Guide to **Duke Farms**

This guide offers an introduction to the habitats, green initiatives and cultural heritage at Duke Farms. Use it to help you identify common plants and animals, and learn more about our transformation from farm to country estate to center for land stewardship and sustainability.

**Section 1: Living Habitats**

A habitat is the natural environment where a plant or animal lives. Duke Farms is regenerating habitats that have been damaged by mowing, draining, and planting non-native invasive species. This protects species diversity and the many goods and services that plants and animals provide. This section will help you identify some of the common species at Duke Farms. Plants are organized by the habitat where they are most often found (meadow, woodland or wetland). Animals are arranged by type (butterflies, amphibians) and sometimes by habitat (meadow birds, forest mammals). For a full species list, go to www.dukefarms.org.

**Section 2: Green Initiatives**

Duke Farms is committed to reducing the energy and water demands of its buildings and landscapes through sustainable restoration and management techniques. This section will help you identify innovative ideas to implement in your home, workplace, school, and town or city. Your efforts can protect the environment and save you money!

**Section 3: Cultural Heritage**

This section will assist you in identifying key landmarks on the landscape that were added by J.B. and Doris Duke. These include the buildings, stonework, fountains, and statuary.
Living Habitats

**Meadow Plants**
- Introduction to Meadows ............................................. 4
- Meadow Wildflowers ................................................. 5
- Meadow Grasses ..................................................... 6

**Woodland Plants**
- Introduction to Woodland Plants ....................................... 8
- Woodland Shrubs and Vines .......................................... 9
- Woodland Wildflowers and Ferns ..................................... 10
- Woodland Trees .................................................. 11-12

**Wetland Plants**
- Introduction to Wetland Plants ....................................... 14
- Wetland Wildflowers & Sedges ....................................... 15
- Wetland Shrubs ..................................................... 16

**Lakes and Streams**
- Introduction to Lakes and Streams .................................... 18
- Duke Brook .................................................................. 19
- Raritan River .................................................................. 19
- Yearly Cycle of the Lakes ............................................. 20

**Wildlife**
- Introduction to Wildlife .............................................. 22
- Meadow Birds ....................................................... 23
- Woodland Birds ..................................................... 24
- Waterfowl .................................................................. 25
- Birds of Prey ........................................................ 26
- Butterflies .......................................................... 27
- Bees .................................................................... 28
- Dragonflies and Damselflies .......................................... 29
- More Insects (and a Spider) ........................................... 30
- Amphibians ............................................................ 29
- Reptiles .................................................................. 31
- Meadow Mammals .................................................. 33
- Woodland Mammals ................................................ 34

“...to protect endangered species of all kinds, both flora and fauna... and for agricultural and horticultural purposes, including research.”

from Doris Duke’s Last Will and Testament
The 2742 acres of Duke Farms Habitats are approximately:
Wetlands: 528.5
Woodlots: 810.5
Grassland Bird Conservation: 536
Pollinator Meadows: 594
Lakes 66
Agricultural Fields: 207

Outlined area is open to the public. For a detailed map of this area please pick up a brochure at the Orientation Center.
Duke Farms, a 2,742-acre estate in Hillsborough, New Jersey, was developed by tobacco and hydropower magnate James Buchanan Duke beginning in 1893. Compiled from more than 40 parcels of farmland, Duke Farms is now one of New Jersey’s largest remaining privately-owned open spaces.

After J.B. Duke’s death in 1925, his daughter Doris, inherited the property. Associating Duke Farms with fond memories of her father, Doris Duke made few major changes to the property. Her principal work at Duke Farms included the creation of the indoor display gardens and the purchase and restoration of the western farms and farmstead structures.

As stewards of this land, Duke Farms Foundation is working to regenerate healthy, diverse habitats of native plants and animals, develop the farmland using sustainable practices and create demonstration gardens for the education and enjoyment of our visitors.
A properly established and maintained meadow is a valuable plant community that will provide ecological services and landscape beauty for decades.

Colorful flower displays changing with the flow of seasons and alive with flitting butterflies and swooping birds, meadows are full of charm and action. They also serve us in other, less obvious ways, as builders and binders of soil, cleansers of rainwater runoff, and home base for many pollinators that are crucial for our agricultural production. Hundreds of species of wildflowers and native grasses that are attractive throughout the year are found here, and can be planted throughout our communities. This habitat type advances environmental health and requires much less time, energy, and money to maintain than equal areas of lawns. See our displays of diverse meadows near buildings and trails, which once were high-maintenance lawns. Meadows like these can be added to your town’s landscape or even your backyard, rebuilding natural heritage and ecological value.
Meadow Wildflowers

Wildflowers give glorious color to native meadows, but they are more than just pretty faces. They grow among native warm season grasses, blocking invasion of weedy non-native species. Their root systems help control water run-off and soil erosion. They support pollinators, which are being threatened by habitat loss and pesticides. Pollinators support both native plant biodiversity and our farm crops. Farmers are encouraged to plant wildflowers as field borders to provide beneficial insects with forage and overwintering sites, and to help block agricultural chemical run-off into nearby waterways. Wildflowers are suitable for home gardens because they provide brilliant floral displays, attract birds and butterflies, and reduce the need for watering, fertilizer and pesticides.

**Foxglove beardtongue**  
*Penstemon digitalis*  
**Food web role:** A nectar source for long-tongued bees such as bumblebees, as well as butterflies and hummingbirds. Moth caterpillars feed on its foliage.  
**Flowers in:** Early to mid summer.  
**Habitat:** Fields and open woods.  
**Did you know?** Fine purple lines on its petals are “nectar guides,” which help insects locate the nectar and pollinate the plant.

**Virginia mountainmint**  
*Pycnanthemum virginianum*  
**Food web role:** A nectar source for bees, wasps, flies, small butterflies, and beetles.  
**Flowers in:** Summer.  
**Habitat:** Moist meadows, open moist woods, and shady forest edges.  
**Did you know?** The minty taste of the leaves and stems deters most mammalian herbivores and leaf-chewing insects.

