

Landscapes and Drainage Patterns

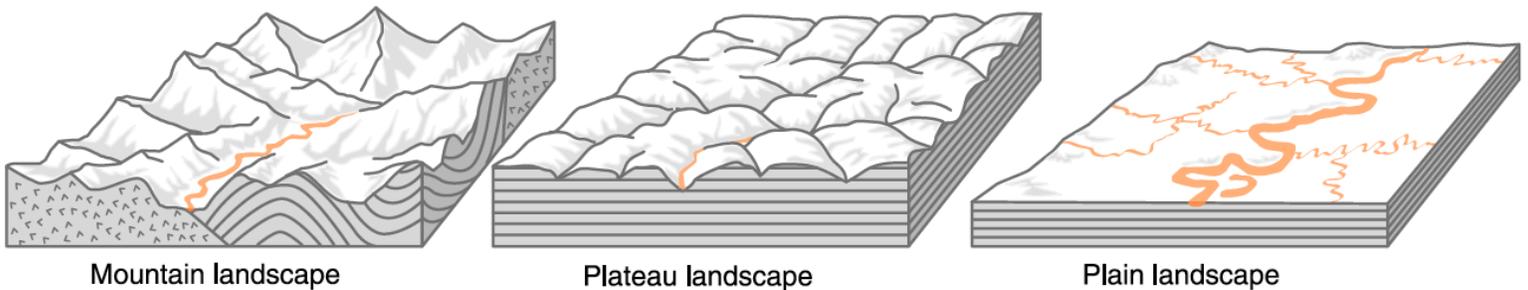
NEW YORK'S NATURAL WONDERS

New York is not one of the largest states of the United States, nor does it have any large national parks to rival Yosemite or the Grand Canyon. But nearly every part of the state has unique and beautiful natural wonders. No matter where you live in New York, inspiring features of geologic interest are no more than an hour or two away. For example, Niagara Falls is a broad sweep of thundering water that carries the outflow of four of the world's largest freshwater lakes over a 60-meter plunge. Other spectacular waterfalls include Taughannock Falls north of Ithaca and Kaaterskill Falls at the eastern margin of the Catskills. The beaches of Long Island offer miles of white sand and pounding surf. And the freshwater beaches in the Finger Lakes and the Adirondack Mountains are famous for their scenic and recreational value. The Genesee River Gorge south of Rochester has impressive cliffs hundreds of meters high. Other gorges in the southern Finger Lakes region and along the Ausable River in the Eastern Adirondacks provide equally impressive experiences with their varied erosional forms. The high peaks of the Adirondacks and natural limestone caverns of the Catskills are scenic travel destinations. The passage of the Hudson River through the Hudson Highlands and cliffs of the Palisades make the Hudson one of America's most scenic rivers.

WHAT ARE LANDSCAPES?

A landscape is the general shape of the land surface. Landscapes include a variety of topographic features related to the processes that shaped the surface. For example, New York's glaciated landscapes include such diverse landforms as U-shaped valleys; rounded, grooved, and polished bedrock surfaces; drumlins and moraines. A landform is a single feature of a landscape. Landscapes are generally made of a variety of related landforms such as mountains, valleys, and river systems. Geological structures are major influences on landscapes.

PLAINS



Most landscape regions can be classified as plains, plateaus, or mountains. Plains are usually relatively flat. That is, the range of elevations is small. Hill slopes are gentle and streams commonly meander over broad flood-plains. The bedrock underlying plains can be any kind of rock that has been in place long enough to be eroded to a low level. Shale and other layered sedimentary rocks are especially common in plains landscapes. Soils tend to be thick and stable due to the low gradients. Much of the Mississippi Valley and central part of the United States is a plains landscape that is mostly underlain by flat layers of relatively soft sedimentary rock.

PLATEAUS

Plateau landscapes have more relief than plains but they are not as rugged as mountain landscapes. Relief is the difference in elevation from the highest point to the lowest point on the land surface. Some plateaus look like relatively level areas that are nearly as flat as plains but at a much higher elevation. Parts of the Colorado Plateau of Arizona and Utah look like a plains landscape that has been pushed up more than 1000 meters. The Columbia Plateau of eastern Oregon was built up by fluid lava flows that spread over great distances. Flat-lying, sedimentary rocks underlie most plateaus, including the Colorado Plateau. Landforms in the eastern part of the United States are generally more rounded than those in dryer areas of the West. Therefore, the Appalachian Plateau, the largest plateau in the eastern United States, is mostly a region of rolling hills.

