9 Protecting Watersheds

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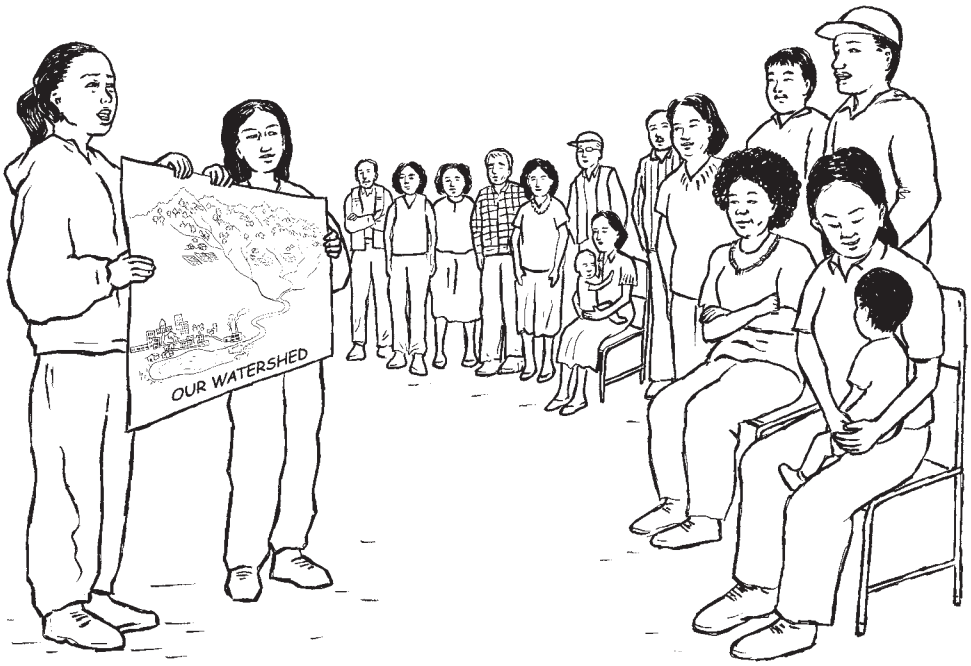
Protecting Watersheds

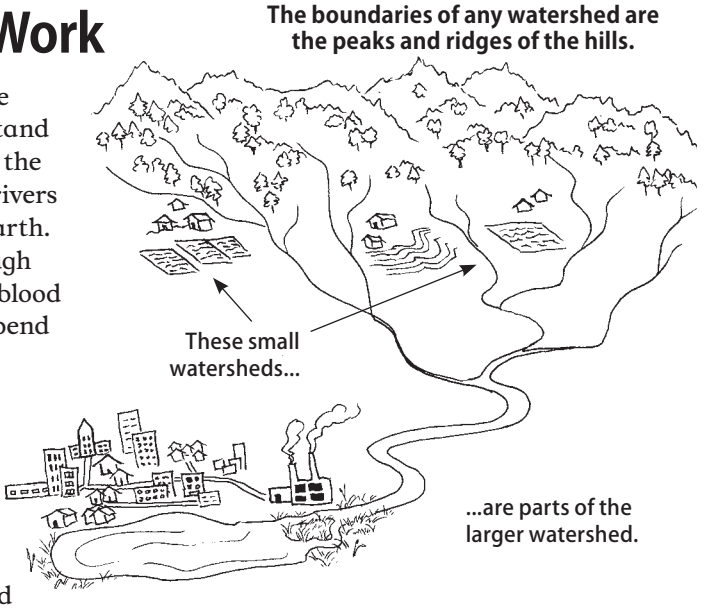


No matter where you are, in a rural or urban area, you are in a **watershed.** A watershed is an area of land where all the water from rain and snow drains downward to a single body of water, such as a stream, river, lake, or wetland. A watershed is also called a **catchment,** because the land uphill and upstream "catches" all the water and then the water runs downhill and downstream.

A watershed can be very large, covering thousands of kilometers of land, or it can be as small as one valley. Within each large watershed where water flows from high hills to low valleys (such as a whole range of mountains) there are many smaller watersheds (such as the small streams and other waterways that run down toward rivers and the sea). See the next page for drawings of different sized watersheds.

A healthy watershed protects water supplies, nurtures forests, plants, and wildlife, keeps soil fertile, and supports self-reliant communities. Large and sudden changes to a watershed, such as clearing trees and brush, dumping waste, or building roads, houses, and dams, can damage the watershed and its water resources. This can affect the land's ability to support healthy communities, and lead to health problems, hunger, and migration. Planning for changes in how water flows through watersheds, and how water and land will be developed and used, can prevent future problems.

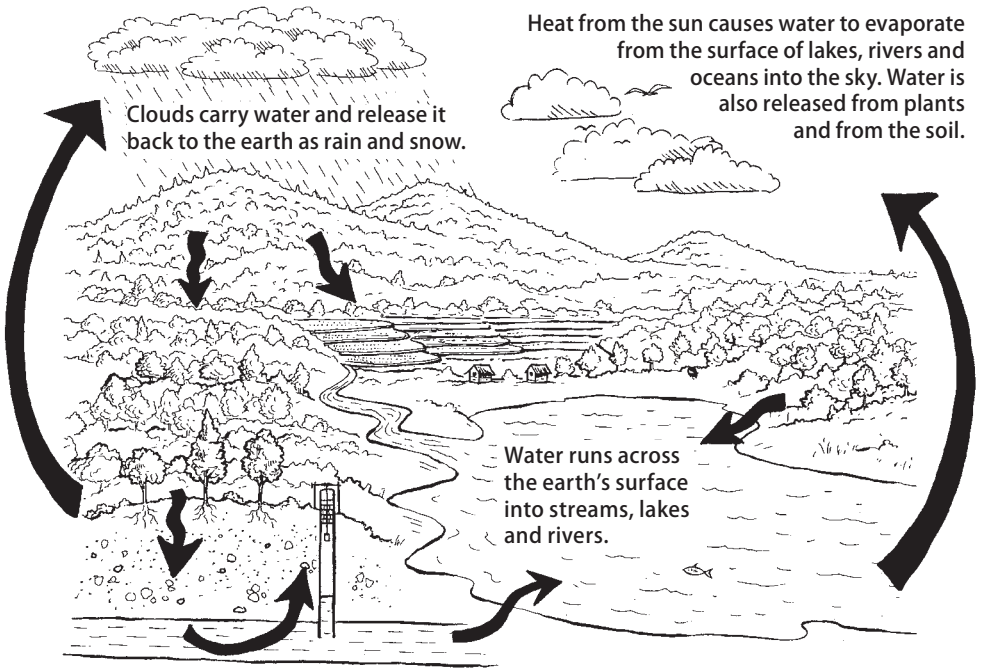
How Watersheds Work



Everyone's health is affected if the watershed is damaged. To understand how important watersheds are to the environment, it helps to think of rivers and streams as the veins of the earth. They carry and move water through the land the way our veins carry blood through our bodies. Just as we depend on blood for life, the environment depends on water for life.

