

# Topography

Topography, the physical contour of the land, is shaped by the interaction of climate and geology through processes such as glaciation and erosion. In Dutchess County, these forces have sculpted the land into small hills, mountains, and valleys.

The shape, character, and location of landforms can be assets or liabilities, depending on how they are used. For example, many of the hilltops and steep hillsides in the county offer fine scenic vistas; yet, developers who wish to build homes on these hillsides to take advantage of their attractive views can face unusually high construction costs for roads, foundations, water supplies, sewer lines, drainage systems, and erosion controls. Communities often face increased costs for maintaining and servicing these hillside developments.

Relief and slope are two characteristics of the landscape that significantly affect the use of land. Relief refers to the pattern of elevations or irregularities on the land surface. The slope of an area is its gradient, or degree of steepness. Both of these attributes are described below.



## Relief

Dutchess County's land surface is irregular with an almost continuous alternation of hills and valleys. The relative elevation of the land divides the county into two topographic regions, apparent in the Elevations Map on the following page. The general area west of the Taconic State Parkway and north of Interstate 84, and including significant areas of Lagrange, Beekman, and East

Fishkill east of the parkway, is characterized by numerous small hills whose heights range from 20 to 300 feet above the intervening valleys. Elevations range from 40 feet above sea level at the Hudson River to 900 feet in the interior of this region.

The second area, to the east of the parkway and south of Interstate 84, is characterized by rounded hills and low mountains that are larger and generally higher than those in western Dutchess. Many of the hills rise 500 to 1,000 feet above the adjacent valleys. The highest elevations occur in the Hudson Highlands to the south and the Taconic Mountains to the east. South Beacon Mountain in the Hudson Highlands rises to 1,602 feet, and the elevation of Brace Mountain north of Millerton, in the Taconic Range, is 2,311 feet. These high elevations form natural separations between Dutchess County and its neighbors to the south and east, Putnam County and Connecticut. They also physically separate communities within Dutchess.

Dutchess also has extensive lowlands. The valley of the Fishkill Creek near the county's southern boundary, the Harlem Valley that runs parallel to its eastern boundary, the Clove Valley in Beekman and Unionvale, the glacial lake plain on the western edge of Red Hook and Rhinebeck, and the valley along the Wappinger Creek are the largest lowland areas. They range from 400 to 600 feet above sea level.



$$\text{Slope} = \frac{30 \text{ Foot rise}}{100 \text{ foot distance}} = 30\%$$

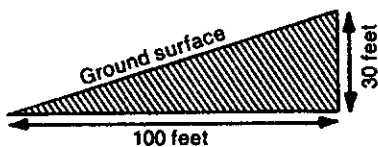


Figure 3.1

### Slope

Slope is expressed as a percentage of incline from the horizontal. Land that rises five feet over a horizontal distance of 100 feet is said to have a five percent slope; if the land rises 50 feet over a 100-foot distance, the slope is 50 percent. A 45-degree incline has a 100-percent slope. This relationship is illustrated in Figure 3.1.

Slope limits the use of land and influences rates of stormwater runoff and soil erosion. The slope classifications in Figure 3.2 are commonly used in gauging the development suitability of land. Although there are limitations to development on all gradients, level land is usually most suitable and steep land least suitable for residential, agricultural, or industrial purposes. On level land the problem of building structures and roads is comparatively straightforward. If soil and other land characteristics are compatible with the proposed use, roads and buildings can be placed and grouped almost anywhere. Grading, controlling drainage, installing utilities, constructing foundations, and providing services are relatively easy. This is not the case on steeply sloping land.

Development constraints increase as slope increases. Slopes greater than 15 percent present severe development constraints for three reasons. First, steep slopes shed more surface water at higher velocities than level areas do. These runoff characteristics accelerate erosion when the land is disturbed or cleared, stripping the slopes of valuable soil and adding to the sediment load of downstream waters. Second, steep slopes in Dutchess County tend to be covered by shallow soils that cannot filter septic wastes properly. The tendency of the effluent to flow downslope can combine with the poor filtering capacity of the soil to produce serious health hazards.

