

An Introduction to Pennsylvania Species, Habitat, Ecosystems, and Biodiversity

What Is Biodiversity?

Biodiversity refers to the variety of species, their genetic make-up and the natural communities in which they occur.

The air we breathe, the water we drink and the food we eat are fundamental to our existence. These essential life supports depend on an intricate web of life involving the interactions of millions of different animals, plants, fungi, and microscopic organisms. All of these organisms provide numerous ecological, economic and aesthetic benefits.

- They give us food, fuel and medicines.
- They help clean our air, purify our water, break down wastes, and provide flood and pest control.
- They are used as the raw materials for buildings, clothing, furniture, paper, and numerous other products.
- They are a constant source of recreation and enjoyment ranging from hiking, hunting and fishing to nature study.

Biodiversity is a scientific concept developed to embrace all living things, including humans. It's how their existence – and survival – is interconnected. Biodiversity encompasses the variety of all species of plants, animals, fungi, and microbes - their genetic makeup and the natural communities in which they occur. Preserving these biological communities is essential to maintaining our quality of life.

Biodiversity is described on three major levels: *genetic diversity*, *species diversity* and *natural community (or ecosystem) diversity*. Each level is interconnected with the other. Genes form species, species form communities and communities, along with the physical environment, form ecosystems.

Biodiversity Levels

Genetic Diversity: Genetic diversity is the variety of genes within and among species. Genes define the traits and behaviors shared by a species and also explain the differences found among the individuals within the species. Expressions of genetic diversity are all around us. The variety of flowers we see in a garden, the red and yellow apples we buy in the supermarket, the many bird songs we hear in the morning, and the diverse hair textures and eye colors we see among our friends are just a few examples. These diverse characteristics stem from the differing genetic codes found within individual organisms.

Genetic codes help determine the potential of individuals to survive and reproduce and the potential of species to adapt and survive. One duckling may be able to swim faster from a predator than another. One population of red maples may be more successful in surviving drought than another. Black-capped chickadees may be more resistant to a disease than

purple finches. These abilities can then be passed to the next generation, helping to ensure the survival of an individual, a population or even, a species.

The total variety of genes found within a species or a population of that species is referred to as its *gene pool*. Scientists are still investigating the importance of genetic diversity to the survival of a species. However, we do know that the greater the genetic diversity in the gene pool, the greater the chance the species will be able to survive the many natural and human-caused changes that occur in the environment.

Knowledge of genetic diversity can be a useful tool for managing biodiversity. Genetic analysis is one method for understanding breeding systems - like how far seeds and pollen are carried and how far adult animals disperse in search of mates. Genetics can also be used to assess the consequences of wildlife introductions, transplantations, stockings, and harvests. However, very little is known about the genetic diversity of individual species in Pennsylvania.

Species diversity: Species diversity is probably the most measured component of biodiversity. Volunteers make inventories of plants and animals in local parks. Children observe the different kinds of birds found on their school grounds. Biologists inventory the bat species found in caves throughout the state. Through the National Audubon Society's Christmas Bird Count, thousands of volunteers monitor Pennsylvania's bird species. All of this information helps to contribute to our knowledge of species diversity.

However, understanding species diversity is not limited to recognizing the total number of species in the state. We must also consider their habitat, their range, how they meet their needs for survival, the number of individuals within each species, and how they interact with other species. Today, we know that Pennsylvania has approximately 25,000 native and non-native species. The vertebrates are the best known - animals with backbones, which include mammals, birds, fish, amphibians, and reptiles. Despite their high visibility, vertebrate species make up barely three percent of the total number of species living in Pennsylvania.

Community Diversity (sometimes called Ecosystem Diversity): The term ecosystem is defined as a community of living organisms combined with their associated physical environment. Ecosystems provide the "home systems" for the variety of species and microorganisms in our state. Our diverse ecosystems also provide important services that we depend on every day.

Every ecosystem has an "intrinsic" natural diversity that defines the system and forms a balance between the living and non-living components. An eastern deciduous forest has typical tree and shrub species and associated wildlife, while a field is characterized by a different group of plants and animals. A loss of this diversity affects an ecosystem's ability to perform valuable services and to sustain species and their interactions. As biodiversity decreases, the ecosystem becomes less stable, natural cycles tend to fluctuate erratically and the entire ecosystem becomes more vulnerable. When the natural diversity is sustained, ecosystems are stable, productive and resilient.

