THE BUSINESS OF ABUSING A LAKE

TEACHER BACKGROUND:

- The teacher should view Chapters 5 & 7 of the *Utah Lake: Legacy* video. (YouTube Links: Chapter 5, Chapter 7).

(Selected excerpts from the book *Utah Lake: Legacy*)

FISHING. A WAY OF LIFE, A MEANS OF SURVIVAL. (from pg. 25)
Using seines (large nets) made of cotton yarn or flax; the pioneer fishermen caught thousands of pounds of Bonneville cutthroat trout, June sucker, Utah sucker, and chub. In 1848, fishing companies were organized to collect fish for desperate settlers who were without provisions. That year, frost killed early sprouting crops. Then came the crickets. Swarms destroyed many crops that survived the freezing temperatures, and hundreds of the valley's early residents stare starvation in the face. Were it not for the plentiful fish in Utah Lake, hundreds of settlers would have suffered severely. Several families were fortunate to have friends who were also skilled fishermen. The Hale family, for example, considered themselves lucky to know Lucas Hoaglund, who provided them with enough fish to survive a very rough year:
"[Hoaglund] used to go to Provo River with fishing parties, ketch fish [*sic*] and salt and dry them. They were very good and considered a rairaty [*sic*]."

More crickets would destroy pioneer crops in years to come. However, the worst attack wasn't executed by crickets, but by Rocky Mountain locusts, commonly known as grasshoppers. These tiny beasts weren't finicky eaters. They gobbled up wheat, corn, oats, barley, clover, grass – even clothing. They also ate almost everything in the typical backyard garden, including potatoes onions, peppers, rhubarb, beets, cabbages, radishes, and turnips. At times like these, when insects viciously took away what the earth so generously provided, the only thing left to do was fish. Motivated by hunger and the will to survive, settlers fished frequently and recklessly. Soon, laws were written to prevent the needless destruction of fish, to regulate fishing methods, and to control the number of fish being taken from the lake. But these laws were ignored by many locals, who seined night and day. Fishermen also placed stationary gill nets across the mouth of the Provo River. These nets indiscriminately caught thousands of fish – many of which were attempting to spawn.

"Indeed, so great was the number of suckers and mullets passing continuously upstream that often the river would be full from bank to bank as thick as they could swim for hours and sometimes days together." --George Washing Bean, 1854.

CHANGE IS GOOD? (from pg. 26)
Very often, change is good. But in the 1880s, when carp were introduced to Utah Lake, the results weren't good at all. The intent was to replace the dwindling number of Bonneville cutthroat trout and to provide locals with a hardy fish that was also a very popular dish in other areas of the world. Yet, the newly integrated carp had long-lasting, negative impacts on the lake's native fish population. The carp's aggressive foraging habits eventually destroyed the pondweed on the surface and the plant life on the lake floor. This directly impacted the native fish populations. The reduced amounts of vegetation made it easier for waves to bring sediments up from the bottom, making the water more turbid and green in appearance. Most

people didn't know it then, but high levels of sediments and nutrients fuel algae growth. If algae grows out of control, oxygen levels become too low for many fish to survive.

As the human population grew, so did competition for fish and water. Farmers needed water to irrigate fields, so dams and canals were built, many to redirect flows from the Provo River. At first, irrigation ditches were unscreened, so thousands of fish were carried into farmers' fields and stranded. Many of the townspeople gathered the fish for dinner, other fish were left to fertilize crops. As a result of over-fishing, the introduction of nonnative fish, water depletion caused by irrigation, and later, the straightening, channeling, and dredging of its main tributaries, the health of the lake and its native fish began to decline.

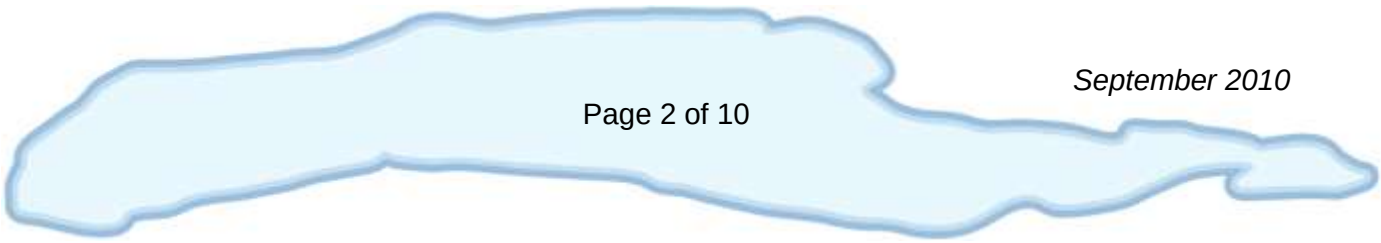
"Fish were plentiful in those days in all streams around the Provo. We could get all we wanted when we irrigated our crops. There would be plenty of fish on the land after the water has suck into the ground." -- Clarence Merrill, 1850s.