**Orange coneflower**  
*Rudbeckia fulgida*  
**Food web role:** A nectar and pollen source for bees, small butterflies, flies and some beetles. Caterpillars eat the flower heads. Deer, songbirds, and rabbits eat the seeds. Groundhogs eat the foliage.  
**Flowers in:** Late summer.  
**Habitat:** Moist woods or meadows.  
**Did you know?** It is a wild relative of the popular black-eyed susan cultivar ‘Goldsturm.’

**Butterfly weed**  
*Asclepias tuberosa*  
**Food web role:** A nectar source for bees, wasps, butterflies and hummingbirds. Monarch caterpillars and other specialist insects eat the leaves.  
**Flowers in:** Summer.  
**Habitat:** Dry fields.  
**Did you know?** Monarch caterpillars store the toxins of this and other milkweed plants, making them distasteful to predators.

**Joe-pye weed**  
*Eupatorium purpureum*  
**Food web role:** A nectar and pollen source for some bees and butterflies. Food for moth caterpillars and swamp sparrows.  
**Flowers in:** Mid-summer to fall.  
**Habitat:** Wet meadows, stream banks, and open woods.  
**Did you know?** Legend says Native American healer Joseph Pye treated typhus fevers with a tea made from this plant.
Native grasses grow in Northeastern meadows as well as Western prairies. Their deep roots stabilize soil, preventing erosion and reaching water even during periods of summer drought. They provide seed, cover and nesting area for birds, and food for mammals. Many grasses are “warm season” grasses, which grow in the summer, flower in late summer or fall, and go dormant for the winter. Their clumps leave open space for wildflowers to colonize, adding color to the meadow along with food and shelter for pollinators. The stiff, dried stems stay upright under snow cover, providing winter protection for birds, mammals and insects. Native grasses are planted by conservationists for ecological benefits, and by gardeners for their summer drought tolerance and lovely fall colors.
Section 1: Living Habitats

Habitat Type | Species
---|---

![Image of forest with trees and leaves]

- Forest
- Woodland
- Savanna
- Tundra
- Desert

- Oak
- Pine
- Maple
- Spruce
- Cherry

- Deer
- Bear
- Owl
- Hawk
- Fox
- Rabbit
Healthy woodlands have a tall canopy of trees that cast dappled shade over the understory of shrubs and small trees and a ground layer of herbs and tree seedlings.

Plant communities in this region change from place to place. For example, oaks, hickories and pines are common in drier soils; maples, beech, and ash in moister areas. Hundreds of other plant species live under the canopy that these trees provide. Woodland habitats have great value as suppliers of timber, protectors of soil and water, and cleansers of air. Tall trees with a diverse, shaded understory once covered most of this region, but their numbers decreased as forests were cut down to allow the growth of agricultural land and later the spread of residential and commercial areas. Isolated forest edges caused by devegetation are drier, encourage many invasive species, and are not favorable sites for many forest animal species. Expanding and connecting our remaining woodlots will restore some of the vital services trees provide and create long-living forests. How can we enhance our forest resources near our homes and workplaces? Visit our regenerating woodlots and Research Woods to see ways of enriching your forest resources.
Shrubs are erect, many-stemmed, woody plants, usually lower than 25 feet. Vines are plants that climb and twist along the ground and on taller shrubs and trees. Although a few species grow well in full shade under the trees, most shrubs and vines grow best and produce the most seeds in openings such as road edges, old fields, and borders of forest stands, where the sunlight is not limiting for them. During winter, birds and mammals find shelter between branches and foliage of shrubs and vines. Their succulent berries offer a variety of long-lasting food sources for wildlife from the summer to the winter months. Most seeds eaten by birds and mammals are dispersed in their droppings, ready to germinate in a new place.

**Smooth sumac**  
*Rhus glabra*  
**Food web role:** Nectar source for flies, wasps and bees. Moth and butterfly caterpillars and deer eat its foliage. Birds eat its fruit.  
**Flowers in:** Spring.  
**Fruits in:** Summer to fall.  
**Habitat:** Fields and open slopes.  
**Did you know?** Native Americans used its fruit to make red dyes and its inner bark to make yellow dyes.

**Lowbush blueberry**  
*Vaccinium angustifolium*  
**Food web role:** Nectar and pollen source for bees and butterflies. Many animals, including humans, eat its berries.  
**Flowers in:** Late spring.  
**Fruits in:** Summer.  
**Habitat:** Dry woods.  
**Did you know?** Between 50 and 90 million pounds of blueberries are produced every year in New Jersey for human consumption.

**Virginia creeper**  
*Parthenocissus quinquefolia*  
**Food web role:** A nectar and pollen source for bees. Insects eat its foliage. Songbirds eat its berries. Deer and rabbits eat its branches and leaves.  
**Flowers in:** Spring.  
**Fruits in:** Summer to fall.  
**Habitat:** Woods, fields and edges.  
**Did you know?** Its berries are highly toxic to humans. Its sap can also cause skin irritation.

**Fox grape**  
*Vitis labrusca*  
**Food web role:** Its fruit is an important food source for birds, mammals, and humans.  
**Flowers in:** Late spring.  
**Fruits in:** Fall.  
**Habitat:** Rocky woods, moist thickets, and along stream banks.  
**Did you know?** Its seeds were used in the 19th century to create the Concord grape, which has become an important agricultural crop in the United States.

**Poison ivy**  
*Toxicodendron radicans*  
**Food web role:** Mammals and moth caterpillars eat its foliage. Birds like flickers and woodpeckers eat its fruit.  
**Flowers in:** Summer.  
**Fruits in:** Summer to fall.  
**Habitat:** Open woods, roadside thickets, fencerows, and edges.  
**Did you know?** It causes an itching rash when you touch it. Follow the advise of the rhyme, “leaves of three, let it be.”
Woodlands usually provide low sunlight conditions, moist environments and nutrient-rich soil. This creates an environment for wildflowers and ferns. Many woodland wildflowers bloom early in spring, before tree foliage grows completely and reduces sunlight on the forest floor. As tree leaves develop, the ground becomes shady, making photosynthesis more difficult for wildflowers. The forest floor also becomes drier, because a lot of water is used by the trees once they “leaf out.” Later in the summer, only very shade-tolerant plants appear and bloom. Woodland wildflowers provide nectar and pollen for many insects, and food for birds such as the wild turkey and some songbirds, and mammals such as mice, raccoons, foxes and deer.