Forests are the most prominent ecosystems in our state. When Europeans first arrived, more than 80 percent of our landscape was forested. Pennsylvania still has about 17 million acres of forest, but the age, structure, and composition of these forests have changed since Europeans first settled the state.

Why Is Biodiversity Important?

The ecological services provided by biodiversity are vital to everyday life. Not a day, hour or even second goes by that we do not depend on biodiversity for survival.

- The oxygen we breathe is a product of photosynthesis by green plants.
- Insects, worms, bacteria, and other tiny organisms break down wastes and aid in the decomposition of dead plants and animals to enrich soils.
- More than 90 percent of the calories consumed by people worldwide are produced from 80 plant species.
- Almost 30 percent of the medicines on the market were developed from plants and animals, and many more are derived from these sources.
- Wetland ecosystems filter toxins, clean the water, and control floods.
- Estuaries act as seafood nurseries.
- Forest ecosystems supply fresh water, control erosion and remove carbon from the atmosphere.

Biodiversity is also economically important, both in terms of dollars and jobs. The forest industry in Pennsylvania provides 90,000 jobs in 2,500 firms and contributes over \$4.5 billion to the economy. In 2001, activities associated with hunting and fishing contributed over \$1.5 billion to Pennsylvania's economy while visitors and residents involved in wildlife watching generated another \$962 million. (U. S. Fish and Wildlife Service, National Survey of Fishing, Hunting and Wildlife-Associated Recreation, 2001.) Thousands of Pennsylvanians and visitors to our state spend many hours enjoying our natural wonders through hiking, biking, cross-country skiing, and other outdoor recreation.

What Do We Know About Pennsylvania's Biodiversity?

Although we acknowledge the essential role Pennsylvania's biological diversity plays in supporting our economy and our lifestyle, there is much that we don't know about the plants and animals in our state – what exists, how they interact with each other and how we interact with them.

Present Species Diversity

The number of species in Pennsylvania is not constant. Over geological time, many species died out and were replaced by new ones, gradually shaping the composition and structure of today's plant and animal life. While human activities, particularly habitat destruction, have led to a reduction in native species diversity, natural forces, such as climate change, also have altered biodiversity in Pennsylvania over time.

Over the past 860,000 years, there have been eight episodes of global cooling severe enough to cover parts of Pennsylvania in ice year-round. The interglacial period that occurred approximately 128,000 to 67,000 years ago is particularly interesting because it was most like the present one, except human influence was absent. Most species now native to the state were probably present, but they lived side-by-side with species long absent. For example, white-tailed deer and elk inhabited what is now Pennsylvania, along with two extinct deer

species, three peccaries, a giant horse, two tapirs, black-bear sized beavers, and the American mastodon!

The arrival of European settlers in the 1600's initiated the major changes in Pennsylvania's biodiversity that we are addressing today. In fact, this is the time period most often used to distinguish between species that are native to Pennsylvania and species that are not.

When Europeans first arrived, the land was covered in forests. Deer, elk and turkey were plentiful. Otters and beavers shared streams with a variety of fish and mussels. Huge flocks of passenger pigeons shared forests with a multitude of songbirds. Moose inhabited the swampy northern hardwood forests and bison herds roamed valley grasslands. As more and more settlers arrived, forests were cleared for farms, towns and cities. Timber, coal, iron, market hunting (unlimited hunting of wild animals for use in restaurants and other businesses), and textile businesses boomed. There was little, if any, control on hunting, land-use and pollution. By the end of the 19th century, our waterways were polluted, land was deforested and many wildlife species were decimated. Deer and turkey were almost gone from the state. Elk, beaver and other species were extirpated and the passenger pigeon was nearly extinct.

In 1914, the last passenger pigeon on earth died at the Cincinnati Zoo.