(from pg 33)
The 1930s ushered in two destructive signs of the times: The Depression and drought. During this time, Utah Lake was receding as each year passed. By 1933, the Provo River had become narrow and shallow, and with a sandbar across its mouth, no large boats could pass through. The drought continued, and between 1935 and 1936, the water in the lake was too shallow for most boats to cruise. Utah Lake contained only 10,000 acre-feet of water that inadequately covered 20,000 acres. The surface area of Utah Lake, under normal conditions, is about 96,000 acres. The volume of water at that level is about 900,000 acre-feet, about one-third of which is lost to evaporation each year.

Construction of the Provo Boat Harbor began in the 1930s with the purpose of replacing the defunct Provona Resort. When World War II began, the harbor was left unfinished, but after peaceful times returned, it was finally completed. With a secure place to park their boats, skippers from all over the state came to Utah Lake to race. The Memorial Day boat races were by far the most popular. These events drew spectators from far and wide to watch some of the fastest boats ever seen zip around the lake.

The Utah Lake State Park was born in 1967 when the state park system took over the Provo Boat Harbor from the city of Provo. New facilities were added, including a toll booth at the parks' entrance. Not surprisingly, the number of lake visitors dropped. People were so accustomed to freely accessing the beaches and picnic areas that they begrudged paying to get through the newly posted gate.

Industrial development brought more jobs and even more people to Utah County. The water in Utah Lake was in its worst condition, and recreation on the lake began to decline. People were beginning to see the damage that so many years of abuse had rendered. The effects of agricultural and industrial pollution and the deposition of raw and treated sewage did more than keep swimmers away; they also had negative impacts on the native fish community. As the 1960s and 1970s progressed, signs warning swimmers not to go into the water were posted. Most of the recreational resorts were closed by that time. Convincing swimmers, campers, boaters, and water skiers to recreate at Utah Lake was a sales pitch that fell on deaf ears.



THE BUSINESS OF ABUSING A LAKE

THE PRICE OF PROGRESS (from pg. 37)

The abuse of Utah Lake's tributaries and ecosystem began earlier than most people realize. Beginning in the 1890s and continuing into the 1950s, raw sewage was drained into the creeks and streams flowing into the lake. Also in the 1880s, sugar mills deposited waste from the processing of sugar beets into the tributaries of the lake and the Jordan River. Sawmills were guilty, too. Instead of paying to have sawdust removed with team and wagon, owners dumped it into the streams that ran into lake tributaries and the Jordan River. The sawdust got lodged in the gills of trout and suffocated large numbers of them. Cottonwood, Nebo, Santaquin, and Payson creeks were among the streams affected.

The waste disposal practices of the mills were in violation of an 1872 law passed by the Territorial Legislature. This law made it illegal to put any deleterious substances that would kill fish and pollute culinary water into public streams. Legislators, concerned citizens, and the recently formed Utah Fish and Game Protective Society worked together to pressure mill owners into obeying the law.

Several agricultural practices had devastating effects on the lake's native fishes and their habitat. Fertilizer run-off into drainage ditches, which caused phosphates to seep into the lake, was part of the problem. Yet, many believe the most staggering losses of fish occurred as a result of irrigation. Unscreened irrigation ditches carried thousands of fish into farmers' fields to die. Irrigation diversion dams along rivers and streams presented insurmountable barriers for spawning fish. They hindered the spawning runs of many sucker and trout, and directed newly hatched fish into irrigation ditches instead of back to the lake.

In 1872, lawmakers worked to correct the problem dams by passing a law requiring owners of all new structures to install fishways, which would allow fish to pass over dams that blocked their spawning runs. In 1874, the law was amended to include existing dams as well. Today, fishways are no longer required and diversion dams still prevent June sucker from accessing suitable spawning grounds.