MOUNTAINS

Mountain landscapes have the greatest relief. Variations in rock types, which are common in mountain areas, often include hard metamorphic and igneous rocks as well as weaker kinds of rock. The harder rocks

are usually found in the highest areas, and the weaker rocks have been eroded to make deep valleys. Tectonic uplift and deformed rock structures such as folds and faults contribute to the complexity and relief of mountain landscapes. A close look at the rocks in any major mountain area, such as the Rockies, the Alps, or the Himalayas, is likely to reveal a complex geologic history and a wide variety of rock types.

WHAT FACTORS INFLUENCE LANDSCAPE DEVELOPMENT?

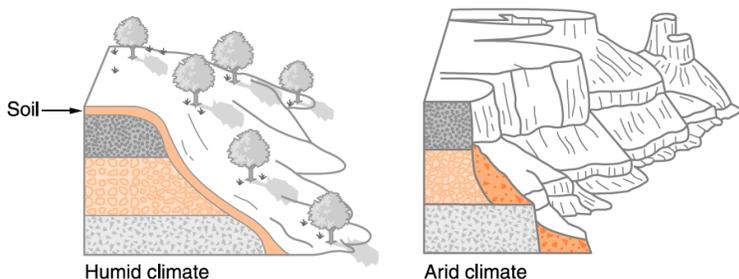
The factors that influence landscapes are geologic and climatic. Geologic factors include crustal movement, rock type, and geologic structures. The major climatic factor in landscape development is the annual precipitation.

GEOLOGIC FEATURES

Among geologic factors, vertical movement of Earth's crust is very important. Where Earth's crust is being pushed up, high peaks and deep valleys characterize young mountain ranges, such as the Himalayas of Asia. Rapid uplift and steep slopes also result in rapid erosion. Rivers that drain the great Himalayas carry more sediment into the oceans than rivers from any comparable area of Earth's surface. The characteristics of rock types, especially their resistance to weathering and erosion, are very important in landscape development. The hardest rocks of any area usually are found at the highest land elevations. In places where some bedrock is more resistant to weathering and erosion than others, ridges tend to follow the hardest rock types. Valleys in these areas generally follow the softer and/or fractured rock. A major landform called the Niagara Escarpment runs from the Niagara River south of Lake Ontario across much of western New York State. An escarpment is a steep slope or a cliff of resistant rock that marks the edge of a relatively flat area. The Niagara Escarpment, which separates the lowlands along Lake Ontario from higher land to the south, owes its existence to a particularly hard sedimentary rock known as the Lockport Dolostone. (Dolostone is a sedimentary rock similar to limestone but with a slightly different mineral composition.) Geologic structures also influence landscapes. The Hudson Highlands, about 30 km north of New York City, is a block of Earth's crust that has been pushed up. The Highlands are bounded by geologic faults to the north and south. In addition, the Adirondack Mountains have been pushed up into a broad dome structure. The waves of hills of the Appalachian Plateau north of Harrisburg, Pennsylvania, are the direct results of large folds in the bedrock caused by compression of the crust. Faults are zones of crushed bedrock along which relative movement has occurred. These lines of weakened rock influence the course of streams and enable rapid erosion. The zigzag route of the Hudson River through the Hudson Highlands is probably a result of erosion along geologic faults. Faulting also controls the direction of many northeast-flowing streams in the high peaks region of the Adirondack Mountains.

CLIMATE FACTORS

Climate is the other major factor in landscape development. A humid climate favors chemical weathering, which produces rounded, less angular landforms. Most of the hill slopes of New York State are rounded and gentle because of the relatively humid climate. A moist climate also allows plants to grow and protect soil from erosion. Desert areas sometimes have a steplike profile, with flat hilltops and terraces separated by steep escarpments. The climate of New York State does not change very much from place to place. All of New York has a moist, temperate, mid-latitude climate. Therefore the landscape differences in New York State are not the result of differences in climate. The variations seen in the New York landscape are caused by geological factors.

