work in their small groups to fill out the section of the stakeholder analysis table that pertains to their stakeholder. You may wish to do one together as a class to demonstrate how to fill in the table. Share answers among groups to complete the entire table for all stakeholders among the class.

7. Have each group generate questions they would ask other stakeholders. Have students act out these interviews in front of the entire class.

Controversies

- **Safety**
  - Potential human health impacts, including allergens, transfer of antibiotic resistance markers, unknown effects
  - Potential environmental impacts, including: unintended transfer of transgenes through cross-pollination, unknown effects on other organisms (e.g., soil microbes), and loss of flora and fauna biodiversity
- **Access and Intellectual Property**
  - Domination of world food production by a few companies
  - Increasing dependence on industrialized nations by developing countries
  - Biopiracy, or foreign exploitation of natural resources
- **Ethics**
  - Violation of natural organisms' intrinsic values
  - Tampering with nature by mixing genes among species
  - Objections to consuming animal genes in plants and vice versa
  - Stress for animal
- **Labeling**
  - Not mandatory in some countries (e.g., United States)
  - Mixing GM crops with non-GM products confounds labeling attempts
- **Society**
  - New advances may be skewed to interests of rich countries