**Woodland Wildflowers and Ferns**

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Food Web Role</th>
<th>Flowers in</th>
<th>Habitat</th>
<th>Did You Know</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Christmas fern</strong>&lt;br&gt;Polystichum acrostichoides</td>
<td>Food web role: During the winter, the evergreen fronds can be eaten by white-tailed deer. Young fronds are eaten by upland birds like ruffed grouse and wild turkey. <strong>Habitat:</strong> Rich moist woods, stream banks, and shaded roadsides. <strong>Did you know?</strong> Native Americans used its stems and roots to make a tea for chills, fevers, pneumonia, and to induce vomiting.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mayapple</strong>&lt;br&gt;Podophyllum peltatum</td>
<td>Food web role: Nectar and pollen source for long-tongued bees. Box turtles and mammals such as opossums and raccoons eat its fruit and disperse its seeds. <strong>Flowers in:</strong> Early spring. <strong>Habitat:</strong> Moist woods. <strong>Did you know?</strong> Its leaves, roots and seeds are poisonous if ingested, but its ripe, golden fruits can be used in jellies.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Violet</strong>&lt;br&gt;Viola sororia</td>
<td><strong>Food web role:</strong> Pollen source for bees. Butterfly caterpillars, mammals, and wild turkeys eat its leaves, roots or seeds. <strong>Flowers in:</strong> Mid-spring to early summer. <strong>Habitat:</strong> Rich moist woods. <strong>Did you know?</strong> It is the state flower of Wisconsin, Illinois, Rhode Island and New Jersey.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>White snakeroot</strong>&lt;br&gt;Ageratina altissima</td>
<td><strong>Food web role:</strong> Food source for honeybees and butterflies. <strong>Flowers in:</strong> Mid-summer to fall <strong>Habitat:</strong> Woods, meadows and roadsides. <strong>Did you know?</strong> It is very poisonous to cattle and humans, even if we consume poisoned cattle meat or milk. Abraham Lincoln’s mother is believed to have died from this type of poisoning.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Jack in the Pulpit</strong>&lt;br&gt;Arisaema triphyllum</td>
<td><strong>Food web role:</strong> Woodland birds like the wood thrush and wild turkey eat its berries. <strong>Flowers in:</strong> Early summer. <strong>Habitat:</strong> Moist woods and swamps. <strong>Did you know?</strong> Its flowers are pollinated by fungus gnats and the larvae of parasitic thrips, which usually die because they get trapped in the tubular flower.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Woodland trees provide many services to humans and the environment. They store carbon in their trunks and improve air and water quality. Their roots retain soil, which guards against erosion. They provide high quantities of organic matter in the form of dead leaves and wood, which helps build the soils where they and many other plants, microorganisms, and animals live. There are many kinds of trees that provide food and shelter for various animals. Some trees depend on animals like bees for the pollination of their flowers and on birds and mammals for the dispersal of their seeds.

Red maple  
_Acer rubrum_  
**Food web role:** A host for many insects. Songbirds often hunt for insects on maples. Birds and squirrels eat its fruit and deer eat its twigs.  
**Habitat:** Upland woods, sandy woodlands and forested bogs.  
**Did you know?** It is one of the more widely planted American trees. Large trees were cut for masts for the British Royal Navy.

White oak  
_Quercus alba_  
**Food web role:** Host for many species of moths and other insects. Birds such as turkey and woodpeckers, and mammals such as squirrels, deer and mice eat its acorns.  
**Habitat:** Dry to moist woods.  
**Fun fact:** Native Americans ate its acorns. To remove bitter tannins, they boiled, leached, soaked, or buried the acorns over the winter.

Black gum  
_Nyssa sylvatica_  
**Food web role:** Birds and mammals eat its fruit, deer eat its sprouts. Flower nectar is used by bees for honey.  
**Habitat:** Moist, wooded areas like swamps and bogs.  
**Did you know?** Its trunk can develop cavities that provide dens for various small mammals and nesting habitat for some birds.

White pine  
_Pinus strobus_  
**Food web role:** Squirrels and songbirds eat its seeds. Deer can eat young saplings.  
**Habitat:** Upland woods, sandy woodlands and forested bogs.  
**Did you know?** It is one of the more widely planted American trees. Large trees were cut for masts for the British Royal Navy.

Flowering dogwood  
_Cornus florida_  
**Food web role:** Nectar source for bees and flies. Many birds, squirrels, chipmunks and mice eat its fruit. Deer and rabbits eat its bark, twigs and buds that flower in mid-spring.  
**Habitat:** Open woodlands, edges and fields.  
**Did you know?** It has been used in the production of inks and scarlet dyes.

Eastern redbud  
_Cercis canadensis_  
**Food web role:** Birds such as quail, cardinal and goldfinch eat its seeds. Deer browse its foliage in the summer.  
**Habitat:** Rich woods, river valleys, savannas, and thickets.  
**Did you know?** Its stunning purple flowers open in mid-spring. They may be eaten in salads or fried (a common practice in Mexico).
Section 1: Living Habitats

### Woodland Trees

#### Food web role:
- Caterpillars, weevils, and other insects feed on its leaves, fruit, and bark. Nuts eaten by fox, squirrels, mice, and other mammals and also by many birds.

#### Habitat:
- Moist woods.

#### Did you know?
- Its nuts are sweet and edible; they can be used as a substitute for pecans in baking.

---

#### Wild black cherry
*Prunus serotina*

**Food web role:** Flowers give nectar and pollen to bees, flies, and ants. Insects feed on the leaves and the fruit. Birds and mammals eat the fruit and deer browse on the twigs.