Utah's economic development progressed into the 1900s when the steel industry came to Utah Valley via the newly constructed railroads. Columbia Steel Corporation's Ironton Plant started operations in the 1920s. The plants provided jobs for eager workers and transported steel products to various parts of the country by train. Geneva Steel began operations in 1942 and became a magnet for jobseekers of all levels, from the manufacturing floor to the upper stations of engineering and management. The company caused a sharp population increase and helped spark the local economy, but the steel industry wasn't good for the lake. Steel plants were accused of severely polluting the water. They later worked to repair the damage by funding extensive cleanup efforts.

THE LAKE THEN AND NOW (from pg. 38)

In the 1970s, a study led by Dr. Willis H. Brimhall of Brigham Young University found that Utah Lake was less turbid in pioneer times. Brimhall's study noted that since its inception, the lake has never been perfectly clear because it has always been shallow. This lack of depth contributes to its turbidity, large loss of water to evaporation, slightly saline water, warm summer temperatures, and an abundance of algae. Brimhall also concluded that some 28 feet of sediment accumulated on the lake's bottom over the past 10,000 years. The rate of sedimentation has doubled since the first settlement and the later urbanization of Utah Valley.

THE BUSINESS OF ABUSING A LAKE

In the 20th century, the increased amounts of fertilizer and sewage that were dumped into the lake fueled algae growth, harmed the quality of water, and damaged the habitat of the native fish. Urban growth around the lake has increased erosion, and the carp population has stripped the lake of nearly all of its aquatic vegetation. These factors, combined with the lake's historically shallow depths, have kept the water in a turbid state.

In recent years, the introduction of more nonnative fish, including predators such as white bass, has also contributed to the demise of the lake's ecosystem and native fish community. White bass compete with native fish like June sucker for food and also prey upon sucker young. Nonnative carp, which currently comprise 90 percent of the fish biomass (weight) in the lake, destroy the vegetation on the lake's bottom. This leaves less cover to protect June sucker from predators. With so many obstacles placed in the reproductive path of this native fish, it's no surprise that most June sucker found in the lake today are estimated to be between the ages of 20 and 43 years old.

Utah Lake attracts boaters, anglers, duck hunters, kayakers, water skiers, and campers. However, recreational use is low compared to other lakes and reservoirs in Utah. Anglers cast their lines for channel catfish, walleye, white bass, black bass, and different species of panfish. The lake will always be a special place for the many generations who have enjoyed it over time, and it is a critical resource for local residents. Water is distributed for irrigation and residential use from the lake's drainage basin through tributaries like the Provo, Spanish Fork, and American Fork rivers, and the Jordan River outlet. The lake's tributaries remain the primary source of fresh water for much of the ever-growing population of the Wasatch front. Clearly, for more reasons than most people realize, we need Utah Lake. And perhaps even more importantly, it needs us.

A TIME TO HEAL. (from pg. 38)
Municipal and industrial discharge, urban growth, and poor land use practices have impaired water quality and severely damaged the June sucker's only indigenous habitat. The recovery of June sucker and the revitalization of Utah Lake go hand-in-hand. A healthy habitat for the fish benefits the entire ecosystem of the lake and the people who live around it. There is a great need to improve habitat for both fish and animals, and to control the nonnative fish populations so that the lake and its rivers can once again host a balanced fish community. Also, water supplies must be managed to meet the needs of fish and other species without interrupting water service to human residents.

Working together, we can restore Utah Lake to become a better home for the June sucker and a more efficient water resource for our communities. Ultimately, a restored habitat will enable this extraordinary fish to live and breed in its only natural home. Improving Utah Lake will also allow for the continued use of its water to meet the needs of our growing population – be it for necessity or for pure fun.

FISH TROUBLE. (from pg. 50)
Both humans and Mother Nature contributed to the demolition of Utah Lake's native fish community. In 1872, a dam was constructed across the Jordan River (the Lake's only outlet) for using the lake as a storage reservoir. In the coming decades, the high-mountain reservoirs were created to retain increased springtime runoff. Some of these reservoirs still exist and

continue to provide water to the Wasatch Front for agriculture, industry, recreation, and municipalities.