The 20th century is marked with losses and gains in conserving Pennsylvania's biodiversity. The beginning of the century reflected a time of contrasts. Some species were completely protected while others were considered nuisances, including many predators, and subject to bounty hunting. As the century progressed, laws and regulations were established and repealed to better conserve our wild plants and animals. And, through the work of state and federal agencies, conservation organizations, nature centers, and individuals, such as Rachel Carson, an increased understanding of the connections between wildlife, plants, people, and the environment emerged. Ultimately, major progress was made in cleaning up our rivers; controlling air, land and water pollution; and restoring wildlife populations. However, many threats to species diversity still exist, with habitat loss being of major concern for all species in the state.

During the 20th century fishers, beavers, elk, peregrine falcons, osprey, bald eagles, and river otters were reintroduced into our state.

Today, we share our state with at least 25,000 known native and non-native species. The vertebrate species, along with the vascular plants, (flowering plants, deciduous and coniferous trees and ferns) are fairly well documented at least at the state level. But these two groups comprise only about 17 percent of the total known species of the state.

By far, the most abundant and least known organisms in Pennsylvania are the insects and other invertebrates. Fewer than 12,000 species have been documented for Pennsylvania, which is probably less than one-half of the invertebrate species that currently live in the state. While discoveries of new species for Pennsylvania in the better-known groups of plants and animals are rare, reports of new species discovered in Pennsylvania and even in the world are not uncommon for invertebrates, especially terrestrial insects. In addition to our lack of

knowledge about insects, very little is known about the diversity of other groups of organisms in Pennsylvania, including green algae, molds, bacteria, and other microorganisms.

Of the total organisms in the state, more than 650 are listed as threatened and endangered and more than 800 are considered to be of conservation concern.

Over half of Pennsylvania's 65 native species of freshwater mussels are endangered or extirpated. Nearly 30% of Pennsylvania fish are of conservation concern.

Currently, 130 species still living in Pennsylvania are ranked as globally endangered, threatened or rare.

During the 1900's, the Asian chestnut blight, caused by a fungus, spread throughout the eastern forests attacking American chestnut trees. By the 1950's, the tree was gone from Pennsylvania and eastern U.S. forests. Today American chestnuts persist as stumps, sprouts and small trees that become infected before they can grow to maturity.

Numbers of Species in Pennsylvania

The number of species in a given area is not static. Therefore, the exact number of species in Pennsylvania changes continuously as the status of known species changes and as more species are discovered. These numbers are based on information known in the year 2003

Group	Total Known Species Considered Native to Pennsylvania	Native Species Currently Found in Pennsylvania ¹	Listed as Pennsylvania Endangered or Threatened	Extirpated	Extinct	Non-Native Species Found in Pennsylvania	Total Number of Species Currently Found in Pennsylvania (Native and non-Native) ²
Mammals	73	63	6	10	-	2	65
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Birds	401	394*	14	5	2	5	399
Reptiles	39	37	5	2	-	1	38
Amphibians	37	36	4	1	-	0	36
Fishes	151	142	43	8	1	10	152
Mussels	65	41	3	24	-	3	44
Vascular plants	2,244	2,151	297	91	2	1,281	3,434
Invertebrates*	11,502?	11,447?	280	55?	?	200?	11,647?
Fungi*	7,447?	7,447?	?	?	?	?	7,447?
Bryophytes & lichens*	820?	820?	?	?	?	2	822?
Algae*	1,242?	1,242?	?	?	?		1,242?
Total	24,317	23,816	652	196	5	1504	25,322

1, 2 Does not include extirpated or extinct species

? Information known at this time. Not enough is known for accurate counts. Data uncertain due to lack of inventory data.

* 182 of these bird species commonly nest and breed in Pennsylvania.

Community or Ecosystem Diversity

Pennsylvania's landscape can be separated into seven major categories – forests, grasslands and herbaceous openings, barrens, subterranean areas, wetlands, aquatic, and suburban/urban communities (sometimes referred to as areas disturbed by people or disturbed areas). These broad categories can then be further subdivided based on a variety of criteria including dominant plant species, elevation and hydrology. In fact, 113 different terrestrial and wetland communities have been identified in our state.