The water cycle

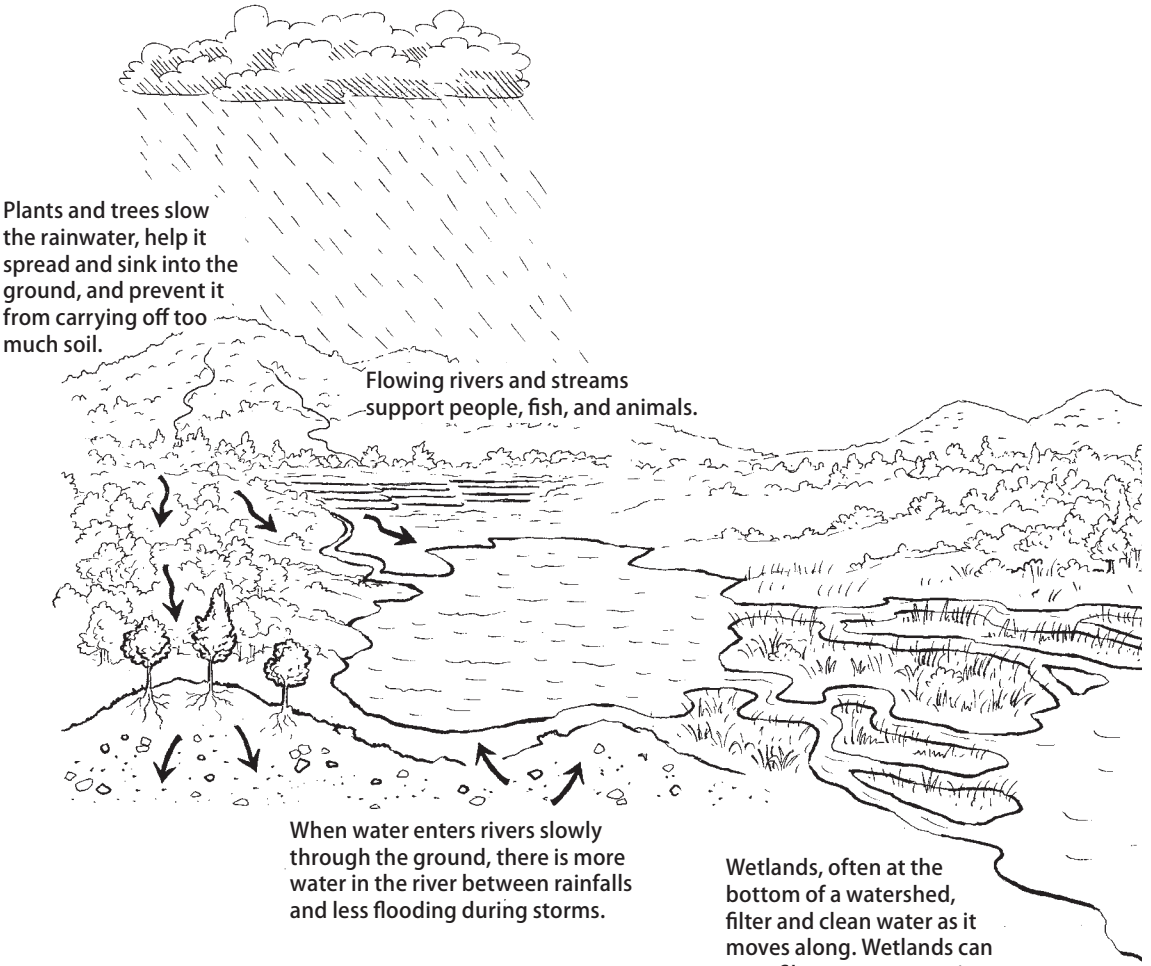
Water is always moving. Sometimes it moves by flowing along, like a river. Sometimes it moves by changing from a liquid (water) to a gas (steam or water vapor) or to a solid (ice or snow). But the total amount of water in the world never changes. All the water there is moves from the sky to the earth, soaking into the ground, flowing into rivers, lakes, and oceans, and then evaporates back into the sky. This movement of water is called the water cycle.



How watersheds protect water and soil

Most of the water in a watershed is not in the rivers and lakes, but in the soil itself. A healthy watershed has a supply of clean water and rich soil. Trees and plants, especially grasses, in the higher parts of the watershed and along the banks of rivers and streams, improve the quality and quantity of groundwater.

By protecting and conserving water, plants, and soil, we protect the watershed.



Make a watershed

This activity helps people understand how a watershed works and how all things within a watershed are important to the health of all the people living in the area.

Time: 30 to 45 minutes

Materials: For each group a large sheet of paper, a basin or pan, colored pencils or water-based colored pens, and water

1. Divide into groups of 3 to 5 people.
2. Each group takes their large sheet of paper, crumples it up, and then partly smoothes it out, being sure to leave some ridges and raised areas.
3. The group colors different features of the watershed on the paper, showing ridges in brown, valleys in green, rivers and waterways in blue. Then different colors can be added to show what people have added to the watershed: red for waste dumps, black for pesticides, gasoline, and other chemicals, and so on.
4. Place the paper in the pan or basin and fix the shape so that it resembles a watershed, with creased lines to show ridges and depressions to show valleys.
5. People in the group wet their fingers with water and gently flick water on top of the watershed until the colors begin to run on the paper. Within each group, discuss what happens to the colors as they run down into the lowest parts of the watershed.
6. Bring the groups together to discuss how what they have seen represents what happens in a real watershed. Note the distance that things can travel and the way different elements mix within the watershed.

Questions for discussion:

- What health problems can runoff from waste dumps (red color) and pesticides (black color) cause for people living downstream?
- What changes do you think your community would see if the watershed were damaged?
- What actions could your community take to protect or restore the watershed?

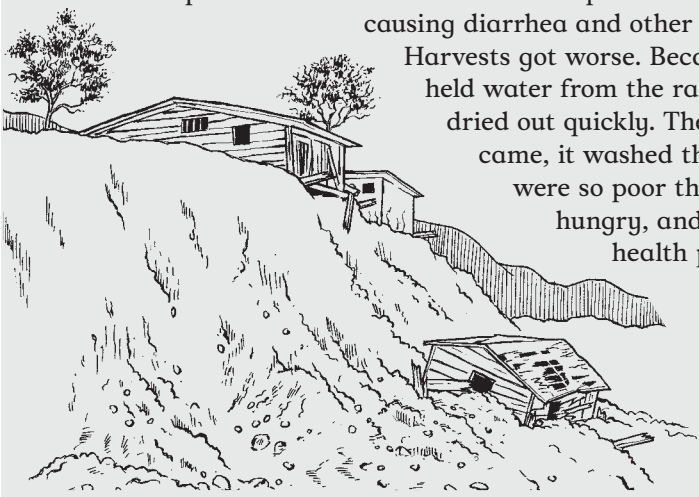
Watershed damage in the Aguan River Valley

40 years ago the hills above the Aguan River were forested. The valley was one of the most fertile regions in all of Honduras, and provided a good livelihood for people in many villages and farms. Many small, clear streams flowed down from the hills into the blue Aguan River. The river flowed through the heart of the valley and into the Caribbean Sea.

