# Savanna Formation

1. Located in tropical areas at low altitudes, savannas are stable ecosystems, some wet and some dry consisting of vast grasslands with scattered trees and shrubs. They occur on a wide range of soil types and in extremes of climate. There is no simple or single factor that determines if a given site will be a savanna, but some factors seem to play important roles in their formation.
2. Savannas typically experience a rather prolonged dry season. One theory behind savanna formation is that wet forest species are unable to withstand the dry season, and thus savanna, rather than rain forest, is favored on the site. Savannas experience an annual rainfall of between 1,000 and 2,000 millimeters, most of it falling in a five- to eight-month wet season. Though plenty of rain may fall on a savanna during the year, for at least part of the year little does, creating the drought stress ultimately favoring grasses. Such conditions prevail throughout much of northern South America and Cuba, but many Central American savannas as well as coastal areas of Brazil and the island of Trinidad do not fit this pattern. In these areas, rainfall per month exceeds that in the above definition, so other factors must contribute to savanna formation.
3. In many characteristics, savanna soils are similar to those of some rain forests, though more extreme. For example, savanna soils, like many rain forest soils, are typically oxisols (dominated by certain oxide minerals) and ultisols (soils containing no calcium carbonate), with a high acidity and notably low concentrations of such minerals as phosphorus, calcium, magnesium, and potassium, while aluminum levels are high. Some savannas occur on wet, waterlogged soils; others on dry, sandy, well-drained soils. This may seem contradictory, but it only means that extreme soil conditions, either too wet or too dry for forests, are satisfactory for savannas. More moderate conditions support moist forests.
4. Waterlogged soils occur in areas that are flat or have poor drainage. These soils usually contain large amounts of clay and easily become water saturated. Air cannot penetrate between the soil particles, making the soil oxygen-poor. By contrast, dry soils are sandy and porous, their coarse textures permitting water to drain rapidly. Sandy soils are prone to the leaching of nutrients and minerals and so tend to be nutritionally poor. Though most savannas are found on sites with poor soils (because of either moisture conditions or nutrient levels of both), poor soils can and do support lush rain forest.
5. Most savannas probably experience mild fires frequently and major burns every two years or so. Many savanna and dry-forest plant species are called pyrophytes, meaning they are adapted in various ways to withstand occasional burning. Frequent fire is a factor to which rain forest species seem unable to adapt, although ancient charcoal remains from Amazon forest soils dating prior to the arrival of humans suggest that moist forests also occasionally burn. Experiments suggest that if fire did not occur in savannas in the Americas, species composition would change significantly. When burning occurs, it prevents competition among plant species from progressing to the point where some species exclude others, reducing the overall diversity of the ecosystem. But in experimental areas protected from fire, a few perennial grass species eventually come to dominate, outcompeting all others. Evidence from other studies suggests that exclusion of fire results in markedly decreased plant-species richness, often with an increase in tree density. There is generally little doubt that fire is a significant factor in maintaining savanna, certainly in most regions.
6. On certain sites, particularly in South America, savanna formation seems related to frequent cutting and burning of moist forests for pastureland. Increase in pastureland and subsequent overgrazing have resulted in an expansion of savanna. The thin thin upper layer of humus (decayed organic matter) is destroyed by cutting and burning. Humus is necessary for rapid decomposition of leaves by bacteria and fungi and for recycling by surface roots. Once the humus layer disappears, nutrients cannot be recycled and leach from the soil, converting soil from fertile to infertile and making it suitable only for savanna vegetation. Forests on white, sandy soil are most susceptible to permanent alteration.

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3. The word “prolonged” in the passage is closest in meaning to:

* Predictable
* Destructive
* Lengthy
* Unproductive

1. In paragraph 2, the author mentions savannas in Central America, Brazil, and the island of Trinidad in order to:

* Argue that these savannas are similar to those in South America and Cuba
* Point out exceptions to the pattern of savanna formation in areas with drought stress
* Provides additional examples of savannas in areas with five- to eight-month wet seasons
* Indicate areas where savannas are being gradually replaced by rain forests

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2. According to paragraph 3, rain forests and savannas differ in that:

* The soils in rain forests contain fewer minerals than savanna soils do
* Savannas affect soil conditions more than rain forests do
* Unlike rain forests, savannas prefer sandy, well-drained soils to soils that are very wet
* Unlike rain forests, savannas may develop under both very dry and very wet soil conditions

1. The word “notably” in the passage is closest in meaning to:

* Similarly
* Especially
* Usually
* Relatively

1. According to paragraph 3, all of the following are true of savanna soils EXCEPT:

* They have high concentrations of potassium.
* They contain high levels of aluminum.
* They are very acidic.
* They contain large amounts of certain oxide minerals.

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2. According to paragraph 4, which of the following is true of waterlogged soils?