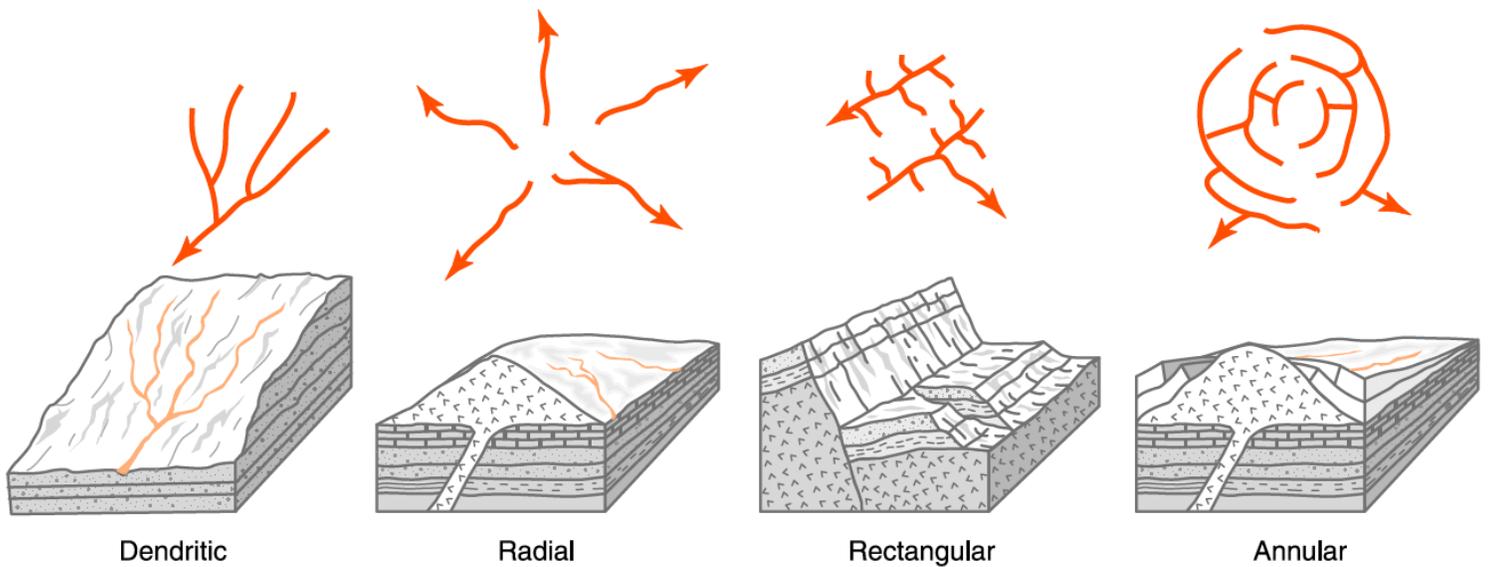


WHAT IS A DRAINAGE PATTERN?

Streams seek the lowest path as they move downhill, and they tend to erode their beds in places where the ground is weak. Therefore, both topography and geologic structure influence the path streams follow through an area, which we call the drainage pattern. By

looking at a map view of a stream, you can often infer the underlying bedrock structures. The most common stream pattern is a dendritic drainage. Dendritic streams flow downhill in the same general direction and they join to make larger streams. As a result, they have a branching appearance. This pattern is common where the bedrock is uniform, without faults, folds, or other major structures or zones of weakness to capture the streams. Dendritic drainage is also common where the rock layers are horizontal.

Much of the region of western New York State north of the Pennsylvania border has dendritic drainage because rock layers are flat and there are few faults or folds to divert streams. A region that has prominent parallel and perpendicular faults, repeated folds, or a strong rectangular jointing pattern will display a rectangular drainage pattern. (Joints are cracks in bedrock along which no significant movement has occurred. They may be related to expansion or regional forces acting on bedrock.) Streams seek the lowest areas of folds, fractured rocks along faults, or the weakest surface bedrock locations. Annular drainage is a pattern of concentric circles that are connected by short radial stream segments. This type of drainage occurs in an eroded dome. A radial drainage pattern resembles the spokes of a wheel. Streams flow away from a high point at the center of the pattern. Radial drainage may develop on a smooth dome or a volcanic cone. The Adirondack Mountain region of New York displays radial drainage, although rock structures such as faults and folds in the Adirondacks alter the regional pattern and may make radial drainage hard to observe. The important point is that the underlying rock types and geologic structures influence streams, and that different structural features produce different patterns of drainage.