Then people started cutting down trees to use more land for farming and cattle grazing. Big fruit companies came in and cut down more trees to make banana plantations. Families started moving into the hills because the best valley land had been taken by rich landowners. Finally, most of the trees were cut down and there were many more people living on the hillsides. There was less water in the river and streams, and the water was no longer clear.

The people of the Aguan Valley knew things had changed, but it took a hurricane to make them understand how much their watershed had been damaged. Heavy rains caused landslides in the hills. Many homes and entire villages were washed away. Many people died and many more became ill.

As they worked together to recover from the storm, people began to see that the loss of trees on the hillsides, the landslides, and their health problems were all related. Cattle polluted their drinking water, causing diarrhea and other illness in their children. Harvests got worse. Because the soil no longer held water from the rainy season, the fields dried out quickly. Then when the winter rain came, it washed the soil away. Harvests were so poor that people were always hungry, and hunger made their health problems worse.



The villagers began to understand that to improve their health, they had to protect their watershed.

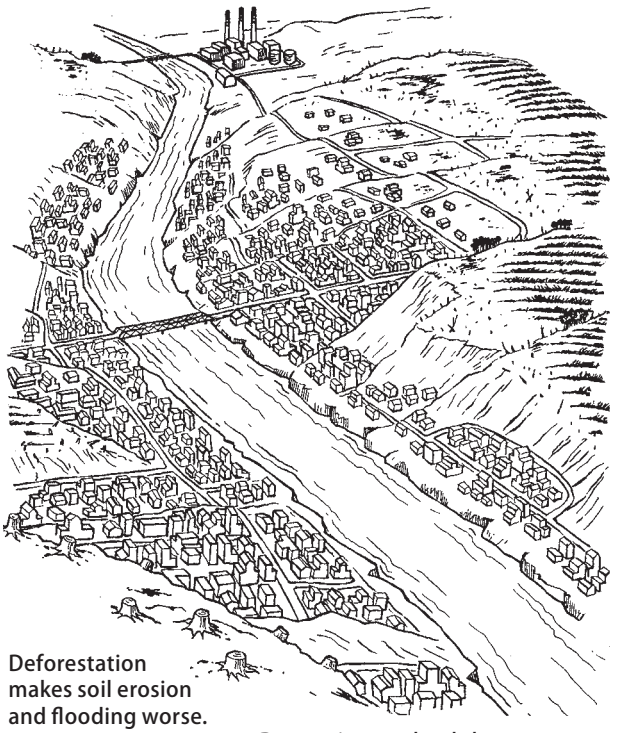
After the discussion of the "Health effects of damaged watersheds," the Aguan River Valley story continues on page 163.

Health effects of damaged watersheds

When land is cleared of trees and plants (deforestation), soil holds less water, drying up wells and springs. Dry periods may become longer or more frequent, causing all the health problems of not having enough water (see Chapter 5). Deforestation also causes loss of soil (erosion, see page 200) which makes growing food more difficult, leading to hunger and migration.

When wetlands are destroyed, they cannot filter toxic pollution out of the water, leading to greater contamination. Damage to wetlands and deforestation both cause flooding, which leads to injury, death, and increases in diarrhea diseases.

Water contamination from industry, oil, mining, and industrial farming pollutes water.



Deforestation makes soil erosion and flooding worse.

Destroying wetlands by too much building or paving over land causes more flooding and water contamination.

Changes in a watershed increase illnesses from mosquitoes

Mosquitoes breed in slow-moving and standing water. When large or sudden changes are made in how land is used and how water flows through the watershed, they often create conditions for mosquitoes to breed. Changes from:

- Digging out riverbeds for building materials like gravel and sand, and precious minerals like gold, often leaves stagnant pools.
- Damming rivers creates standing water, and changes the way water flows (see page 170).
- Building roads can block the flow of water and create stagnant pools.

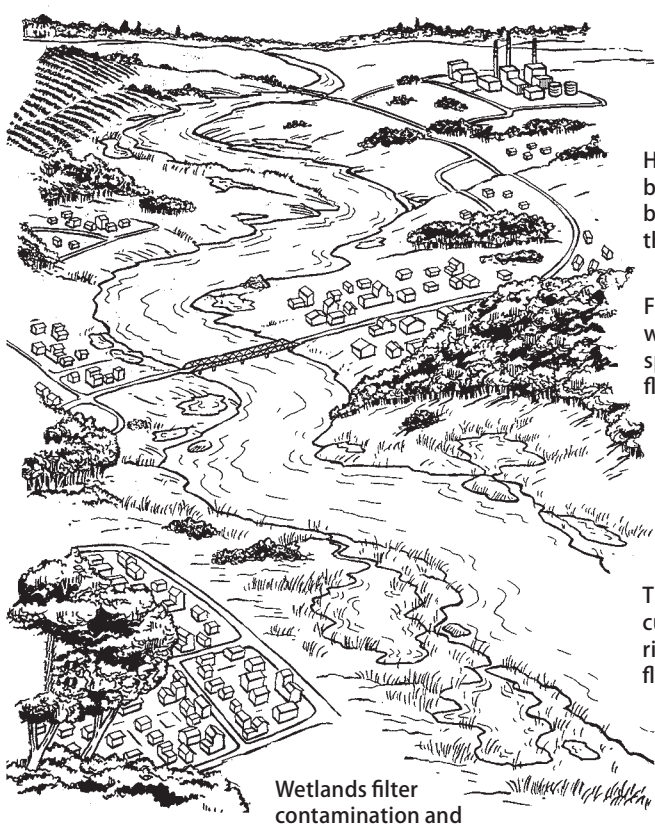
If you can keep the water moving, changes to the watershed do not have to lead to more mosquito-borne illnesses such as dengue, malaria, and yellow fever. For more about preventing problems from mosquitoes, see Chapter 8.

Protecting and Restoring Watersheds

The land in a watershed is usually owned by many different people. It can be difficult to get everyone's cooperation to restore and improve a watershed. But because the watershed includes everyone, it is important for as many people as possible to support and participate in efforts to protect the watershed.