**Habitat:** Deciduous woodlands, open woods, and vacant lots.

**Did you know?** Its fruit is used to flavor soda, rum, brandy, and ice cream.

---

#### American beech
*Fagus grandifolia*

**Food web role:** A host plant of moth caterpillars and larvae of wood-boring beetles. Birds and mammals feed on its protein- and fat-rich nuts.

**Habitat:** Moist woods and shady riverbanks.

**Did you know?** Its wood is good to use for furniture because of its high density and fine, even grain.

---

#### Shagbark hickory
*Carya ovata*

**Food web role:** Caterpillars, weevils, and other insects feed on its leaves, fruit, and bark. Nuts eaten by fox, squirrels, mice, and other mammals and also by many birds.

**Habitat:** Moist woods.

**Did you know?** Its nuts are sweet and edible; they can be used as a substitute for pecans in baking.

---

#### Witch hazel
*Hamamelis vernalis*

**Food web role:** Its nectar and pollen feeds insects. Turkeys and rodents eat its seeds. Deer browse on its foliage.

**Habitat:** Moist and sandy woodlands, and open woods.

**Did You Know?** The seed capsules resemble miniature cannons that burst open, discharging seeds up to several yards from the parent plant.

---

#### Red oak
*Quercus rubra*

**Food web role:** Insects feed on leaves, wood, or acorns. Birds and mammals eat its acorns. Saplings are browsed by deer and rabbit.

**Habitat:** Dry to moist woods.

**Did you know?** Duke Farms is home to the fourth largest Red Oak in New Jersey.

---

© Ashley Bradford
Natural wetlands are important because they support high biodiversity, conserve soil, reduce flooding and clean our water. Wetland plants provide food and shelter for a diverse array of wetland wildlife. The plants’ deep roots stabilize soil and soak up water from waterways and runoff from urban areas, which helps control flooding. Wetlands naturally filter water before it re-enters the water supply. As part of an environmental stewardship initiative, Duke Farms is working in partnership with the Natural Resources Conservation Service, a division of the U.S. Department of Agriculture, to restore and preserve more than 500 acres of wetlands along the Raritan River and other areas of the Duke Farms property. Duke Farms has also established a constructed wastewater wetland, which mimics the natural wetlands’ process of cleaning water to treat wastewater from the Farm Barn Orientation Center. The water is then used for irrigation and other non-potable needs on the property.
Planting the shorelines of natural and artificial bodies of water with native wildflowers, grasses and shrubs has many ecological advantages. These native species prevent soil and nutrient erosion and filter out pollutants such as sediments, excessive nutrients and pesticides, preventing these harmful materials from entering our water supply. These plants also provide food and shelter for aquatic and riparian wildlife. In addition to protecting a variety of animal species, the cover offered by these plantings also keeps water temperatures cooler, inhibiting summer algal blooms.

**Rose swamp mallow**  
*Hibiscus moscheutos*  
**Food web role:** Pollinated by the rose mallow bee. Attracts the Ruby-throated hummingbird. Eaten by insects such as beetles, aphids and butterflies.  
**Habitat:** Marshes, moist meadows, shores and ditches.  
**Did you know?** If its seeds fall into running water, they can be dispersed up to tens of miles.  

**Tussock sedge**  
*Carex stricta*  
**Food web role:** Various insects feed on sedges. Some gamebirds and songbirds eat the seeds. It provides good habitat for many wetland animals, like frogs, rodents and some birds.  
**Habitat:** Meadows, bogs, marshes and wet woodlands.  
**Did you know?** Its leaves have been used for rug making.  

**Wool grass**  
*Scirpus cyperinus*  
**Food web role:** Muskrats, geese and many species of ducks eat the seeds or the leaves and roots. It also provides habitat for wetland birds.  
**Habitat:** Marshes, moist meadows, shores and ditches.  
**Fun fact:** The fruiting tops of the plant were used as a resilient material for stuffing and making pillows.

**Cardinal flower**  
*Lobelia cardinalis*  
**Food web role:** The nectar of its flowers attracts the Ruby-throated hummingbird and several butterflies and bees.  
**Flowers in:** Summer.  
**Habitat:** Wet meadows, swamps and riverbanks.  
**Did you know?** Native Americans used it for many purposes, from treating syphilis and fevers to making love potions.  

**Soft rush**  
*Juncus effusus*  
**Food web role:** Some insects feed on its stems. Wetland birds and mammals feed on the seeds. It provides habitat for birds, amphibians and spawning areas for fish.  
**Habitat:** Swamps, moist fields, floodplains, shores and ditches.  
**Did you know?** Its stems have been traditionally used for making floor mats and chair seats.
Some wetlands are occupied by thickets of shrubs and small trees. These trees and shrubs are adapted to soils with low amounts of oxygen and to frequent floods in the spring. Some species, like buttonbush and the smooth alder, need to live in such wet places but others, like sweet pepper bush and elderberry can occur both in wetlands and uplands. Shrub wetlands may seem inhospitable to people, but their dense thickets provide habitat for many wildlife species. They are important for fish and amphibian breeding and are a source of food and refuge for waterfowl and migrant birds. Maintaining the hydrology is key to maintaining the wetland. Changes in the quality or quantity of water reaching the wetland would alter the vegetation and its habitat values.

### Sweet pepper bush
*Clethra alnifolia*

**Food web role:** Hummingbirds and butterflies drink its nectar. Deer eat it only when other forage vegetation is limited. Birds eat the fruit and aid in seed dispersal.

**Habitat:** Wet woods, swamps and bogs.

**Did you know?** Its flowers last up to 6 weeks or more in summer while other flowering shrubs are not blooming due to the heat.

### Buttonbush
*Cephalanthus occidentalis*

**Food web role:** Nectar and pollen source for insects such as bees, butterflies, beetles, and hummingbirds. Waterfowl eat its seeds. Deer eat its foliage.

