AP® ENVIRONMENTAL SCIENCE
2008 SCORING GUIDELINES

Question 3

(a) Identify TWO characteristics of forests that develop when fires are suppressed, and explain why the practice of fire suppression does not reduce, but actually increases, the risk of intense and extensive forest fires.

(Three points can be earned: 1 point for each correct characteristic, and 1 point for a correct explanation. Only the first two characteristics given are scored.)

Characteristics of Forests

- Accumulation of combustible materials (layer of leaf litter and debris on forest floor, dead trees, etc.)

- Increase in understory growth (grasses, shrubs, brush, ladder trees)

- Larger trees develop

- Even-aged stands develop

- Tree density increases

- Fire-intolerant species increase in number in the understory

- Fire-tolerant species that need fire to germinate seeds decrease in population

- Increased canopy coverage eliminates understory growth

- Increase or decrease in the rate of nutrient cycling (e.g., release of nutrients of litter, lack of nutrient-rich ash)

- No loss of nutrients to burning in intense fires

- Increased susceptibility to disease/parasites

Explanations for Increased Fire Risk

Adds to fuel load [intensity]

- Increased leaf litter

- Increased density of large trees

- Increased size of trees

- Increase in brush and small trees

- Species composition change

Adds to spreading of fire [extent]

- Increased density of trees

- Increased density of understory growth

- Ladder trees leading to crown fires

(b) The effects of the HFI are expected to extend beyond fire reduction. Excluding fire reduction, describe ONE positive and ONE negative effect likely to result from the implementation of the provisions of the HFI.

(Two points can be earned: 1 point for a correct positive effect and description; 1 point for a correct negative effect and description.)

Positive Effect and Description	Negative Effect and Description
Increased removal of medium and large trees/small tree brush removal will: • lead to economic growth in the lumber industry Increased removal of medium and large trees will: • allow understory to develop into larger trees, potentially enhancing forest habitat • make additional timber available to use (must indicate usage) • result in thinned trees resistant to pests and disease/impede spread of diseases and pests • enhance economic value of the surrounding areas (housing, lower insurance) • lower the cost of timber • result in a change of aesthetics (with explanation)	The removal of medium and large trees/small tree brush removal will: • reduce available habitat for other organisms in the forest biome • allow timber companies to cut in areas remote from forest communities not threatened by forest fires • cause a reduction in biodiversity (must include a specific example: reduction in nest sites, decrease in seed trees, etc.) • increase soil erosion • increase logging practices (e.g., roads providing access to new areas) • reduce public input • result in a change in aesthetics (with explanation)

(c) Describe TWO ecosystem services provided for humans by forests. Explain how clear-cutting would affect each ecosystem service you describe.

(Four points can be earned: 1 point for each correct ecosystem service, and 1 point for each correct link that describes the impact of clear-cutting. Only the first two characteristics given are scored.)

Ecosystem Service	Impact of Clear-Cutting
Carbon that is removed from the atmosphere by trees helps to limit the magnitude of the atmospheric greenhouse effect.	• Some carbon will be released to the atmosphere or will not be removed
Forests provide oxygen (via photosynthesis).	• Some loss of oxygen, without which we cannot live
Forests provide food products for human consumption (deer, nuts, fungi).	• Can change available browsing places and sighting of animals due to species composition change, increasing their availability for humans (e.g., deer)
Forests provide habitat for many species, some of which provide food and goods for humans, some of which cause harm.	• Loss of habitat (biodiversity)
Forests provide wood (e.g., construction material, paper)	• Increase in the short-term availability of wood, but potential long-term loss of availability
Forests provide wood for fuel.	• Increase in the short-term availability of wood, but potential long-term loss of availability
Many products, such as glue, rubber, and medicines, are produced with forest products.	• Increase in the short-term availability of these products, but potential long-term loss of availability
Forests influence the local microclimate affecting humans (change in temperature, shade, UV, wind breaks).	• Change in the microclimate
Forests have aesthetic value (hiking, camping, photography, tourism, etc.).	• Decreases in natural beauty
Forests improve the quality of soil and water used by humans. (Soil and water must be linked to a specific human use.)	• Increases in erosion and runoff and decreases in groundwater recharge, changing water quality

Ecosystem Service	Impact of Clear-Cutting
Forests maintain watershed integrity (e.g., flood control with specific human application).	• Decreases in watershed integrity

(d) Identify a specific type of plant community or biome (other than a forest) that is naturally maintained by fire. Explain how the fire maintains the community or biome.

(Two points can be earned; 1 point for identification of biome; 1 point for correct explanation of how fire maintains biome.)

Grasslands (savannah, steppe, veldt, pampas, prairie, marquis, garrigue—regional descriptions should include mention of grasslands):

- Fire destroys invasive plant species (e.g., other grasses and trees) that compete for resources with native grasses.
- Fire removes cover and allows sunlight penetration.
- Fire helps the seeds of native grasses to germinate.
- Fires enhance cycling of nutrients back into the soil.

Chaparral (Mediterranean scrubland, Mediterranean shrubland—regional descriptions should include mention of location):

- Fire removes brush, reducing competition for resources.
- Fire helps plants that require fire or lack of brush cover to germinate.
- Species that vigorously stump sprout quickly regenerate themselves.
- Fires enhance cycling of nutrients back into the soil.

Note: Any forest biome earns no credit.

Question 4

(a) Create a graph of the data from table 1 below on the axes provided.

(Two points can be earned: 1 point for correctly plotting the data [no more than one data point may be misaligned], and 1 point for correctly setting up BOTH axes with a consistent scale interval.)

