APES- *Water Diversions*
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Purpose: *Conduct research to analyze the effects of water diversions on surrounding ecosystems and human communities.* ***Compare and contrast*** *the problems and successes of various water diversions and describe possible remediations.*
Introductions: *Humans have been diverting water for irrigation, flood control, and a constant drinking supply for thousands of years. When populations were small, the diversions were small. Over the last 150 years, human populations have grown rapidly and our technical abilities have vastly improved. These two changes, worldwide, have led to many large-scale projects that have altered the environment of sizable regions. This investigation focuses on three major water diversions:* ***The Salton Sea, Lake Chad, Aral Sea, Mono Lake, Yangtze River, and The Colorado River.***

Salton Sea

1: Describe the location of the **Salton Sea.** *What is the climate and geography of the area?*
-The Salton Sea is a shallow lake located in the Colorado Desert. The area is arid and hot, and the area is subject to very little rainfall.

2: How did the *Salton Sea form*? Explain what role humans played.
-Irrigation canals were built by the California Dev. Co. from the Colorado River to the Salton sink. However, the canal was blocked from silt, and heavy rainfall and snow caused the river to overflow and create 2 rivers: the Alamo and New River. These 2 rivers diverted floodwater to the Salton sink and crated the Salton Sea.

3: What is the present condition of this body of water? ***How has it changed over the last 25 years? Why?***
-The Sea is maintained by runoff from irrigation in the Imperial/Coachella valleys. Salinity has changed dramatically in 25 years due to evaporation, which increases salinity.

4: Describe several ways the Salton Sea has altered the ecosystem of the region. *Explain the stability of that ecosystem. How is it changing over time?*
-The ecosystem is now a wasteland, and the ecosystem is unstable with little biodiversity due to the 1% yearly salinity level increase.

5: Outline ***3 environmental and 3 economic reasons*** the Salton Sea is important.
-It houses numerous tolerant species, it is a sink for runoff, and it prevents harmful substances from entering soil. It is also a recreational area.

6: What steps are being taken to ***remediate*** the Salton Sea? *What are the chances of success? Explain.*
-Pipeline construction is being used to reallocate ocean water into the sea to reduce salinity. Efforts so far have been futile, however, since the sea is already immensely polluted.

7: Compare the **similarities and differences** between the Salton Sea and Lake Chad in Sub-Saharan Africa. **(Make a VENN Diagram)**

The Aral Sea

1: ***Where*** is the Aral Sea located?
-Kazakhstan and Uzbekistan

2: ***Which rivers*** mainly supply the Aral Sea?
-Amu Darya and Syr Darya

3: ***What government agency*** is responsible for the Aral Sea and its plight?
-World Bank Uzbek

4: Why was the water supply to the Sea *diverted?*
-To irrigate the desert region for agriculture rather than basin supply

5: *What resources* did the Aral Sea supply to the local inhabitants?
-Fish, water, transportation, recreation

6: Describe ***3 negative environmental*** effects of the fading of this sea.
-The sea's recession has left huge plains covered in salt and contaminants, left population without water, and health has decreased due to crop destruction from salinity.

7: Describe ***3 economic impacts*** in the region because of the water diversion.
-Fish catch has crashed, fishing towns are abandoned, and empty boats are scattered along the remains of the sea.

8: How is the situation of the Salton Sea *similar* to the Aral Sea? *How is it different*?
-Both were caused by human actions that caused an increase in salinity, toxins, and a decrease in biodiversity. However, the Salton Sea has decreased due to the diversion of its two main sources; and salinity increased because water could not flow out.

9: How would you describe this region today, *other than as a "sea"?*
-A really really really salty wasteland.