**Flowers in:** Summer.

**Habitat:** Floodplain forests, wet thickets, streams and swamps.

**Did you know?** Though toxic, it was traditionally used for medicinal purposes.

### Elderberry
*Sambucus nigra*

**Food web role:** Songbirds, squirrels and white-footed mice eat its fruit in late summer and early fall. Deer and rabbits eat its leaves and stems.

**Flowers in:** June.

**Habitat:** Moist meadows, woods, fields and swamps.

**Did you know?** Its fruit is frequently gathered for wine, jellies, pies, and sauces.

### Smooth alder
*Alnus serrulata*

**Food web role:** Many birds, like the eastern goldfinch, woodcock and ruffed grouse eat the seeds. Mammals like the beaver, deer and mice also feed on it, and the wood turtles eat the fallen leaves.

**Habitat:** Wet woods and swamps.

**Did you know?** It produces nitrogen for itself thanks to nitrogen-fixing bacteria located in root nodules.

### Winterberry holly
*Ilex verticillata*

**Food web role:** Bees and flies visit the flowers. Its red berries are a particularly important emergency food source for birds in winter.

**Flowers in:** Late spring.

**Habitat:** Swamps, bogs, wet woods and moist shores.

**Did you know?** Male and female flowers grow in separate plants. Only female plants produce the red berries.

### Wetland Zones
Wetlands have zones of vegetation determined by soil moisture. A typical lake or freshwater marsh has three zones—aquatic, edge and upland. Wetland shrubs typically grow in upland soil, which is damp but not continually saturated.
The natural water supply, vital to our lives and industries, starts with small depressions that collect rainwater and melting snow. These merge and grow to form creeks, then streams and local rivers. The waterways and their vegetation help remove pollutants and excess nutrients from the water. The network of flows also supplies water infiltration into the soil, supporting our habitats and all living things. All precipitation around our homes and communities participates in this vast system, and our built structures can be designed to support the water cycle, not weaken it. Many of the ponds and drainages here at Duke Farms are constructed and are being modified to better manage water resources for our common benefit. Streamside habitats and simple collection or storage systems around homes and workplaces can all improve our water supply for a sustainable future.
Duke Brook

Duke Brook is a minor tributary of the Raritan River. Flowing along Duke Parkway West, it offers habitat for resident and migratory wildlife. Some of the migratory birds you will see here include the great egret, the green-winged teals, and the greater yellowlegs. A great blue heron is often seen feeding near the falls just at the entrance to the core of the property near South Gate.

Raritan River

Duke Farms’ location near the Raritan river was one of the reasons that J.B. Duke purchased this property. The river forms at the confluence of the North and South Branches, just west of Somerville and flows through central New Jersey and into the Raritan Bay. It has served as an important water transportation route since the days of the Lenape Native Americans and today is used for recreation and as a source of drinking water (after passing through two purification plants).
Section 1: Living Habitats

Spring Lake

Warmer temperatures bring new life to lake habitats in spring. Nutrients are released when water temperatures moderate and allow layers of water to mix. This provides a nutrient-rich environment for the algae that fuel the lake food web. Wetland plants along the lake edge begin to flower and provide food and shelter for animals.

Summer Lake

Deep, unpolluted lakes are clear in the summer when nutrients are trapped in the cool, dense water on the lake bottom and are unavailable for algal growth. At Duke Farms, the shallow lakes contain high levels of nutrients, so algae blooms are common on lakes in the summer.

Fall Lake

As temperatures fall, the top layer of water cools, sinking and mixing with the cooler water below. This “fall overturn” allows nutrients that have been trapped in lower depths to mix into all layers of water.

Winter Lake

Temperatures drop to below freezing, causing the water to stratify; ice often forms on the top layer. Apart from evergreens and winter berries, food is scarce for herbivores. Many animals hibernate or become less active to conserve energy when food is scarce and temperatures are low.
The diverse variety of plant life in different habitats supports an equally vast array of wildlife species. From ants that aerate soil to the predatory bald eagle, Duke Farms is teeming with life. Hundreds of species live under the shady canopy of the woodlands, nest in and forage on meadow grasses, and rely on the lakes as a fresh water supply. Native wildlife contribute to habitat health by controlling pest populations, pollinating native plant species and playing a role in a complex food web. They are adapted to consume native plant species, so the health of native plants is vital to the survival of native animals. Non-native animals are also a threat because they compete with native animals for resources or use native animals as prey. Duke Farms staff and volunteers are undertaking measures to actively control invasive non-migrating Canada geese and monitor the health of native species. Continued monitoring and maintenance will promote healthy habitats that can support a growing population of beneficial native wildlife.

"Uniformity is not nature’s way; diversity is nature’s way.”
~ Dr. Vandana Shiva
Meadows are very important bird habitats, providing critical resources all year long. During the spring and summer, some bird species make their nests at the base of thick clumps of grasses and wildflowers, providing their nestlings shelter from the environment and protection from predators. Many birds that nest in the wooded areas come to meadows to forage on the abundant insects here. In addition to providing nourishment for adults, insect protein is critical for the proper growth and development of young birds. During fall and winter, birds feast on the vast amount of seeds produced by wildflowers and perennial grasses, which give birds enough energy to survive the harsh winter months. Here are some of the many bird species you will see in the meadows.

**Eastern bluebird**
*Sialis sialis*

**Food web role:** Hunts ground insects and spiders. Feeds on fleshy fruits in winter. Eaten by kestrels, raccoons and cats.

**Habitat:** Areas with little or no understory such as pastures, orchards and meadows.

**Did you know?** When a predator approaches, females let out a warning cry to attract a male for help.

**American goldfinch**
*Spinus tristis*

**Food web role:** Eats almost exclusively seeds, preferably from grasses, sunflowers, asters, and thistles. Eaten by raptors, snakes, and domestic cats.

**Habitat:** Perennial grass and wildflower meadows. Nests in shrubs and small trees in open habitats.

**Did you know?** It is the New Jersey state bird!

**Barn swallow**
*Hirundo rustica*

**Food web role:** Primarily eats flying insects. Eaten by raptors, house cats, raccoons and snakes.

**Habitat:** Rural to urban land. Nests in human-made structures like houses, barns, and docks close to open areas and water.