Notes: Bar graphs are acceptable. Students need not connect the data points. Award no credit for flipped axes.
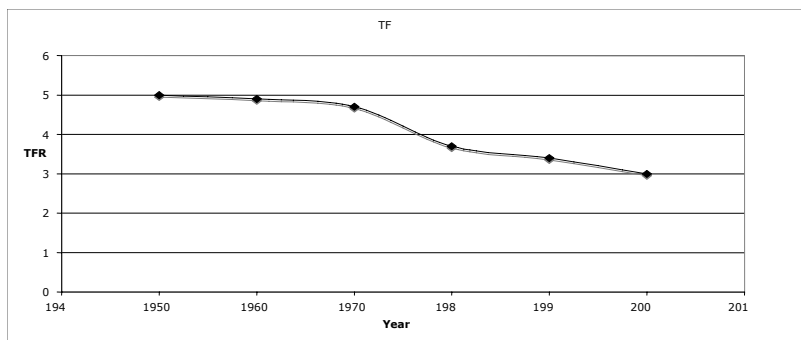
(b) Identify and discuss TWO of the causes for the trend in the worldwide TFR that you graphed in part (a).

(Three points can be earned: 1 point for each valid cause, and 1 point for discussion of a valid cause—cause and discussion MUST BE LINKED. Two points maximum may be earned for causes; 1 point maximum for discussion. A single discussion point may be earned by itself.)

Cause	Discussion
Increased/improved family planning	• Fewer pregnancies/control of fertility/choice in number of children born
Increased education for women (stay in school longer)/improved social status of women	• Delay having children/choosing to have fewer children
More women enter the workforce	• Delay having children
Reduced need for children in workforce/on farm	• More industrialization/less agriculture/increased urbanization
More industrialization/less agriculture/increased urbanization	• Reduced need for children in workforce/on farm

Cause	Discussion
Improved health care (lower infant mortality)	• More children will survive to adulthood
People marry later	• Childbearing delayed/fewer children
Changing cultural values	• Socially acceptable to have fewer children
Government policies that restrict number of children allowed per woman	• Countries are facing overpopulation issues
Increased cost of raising children	• Standard of living and education costs have increased
Increased urbanization	• Lessens living space for more children

(c) **Consider the data in table 2 above. Identify and discuss TWO economic or societal factors that account for the difference between the TFR of Kenya and that of the United States.**

(Four points can be earned: 1 point for each correct factor, and 1 point for each correct discussion of the factor. Discussion points may be earned without an identified factor. However, if factors are given, discussion and factors MUST BE LINKED.)

Factors (Societal or Economic)	Discussion
Kenya has a much higher infant mortality rate.	• There is a shortage of prenatal and pediatric care due to poverty in Kenya. • Kenyans have more children to ensure that some survive.
Kenya is more agricultural (second stage of demographic transition).	• In Kenya more children are needed to help farm.
Kenya is a less-developed country (lower per-capita income)/poorer/nonindustrialized.	• Children provide income to the family. • Contraceptives are not affordable.

Factors (Societal or Economic)	Discussion
Women in Kenya lack education and job opportunities.	• Women in Kenya have fewer career/work choices so they have children at an earlier age than women in the United States do. • Women in Kenya do not delay childbearing, in contrast with women in the United States who often delay starting a family due to the high cost of childcare.
There is no pension system to support people as they age in Kenya.	• More children are needed to support parents in old age.
There is less education about family planning in Kenya.	• There is less ability to control fertility.
Cultural values favor larger families in Kenya.	• More children mean greater social status.
Women in Kenya have a low social status /marry at an earlier age.	• Women have little or no choice/control of their fertility; they have more years of childbearing.
There is a preference for male children in Kenya.	• People have more children to get as many sons as possible, because sons will continue to support the family.
The cost of raising a child in the United States is much higher than in Kenya.	• People in the United States choose to have smaller families.
Abortion is illegal in Kenya.	• Results in more births.
Religious values in Kenya prohibit contraception/abortion.	• Results in more births.

(d) Describe TWO human activities related to the rapidly growing world population that are having an impact on Earth's biodiversity.

(Two points can be earned: 1 point for each accurate description. The student must link a specific activity to a specific impact on biodiversity.)

- Deforestation for the following purpose destroys habitats and reduces biodiversity (may use two activities for 1 point each):
  - farming (i.e., creation of monocultures);
  - housing/development (i.e., urbanization);
  - fuel (wood);
  - fossil-fuel recovery (mining and drilling).
- Fossil-fuel burning releases carbon dioxide resulting in climate change, altering global/regional/local temperature and precipitation patterns leading to reduction of biodiversity within ecosystems where organisms have very specific climatic requirements for survival.
- Pollution (student must identify specific contaminants linked to human activity that have a negative impact on species and biodiversity).
- Intensive fish farming spreads parasites and disease to native species, reducing biodiversity.
- Diversion of freshwater for agricultural, municipal, and industrial use reduces water supply for biodiverse freshwater ecosystems.
- Damming of rivers makes it difficult for species that breed/spawn upstream (e.g., salmon) to reproduce, reducing biodiversity.
- Overfishing leads to small, unsustainable populations of fish species, reducing biodiversity.
- Building landfills for increased amounts of trash destroys habitat, reducing biodiversity.
- Poaching of wild animals (e.g., bush meat) due to increased human population and demand for food leads to dwindling populations that may not be sustainable.
- Using genetically modified crops to increase yield of food crops can negatively impact other species (e.g., monarch butterfly larvae can be killed when they ingest toxin-containing genetically modified corn pollen that has settled on milkweed leaves near genetically modified corn fields).