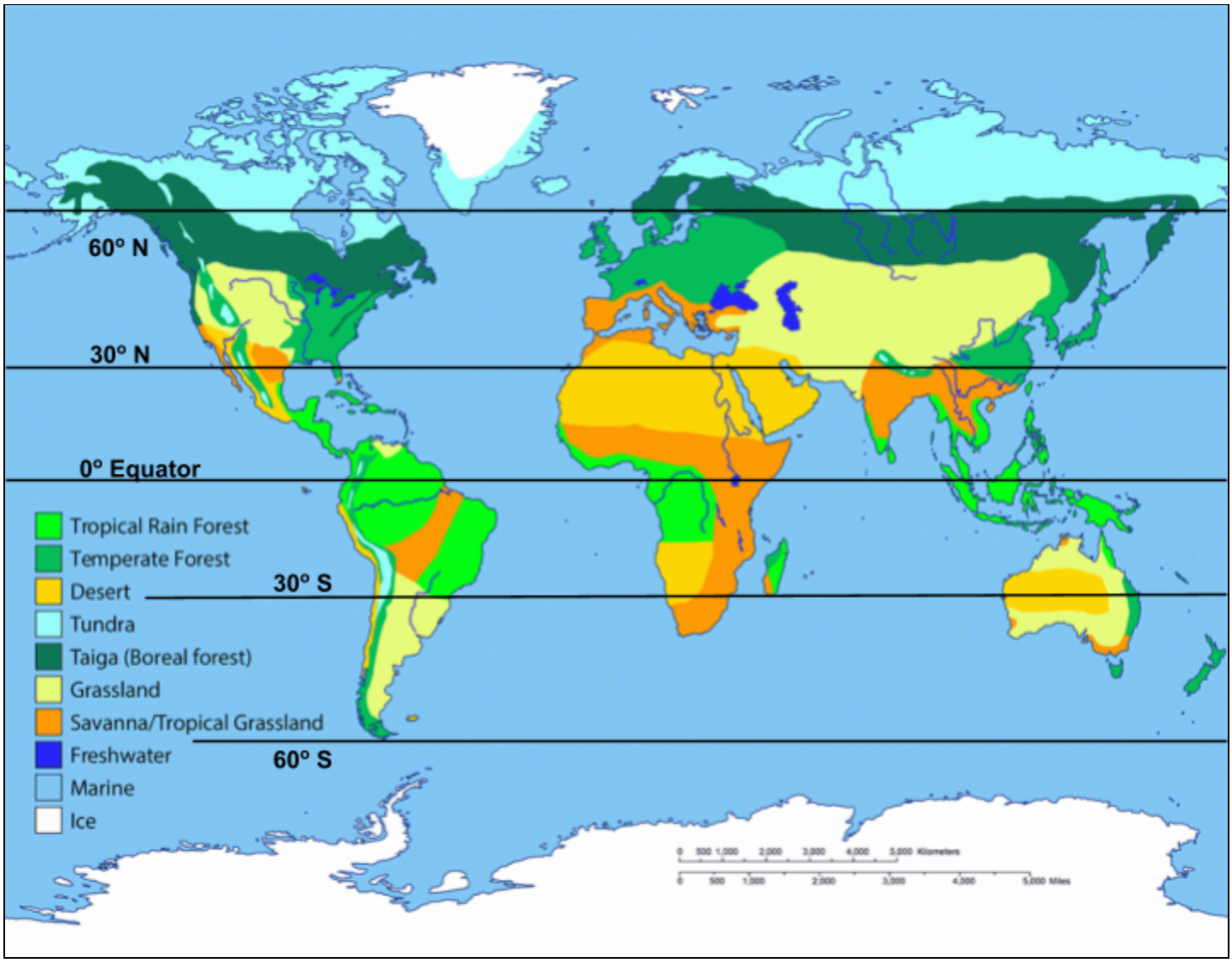
1. The map below shows the biomes on Earth in relation to major latitude lines:



Source: © Arizona Board of Regents / ASU Ask A Biologist. Used under CC BY-SA 3.0 / latitude lines added

(a) Using the diagram, **identify** a terrestrial biome that exists on Earth at 15ºN latitude.

