

ENGR 125CS

Three Gorges Dam, Yangtze River, China

(source: <http://www.pbs.org/itvs/greatwall/dam.html>)



Deep in China's rural heartland, along the third longest river in the world, a massive construction project is underway. Once completed, the Three Gorges Dam will be the largest and most powerful hydro-electric project in the world. Towering 610 feet high and stretching 1.3 miles wide, the dam will create a reservoir that extends nearly 400 miles upstream, forever changing the landscape of one of the most beautiful regions in China.

The project has been under consideration by various leaders in China since the idea of a dam was first proposed in 1919. The Three Gorges Dam is both a marvel of engineering and the greatest challenge its designers have ever faced. When finished, the dam will contain twice the amount of concrete of the Itaipu project in Brazil, currently the world's largest dam. The Three Gorges project has been engineered to store over 5 trillion gallons of water and to withstand an earthquake of 7.0 on the Richter scale. The reservoir will allow 10,000-ton freighters to enter the nation's interior, which currently limits access to boats less than 1,500 tons. In addition to increasing commercial shipping access to China's interior, the government says the dam will control devastating floods and provide much-needed electrical power to China's growing cities.

But critics question whether both effects can be achieved at the same time. Flood control requires the reservoir maintain low levels of water to allow for the inflow of flood waters, while power generation requires high levels of water in the reservoir. In addition, critics doubt that the human and cultural losses are worth the projected benefit, and they say both flood management and power generation could be achieved by faster, less expensive means. When the dam becomes operational, over a million people will have been relocated, over a thousand archeological sites will be submerged beneath the reservoir, and endangered species may be driven to extinction.



Regardless of the differing perspectives, everyone agrees that the Three Gorges Dam is an incredible undertaking. The Chinese government and the dam's engineers view the project as a symbol of national pride, proving China's participation in new global markets.

Facts and Figures

- The Three Gorges Dam will consist of a 610-foot high wall running 1.3 miles from bank to bank.
- The reservoir created by the backflow of the dam will extend 360 miles up river to Chongqing ("Chong-ching"), a distance equal to nearly half the length of California.
- Once operational, the dam will produce the energy of 15 nuclear power plants.
- The project is estimated to be completed in 2009 at a cost of over \$30 billion.
- In the past 2,000 years, the Yangtze River has experienced 215 catastrophic floods.
- In 1998 flooding in the area expected to be controlled by the dam resulted in 4,000 dead, 14 million left homeless and \$24 billion in economic loss.
- When the dam is completed, 13 cities, 140 towns and over 1,300 villages will be submerged by the Three Gorges Reservoir.
- To make way for the Three Gorges Dam, 1.5 million people will have to abandon their homes. More than 160,000 citizens have already been relocated.
- Upon the dam's completion, 1,300 known archeological sites will be lost forever under water.
- Over 265 billion gallons of raw sewage are dumped into the Yangtze annually. Currently the river flushes this downstream and out into the ocean. Upon completion of the Three Gorges project, the sewage will back up in the reservoir.
- Over 1,600 factories and abandoned mines will be submerged when the dam is completed. Environmentalists predict that toxins associated with industry and mining will create a hazard for the animals and people who depend on the river for survival.
- Over 700 million tons of sediment are deposited into the Yangtze annually, making it the fourth largest sediment carrier in the world. Experts believe that this sediment will build up behind the dam, with only an unproven system of sluice gates to release it.
- Over 360 million people live within the watershed of the Yangtze River. If the one in one thousand chance of a dam collapse occurred, the millions of people who live downstream would be endangered.



The Controversy

Nature and progress struggle to co-exist. As with most developing nations, China has sought to create a balance between environment and industry, conservation and survival.

The Three Gorges Dam project promises to bring clean, renewable energy to a country whose air is among the most polluted in the world. It hopes to control devastating natural floods that have affected millions of people. At the same time, it threatens rare wildlife, ancient monuments and the natural environment it tries to reshape.

Has the Chinese government struck the right balance with the Three Gorges Dam? Read about the controversy and decide for yourself.

Endangered Treasures

Among the potential tragedies of the Three Gorges Dam project are over one thousand sites of archeological and historical importance that will be submerged and lost forever upon completion of the dam. Ancestral burial grounds and centuries-old temples, fossil remains and archeological sites dating as far back as the Paleolithic Age risk being obliterated from public access and scholarly pursuit if they are not unearthed and relocated before the waters rise.



Ba Civilization: Artists and Metal Workers

When initial excavations began for the Three Gorges Dam, archeologists uncovered artifacts unlike any they had seen before. These relics have since been attributed to the formerly unknown Ba people, now considered an important part of early Chinese history. Since the discovery of bronze masks in the 1970s, archeologists have located 100 sites that belonged to the Ba people, each considered a historical archive. The Ba disappeared after 316 B.C. with the invasion of the Qing Dynasty, and their whimsical animal statues and ornately inscribed daggers are all that is left behind.