Use pages 2 and 3 of your ESRTs to fill in the boxes in the table below. The Manhattan Prong has been completed for you as an example.

Landscape Region Name	Bedrock Age	Bedrock Type	Plain (lowland), Plateau (highland), or
Manhattan Prong	Cambrian, Ordovician, and Middle Proterozoic	Metamorphic	Plateau (highland)
Allegheny Plateau			
Adirondack Mountains			

Landscape Region Name	Bedrock Age	Bedrock Type	Plain (lowland), Plateau (highland), or
St. Lawrence Lowlands			
Taconic Mountains			
Erie–Ontario Lowlands			
Tug Hill Plateau			

Answer the following questions using your ESRTs when necessary.

- Which kind of landscape is not likely to be underlain by flat lying sedimentary rocks?
 - lowlands
 - plateaus
 - plains
 - mountains

- What kind of landscape region is often characterized by flat-lying layers of sedimentary rock that have been uplifted by forces within Earth without major folding and faulting, and then eroded to form deep stream valleys?
 - plains
 - mountains
 - plateaus
 - coastal lowlands

- In which part of the United States would you be most likely to find thin soils and steep, rocky slopes?
 - the Great Plains of Kansas and North Dakota
 - the coastal plains of Florida and Louisiana
 - the hills of the Appalachian Plateau
 - the desert plateaus of Utah and Arizona

- In the 1800s the Erie Canal was built from from the Albany area throug Utica and Syracuse, then just south of Rochester to Buffalo. What landscapes did the canal follow?
 - The canal was built primarily through valleys in mountain landscapes.
 - The canal was built mostly through plateau landscapes.
 - The canal was built across plains landscapes whenever possible.
 - The canal connected all the landscape regions of New York State.

- Within New York State, the Genesee River and the Susquehanna River flow mostly through which landscape region?
 - the Hudson–Mohawk Lowlands
 - the Allegheny Plateau
 - the Atlantic Coastal Plain
 - the Adirondack Mountains

- Tilted, metamorphosed bedrock is typically found in which New York State landscape region?
 - Taconic Mountains
 - Tug Hill Plateau
 - Atlantic Coastal Plain
 - Erie–Ontario Lowlands

- The Catskills are actually a part of what larger landscape region?
 - the Adirondack Mountains
 - the Allegheny Plateau
 - the New England Highlands
 - the Manhattan Prong

8. What is the smallest distance from the southern boundary of the Adirondack Mountains landscape to the northern boundary of the Allegheny Plateau?
- (1) approximately 10 km
 - (2) approximately 100 km
 - (3) approximately 50 km
 - (4) greater than 200 km
9. Which two locations are in the same New York State landscape region?
- (1) Albany and Old Forge
 - (2) Massena and Mt. Marcy
 - (3) Binghamton and New York City
 - (4) Jamestown and Ithaca
10. Buffalo, New York, and Plattsburgh, New York, are both located in landscape regions classified as
- (1) highlands
 - (2) plateaus
 - (3) lowlands
 - (4) mountains
11. It is feared that global warming could melt the polar ice caps and cause sea level to rise. Which part of New York State would most likely be flooded if this were to occur?
- (1) Allegheny Plateau
 - (2) Adirondack Mountains
 - (3) Erie–Ontario Lowlands
 - (4) Atlantic Coastal Plain
12. In which New York State landscape region is surface bedrock generally composed of metamorphic rock?
- (1) Tug Hill Plateau
 - (2) Newark Lowlands
 - (3) Adirondack Mountains
 - (4) the Catskills
13. What landscape region is located at 44°N latitude, 74°W longitude?
- (1) Allegheny Plateau
 - (2) Adirondack Mountains
 - (3) Erie–Ontario Lowlands
 - (4) Atlantic Coastal Plain
14. Which town or city is located within the New York State landscape region with the greatest difference in elevation from the highest to the lowest land levels?
- (1) Buffalo
 - (2) Old Forge
 - (2) Rochester
 - (3) Massena