10: Explain **five health effects** on people related to the vanishing Aral Sea.
-Higher rates of cancer, lung disease, digestive disorders, and anemia

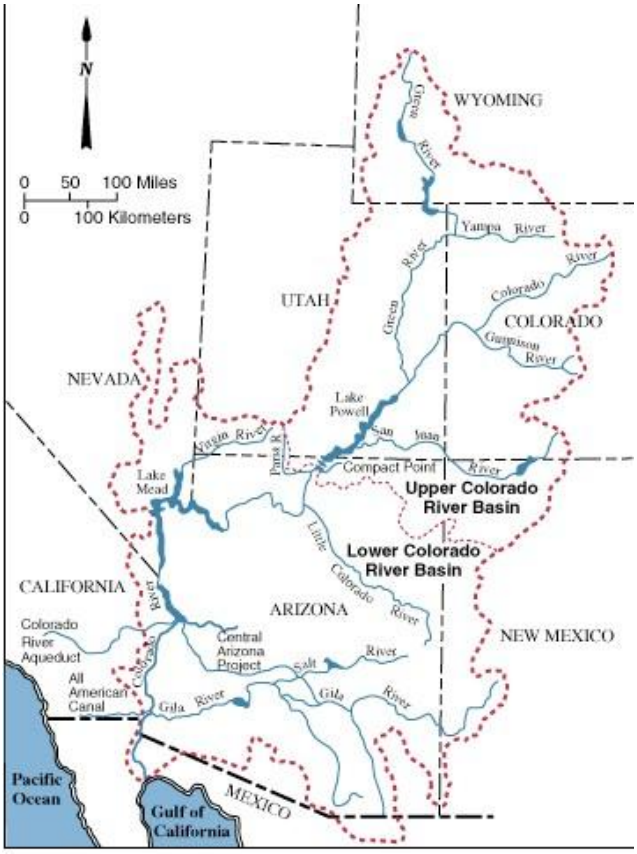
11: **How** can the Aral Sea be *realistically rehabilitated*?
-By improving irrigation canals, providing more freshwater allocation to the sea, installing desalinization plants, and using fewer chemicals in the area

12: **Compare** the situation in *Mono Lake, California with that of the Aral Sea*
How did the Mono Lake problem arise?
-From LA's diversion of water from Mono Lake to the growing population

Describe *3 ways the problems* of Mono Lake are similar to those of the Aral Sea
-Water was diverted for human use, species declined, and both affected the area around it.

Outline three ways the problems of Mono Lake differ
-Fishing industry was ruined in the Aral, but species still thrive in Mono Lake; Russia diverted water for irrigation while LA used it for the population; Mono Lake's situation is reversible, the Aral Sea is screwed up

13: Summarize the **proposal and actions** to remediate Mono Lake
-A committee dedicated to the restoration of the lake is educating the public about water use and the environmental impact of it. The CA Fish and Game service has partially restored fish populations, and the CSWRCB ordered the DWP to raise the level to above 6932 ft.



<u>Colorado River Basin</u>

1: Compare water diversion influences on the Colorado River with those on the Salton Sea and the Aral Sea. ***Describe three ways they are different.***
-The diversion of the Aral Sea for the population and the Salton for irrigation purposes had influenced the Colorado River to divert water for agriculture as well. While the Colorado had less of an impact, the Aral Sea diversion caused the sea to recede. The Salton Sea's diversion also caused the water to become more saline.

2: **Look at the map**- *Where is the source of the Colorado River?*
-The Gulf of California

What are some of the main tributaries and their source?
-Gila River (Arizona), San Juan River (New Mexico, Colorado, Utah), Green River (Wyoming, Colorado, Utah), Gunnison River (Colorado)

What is the most important origin of the water in the Colorado River?
-The Rockies

3: **Politics:** Who decides where the water in the river system goes? *How is the resource divided between the various states in the watershed and beyond?*
-The 7 states of the river basine decides water allocation in the upper and lower basins

4: How do the individual states use the water? *Who are the top five consumers of the water?*
-Through dams that send water through aqueducts, which is used for consumption and irrigation. California, Colorado, Arizona, Utah, New Mexico

5: Describe some of the conflicts that arise over water use. *How are they usually resolved?*
-Conflicts include water division conflict (such as when an endangered species needs more, and drought). They are usually resolved through conferences that overview the situation.