* Their upper layers are usually sandy and porous.
* They cannot support savannas.
* They contain little oxygen.
* They are prone to the leaching of nutrients and minerals.

1. The fact that “poor soils can and do support lush rain forest” suggests that:

* Poor soils alone may not be enough to explain why an area becomes a savanna
* Rain forest vegetation can significantly lower the quality of soils
* Drought stress is the single most important factor in savanna formation
* Minerals are more important than moisture for the growth of trees

1. Most savannas probably experience mild fires frequently and major burns every two years or so. Many savanna and dry-forest plant species are called pyrophytes, meaning they are adapted in various ways to withstand occasional burning. Frequent fire is a factor to which rain forest species seem unable to adapt, although ancient charcoal remains from Amazon forest soils dating prior to the arrival of humans suggest that moist forests also occasionally burn. Experiments suggest that if fire did not occur in savannas in the Americas, species composition would change significantly. When burning occurs, it prevents competition among plant species from progressing to the point where some species exclude others, reducing the overall diversity of the ecosystem. But in experimental areas protected from fire, a few perennial grass species eventually come to dominate, outcompeting all others. Evidence from other studies suggests that exclusion of fire results in markedly decreased plant-species richness, often with an increase in tree density. There is generally little doubt that fire is a significant factor in maintaining savanna, certainly in most regions.
2. Which of the sentence below best expresses the essential information in the highlighted sentence in the passage? *Incorrect* choices change the meaning in important ways or leave out essential information.

* Rain forest species seem unable to adapt to fires created by humans.
* Ancient charcoal remains suggest that, prior to the arrival of humans, fires occurred frequently in rain forests.
* Ancient charcoal remains in Amazon forests suggest that rain forest species adapted to the area long before the arrival of humans.
* Rain forests species appear unable to adapt to frequent fires, but evidence from the past suggests that rain forests sometimes do burn.

1. The word “markedly” in the passage is closest in meaning to:

* Dangerously
* Noticeably
* Rapidly
* Gradually

1. Paragraph 5 supports which of the following statements regarding the importance of fires in maintaining savannas?

* Fires prevent the growth of pyrophytes.
* Fires eliminate some species and thus reduce the overall diversity of the ecosystem.
* Fires that occur once every two years are unlikely to help maintain savannas.
* Fires prevent some species from eliminating other species with which they compete.

1. On certain sites, particularly in South America, savanna formation seems related to frequent cutting and burning of moist forests for pastureland. Increase in pastureland and subsequent overgrazing have resulted in an expansion of savanna. The thin upper layer of humus (decayed organic matter) is destroyed by cutting and burning. Humus is necessary for rapid decomposition of leaves by bacteria and fungi and for recycling by surface roots. Once the humus layer disappears, nutrients cannot be recycled and leach from the soil, converting soil from fertile to infertile and making it suitable only for savanna vegetation. Forests on white, sandy soil are most susceptible to permanent alteration.
2. The word “subsequent” in the passage is closest in meaning to:

* Expanded in area
* Harmful
* Following in time
* Repeated

1. According to paragraph 6, human activity affects soils in all of the following ways EXCEPT:

* Decomposition of leaves occurs too fast for surface roots to obtain nutrients.
* Nutrients are not recycled.
* Humus is destroyed.
* Certain soils become unable to support vegetation other than savanna vegetation.

1. **In addition, humans have contributed to the conditions favoring the formation of savannas.**

Where would the sentence best fit?

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2. 【3】On certain sites, particularly in South America, savanna formation seems related to frequent cutting and burning of moist forests for pastureland. 【4】Increase in pastureland and subsequent overgrazing have resulted in an expansion of savanna. The thin upper layer of humus (decayed organic matter) is destroyed by cutting and burning. Humus is necessary for rapid decomposition of leaves by bacteria and fungi and for recycling by surface roots. Once the humus layer disappears, nutrients cannot be recycled and leach from the soil, converting soil from fertile to infertile and making it suitable only for savanna vegetation. Forests on white, sandy soil are most susceptible to permanent alteration.
3. Prose Summary

**Several factors seem to play important roles in savanna formation.**

Answer Choices

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| --- | --- |
| 1. Savannas can form in areas with a five- to eight-month wet season, but they more commonly have a longer wet season. | D. Drought stress affects trees and shrubs in savannas far less than it affects savanna grasses. |
| 1. Soil stress caused by drought, extreme moisture, or low nutrient levels favors the formation of savannas. | E. Frequent fires is a major factor contributing to the formation and maintenance of savannas. |
| 1. Studies conducted in various regions indicate that an upper layer of white, sandy, soil is present in most permanent savannas. | F. In some areas, human cutting and burning is associated with savanna formation, and increase in pastureland has led to savanna expansion. |