A third factor limiting the use of steep slopes is cost. Developing and maintaining such areas in ways that limit erosion, provide adequate waste treatment, and preserve natural features, is expensive. Roads, utilities, and building construction in rough terrain can require excessive cutting, filling, and grading. Maintenance costs also increase in steeply sloped areas. Road surfaces deteriorate, roadside ditches erode, and downstream culverts fill with sediment. These conditions can be fixed only temporarily, and at public expense.

Dutchess County contains approximately 97,000 acres of land that have slopes greater than 15 percent. This equals almost 20 percent of the county's total area. Table 3.1 lists steep slope acreages for each municipality. All of the towns with more than 6,000 acres of steep slopes are located in the northern half of the county. They include Hyde Park, Clinton, Stanford, and Northeast. Hyde Park and Clinton also have the highest percentages of steep land, followed by Milan, Red Hook, Northeast, Stanford, Poughkeepsie, Rhinebeck, and Pine Plains. Aside from the villages and the city of Poughkeepsie, the towns of Unionvale, Pawling, Wappinger, and Dover have the smallest percentages of steep land.

**Slope Categories**

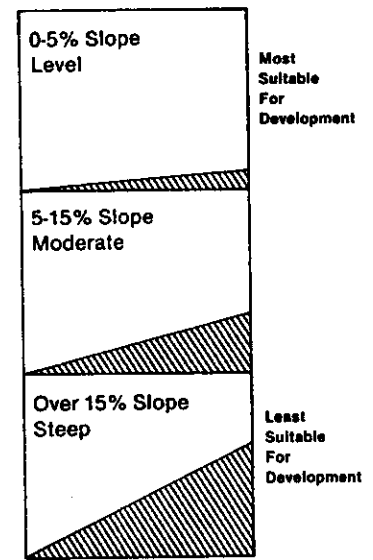


Figure 3.2

**Table 3.1 Steep Slope Acreages by Municipality**

Municipality	Acres of Slopes Over 15 Percent	Steep Slopes as Percentage of Total Acreage <sup>1</sup>
Amenia	4,368	15.7
Beacon City	628	19.6
Beekman	3,217	16.4
Clinton	7,678	30.9
Dover	5,036	14.1
East Fishkill	5,383	14.6
Fishkill	2,580	15.1
Fishkill V.	--	--
Hyde Park	8,335	35.1
LaGrange	3,978	16.0
Milan	6,608	28.4
Millbrook V.	52	4.4
Millerton V.	--	--
Northeast	6,158	22.4
Pawling	3,085	11.2
Pawling V.	149	11.6
Pine Plains	4,046	20.5
Pleasant Valley	4,138	19.5
Poughkeepsie	3,940	21.1
Poughkeepsie C.	161	4.8
Red Hook	5,578	25.4
Red Hook V.	43	6.4
Rhinebeck	4,533	20.5
Rhinebeck V.	22	2.3
Stanford	6,769	21.1
Tivoli V.	86	8.8
Unionvale	2,463	10.3
Wappinger	2,031	11.9
Wappingers Falls	50	6.4
Washington	5,706	15.6
<b>DUTCHESS COUNTY</b>	<b>96,649</b>	<b>18.7</b>

Source: Physiography and Land Use, Dutchess County Planning Board, 1965.

<sup>1</sup>Total Acreage Excluding Hudson River

Both Table 3.1 and the accompanying Slope Map clearly show the distribution of steep slopes in Dutchess County. A broad band dominated by the Hudson Highlands extends along the county's boundary with Putnam County. Steep slopes are also found on both sides of the Harlem Valley, along the Clove Valley in Unionvale, and on

Stissing Mountain in Pine Plains. Smaller steep areas are scattered throughout the county, with concentrations in Pleasant Valley and LaGrange along the Taconic Parkway and at the boundary between Milan and Pine Plains.