6: How are conflicts between *public and private use managed?*
-Through the Colorado River Salinity Control Program

7: Serious differences with Mexico exist concerning the amount of water the Mexicans receive from the river. ***Explain why this problem exists and what can be done to work out this dispute between the countries.***
-Colorado River water supply has decreased, which has led to less for Mexico. Since we use water faster than it is replenished, the river should be left to remediate to supply water for all involved territories.

8: The Tigris and Euphrates Rivers cross international boundaries in their path to the Persian Gulf. ***Why is this problem potentially greater than the one that exists on the Colorado River?***
-The countries in these areas require more water than other countries since they are located in arid regions. This causes international relations to become weakened and unstable.

9: Compare the problem of water diversions on the ***Yangtze River in China*** with those of the Colorado River.
-The Yangtze River has a higher discharge rate than the Colorado River, but both situations are due to growing populations in their respective areas.

10: The **Three Gorges Dam** on the Yangtze River is very controversial. *Why is this dam being built?*
-The dam is being built to hold back flood water and supply electricity to the region.

11: **Describe how this dam differs** from dams on the Colorado River, such as the Glen Canyon Dam or Hoover Dam, with respect to:
the disruption of human life
impact on the environment
archaeology
local culture and natural beauty
-The dam has forced millions of people to relocate, as well as the native species around it (300 dish species cannot move upstream). In the 3 gorges, 44 archaeological sites are affected if the dam were to become flooded. The construction of the dam also destroyed the beauty of the area around it and many artifacts.

Water Diversion- FRQ
Q: *The Colorado River runs 1,450 from the headwaters of the Rocky Mountains to the Gulf of California. The primary source of Colorado River water is melting Rocky Mountain snowpack. Once the river descends from the Rockies, it flows through a landscape that is dominated by desert. Colorado River water carries a high load of sediment. The river has many dams, aqueducts and canals that divert the water in order to supply for electricity, irrigation, recreation, and domestic use.*
a: Describe and discuss ***two environmental issues*** *associated with water diversion projects.* ***Identify two benefits*** *other than agriculture and recreation that people derive from that system of dams.*
-If water is diverted from a source, then the source may suffer from lowered water levels, which may make the source unable to remediate if water is taken faster than it is replenished. There is also a risk of complete water quality change, such as the situation with the Salton Sea, where salinity still increases to this day due to evaporation. Dams are beneficial in the sense that they produce additional electricity with a fraction of the emissions of a traditional fossil fuel plant. They also provide water in times of drought, since dams can hold a substantial amount of water.

b: If there is a shortage of water, decisions will have to be made as to whether the 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 water to flow to natural areas.***
-Water is a vital resource – no life on earth can live without it. If we divert water to anywhere else, we may risk our population stability.
-Natural areas also need water in dire times. Ecosystems can naturally filter out water and protect against disasters, some also provide us with food and materials.

c: 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.***

-Another example of a large-scale diversion project would be the Aral Sea. The diversion caused lower water levels, and increased salinity, which affected both people and organisms in the sea.

d; Identify ***two possible environmental consequences of climate change*** *on the hydrology of the Colorado River system.*

-If the climate changes in the area, then water temperatures may increase/decrease and render water as insufficient in supporting the organisms that inhabit the river now. Climate change may also cause evaporation, which leads to salinity increase.

e: In addition to impacts on the Colorado River system, climate change is impacting the hydrology of coastal ecosystems. ***Identify and describe TWO possible consequences of climate change on coastal ecosystems.***

-Climate-sensitive organisms may die off if coastal ecosystems are subject to climate change. In more extreme cases, ecosystems can flood or dry out, which can render some ecosystems uninhabitable.