Ancient Fossils at Dragon Bone Cave

One of the most exciting discoveries in the region are remnants of early man from two million years ago. A jaw bone and stone tools found 12 miles south of the river at Dragon Bone Cave provide evidence that cave dwellers lived in the region at the same time as the earliest humans on the African continent. The jaw bone, identified as belonging to a new sub-species of Homo Erectus, indicates that humans arrived in Asia almost a million years earlier than previously believed.



Shibaozhai Temple

Dating back to 1545, this Ming Dynasty temple was built against the side of a massive cliff that stands like a pillar on the bank of the Yangtze River. Called the "Pearl of the Yangtze," the 12-story, wooden pagoda rises to a height of over 183 feet. It contains portraits of famous historical figures from the Sichuan Province. An architectural marvel in Chinese history, it has been classified as one of the "eight strange structures of the world."



Zhang Fei Temple

Located in Yunyang county, this temple from the Northern Song Dynasty (960-1127 A.D.) honors the famous Shu Kingdom general, after whom the temple was named. Zhang Fei was one of the Three Sworn Brothers during the Three Kingdom Period (220-265 A.D.). It is said that when he was murdered by two subordinates, his body was buried in Lang Zhong and his head brought to Yunyang. Among other artistic treasures, the temple contains a statue of the legendary hero.

Ancient Village of Dachang. Situated on the banks of the Danning river, a tributary north of the Yangtze, lies the ancient village of Dachang. Built during the Ming Dynasty, entire street blocks exist as they did over 500 hundred years ago. A traditional way of life survives as it has for centuries. Remnants of family histories dating back to the Ming Dynasty still remain within the walls of houses untouched by the passage of time. The government has plans to move Dachang to higher ground.



Giant Buddha Sculpture. A massive sculpture of the seated Buddha rests in the yellowish sandstone cliffs at Single Pebble Village (Danzishizhen) just east of Chongqing. When the tide is high, the statue's base is flooded, and there are watermarks indicating various water levels on the Buddha's feet, legs and lower belly. The sculpture was carved by artist Zou Xing, a cadre general under Ming Yuzhen in the late 14th century. Ming, who later founded a dynasty, led a political party that believed that the Future Buddha, depicted in the statue, would descend from Heaven and end the reign of Mongolian-dominated Yuan Dynasty.



Song Dynasty Tombs. Song Dynasty tombs (420-479 A.D.) are rarely found in the Three Gorges area, but the region has only recently come to the attention of the archeological community. Currently, archeologists are excavating recently discovered sites in a race against time, measuring remains and documenting as much as they can before the entire area is submerged. Many mysteries of the tombs have yet to be answered: Why is the head missing from a nearly complete skeleton? Why is the upper half of the skeleton elevated, facing northeast - away from the river?



Various Han through Qing Monuments. Other endangered sites include the Dingfang Towers from 25-200 A.D. (pictured left), Precious Stone Treasury and Pagoda near Zhongxian, the White Emperor City (Baidicheng), the Qu Yuan Temple at Zigui, Temple of the God of the Underworld at Fengdu, the hanging coffins on the Daning tributary that runs south into the Yangtze at Wushan, and the Late Warring States Ba cemetery at Fuling.

Endangered Species

The Three Gorges Dam project threatens many endangered species that are native to the Yangtze River. The baiji dolphin, the ancient river sturgeon and the finless porpoise depend on the Yangtze for their survival. The population of Siberian cranes in Poyang Lake will also be affected by the dam. These species may soon be extinct, and the Three Gorges Dam will accelerate their decline.



Known as "pandas in water," the baiji dolphin is a living fossil. Paleontologists believe that its ancestors moved from land to water over 70 million years ago. Today's baiji is the last surviving species of this lineage, and it has been given the highest level of protection by the Chinese government. But fishing and river traffic have already depleted the baiji population. Dams block access to tributaries and lakes where baiji once caught fish and nurtured their young. There are fewer than one hundred dolphins alive today. Efforts to breed the baiji in captivity have failed. All potential mates for QiQi, the lone baiji male at the Institute of Hydrobiology in Wuhan, have died in the transition to captivity.



Siberian cranes feed on the frogs, mollusks, insects and fish in Poyang Lake, which is filled by the seasonal flooding of the Yangtze. The dam's control over the water that fills the lake would affect the animals living there. Siberians are the most endangered of all cranes. Captive breeding of these cranes is very difficult. The largest flock of 3,000 birds depends on its winter habitat on Poyang Lake. The cranes migrate 3,100 miles to the Yangtze region from their breeding ground in western Siberia.