Sustainable development protects watersheds

Some changes to watersheds, such as building roads, damming a river to provide irrigation or electricity, or draining wetlands to reduce breeding grounds for insects, are made in the hope of improving people's lives. But if these changes are made without considering how water naturally moves through the watershed, they may cause more harm than good.



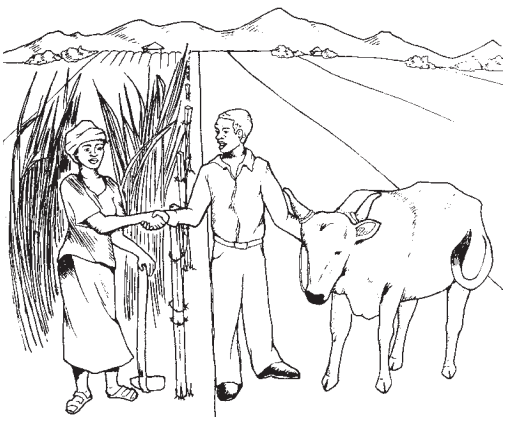
There are many ways to make improvements to living conditions that will not damage the watershed, helping it to remain healthy for people now and in the future.

- Make sure water supply and sanitation projects are well managed for the benefit of local communities and the environment (see Chapters 6 and 7).
- Work to keep the forests healthy (see Chapter 10).
- Plant crops using sustainable methods to keep farmland rich and fertile (see Chapter 15).
- Get rid of waste safely and create less of it (see Chapters 18 and 19).
- Build houses, roads, and settlements so as not to change the natural flow of water through a watershed or cause erosion, and so they are protected from seasonal flooding.

Benefits of protecting a watershed

Protecting a watershed often involves settling disputes over land, marking clear boundaries, developing plans for the flow of water, making agreements among neighbors about the use of land and water, and gathering and sharing the resources necessary to do the work.

In many communities, these are not easy projects. Local and regional governments may become involved in settling disputes — sometimes for better, sometimes for worse.



When communities work to protect their watersheds, there is more water for everyone.

But if people can work together to protect the watershed, it will mean having more water. Since water scarcity causes or worsens conflicts, having more water will improve relations among people as well as protect community health.

Some benefits of protecting a watershed are:

- more and cleaner water in wells and springs.
- better crop yields, even during dry times.
- healthier livestock.

With more water, more crops are produced. This increases people's incomes, making them less likely to leave their homes in search of work.

The story from page 159 continues here.

Improving health in the Aguan River Valley

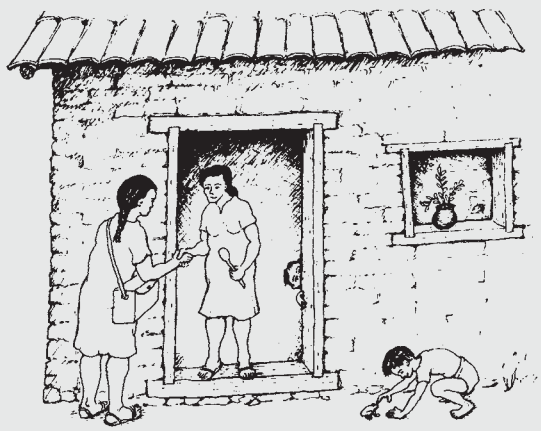
The hurricane that hit Honduras affected everyone in the Aguan River watershed, so everyone was willing to work together to recover. People from towns and villages all over the valley began to meet. There had been landslides everywhere and many people were without homes. With help from the Catholic church, they began talking about how to fix their problems in a lasting way.

As they rebuilt their communities, they learned that the way they farmed could either damage or protect the land. Farmers could improve the soil and prevent erosion by planting in rows across the hillsides instead of up and down. And drainage ditches, stone walls, and other barriers they made could protect their hillsides. The farmers were glad to learn new ways to protect their lands. But they also knew that the people doing the most harm were the cattle ranchers and plantation owners.

Villagers and farmers began visiting families who had large banana plantations or ranches with many cattle. The villagers spoke with the large landowners about the importance of protecting the water for everyone. "It is not only the poor who suffer from the effects of damaged land and contaminated water," they said. "It is all of us."

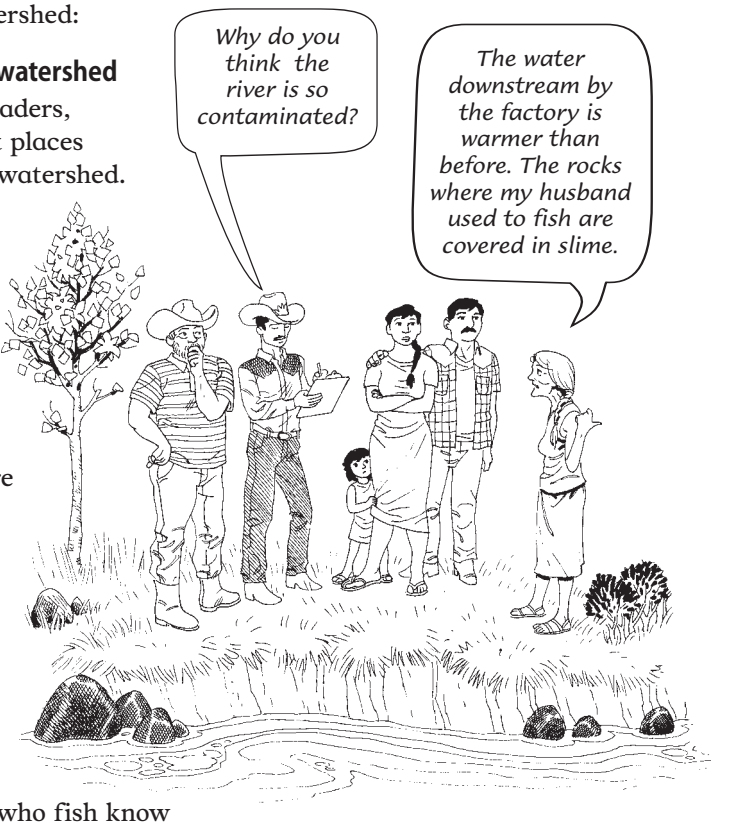
Over time, even the richest landowners in the valley began to help in the recovery effort. Some agreed to fence the creeks and springs to keep cattle out. Others, who owned land in the hills, let the villagers who had land below plant trees on their hillsides. Farmers from the valley approached landowners near the hilltops and offered to trade some of their land for permission to fence and protect the lands above. It was better for ranchers to have valley land for their cattle and better for the whole community to keep cattle off the hilltops, so the plan helped everyone.

After the hurricane, villagers in the Aguan River Valley began to have good relations among people who once had rarely spoken to each other. They learned that by protecting their watershed, they and their children would have cleaner water and safer homes. This is good for the watershed and good for the community.