Forests, by far, are the major ecosystem type in our state. When Europeans first arrived they viewed a land almost totally covered in forests. Large expanses of hemlock, beech, and pine were found in the northern part of the state while oak, along with chestnut and hickory, covered the ridges and valleys. From the 1600's through the 1800's, the forests were increasingly cleared, burned and logged to make room for farms, towns and cities and to enhance blueberry production, make charcoal and produce timber for a variety of uses, including buildings, mine shafts and ship masts. By the end of the 19th century, most of the forests in our state had been cleared or burned at least once and many wildlife species were in decline. In the early 1900's, land use began to change. Many farms and old fields were abandoned and forests began to reclaim the land. Today, Pennsylvania has about 17 million acres of forest covering over 60% of our landscape. The majority of Pennsylvania's forests are considered second growth forests and are around 100 years old.

The age and composition of a forest affects associated wildlife. Second-growth forests are valuable for a variety of wildlife including the wild turkey, black bear, white-tailed deer, ovenbird, and scarlet tanager. Young forests (early successional forests), with an abundance of shrubs and saplings, are not common in our state, but can be found in areas that have been recently clear cut. Studies have shown that species relying on this stage, such as the woodcock, are declining.

Old growth forests are also rare in Pennsylvania. Typically, forests are considered old growth if they are over 150 years old, however this will vary depending on forest type. Most of our old growth forests occur in small patches of less than 500 acres, but there is a large area (3000 acres+) of old growth forest in the Allegheny National Forest in northwestern Pennsylvania. These older forests provide preferred and, in some cases, critical habitat for a variety of species including the fisher, pine marten, flying squirrel, blackburnian warbler, brown creeper, and Swainson's thrush.

Pennsylvania consists of 28,991,096 acres. Forests cover 62%, of the total acreage with herbaceous openings covering about 26% (mostly farmland), and wetlands covering at least 2.5%.

Urban forests make up 4% of Pennsylvania's total forest cover. Some woodland animals, like the great horned owl, deer, raccoon, skunk, and red-tailed hawk have successfully adapted to the urban/suburban environment.

There are eight different types of forests in Pennsylvania. *Northern Hardwood* and *Appalachian Oak-Hickory* are the most common. *Northern Hardwood Forests* are found mostly in the northern part of the state. These forests are characterized by white pine, hemlock, sugar maple, beech, birch, basswood, ferns, witch hazel, rhododendron, and orchids. The *Appalachian Oak-Hickory Forests* are found throughout the southern part of the state, as well as in some of the northern counties. Species common in this forest type are oak, beech, red maple, elm, tulip, ash, dogwood, ferns, and bloodroot. Soil is typically rich and slightly acidic.

Some changes in Pennsylvania forests since European settlement

- *American chestnuts are gone except in isolated areas*
- *There are fewer hemlock and white pine today.*
- *Wild black cherry is a major timber tree.*
- *Little old growth forest remains due to extensive logging in the late 1800s and early 1900s to build the infrastructure of a growing nation.*
- *Except for a 4,200-acre tract on the Allegheny Plateau, nearly all of the old growth forests are in fragments of less than 500 acres.*
- *Most of the forest ranges from 80 to 100 years old and is of uniform maturity.*

Grasslands and Herbaceous Openings comprise only 26% of Pennsylvania's total land cover. Natural grasslands are rare in Pennsylvania. The only patches of true prairie occur in western Pennsylvania and are extensions of the mid-western prairie. Most herbaceous openings today are the result of human disturbance primarily for agriculture and surface mining. In addition to farmlands, open areas include re-vegetated strip mines and landfills, old fields, mountain balds, and forest openings. Fields, not planted in crops, are typically characterized by a variety of grasses such as fescues, orchard grasses, timothy, and foxtails interspersed with goldenrods, ragworts, fleabanes, black-eyed Susan, Queen Anne's lace, daisies, yarrow, dandelion, and wild strawberry. Some of these species are native, while others, like Queen Anne's lace, are non-native, but widely dispersed throughout the state. Grasslands and herbaceous openings provide habitat for a variety of wildlife including grasshopper sparrows, eastern meadowlarks and bobwhite quail which have declined by 80% or more since the mid-1960's (*Breeding Bird Survey as reported in Wildlife Habitats in Pennsylvania: Past, Present and Future*).