(b) **Identify** the approximate latitude of a biome on Earth that would be dominated by conifer trees such as pine and spruce.

(c) **Describe** how warm air moves away from the equator towards higher latitudes.

(d) **Explain** why hot deserts on Earth exist around 30º N and S latitude.

(e) **Identify** in which layer of the atmosphere greenhouse gasses accumulate.

(f) **Describe** how greenhouse gasses lead to the warming of the Earth.

(g) Researchers collected soil samples from a watershed basin area that includes forests and agricultural areas. The samples were collected over the course of one month, and their proportion of sand, silt, and clay were analyzed to compare with their permeability.

(i) **Identify** a research question for this study.

(ii) **Identify** the dependent variable for this study.

(iii) **Identify** a variable not described that could affect the results of the study.

(iv) **Describe** a modification that could increase the reliability of the study.

2. The table below contains water quality data for three sampling sites along a stream in the Midwestern United States taken in June 2019. Site A is located the farthest upstream. Site B is located downstream of Site A, and Site C is located the farthest downstream.

Sampling Site	DO (mg/L)	Nitrate (mg/L)	Phosphate (mg/L)	Turbidity (NTU)
A	10.0	2.0	1.0	5
B	2.1	11.2	1.2	42
C	6.7	4.6	1.1	7

(a) Using the data in the table above,

(i) **Identify** the sampling site with the highest level of dissolved oxygen.

(ii) **Describe** the relationship between dissolved oxygen and nitrate levels in this stream.

(iii) **Make a claim** using evidence to explain the most likely location of a dairy farm in this area.

(iv) **Explain** how the data in the table could be used to predict the biodiversity of the stream.

(b) **Identify** a human activity that can increase phosphate levels in freshwater ecosystems.

(c) **Describe** an environmental problem that can be caused by increased phosphate levels in a freshwater pond.

A large commercial farm applies synthetic pesticides to its crops to prevent insects from consuming crops and reducing their crop yields. Downstream from the farm, a team of researchers is studying the effects of the pesticide runoff on aquatic species.

(d) **Describe** an unintended consequence of the farm applying pesticides to their crops to kill insects.

(e) **Describe** how pesticide runoff from the farm could affect aquatic species downstream, other than causing death.

(f) **Propose a solution** to the environmental problem described in (e).

(g) **Justify** the solution proposed in (f) by describing a potential economic advantage of that solution.

3. According to the US Department of Agriculture, there were 58 million irrigated acres of cropland in the United States in 2017. The most irrigated crops were corn and soybeans grown for livestock feed and biofuel.

(a) **Identify** a type of irrigation that uses water inefficiently.

(b) **Describe** how the amount of water used for irrigation could be reduced.

(c) **Describe** one environmental problem related to water use that can be caused by an increasing human population.

(d) **Make a claim** that proposes a solution to an environmental problem described in (c).

(e) **Describe** a potential disadvantage of the solution proposed in (d).

(f) In 2019, the country of France had a crude birth rate of 12.0 per thousand, a crude death rate of 9.6 per thousand, and a net migration rate of 1.1 per thousand. The total population of France in 2019 was approximately 67.6 million people.
Sources: https://www.cdc.gov/globalhealth/infographics/food-water/water_use.htm, US Census International Database

(i) **Calculate** the total growth rate of France. Show all work.

(ii) **Calculate** the doubling time for France. Show all work.

(iii) In the US, the average water use per capita is 709 liters. By comparison in France the average resident only uses 291 liters of water per person per day. If there are 3.78 liters in a gallon, **calculate** how many gallons of water the entire population of France would use per year. Show all work.