**Did you know?** Having barn swallows nest on your property is considered good luck.

**Song sparrow**
*Melospiza melodia*

**Food web role:** Eats insects during the breeding season and berries in the non-breeding season. Eggs and young are eaten by crows, snakes and mammals. Adults are eaten by foxes and raptors.

**Habitat:** Woodland edges, weedy fields and brushy thickets, close to fresh water.

**Did you know?** Males can sing more than 13 different songs.

**Eastern meadowlark**
*Sturnella magna*

**Food web role:** Eats large insects like crickets, grasshoppers, and caterpillars. Eaten by hawks, foxes, and cats.

**Habitat:** Meadows, grassy fields and pastures. Often seen singing on fence posts. Nests in grasses low to the ground.

**Did you know?** Males typically have two mates at the same time and do not spend much time caring for nestlings.

**Grassland Habitats**

Many meadow birds need large open spaces to thrive, but grassland habitats are shrinking across the country as a result of urban land development and agricultural practices. Continued preservation of open grasslands, along with sound land management practices, are necessary for the survival of these species.
A rich bird biodiversity depends on the vast complexity of forest structure. Tree species have varying heights, leaf characteristics, and seed production, and each bird species finds its own niche within a wide array of microhabitats, or smaller habitats, within large habitats. Some birds forage among tree leaves, while other scour the bark of trunks and limbs. Some species forage only in the tree tops, while others only at lower heights. Different bird species find suitable nesting sites from the ground up to the tops of trees, either in cavities within the tree or nestled at the base of two branches. Here are a few of the birds you will see in the woodlands at Duke Farms.

<table>
<thead>
<tr>
<th>Habitat Type</th>
<th>Species</th>
<th>Food web role</th>
<th>Habitat</th>
<th>Did you know?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woodland</td>
<td>Red-bellied woodpecker</td>
<td>Eats acorns, nuts, and seeds and a few insects and salamanders.</td>
<td>Mixed deciduous forests interspersed with clearings, foraging on the ground and roosting in trees.</td>
<td>It can run up to 29 MPH and fly up to 55 MPH.</td>
</tr>
<tr>
<td></td>
<td>Melanerpes carolinus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wild turkey</td>
<td>Eats acorns, nuts, and seeds and a few insects and salamanders.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Meleagris gallopavo</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>White-breasted nuthatch</td>
<td>Eats insects, acorns, nuts, and seeds. Eaten by small hawks and owls.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sitta carolinensis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black-capped chickadee</td>
<td>Poecile atricapillus</td>
<td>Eats caterpillars, spiders, other insects, berries, and seeds. Regularly eats seeds and fruits.</td>
<td>Lives in open woods and woodland edges. Prefers to nest in birches or other “softwood” trees.</td>
<td>It calls out its own name, “chick-a-dee-dee-dee.”</td>
</tr>
</tbody>
</table>

Did you know? This bird’s scientific name describes where it lives: “dendron” = tree, “aicos” = home, “pinus” = pine tree.
Water is an attractive and useful resource for many species of birds. Whether a species is sifting through the sediments for microorganisms, creeping along the shoreline stalking an unsuspecting frog or insect, or diving into the water for a fish from a high perch, aquatic habitats offer a wide array of prey items. The thick vegetation often found along water edges can provide perching or nesting sites and camouflage against predators. Here are just some of the many birds that use the lakes at Duke Farms.

**Can you spot the great blue heron in the falls at Duke Brook in the photo below?**

---

**Wood duck**

*Aix sponsa*

**Food web role:** Eats fish, insects, small mammals, amphibians, and crustaceans. Adults eaten by owls, raccoons and foxes. Eggs and young eaten by raccoons, snakes and woodpeckers.

**Habitat:** Streams and riverbanks, ponds, lakes, and marshes.

**Did you know?** Day-old ducklings must jump out of their nest from a height of up to 22 feet to get to the aquatic feeding ground.

**Belted kingfisher**

*Ceryle alcyon*

**Food web role:** Eats mostly fish, and some crustaceans and amphibians. Adults and young eaten by raptors. Eggs eaten by mammals and snakes.

**Habitat:** Any calm and clear surface water, both fresh and brackish.

**Did you know?** It makes its nest in burrows dug into the sides of steep banks.

**Great blue heron**

*Ardea herodias*

**Food web role:** Eats fish, insects, small mammals, and crustaceans. Adults have no commen predators. Eggs and young eaten by raccoons, snakes and crows.

**Habitat:** Streams and riverbanks, ponds, lakes, and marshes.

**Did you know?** Special vertebrae allow its neck to form an “S” shape, which aids in quick strikes on prey.

**Greater yellowlegs**

*Tringa melanoleuca*

**Food web role:** Eats fish, insects, and molluscs. Eaten by raptors.

**Habitat:** Found in lakes, ponds, coastal marshes and swamps. Only here as a winter resident or during migration.

**Did you know?** It is a very noisy wading bird, loudly calling “whew-whew-whew.”

**Canada goose**

*Branta canadensis*

**Food web role:** Eats grasses, sedges, some seeds and berries. Adults eaten by bald eagles and coyotes. Eggs and young eaten by many animals.

**Habitat:** Open landscapes such as lawns, lakes and ponds. Can live in urban conditions.

**Did you know?** Non-migratory Canada geese are considered a pest species in many locations, including Duke Farms.
Raptors are carnivorous birds with keen eyesight, sharp talons for seizing live prey, and hooked beaks for tearing flesh. Raptor families include hawks, eagles, falcons, owls, and vultures (who usually feed on animal carcasses). This guild provides several ecosystem services, including reducing rodent populations and regulating waste, while also serving as cultural icons. North American raptors suffered major declines throughout history as a result of human persecution, trapping, pesticides and heavy metals. With the passing of stricter conservation and environmental regulations, raptor populations have rebounded. However, many species are still vulnerable to habitat loss, human disturbance, and collisions with buildings and motorized vehicles.