The finless porpoise prefer to live in shallow, warm waters like those of the Yangtze River. Although they are legally protected in China, their populations are declining due to habitat destruction. They are easily identifiable by their lack of dorsal fins (on their backs), for which other porpoises are known. Among the smallest creatures in the whale family, at an average length of 5 feet, the finless porpoise is found only in Asian rivers and the western Pacific Ocean. Some have been bred in captivity at the Tian'ezhou White-Flag Dolphin National Nature Reserve in central China's Hubei Province.



The giant Chinese river sturgeon breeds at Changshu, on the Yangtze River. This fish, which dates back 140 million years, is among the most endangered of China's wildlife. Fishermen catch as many as 3,000 sturgeon by mistake every year. In August 2000, when a fisherman spotted a rare sturgeon on the Qiantang River, elders recalled that the fish disappeared from the river after the Xinanjiang Reservoir was built in the 1950s. The reservoir affected the temperature of the water, making it unsuitable for this prehistoric creature.

Environmental Concerns

Environmental concerns about the Three Gorges Dam go beyond the affected wildlife and endangered species. River sediment is a major threat that could undo all the positive effects the dam is supposed to bring. Extensive farming and unrestricted logging along the Yangtze's banks have increased the earth's erosion into the river, making it the fourth largest sediment carrier in the world.

Sediment buildup from the natural flow of the river will slowly cause the water level in the reservoir to rise - potentially flooding low-lying parts of Chongqing. Rising water levels could eventually transform the Three Gorges Dam into a massive waterfall. Tens of millions of the people who live downstream of the dam would be endangered by overflow, or worse yet, the one-in-one-thousand chance of a dam collapse due to war, earthquake or design flaws.



Three Gorges Dam sluice gates

Chinese experts have proposed a solution to the sediment problem. In order to flush sediment through, project engineers have designed a series of openings known as sluice gates at the base of the dam. These sluice gates have never been tested on a dam of this magnitude. Nowhere in the world is there a successful model that deals with sediment on this scale.

Another environmental hazard is toxin contamination from over 1,600 factories and mines that will be flooded in the Three Gorges area. These dangerous materials may affect the water of the reservoir once the factories and mines are submerged. In addition, an estimated 265 billion gallons of raw sewage are dumped into the Yangtze annually. Damming the river will prevent this sewage from being naturally flushed out.



International Perspective



Mao Tse Tung

Chinese and International Views

The Three Gorges Dam sparks controversy on many fronts. The debate began in 1919 when the founder of the Chinese republic, Sun Yat-Sen, first proposed a dam in the area. Since that time, the Chinese government has alternately supported and shelved plans for the project. The United States was involved until the communist takeover in 1949. Communist Leader Mao Tse Tung supported the project, but economic disaster and technical debate prevented its progress.

After the Tiananmen Square crackdown in 1989, political tensions regarding the dam rose when the publication of Dai Qing's collection of essays against the Three Gorges Dam provoked the government to ban the book and imprison its editor. In 1992 Chinese Premier Li Peng finally won the approval for the dam by the People's National Congress, even though one third of its delegates either voted against it or abstained.

Since ground was broken in 1994, construction of the dam has become a symbol of Chinese national pride. Conquering its challenges has become the quest of Chinese engineers. Yet international organizations of all kinds speak out against the dam, year after year. And the Chinese people who must be relocated await the government's word on their fate - silenced by police scrutiny and arrests.

Chinese Perspectives

The Chinese government estimates that energy from the dam will increase industrial output and generate millions of desperately needed jobs.

To prosper in the global economy, China must increase its economic strength. One key element is the development of infrastructure. As China develops its urban centers, new factories, offices and homes create increased power demands. To avoid burning coal for power and causing massive pollution, China must develop alternative resources. The hydroelectric power produced by a dam is clean, renewable energy. The Three Gorges Dam will not only provide that energy, but it will increase shipping and commerce in the region, bringing economic opportunities to people in the middle of the country.

The dam will control natural flooding and protect millions of people left homeless when the waters surge beyond their banks.

In addition to flood control, Chinese scientists state that the Three Gorges project will have an overall positive effect on the environment. Experts found that construction of the reservoir may help the climate of the area, causing winters to become warmer and summers cooler.



International and U.S. Perspectives

A leading funder of hydroelectric projects around the world, the World Bank declined to participate in the Three Gorges Dam project.

Responding to mid-1990s protest campaigns against the Three Gorges Dam by an international coalition of environmental, developmental and human rights groups, the U.S. National Security Council concluded that the federal government should avoid further involvement in the Three Gorges Dam. The U.S. Bureau of Reclamation withdrew its support of the project. In May 1996, the U.S. Export-Import Bank announced that it would not support loans to U.S. companies pursuing Three Gorges contracts. Nevertheless, some banks in the U.S. have invested in the dam. As protests continue around the world, the Chinese engineers say that nothing will stop the construction of the dam.