The reservoirs and irrigation practices mentioned earlier initiated a gradual change in Utah Lake's water quality, and this resulted in the deaths of many fish. Return flows from irrigation raised the lake's water temperatures and increased turbidity. Thousands of tons of sucker died during the drought of the 1890s, when rivers were drained in an effort to water parched fields. These actions left fish stranded on dry river beds to perish. A severe drought in the early 1930s prompted farmers to dewater the Provo River in a futile attempt to save their dying crops. At the same time, Utah Lake shriveled to an alarming average depth of one foot. Scientists later concluded that the native fish population never fully recovered from the effects of such catastrophic droughts and the continuing practices of poorly managed irrigation.

FROM PLENTIFUL FISH TO ENDANGERED SPECIES. (from pg. 51)

In addition to the careless fishing and irrigation, methods practiced by man, the merciless acts of nature, the introduction of exotic or nonnative species of fish has played a major role in the demise of June sucker. In the past 100 years, more than 20 species have been mixed with the native fish of Utah Lake. These new species include common carp, largemouth bass, black bullhead, channel catfish, walleye, white bass, and others. After rebounding from the 1930s drought, a significant decrease in sucker numbers was documented in the mid-1950s. Scientists hypothesized that the primary reason for the decline was the result of young sucker falling prey to white bass and walleye.

Today, June sucker young continue to be an easy meal for white bass and other predators. Historically, June sucker traveled further up the Provo River or other tributaries to spawn, but today, the lower Provo River is the only area where June sucker are known to spawn successfully. Sucker possess no jumping ability to progress past even the smallest of barriers, let alone the irrigation diversion dams on the Provo River. These obstacles prevent spawning sucker from migrating further than 4.9 miles upstream. When their young drift downstream from the safe haven of the lower Provo River on their way back to the lake, the young fish's chances of living long are very slim. Predators like white bass need not travel far to intercept these small June sucker.

Thousands of trout and sucker died in 1872 and in later years, when killing fish with what was then called "giant powder" (now referred to as dynamite) became common. After a law was passed creating a trout seining season, it was illegal for fishermen to net trout during spawning runs. But the public kept its taste for trout, so unscrupulous fishermen decided that if they couldn't seine for large amounts of trout during the closed season, they would blast. Such a cruel method of catching fish created protests from citizens throughout the Wasatch Front. After passing and overturning several blasting laws with varying degrees of punishment, dynamiting fish became a felony in 1896. A hefty fine was levied on offenders from that year until the turn of the century. The thought of parting with money was too much to bear for many offenders. As a result, the frequency of blasting decreased.

THE BUSINESS OF ABUSING A LAKE

DOWN BY THE OLD MILLSTREAM. (from pg. 75)

Mill owners of the late 1800s and early 1900s joined the assault on water quality by regularly dumping sawdust and other forms of waste into the tributaries of Utah Lake and the Jordan River. Large numbers of trout suffocated when the sawdust clogged their gills. Public outcry led to legislative law, which helped control the problem, but serious damage had already been done.

The Provo Woolen Mills, a cooperative formed by shareholders belonging to the LDS Church, helped the local economy grow. However, the dye, lanolin, and other waste from the mill's manufacturing process also went into the mill race, which ran into the Provo Bay on Utah Lake.

Near the beginning of the 20th century, Telluride Power announced plans to deliver electricity to the Mercur mines on the lake's west side. To accomplish this feat, the company said it would be necessary to build a large dam, up to 84 feet in height, across the Provo River just above Bridal Veil Falls. Provo residents protested. Among their many complaints, the issue of a dam creating serious problems for spawning fish was overlooked. Permission to build the large dam was denied, but Telluride was later given the go-ahead to construct a smaller dam. Later, when sportsmen discovered that spawning trout could not get over the dam, the company built a fall and pool system of water-filled tanks. The system was designed to help trout swim over the dam and progress on their spawning routes, but residents deemed the system ineffective. In efforts to satisfy both fish and people, Telluride built, at their own expense, three more fishways in quick succession. None of these worked. Finally, with the advice of Washington, D.C. fish experts and the approval of Utah County officials, Telluride built a fifth fishway. This final fishway was the company's last attempt to please everyone.