Barrens are a rare type of ecosystem found in several areas of the state and comprise about three percent of Pennsylvania's land cover. They are represented by sparsely vegetated gravel/rock outcrops and slopes, grasslands, savannas, thickets, and scrub woodlands. There are several types of barrens in Pennsylvania from shale barrens to scrub oak barrens. Most barrens have shallow, nutrient-poor soils and are located on exposed ridges or slopes where wind conditions and temperatures can become extreme and fire is frequent. Because of these harsh conditions, barrens often contain highly adapted, rare species of plants and animals and, thus, although small in extent, barrens are critical in terms of biodiversity. The serpentine barrens in southeastern Pennsylvania, contain the largest number of endangered plant and animal species in the state.

Subterranean areas, such as caves, are often overlooked as a habitat type. Caves, with their unique formations, temperatures, moisture conditions, and air dynamics provide an important, but fragile, habitat for many invertebrates and vertebrates. Some invertebrates in Pennsylvania caves are found nowhere else in the world. Pennsylvania's caves also provide habitat for many bats, including the federally endangered Indiana bat and other small mammals such as the eastern woodrat, which is listed as threatened in the state.

Wetlands are transitional between upland and open-water habitats and are delineated on the basis of vegetation, hydrology and soils. Most of Pennsylvania's more than 400,000 acres of wetlands are located in Crawford, Erie, Monroe, Pike, Wayne, Luzerne, and Mercer counties.

Wetlands include *marshes* (dominated by herbaceous plants), *swamps* (dominated by trees), and *scrub-shrub wetlands* (dominated by shrubby plants). *Bogs* are a special category of scrub-shrub wetlands with highly acidic soils and dense mats of sphagnum moss.

Wetlands provide important habitat for plants and animals, and are home to some of the rarest species in the state, including bog turtles and the spreading globe-flower. More than 50 percent of Pennsylvania's original wetlands have been lost or substantially degraded by filling, draining or conversion to ponds.

Aquatic communities are habitats that continually maintain open water and include *tidal*, *riverine* and *lake habitats*. These areas provide food and shelter to a diversity of plants and animals. In Pennsylvania, *tidal systems* are limited to the lower Delaware River and its tributaries.

With more than 83,000 miles of streams – second only to Alaska in the number of stream miles – Pennsylvania has abundant *riverine habitats*. Many of these miles, however, have been adversely impacted by industrial practices, including more than 3,100 miles impaired by abandoned mine drainage and 3,116 miles by agriculture.

Most of Pennsylvania's *natural lakes* are found in the northwestern and northeastern parts of the state. Although often overlooked, small seasonal pools of less than one-half acre play an important role as breeding grounds for many amphibians, insects and other aquatic invertebrates in the state.

Urban and Suburban (and disturbed areas strongly affected by people) include roadsides, cities, towns, neighborhoods, backyards, playgrounds, malls, and other developed land. Urban/suburban areas are increasing at a greater rate than any other community type in Pennsylvania and may account for up to 10-15% of land cover. (USDA, Natural Resource Inventory, 1997 revised 2000; actual percentage will vary depending on method of inventory.) The native biodiversity of these developed areas depends on a variety of factors including the intensity of the development, the vegetation and design used in landscaping and the use of pesticides and other lawn and road maintenance chemicals.

Although primarily habitats for very common species, developed areas can help maintain native wildlife and wild plants in the state. Trees and shrubs that produce fruit are often planted around homes and businesses where they provide food for birds and small mammals. The range of the northern mockingbird has expanded due, in part, to suburban landscaping. Plantings for birds and butterflies are becoming popular in backyard landscaping and bird feeding has been shown to have a major affect on local bird numbers. The interest in using native species in landscaping is increasing and native plants are becoming easier to find in local nurseries.

While developed areas continue to have a high proportion of alien species they do provide habitat for a variety of native species including woodchucks, deer mice, meadow voles, rabbits, robins, squirrels, chipping sparrows, and goldenrods.

In 1989, there were almost two million acres of turf grass in Pennsylvania – an area that would cover the states of Delaware and Rhode Island combined!

Land lost to development increased from 100 to 300 acres per day from 1982 to 1997 and the trend continues!

Habitat

The term *habitat* refers to the place where an animal lives. Essentially, habitat is the “home address” for a species. The term *habitat* is used in association with a specific species. Each species has its own habitat requirements. For example, the cardinal lives in backyards, parks and forest edges while chimney swifts inhabit urban areas. Pennsylvania’s diverse ecosystems provide habitat for a wide variety of plants, animals and other organisms. However, good habitat for one species is not necessarily suitable habitat for another.