Steep slopes provide a scenic backdrop to the county's valley floors and contribute to people's sense of place. Because they tend to be less developed than more level areas, steep hillsides support much of the county's wildlife and natural vegetation, and recreational facilities such as the Appalachian Trail. Their forests contribute immeasurably to the county's beauty, recreational values, and tourism industry.

Erodible, shallow soils and other limiting factors do not make steep slopes uniformly undevelopable. In many areas, careful builders working with well-informed local officials can use hillsides attractively without significant environmental harm. Such development is likely to be costly, but the damage caused by careless development on such sensitive areas is at least equally costly, and often irreparable.

Extensive areas of level land are located in the valley lowlands of the Fishkill Creek, Tenmile River, and Wappinger Creek in Pine Plains, and at the Astor Flats along U.S. Route 9 in Rhinebeck. The southwestern part of the county, particularly the towns of Wappinger, Fishkill, and East Fishkill, contains the greatest amount of level land. A comparison of the Elevations Map and Slope Map reveals how closely the level and low areas coincide.

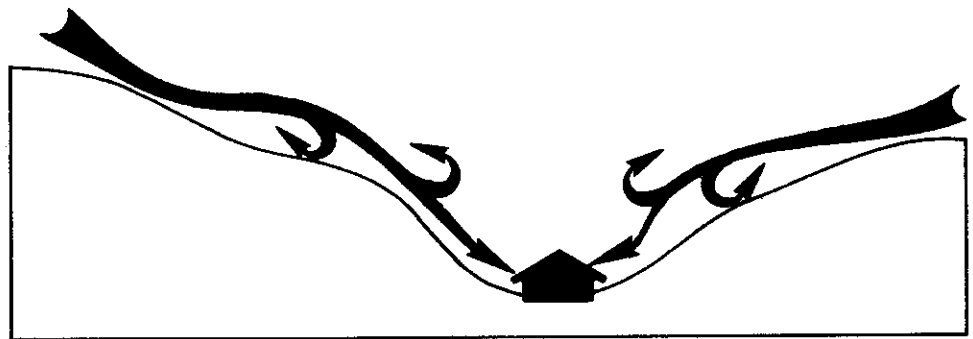
## **Resource Management Implications**

The varied slopes and elevations of Dutchess County contribute greatly to the diversity of the county's land uses and the beauty of its landscapes. They influence the distribution and development of soils, vegetation, water resources, and identifying features such as scenic vistas and physical landmarks. Topographic features also influence the county's growth; by placing physical limits on the possible uses of different landforms, topography determines where activities such as intensive development or agriculture can occur.

On a community and county-wide basis, zoning and land use policies based on an awareness of topographic constraints can prevent costly development mistakes and environmental damage. Such awareness can also help decision-makers anticipate where competition for developable land will be keenest, enabling communities to make fundamental land use choices with long-term goals in mind.

On a site-specific basis, there are distinct advantages to considering site topography. Landowners can work with the contours and orientation of their land to avoid hazardous building sites, keep construction costs low, and take advantage of solar energy access and wind protection. For example, dense, cold air and runoff water collect in small basins surrounded by hills, as shown in Figure 3.3. These low areas, or hollows, often have limited access to sunlight. The combination of cold temperatures, drainage problems, and limited sunlight makes some hollows unsuitable for home sites and crops, but adequate for activities such as livestock grazing. An awareness of these topographic influences can make the difference between a sensible use of the land and an expensive mistake. Good development proposals always reflect a sensitivity to slope, orientation, and relief.

**Hollows are usually colder than hillsides because cold air collects in them to form "frost pockets." They also often receive less sun. Heating costs for buildings situated in such pockets can be very high.**



Adapted from: Hendler, Bruce, *Building in the Wildlands of Maine*.