VALLEY OF STEEL. (from pg. 78)

California wasn't the only place where the riches of the earth could be found. Gold, silver, lead, zinc, and copper were all mined in and around Utah County. The expansion of the railroads enabled shipments of dynamite to enter the valley. As more mine tunnels were blasted, previous timber was taken from the surrounding mountainsides and cut into massive wooden beams. These were used to support the tunnels in an effort to avoid cave-ins. As greater areas of forest were cleared, the earth that had been held in place by trees filtered into Utah Lake, contributing to the water's turbidity.

The railroads not only kept busy hauling the products of the growing mining industry to cities throughout the west, they also helped usher the steel industry into Utah County. In the early 1900s, trains made available the essentials for steelmaking – iron ore from Iron County, and coal from Carbon and Emery counties. In the early 1920s, Columbia Steel Corporation's Ironton Plant took advantage of these plentiful resources and began producing steel.

Later, a larger and more versatile steel mill was built near Utah Lake. From 1941 to 1944, 10,000 workers labored to build a $200 million, federally financed facility near the old Geneva Resort, for which the plant was named. Geneva Steel's purpose was to ensure that both

military (the plant supplied steel for ship building in California during World War II) and industrial needs for steel would be met. The location near Orem was chosen for several reasons. The essential raw materials were all within reach: In addition to readily available coal and iron ore supplies, limestone, and dolomite were found near Payson, and water could be drawn from Deer Creek Reservoir and from on-site artesian wells. The company could also recruit from an educated and stable local work force. And, because the plant was situated inland, it would likely be protected from attacks by enemy warplanes.

Geneva Steel not only provided lucrative jobs to hundreds of local people, it also drew many easterners to work at the plant. Such a sudden increase in population instigated a residential building frenzy. Utah Valley communities seemed to expand overnight as 4,500 new residents arrived. The local economy was prospering, but the water in Utah Lake began to suffer. Increased amounts of raw sewage from Provo and other cities were being funneled into Provo Bay and Utah Lake. The influx sparked a need for new utility services and sewage management.

Perceptions of Utah Lake's condition steadily became more negative. In the 1940s and early 1950s, Provo residents experienced a polio scare. People knew that raw sewage was being emptied into the lake, and they connected exposure to that waste with the proliferation of polio. As more people comprehended the apparent link, the public became alarmed. Wastewater treatment facilities were established to help ensure that only treated waste was deposited into Utah Lake, but not many minds were put at rest. Only the development of the Salk vaccine helped calm nerves.

Changes were not only taking place around the lake, but to the lake itself. During the height of steel production, Geneva Steel, like many other steelmakers, failed to recognize the importance of environmental protection and contaminated the lake with hazardous materials. In the 1940s and 1950s, the needs of the environment simply were not the urgent issues they are today. As a result, Geneva Steel failed to initiate significant environmental practices until the early 1990s.

Geneva Steel struggled for years as global competition in the steel industry reduced the company's profit margins. The plant filed for bankruptcy in 1999 and later closed.

THE BUSINESS OF ABUSING A LAKE

OBJECTIVE:

Students will illustrate historical events relating to Utah Lake. Students will create a class-generated list of past problems Utah Lake has encountered and solutions to address those problems.

TEACHER MATERIALS:

- *Utah Lake: Legacy* video clip—Chapters 5 and 7 (YouTube Links: Chapter 5 and *Chapter 7*).
- *Utah Lake: Legacy* book, Chapter 3, The Business of Abusing a Beautiful Lake (see background information for selected excerpts from the book)
- Chart paper (for class discussion relating problems to solutions)
- T-Chart describing the problems/solutions at Utah Lake over time (see link or page 11)

STUDENT MATERIALS:

- History cards for every two or three students (see link or pages 12-15)
    - Two types of cards are provided (one set is dated, the other is not). See procedures to decide which to use.
- Blank paper for drawing

PROCEDURE:

You may teach this one of two ways. The first method, you would hand out the cards without a date on them and have the students guess where the card should go on the timeline. The second method is to use the cards with the date and take out the element of guessing the time. Draw a time line that corresponds with the cards at the front of the room. Begin with "Prior to 1847" and end with today.

1. Pass out one time card to every two or three students. Instruct each group to illustrate their card and prepare to explain the event to the class. They are to post their card and picture on the timeline across the white board at the front of the room.

2. Lead the class discussion as students share. As a teacher, you will want to have reviewed the teacher materials to aid the discussion.