Habitat has four major components---food, water, shelter, and space. These components must be available in the proper arrangement and within an accessible distance. The amount, type and quality of these components determine which animals can live in a given area. Bluebirds live in fields and farmlands, eat insects and nest in cavities. However, if food is available but is not within easy access of a tree cavity, a bluebird may not live in that field or farm area.

Some animals can live close to each other, while others require more space. In either case, if they become too crowded, problems arise as a result of competition and disease. For all animal populations, habitat must provide an ample amount of properly arranged and good quality food, shelter and water within enough space to prevent crowding.

Each animal has a role or function within its habitat. This role is referred to as its ecological niche. A goldfinch lives in fields, eats seeds and in doing so helps disperse the plant species throughout the area. Of course the goldfinch itself may be a source of food for a hungry Cooper’s hawk.

Food

Food provides an animal with the energy needed to carry out its daily functions. The food requirements of different species vary. Some species eat all different foods, while others are more specific in their needs. An animal’s diet is also affected by age, location, size, sex, behavior, activity level, time of year and food availability. Mallard ducklings eat a tremendous amount of insects and maggots to obtain the needed proteins for growth. Adult mallards tend to eat more seeds and plant materials and then supplement their diet with insects in preparation for migration. In spring and summer, cottontail rabbits feed on grasses, clovers and other leafy vegetation. In the winter, with little leafy vegetation available, cottontails rely on buds, bark, and poison ivy vines. Of course, catastrophic weather, such as, floods, tornadoes and droughts, also affect food availability.

Water

Water is critical for wildlife. Water provides shelter and is necessary for food production, bathing and the health of body tissue. . Some animals will drink from a water source such as a pond, stream or birdbath, while others are able to obtain all the water they need from their

food. During drought years, water can become a limiting factor for wildlife. However too much water can destroy an animal's basic needs such as food and shelter.

Shelter

An animal's shelter serves many functions. It provides living space; a place to feed; a place to raise and care for young; a place of protection from weather and predators; and a place to rest and sleep. People tend to think of shelter as vegetation, but shelter also may be provided by rock piles, holes in the ground, hills, cliffs, trees, billboards, fenceposts, houses and buildings. Animals seek shelter in more than one place depending on the activity in which they are involved. on what they are doing. For example, an evergreen tree near a bird feeder may provide cover for feeding while a hollow in a nearby tree may provide shelter for nesting.

Space

The area within which an animal normally travels to secure its needs is called its *home range*. The size of a home range varies. Generally, small animals have small home ranges and large animals have large ones. However, the size of the home range really reflects the species' need for space and the arrangement of available food, water and shelter. Inside a home range, an animal may have an area it defends against intruders of the same species and sometimes other species, as well. This, area, called its *territory* also varies in size and typically includes the area where the animal spends most of its time and raises its young.

Space plays an important role in the size, health and reproductive success of wildlife populations. In any habitat animals cannot tolerate overcrowding. Too many animals inhabiting an area increases competition for habitat components, such as, food or water. This can lower reproductive success, increase death rates and, generally, compromise the health of individual animals. Overpopulation of some species, like deer, will also cause major damage to the ecosystem, thereby affecting all the species inhabiting the area.

Carrying Capacity and Limiting Factors.

Carrying capacity refers to the number of animals of one or more species a habitat can support at a given time. *Biological carrying capacity* is determined by the quantity, quality and distribution of food, shelter and water in the habitat, as well as the social system of the species inhabiting the area. Some animals, such as the fisher, are solitary. They require large home ranges and will not be found in large groups--even if there is enough food, water and shelter. Other species, such as, Canada geese will live in large flocks. Some habitats just do not have enough food, water, or shelter to support a large number of animals. A *limiting factor* is an ingredient in the environment (usually a resource, like food or shelter) that regulates a population size and prevents a population from growing.

Today, wildlife biologists must consider biological carrying capacity and cultural carrying capacity when managing wildlife and resources. *Cultural carrying capacity* refers to the number of animals in a given habitat that people can tolerate.