Planning a community watershed project

The watershed team of the Aguan River Valley followed these steps in beginning to protect their watershed:

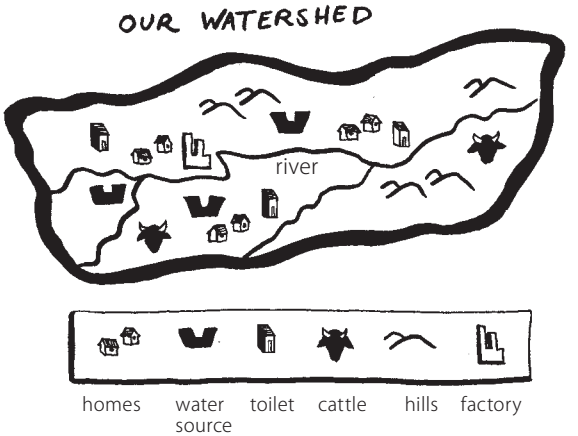


1. Find out the condition of the watershed

As a group, with community leaders, teachers and other people, visit places important to the health of the watershed. Depending on the size of the watershed, this may take 1 day or several weeks.

Visit the main waterways, and note where they connect with one another. Make notes about who lives in which parts of the watershed, and how land and resources are used in different areas. Visit the places where people collect water, places where water may become contaminated (such as near factories, pastures, and places where trash collects) and other areas of concern.

Speak with people about the changes they have noticed over time. Hunters and people who fish know where the animals are, and where they used to be, at different times of the year. Your community is full of experts about your watershed.



2. Make a map or drawing of the watershed

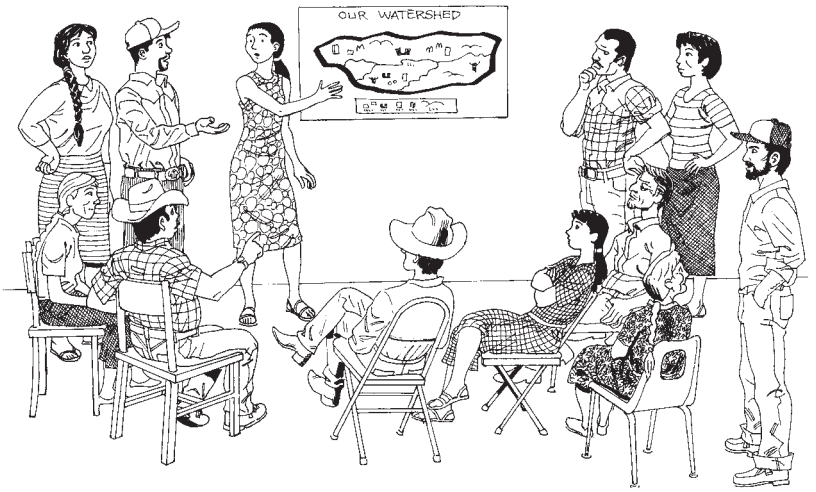
After these visits, discuss what you have learned and how to best share the information with the whole community. Discuss what things can cause harm to the land and water. It can help to make a map of the watershed and mark the places of concern. Elders can help by making maps of how things used to be and how they have changed. (For more about mapping, see page 15.)

3. Organize a community meeting

Organize a meeting of people from all the communities in the watershed. It is especially important to invite health workers, people responsible for water and sanitation, landowners, business owners, and people who collect water.

Use your map or drawing to explain the problems you found. Encourage people to share their concerns about health and discuss how problems might be caused by water contamination, deforestation, soil erosion, and other watershed issues. Remember to talk about both surface water and groundwater.

The goal of this discussion is to begin moving from identifying problems to the process of solving them. As each issue is raised, ask: How could we start solving this problem right now? Will we need technical support, money, or other resources? Who needs to be involved?



4. Build partnerships

Meetings and watershed walks are ways to build partnerships among people in a watershed. Organize meetings with people who live in the downstream parts of the watershed, and other meetings with those who live upstream. Then organize meetings with representatives from the different groups. Identify common goals and find ways of working toward them so everyone benefits.

Partnerships can sometimes be difficult to build, especially in a large watershed. You may have to coordinate among different local groups and also city or legal committees. Different groups or communities will often have their own ideas of what should happen in the watershed and may have difficulty understanding or accepting the needs and ideas of others. Differences in power, resources and influence can cause serious conflicts. But when everyone's needs and contributions are respected, not simply those of people with wealth or status, strong partnerships can develop. Openness and honesty in working relationships will help create trust. And if all partners are expected to contribute to the partnership, they should also benefit from it.

Think about some of the deals made in the Aguan River Valley. One group planted trees on other people's land. Wealthy ranchers agreed to fence creeks and springs. Some people even traded land. Determination, patience, and benefits of more and cleaner water allowed partnerships to grow and succeed.

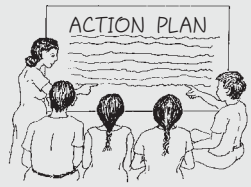
5. Make an action plan

Set clear goals and make an action plan. One goal may be to have trees growing near all water sources in 5 years. Another goal may be to protect a river so that in 50 years it will be safe to drink.

The action plan could include the protection of some land by not using it at all, especially near streams or on hilltops. Post "Watershed Preserve: Do Not Use" signs or mark trees with paint.

The first to benefit from watershed protection are usually people at the bottom of the watershed (by having more water and improved soil). Make an action plan that includes the needs of those at the top of the watershed who will only benefit later. When everyone in the community works together, the plan is more likely to succeed.

Aguan River Valley Watershed Action Plan



1. Do not cut vegetation near water sources.
2. Help young trees grow, and reforest areas that have few trees, especially close to water sources.
3. Start community nurseries to grow plants for reforestation.
4. Organize groups to prevent and fight forest fires. Educate local farmers not to burn their fields, or how to do safe, controlled fires.
5. Fence the area around water sources and post "Protected Area" signs.
6. Encourage farmers to conserve soil by using green manures, recycling crop wastes, building retaining walls, and planting on contour lines.
7. Discourage the use of chemical pesticides and fertilizers.
8. Work with the local government and water commissions to move toilets, sewer systems, and washing areas away from water sources.
9. Organize community trash collection, and prevent trash from washing into streams and rivers.
10. Move cattle away from water sources, and mark areas where no cattle should graze.
11. Make sure people who have just moved to the community and new businesses learn about the watershed and how they can help care for it.