### Red-tailed hawk
*Buteo jamaicensis*

**Food web role:** Eats rodents, rabbits and birds such as pheasant and waterfowl. Has few natural predators; humans cause most deaths.

**Habitat:** Open areas with patches of trees or similar structures like telephone poles, which it uses for nesting.

**Did you know?** When teaching hunting tactics, parents will drop live prey for their young to chase.

### American kestrel
*Falco sparverius*

**Food web role:** Eats large insects and small vertebrates. Eaten by larger birds of prey like red-tailed hawks and peregrine falcons.

**Habitat:** Found in woodland borders, grasslands, open fields, marshes, and suburban areas. Needs perches for hunting.

**Did you know?** At ten inches in length, it is the smallest falcon in North America.

### Turkey vulture
*Cathartes aura*

**Food web role:** Feeds on animal carcasses almost exclusively. It can smell carrion from miles away. Sometimes eaten by foxes, raccoons, and dogs.

**Habitat:** Open fields, woodlands, and farmlands.

**Did you know?** It can soar for 6 hours without flapping its wings, and is often seen soaring with its wings in a “V” shape.

### Bald eagle
*Haliaeetus leucocephalus*

**Food web role:** Prefers fish, but will prey on waterfowl, small mammals, and carrion. Eggs and nestlings eaten by crows, ravens, and raccoons.

**Habitat:** Forested areas adjacent to bodies of water. Nests in tall, preferably dead, trees.

**Did you know?** They do not get their characteristic white head feathers until they are 5 years old.

### Eastern screech owl
*Otus asio*

**Food web role:** Eats songbirds and rodents. Occasionally eaten by larger owls and hawks, but most deaths are caused by humans.

**Habitat:** Tree-dominated habitats with sparse shrubbery in rural and urban areas. Nests in tree hollows. Photo on right is a nest at Duke Farms.

**Did you know?** Swallows prey whole and later regurgitates bones, fur, and feathers as a dry pellet.
Adult butterflies, skippers and moths are important pollinators in natural and agricultural settings because they move pollen from plant to plant as they feed. Caterpillars eat leaves and buds from specific host plants, while most adults feed on sweet nectar from a variety of plants. The eggs, caterpillars and adults of these species serve as important food resources for birds, bats, lizards, snakes, toads, ants, spiders, beetles, parasitic flies, dragonflies, and even humans. Butterflies, skippers and moths are from the same insect group but look slightly different: Butterflies have knobs at the end of their antennae; skipper knobs end in hooks; moth antennae are feathered for males and simple lines for females. Here are some common species found at Duke Farms.

**Monarch**
* Danaus plexippus  
**Food web role:** Caterpillars eat milkweeds. Adults take nectar from milkweeds, goldenrods and asters. Poisonous to most animals, it is eaten by specialist animals that can process toxins.  
**Habitat:** Meadows and wetland edges with milkweeds.  
**Did you know?** Toxins from milkweed plants they ingest as caterpillars make them poisonous to predators as adults.

**Red admiral**
* Vanessa atalanta  
**Food web role:** Caterpillars eat nettles and other members of the nettles family. Adults eat salt from wet soil, sap, rotting fruit, and excrement. They only occasionally eat nectar.  
**Habitat:** Open areas and the edges of deciduous forests.  
**Did you know?** Although migratory, it will sometimes spend winter in northern areas if the weather is mild enough.

**Pearl crescent**
* Phyciodes tharos  
**Food web role:** The caterpillar eats aster leaves. The adult takes nectar from asters, milkweed and dogbane. Eaten by spiders and robberflies.  
**Habitat:** Fields, road edges, vacant lots, and open pine woods.  
**Did you know?** It darts out from its perch to investigate visitors and chase away competing males.

**Peck’s skipper**
* Polites peckius  
**Food web role:** Caterpillars eat grasses. Adults take nectar from milkweeds, New York ironweed, thistles and dogbane. Eaten by wasps, flies, lizards, frogs, and birds.  
**Habitat:** Grassy areas, meadows, woodland openings, and lawns.  
**Did you know?** Its small size allows it to climb into irises to get to the nectar better than larger butterflies.

**Eastern tiger swallowtail**
* Papilio glaucus  
**Food web role:** Eats cherry, ash, lilac, and tulip tree leaves when young and nectar from lilacs and cherries when mature. Eaten by birds, squirrels, mantids, opossums, raccoons, and some hornets.  
**Habitat:** Forest edges, glades, river valleys, suburban areas, gardens and parks.  
**Did You Know?** It mimics the Pipevine Swallowtail, which is distasteful to predators.

**Butterflies**

Monarch  
* Danaus plexippus  
**Food web role:** Caterpillars eat milkweeds. Adults take nectar from milkweeds, goldenrods and asters. Poisonous to most animals, it is eaten by specialist animals that can process toxins.  
**Habitat:** Meadows and wetland edges with milkweeds.  
**Did you know?** Toxins from milkweed plants they ingest as caterpillars make them poisonous to predators as adults.

Red admiral  
* Vanessa atalanta  
**Food web role:** Caterpillars eat nettles and other members of the nettles family. Adults eat salt from wet soil, sap, rotting fruit, and excrement. They only occasionally eat nectar.  
**Habitat:** Open areas and the edges of deciduous forests.  
**Did you know?** Although migratory, it will sometimes spend winter in northern areas if the weather is mild enough.

Pearl crescent  
* Phyciodes tharos  
**Food web role:** The caterpillar eats aster leaves. The adult takes nectar from asters, milkweed and dogbane. Eaten by spiders and robberflies.  
**Habitat:** Fields, road edges, vacant lots, and open pine woods.  
**Did you know?** It darts out from its perch to investigate visitors and chase away competing males.

Peck’s skipper  
* Polites peckius  
**Food web role:** Caterpillars eat grasses. Adults take nectar from milkweeds, New York ironweed, thistles and dogbane. Eaten by wasps, flies, lizards, frogs, and birds.  
**Habitat:** Grassy areas, meadows, woodland openings, and lawns.  
**Did you know?** Its small size allows it to climb into irises to get to the nectar better than larger butterflies.