3. Following the last group (or this could be done as groups share), create a T-chart listing one side as the problems the lake encountered and the other the solutions to the problems. (See the suggested t-chart on pg. 11).
    a. Prior to telling the students what has actually been done to solve the problem, let

them brainstorm what they think could be done. For example, if the problem is that the sawdust dumped into the river or lake gets into the gills of fish and kills them, students will probably be able to figure out the solution is to stop dumping sawdust into the rivers flowing into the lake.

b. At this point the teacher can lead the discussion asking, "How will that be accomplished?" If you have already taught the branches of government, this will be a great opportunity to review that the legislative branch would need to write a law against dumping sawdust into the rivers and lake. Ask, "How would the legislative branch of government know that the sawdust was causing a problem for the lake?" Someone would need to inform them. Scientists can do this and citizens can write letters to legislators. At the time sawdust was being dumped into the lake, a law was in place but not being enforced. Ask the students, "Whose responsibility was it to enforce the law? Review the duties of the executive branch of the law. Discuss once a significant fine was imposed, the mills began to comply with the law.

c. The end of this discussion should focus the need for people to be informed so Utah Lake continues to improve. Point out that money has been spent to educate the leaders of the future, today's fourth grade students!!

Follow this lesson by watching Chapter 5 of the *Utah Lake: Legacy* video.

ASSESSMENT:

- Students may collect newspaper or Internet articles on current events related to Utah Lake or information that might be used for future discussions.

EXTENSIONS:

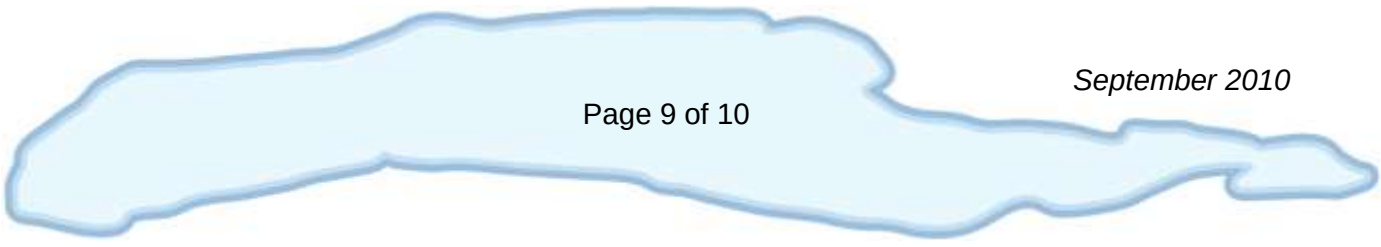
- *Utah Lake: Legacy* Video Clip — *Chapter 7*

STANDARDS ADDRESSED:

Language Arts

Standard 7: Students understand, interpret, and analyze narrative and informational grade-level text.

Objective 3: Recognize and use features of narrative and informational texts.



THE BUSINESS OF ABUSING A LAKE

Science

Standard 5: Students will understand the physical characteristics of Utah's wetlands, forests, and deserts and identify common organisms for each environment.

Objective 2: Describe the common plants and animals found in Utah environments and how these organisms have adapted to the environment in which they live.

Indicators:

e. Find examples of endangered Utah plants and animals and describe steps being taken to protect them

Social Studies

Standard 1: Students will understand the relationship between the physical geography in Utah and human life.

Objective 3: Analyze how human actions modify the physical environment.

Indicators:

a. Describe how and why humans have changed the physical environment of Utah to meet their needs (e.g. reservoirs, irrigation, climate, transportation systems, and cities).

b. Explain viewpoints regarding environmental issues (e.g. species protection, land use, pollution controls, mass transit, water rights, and trust lands).

d. Make data-supported predictions about the future needs of Utahns and the natural resources that will be necessary to meet those needs.

Standard 2: Students will understand how Utah's history has been shaped by many diverse people, events, and ideas.

Objective 3: Investigate the development of the economy in Utah.

Indicators:

f. Examine how economic development affects communities (e.g. dams, sports, tourism, power plants, mining, etc.).

Standard 3: Students will understand the roles of civic life, politics, and government in the lives of Utah citizens.

Objective 3: Investigate the development of the economy in Utah..

Indicators:

f. Examine how economic development affects communities (e.g. dams, sports, tourism, power plants, mining, etc.