



AP[®] Environmental Science 2002 Sample Student Responses

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2. The Colorado River runs 1,450 miles from the headwaters of the Rocky Mountains to the Gulf of California. The river has many dams, aqueducts, and canals that divert water in order to supply water for electricity, irrigation, recreation, and domestic use.
- Describe and discuss two environmental problems that are associated with water diversion.
 - If there is a shortage of water, choices will have to be made as to whether water should be diverted to urban areas, agricultural areas, or natural ecosystems. Make an argument for diverting water for urban consumption and an argument for permitting the flow of water to natural areas.
 - Identify another example (other than the Colorado River) of a large-scale water-diversion project. Discuss two environmental problems that have resulted, or might result, from this project.

2.a) Water diversion is a problem because it interrupts the natural ecosystem. Diverting the water also takes nutrients and organisms with it, thereby reducing nutrients & organisms that end up down stream. Organisms that rely on lost organisms for food will die. Producers that need lost nutrients will be less productive, and the ecosystem will be degraded. Another problem is decreased water levels as the river makes its way down. That means less space for wild-life. Overcrowding will lead to decreased populations. It also makes more soil and sand on the banks susceptible to wind erosion. Eroded banks could lead to flooding of surrounding areas.

b) Water is a main resource used to produce electricity. A shortage of water cannot also mean a reduction in vital electricity needed for every-day human survival. Also, water is key in things, such as human consumption, ^{both for cooking food & drinking}. A final reason is that water is our source for waste removal. Not having that water means no showers, no hand-washing, and no flushing toilets.

c) Water needs to be diverted to natural areas to preserve ecosystems and maintain biodiversity. Animals require water just as much as humans. They use it to drink and as a habitat. Aquatic ecosystems couldn't survive a massive reduction in water flow because they need space and everything the river carries with it.

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c) The California Water Project carried waters from northern California, which had 75% of the rainfall, to more southern parts, which had 75% of the population. All of the wildlife and vegetation in the north lost much of its water supply. Plants withered and died because of the lack of water (the whole hydrologic cycle was interrupted). Without drink, animal populations decreased. Also, the extracted water went to very urbanized areas, so much of the water became heavily polluted, which lowered its quality. The polluted water couldn't be put back into northern ecosystems. Any southern ecosystems it entered became polluted as a result.

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a) One particular consequence of diversion is, such as in the case of the Hoover Dam, the prevalence of siltation upstream and the filling of the river with sediment which would otherwise be washed downstream. Eventually, it is believed, water levels will be decreased upstream to such a point that both the hydroelectric power and the upstream freshwater ecosystem of Lake Mead will be greatly impeded. Water diversion also alters the lives of many organisms in the river ecosystem, such as spawning fish which periodically travel upstream to lay their eggs of the next generation. Dams make such attempts to reproduce impossible.

b) People, of course, need water to survive—plain and simple. If there is an instance of a severe urban water shortage, or, say, a drought in general, human beings always take precedence over other creatures because, from an anthropocentric viewpoint, humans are the world's "most valuable renewable resource." Natural ecosystems could be regenerated over time with assistance from human beings, but human lives cannot be replaced.

On the other hand, natural ecosystems have been created

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over the course of thousands of years, and cannot be readily replaced by human beings - they require geologic and climatic forces acting over millions. Organisms in ecosystems that occur naturally, from a more biocentric or ecocentric perspective, have just as much intrinsic value as humans, and have an equal right to exist. These organisms require water to function, and are entitled to it. With a loss of water to a natural area, so do you lose the beauty of nature contained in the area - the aesthetic concern.

e) The Aswan-High Dam in Egypt is another example of a water diversion project across the world. Located on the Nile River near the Egyptian border of Sudan, the Aswan Dam is one of the highest and largest in the world, harnessing the power of the mighty Nile. Consequently, a large lake has formed upstream of the dam, flooding once valuable arable land covered by riverside freshwater ecosystems and their species. This loss of riverside biodiversity is accompanied by siltation and the filling up of the ^{artificial} ~~actual~~ lake behind the dam. Periodically, when more electricity is required by Egyptians, the dam lets loose a torrent of water in an effort to produce more hydroelectricity. These artificial floods destroy ^{unstable} riverside ecosystems downstream, and the lives of many Sudanese and their farmland are occasionally altered by artificial forces outside their control.

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a) Diverting water away from rivers lowers the flow of water in the river, resulting in higher water temperatures and less water flowing into the ocean. ~~Lowering~~ ^{Raising} water temperatures puts strain on some aquatic organisms which cannot tolerate a change in temperature. Less fresh water flowing into the ocean means that the coastline estuaries get less nutrients and decline in productivity and biodiversity.

b) Water diverted for urban consumption can be used twice, once for direct consumption and use by people, and again for agriculture after it has been treated as sewage effluent.

Diverting water from natural areas ~~is~~ disrupts natural ecosystems because it takes water out of the watershed. Diverting water also disrupts coastal ecosystems (as well as land ecosystems) because estuaries depend on an inflow of fresh water.

c) The case of Mono Lake is an example of diverting water for urban development. Water which normally would flow into the lake was diverted. This resulted in a lowering of the lake water level, which decreased aquatic habitat. Also, evaporation from the lake exceeded input from rivers, resulting in ~~the~~ salinization of the lake. The increased percent of salts in the water

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killed of many fish and other aquatic organisms.