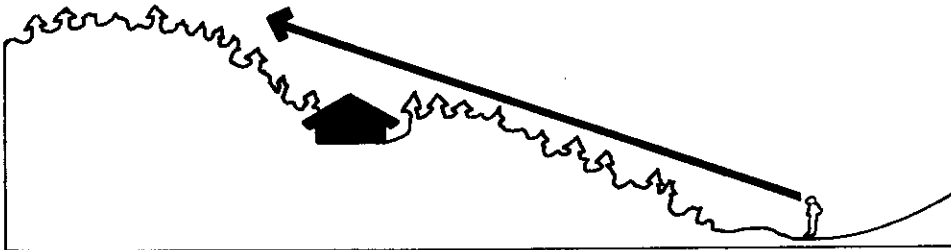
Figure 3.3

### **Uplands**

Upland soils are often shallow and steep. These features make them highly erodible, poorly equipped to filter septic wastes or store water, and unable to recover quickly from development practices that scar the land. Uplands can support only low density uses; the steeper the slope, the more precautions are needed to enable the land to accommodate those uses.

Local governments should not permit slopes between 10 and 25 percent to be developed, unless extreme care is taken to protect these upland areas. Specific design standards should be required of such developments, and strictly enforced, to prevent soil erosion, septic failures, slope subsidence, water pollution, and other forms of environmental degradation. Slopes greater than 25 percent should not be disturbed.

A dwelling set below the crest of a hill is more private and has a more varied view than a hilltop dwelling. The lower site also better preserves the natural appearance of the hill as seen from below.



Adapted from: Hendler, Bruce, Building in the Wildlands of Maine

Figure 3.4

Buildings should be built below ridge tops and hill crests to preserve the scenic value of upland terrain. As shown in Figure 3.4, hillside sites can enjoy vistas and privacy without interfering with scenic views from below. Upland vegetative communities should be protected through selective cutting and natural landscaping. Clearcutting should be discouraged.

The importance of Dutchess County's higher elevations to wildlife habitat, forest production, community identity, surface waters, and scenic beauty, should be recognized at county and local levels. Preventing development of the steepest, most fragile slopes, and carefully managing the use of buildable slopes and upland plateaus will help preserve these areas and the natural and economic benefits they provide.



## **Lowlands**

Low-lying valleys and plains have historically been the focus of development and agricultural activity. In Dutchess County, they contain the most fertile farmlands, the most productive groundwater reservoirs, the largest surface water supplies, the most abundant sand and gravel deposits, the most accessible, easily buildable land, and the most people, buildings, and roads. This concentration of positive features can lead to land use conflicts as residential needs, industry, and agriculture compete for the best land.

Lowlands also contain features that require special care and land use practices. Floodplains are found along all major streams and most tributaries. Wetlands are located in the stream valleys, and in hollows at all elevations where suitable soil and drainage conditions exist. Lowland sand and gravel deposits form the county's best groundwater supplies and are vulnerable to pollution and overuse.

The development constraints and natural values of floodplains, wetlands, and groundwater resources are described in Chapter Four. Here it is sufficient to say that thoughtful land use policies are needed in low-lying areas to ensure that development pressures do not result in the inappropriate use of hazardous, fragile, or unique natural resources.

## **Community Choices**

Communities must learn to balance competing land uses and growth in ways that maintain environmental quality. Sound land use policies must address upland and lowland features equally. Otherwise, policies designed to protect slopes will encourage development of level areas; such development, in turn, will reduce the amount of fertile land available for agricultural use or may encroach on wetlands, floodplains, and groundwater recharge areas. Similarly, one-sided regulations that discourage development of prime soils and sensitive lowland areas increase development pressures on the hillsides. Local land use policies should, therefore, contain a combination of regulations that preserve the most naturally valuable lowland and upland areas, and mandate environmentally sound densities and construction practices wherever the communities decide that development should occur.

More specific land use strategies for each category of natural resources are discussed in subsequent chapters.