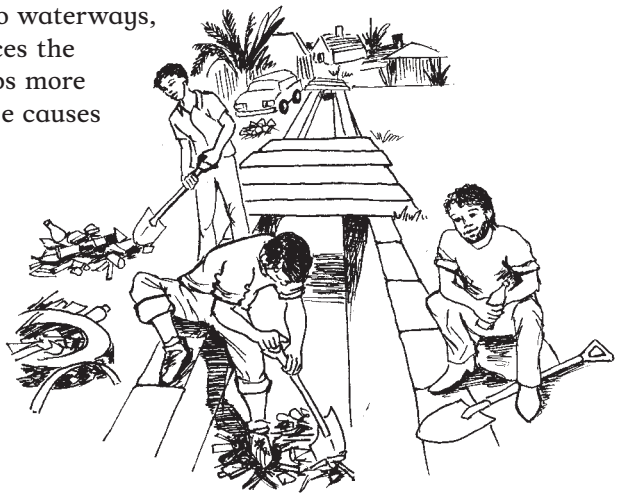
These steps can be a model for any community's watershed protection project. The most important part of the project is to involve as many people as possible in agreements that will benefit everyone in the long term.

Managing the Way Water Flows

When water flows into the ground or into waterways, it is called **drainage**. Good drainage reduces the dangers of flooding and erosion, and helps more water soak into the ground. Poor drainage causes soil erosion and stagnant water.

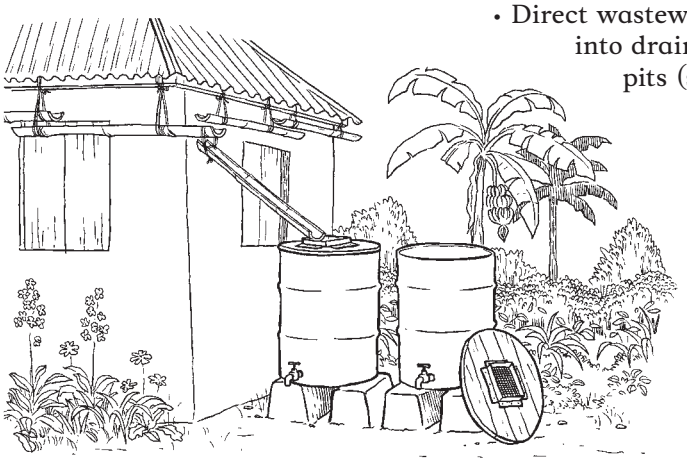
The best way to improve drainage is to make the **surface water** after a rainfall (called runoff) "walk off" rather than "run off," so that it slows down, spreads out, and sinks into the ground. To do this:

- Avoid cutting down plants and trees, especially on slopes and along streams and rivers.
- Direct surface water to plants, irrigation ditches, and low areas. Gardens can be planted or fishponds built in places where water collects (see page 309).



Regular cleaning of drainage channels helps prevent flooding and illness.

- Build live barriers, low walls, and other erosion control structures to hold and direct surface water (see page 293).
- Improve soil using sustainable farming methods, so water sinks into the ground (see pages 282 to 289).
- Direct wastewater from taps and wells into drainage ditches or soakaway pits (see page 82).
- Collect runoff from roofs in cisterns and containers for drinking water (see page 86), or direct it into ponds, fields, and gardens.
- Maintain roadside plant life or build drainage channels alongside roads and keep them clear of blockages.



Turn rainwater into a household resource.

Watersheds in towns and cities

When a town or city is built, it changes the way water flows through the watershed. Urban development brings more hard surfaces such as roads, pavements, and roofs that cause rainwater to run off rather than to soak into the ground. This can cause water to collect and stagnate, providing places for mosquitoes to breed. It may also lead to flooding.

Where people gather in large numbers and industry develops, more pollution contaminates the water. Keeping wetlands and riverbanks healthy in towns and cities can be difficult, but it is especially important because wetlands prevent polluted water from collecting, contaminating plants and animals, and damaging human health.

To protect their part of the watershed, people in towns and cities can:

- Safely dispose of human wastes and toxic chemicals to prevent them from polluting water sources and blocking water flow (see Chapters 7, 16, and 20).
- Restore riverbanks, streams, and wetlands as parks within the city. Some communities plant gardens alongside roads to help water sink into the ground, rather than drain into sewers.
- Campaign to have city governments provide safer homes for people living in dangerous flood areas.
- Pressure businesses and industries to take responsibility for their wastes.
- Get involved through city government and civic organizations in regional planning and sustainable development efforts.

Watersheds in cities and towns are easily contaminated, but they can be protected!

Large Dams Damage Health

A dam is a wall built across a river. Dams are built to block the flow of a river and form a human-made lake called a reservoir. Water stored in reservoirs can be used to control flooding, to provide water for irrigation and drinking, to make electricity, or for recreation.

Dams have contributed to building modern cities and improving many lives. But large dams, more than 15 meters tall and sometimes as tall as 250 meters, also harm people and the land in many ways.

How a large dam made the Yaqui people sick

Many years ago the Yaqui people lived by farming in the hot, dry climate of northern Mexico. Thanks to their river, the Rio Yaqui, they had water for farming, for drinking, and to meet their needs all year.

This all changed when their river was dammed. The Mexican government agreed that half of the water from the dam belonged to the Yaquis. But the Yaquis soon found that no water arrived at their villages. The entire river had been channeled into a giant canal to irrigate many large industrial farms growing wheat and cotton. These large farms soon surrounded the Yaqui villages, and the Yaqui people were left with no water for their own crops.

To grow wheat and cotton in dry desert soil requires a lot of water, chemical fertilizers, and pesticides. Pesticides are sprayed as many as 45 times in the months between planting and harvest. All of this poison ends up in the irrigation canals. With their river diverted and no other source of water, the Yaquis drink from the canals. Over the years, the polluted water made them sick.

After years of drinking contaminated water, Yaqui children were having problems learning, thinking, growing, and playing. Many children also suffered from severe health problems such as cancer of the blood **(leukemia)** and birth defects, such as withered limbs and soft bones. These health problems are most likely caused by drinking water and breathing air poisoned with pesticides.

The Yaqui people's health problems began when their river was dammed.

Dams cause problems upstream and downstream

First, dams create problems for people who live upstream from where the river is or will be blocked.