Succession

Ecosystems change continually. When people do not interfere these changes typically occur gradually and progressively. Ecological succession refers to this gradual, progressive, natural "aging" of an ecosystem.

Some Pennsylvania Habitats with Associated Plants and Animals

Mixed-deciduous forest - The mixed deciduous forest is a distinct ecosystem which thrives in a mild climate with ample water. Forests can be viewed as layers of vegetation with animals inhabiting the different levels. Trees are the dominant species and form an overstory of vegetation that shades the forest floor. Next are the understory and ground cover plants adapted to life in the shade. Trees species typically found in the mixed deciduous forests of Pennsylvania are chestnut oak, red oak, white oak American beech, red maple, sugar maple, black birch, black gum and tulip poplar. These species are interspersed with small areas of evergreens such as hemlock and pine trees. Understory and ground cover include a wide variety of species such as mountain laurel, viburnums, dogwood, redbud, sassafras, spice bush, ferns, virginia creeper and wild flowers. Forests are home to an abundance of wildlife include the scarlet tanager, black bear, wood thrush, white-tailed deer, chipmunk, gray squirrel, etc.

Forest edge-An edge is an area where two habitat types come together, such as where a forest meets a field. A typical forest edge is a transition zone from forest to shrub area to grassy field. These zones provide a rich diversity of food and shelter. Many wildlife species, like turkeys and deer will take cover in the trees and shrubs of the forest and use the neighboring field for food.

Farms and Fields- Many Pennsylvania wildlife species need open spaces to live. Farms and fields provide habitat for these grassland species. On farms, the crops provide some cover and food. And, the brushy areas (called fencerows) often found between farm fields provide additional cover and food, as well contain the grasses and flowers typical of field habitats. A Pennsylvania field ecosystem is characterized by a variety of grasses and wildflowers. Fescues, orchard grasses, timothy, and foxtails are interspersed with wildflowers such as Queen Anne's lace, thistle, goldrods, ragworts, fleabanes, black-eyed susan, daisies, wild strawberry, and yarrow. These plants thrive in direct sunlight and rather dry soil. Some of these plants are native to Pennsylvania, while others, such as Queen Anne's lace, are non-native, but nonetheless are widespread throughout the state. Some farm and field species are the woodchuck, cottontail rabbit, meadow vole, deer mouse and the Red-tailed Hawk. Because farm and field habitats are on the decline in our state, several grassland species are now endangered or threatened in Pennsylvania, such as the Upland Sandpiper and the Short-tailed shrew. If left to nature, most field ecosystems in Pennsylvania will undergo succession to a climax stage of a forest.

Wetlands- Wetlands are defined as areas that are regularly wet or flooded and where the water table is at or near the surface for at least part of the year. Areas are designated as wetlands based on vegetation type, soil type and hydrology. There are many different types of wetland ecosystems such as, forested wetlands, swamps, bogs and the "typical" cattail marsh. A "cattail" wetland is characterized by cattail, grasses, rushes and sedges with very few trees and shrubs.

Wetlands are home to such species as the Red-winged Blackbird, mink and beaver. The number of wetlands in the state has decreased drastically. This has led to the decline of several wetland species now listed as endangered and threatened such as, the bog turtle, Sedge Wren, King Rail and Least Bittern.

Ponds, streams and rivers- Open and moving water play an important role in providing habitat for wildlife. Of course, wetlands are often associated with a pond, stream and river. But the

areas along the length of the stream and river are make an important contribution to wildlife habitat. These areas are called Riparian Zones and support trees and shrubs that prefer moist areas. Riparian zones provide food, shelter, shade, space and transportation corridors for many species wildlife.

Neighborhoods- There are many different types of neighborhoods. Towns and cities are characterized by high concentrations of houses and buildings with small backyards and few trees. And, although these areas provide a limited variety of food and shelter, several wildlife species, such as robins, house sparrows, raccoons and have made cities and towns their homes. In fact, Peregrine Falcons nest on the tall buildings found in cities! In other neighborhoods, houses and buildings are surrounded by large lawn areas, shrubs and trees that provide food and shelter for a wider variety of species. In all neighborhoods, wildlife will use houses, buildings, bridges and other artificial structures for nesting and shelter.