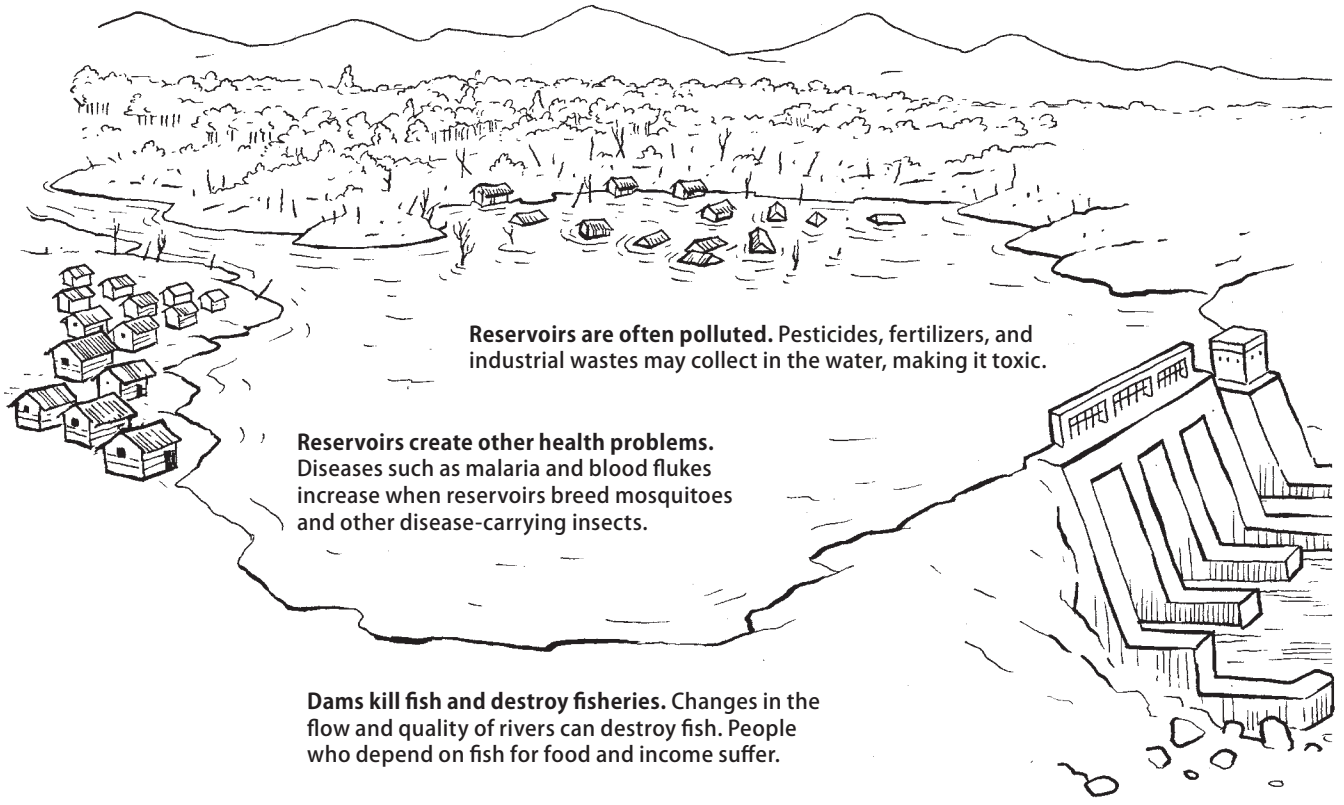
Displacement and poverty

People are displaced by dams and forced to migrate. Many end up living on poor land or in urban slums. Displaced people may be promised money or land. But often money is not handed over by local officials. Many times, only people with legal title to land that will be flooded by the dam receive money or other land. Sometimes, the replacement land is too poor to farm.

Towns that will be flooded by a dam do not receive government funds for upkeep and development, so schools, roads, and health services fall into neglect. Some towns remain like this for many years before they are flooded.

Dams builders are oppressed. They often have unsafe work conditions, poor housing, bad food, and little access to health care. These conditions promote illnesses such as TB and HIV. After a dam is built, they must find another place to live and work.

Dams destroy communities. Families living in the reservoir area lose their homes, lands, and livelihoods. Displaced people are often not resettled together. People are usually poorer after they move.



Reservoirs are often polluted. Pesticides, fertilizers, and industrial wastes may collect in the water, making it toxic.

Reservoirs create other health problems. Diseases such as malaria and blood flukes increase when reservoirs breed mosquitoes and other disease-carrying insects.

Dams kill fish and destroy fisheries. Changes in the flow and quality of rivers can destroy fish. People who depend on fish for food and income suffer.

Dams destroy the natural flow of the river. They cause either an increase or decrease in water flow, depending on the dam. The natural cycle of flood and drought may be disrupted, affecting the entire river and damaging huge areas of land.

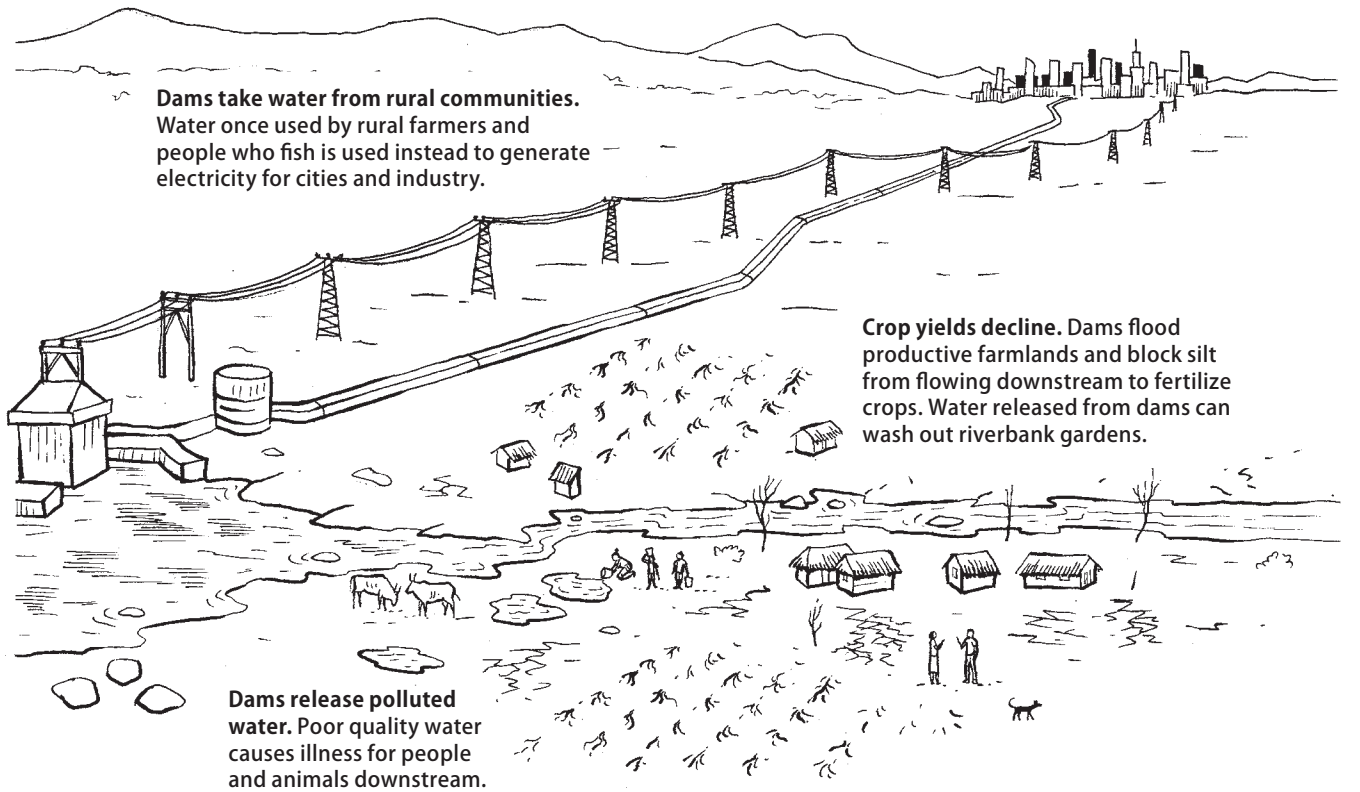
New insect breeding grounds

Mosquitoes breed in the shallow, sunny waters of irrigation canals, and at the edges of reservoirs. Regularly raising and lowering the level of the reservoir can kill young mosquitoes. But the people who manage dams do not usually consider this important.

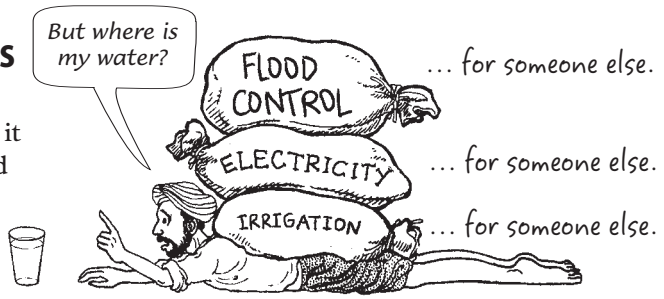
Black flies that spread river blindness lay their eggs in fast flowing water, like the water that flows out of a dam. The still waters in dam and irrigation projects are breeding grounds for snails that carry blood flukes (see page 56).

Erosion of riverbanks and floodplains

When a dam blocks a river, bits of soil and rock carried by the water (silt) settle on the river bottom and in the reservoir instead of on riverbanks. When water is let out of the reservoir, the water has no silt in it. Because silt is part of what makes land rich for farming, downstream lands become poor. And because water released from the dam collects silt as it moves, it further erodes the land as it digs deeper into the riverbed.



Alternatives to large dams



When there are plans to build a dam, the first question to ask is: Is it necessary? Dams are built for flood control, electricity, irrigation, and to provide water to growing cities. These services could be provided in less harmful ways.

The second question to ask is: Who is going to benefit? Around the world, communities that would be harmed have resisted big dams and proposed alternatives. In many cases, they are succeeding.

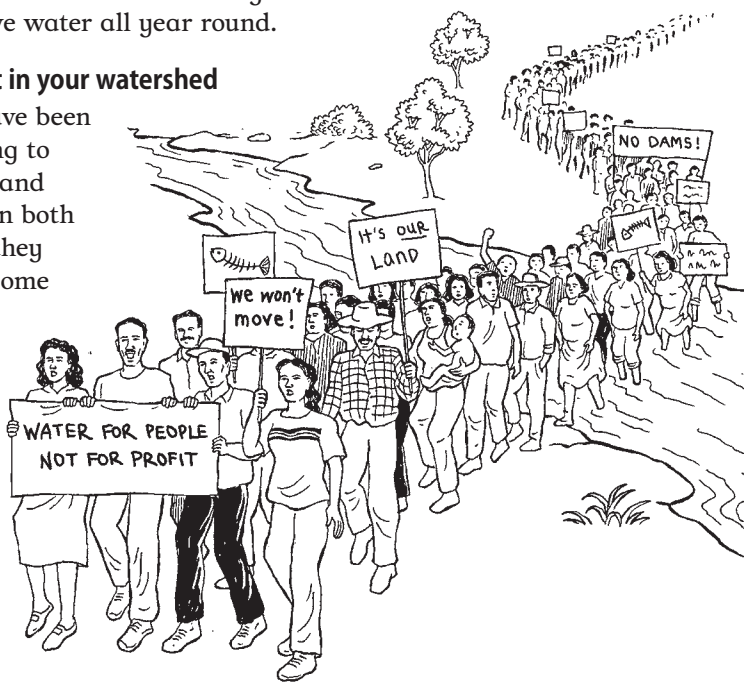
Flood control. If possible, avoid building in natural floodplains and wetlands. Improve warning systems to help people prepare for floods. Preserving the natural flow of rivers can prevent floods more effectively than damming them.

Electricity. Encourage governments and developers to promote wind, solar, or small-scale water power that generates electricity close to where it will be used. Locally managed and controlled energy is more sustainable for people in cities and towns, as well as in rural areas (see Chapter 23).

Irrigation. Local development provides better water security than large dams. In the state of Gujarat in India, thousands of small check dams (see page 293) have been built to collect rainwater for use in the dry season and to replenish the groundwater. The government and villagers share the cost of the check dams. Many villages that once had water to irrigate fields for only half the year, now have water all year round.

If a dam is proposed or built in your watershed

Communities worldwide have been resisting new dams, working to have old ones taken down, and demanding compensation in both money and land for harm they have suffered from dams. Some communities also demand changes in the ways dams are controlled, to help rivers flow more naturally and reduce the harm dams have caused. (For more information, see Resources.)



Intertribal partnership protects the Yukon River

In Alaska and the Yukon Territory at the border of the United States and Canada, the mighty Yukon River flows 2300 miles (3700 kilometers) through many towns and villages. Because the river is threatened by contamination, 60 indigenous communities signed a treaty agreeing to work as partners to keep the river clean for future generations. They formed an alliance called the Yukon River Intertribal Watershed Council.

The Watershed Council did not begin by trying to clean up the entire river. They started with small projects and clear goals. One of their first programs was to ban the use of plastic bags in towns along the river. By banning plastic bags, people along the river learned that taking personal responsibility could make a big difference in protecting the watershed.

After the plastic bag ban succeeded, the communities began cleaning up discarded batteries, oil, and broken down cars. Every community in the watershed built a landfill and set up a bin to collect batteries, keeping poisons out of the soil and water. Then they worked to convince all the small airlines, shipping companies, and military bases in the area to dispose of old batteries, cars, and oil safely.

Now, Yukon tribal governments are improving their sewage systems and landfills, and creating programs to recycle and reuse trash. They teach young people to test the water for pollution and to recognize signs of contamination in order to prevent it.

The Yukon River Intertribal Watershed Council built partnerships with tribal, state, local, and national governments in Canada and the United States, and with environmental and watershed groups, funding agencies, and outside advisers. By bringing many groups together, the Watershed Council was able to make a plan that included everyone in the watershed, and to gather enough resources to get the work done.

By taking small steps at first and then larger steps, the Watershed Council encourages change that is slow, but effective. One member of the Council said, “When I was a child I drank water straight from the river. In 50 years we will be able to drink from the river again.”