Eastern tiger swallowtail  
* Papilio glaucus  
**Food web role:** Eats cherry, ash, lilac, and tulip tree leaves when young and nectar from lilacs and cherries when mature. Eaten by birds, squirrels, mantids, opossums, raccoons, and some hornets.  
**Habitat:** Forest edges, glades, river valleys, suburban areas, gardens and parks.  
**Did You Know?** It mimics the Pipevine Swallowtail, which is distasteful to predators.
Bees are vital pollinators for our plants. As they fly from flower to flower gathering nectar and pollen, they transfer pollen that gets stuck to their bodies to other plants. Around 94 percent of bees are solitary, nesting in the ground or in various natural cavities. Solitary females construct a nest and bring the nectar and pollen for her offspring. The other 6 percent of bees are social, and all bees in those colonies communicate and cooperate. The colony has a queen, whose sole job is to reproduce, and workers who forage, guard, and care for the offspring. Colonies of social bees can increase to hundreds of individuals. North America has more than 3300 species of bees which can be found almost everywhere—below are five species commonly seen at Duke Farms.

### Common eastern bumblebee
*Bombus impatiens*

**Food web role:** Forages on a variety of flowers. An important pollinator of cranberries, tomatoes and blueberries.

**Habitat:** A wide variety of habitats. Nests below ground or under logs.

**Did you know?** It is often thought that hummingbirds have the highest metabolic rate of all animals, but the metabolic rate of a bumblebee is 75 percent higher than a hummingbird’s!

### European honeybee
*Apis mellifera*

**Food web role:** Though not native to this country, it is used to pollinate many of our crops, including cucumber, squash, strawberry and watermelon.

**Habitat:** Managed hive boxes. Occasionally found in dead trees.

**Did you know?** Although known for producing honey and beeswax, its pollination services creating fruits and vegetables are actually 15–20 times as valuable.

### Carpenter bee
*Xylocopa virginica*

**Food web role:** Eats a variety of flowers. Pollinates blueberries. Bites the bottom flowers to rob them of nectar without pollinating.

**Habitat:** Many habitats, even cities. Nests in small circular holes in wood.

**Did you know?** It earns its name by making nests in wood. Despite disfiguring wood structures, some homeowners value them as pollinators and let them stay.

### Plasterer bee
*Colletes simulans*

**Food web role:** Forages on a broad variety of flowers. An important pollinator of apple trees.

**Habitat:** Its nests can be found in grassy areas. Look for holes in the ground since it nests by burrowing into the soil.

**Did you know?** Although solitary, it tends to nest in large villages of individual nests.

### Metallic green sweat bee
*Agapostemon virescens*

**Food web role:** Pollinates many species of meadow wildflowers.

**Habitat:** Open fields, roadsides and gardens with abundant flowers. Solitary, it nests in holes in the ground.

**Did you know?** Bees in this family are called sweat bees because they are attracted to human sweat as a source of salt.

---

**Food Pollinators**

Did you know that one third of agricultural crops are naturally pollinated by pollinators such as bees? Establishing native plants near agricultural crops attracts and benefits bees that pollinate crop plants.
Dragonflies are one of the most visible indicators of wetland diversity and health, and their population changes allow monitoring of environmental conditions. Dragonflies and damselflies are hunters, feeding on mosquitoes, midges, and other small insects, and help keep their numbers under control. The larvae of both dragonflies and damselflies are aquatic and are called nymphs. Dragonfly nymphs are usually the top carnivores in freshwater habitats without fish. Predators of adult dragonflies include frogs, flycatchers, falcons, spiders, and robber flies. Below are five different species commonly seen near the lakes and along the streams at Duke Farms.

**Blue dasher**
*Pachydiplax longipennis*

**Food web role:** Eats many species of insects, including mosquitoes.

**Habitat:** Any habitat that has water. Prefers smaller ponds.

**Did you know?** This is one of the most common species of dragonfly at Duke Farms. It often orients itself in different positions relative to the sun to regulate its body temperature.

**Widow skimmer**
*Libellula luctuosa*

**Food Web Role:** Adults eat a wide variety of insects. Very agile, it catches its prey in flight.

**Habitat:** Ponds and lakes, and occasionally brackish marshes.

**Did you know?** This species’ name means sorrowful, perhaps because the wings seem to be draped in mourning colors.

**Eastern forktail**
*Ischnura verticalis*

**Food web role:** Nymph eaten by large dragonfly nymphs and fish.

**Habitat:** Ponds or slow moving streams. Commonly found in vegetation along pond edges, marshes, lakes and streams.

**Did you know?** The nymph visually detects fish predators and reduces activity levels in their presence.

**Eastern pondhawk**
*Erythemis simplicicollis*

**Food web role:** Can eat prey as large as itself. Hunts from the ground or low perches.

**Habitat:** Primarily quiet ponds, usually with algae and other floating plants. The adult often perches on the ground.

**Did you know?** It is one of the most ferocious dragonflies, attacking even each other.

---

**Is it a dragonfly or a damselfly?**

There are several ways to tell a dragonfly from a damselfly. While at rest, dragonflies hold their wings out to the sides. They have huge eyes that come into contact on top of their heads, and generally have large robust bodies. Damselflies are smaller and more slender, with separated eyes, and wings usually held together over the back.
More Insects (and a Spider)

Insects are among the most diverse and abundant groups of animals in the world with over one million described species—more than half of all known living organisms. Insects can be found in every habitat on earth, including a few species in the oceans. They provide many ecosystem services to humans including pollination, pest control and enhancement of soil health in addition to their production of silk and honey. Here are some fascinating species of insects and spiders you can find at Duke Farms in addition to the lovely bees, butterflies, dragonflies and damselflies!

<table>
<thead>
<tr>
<th>Habitat Type</th>
<th>Species</th>
<th>Food web role</th>
<th>Did you know?</th>
</tr>
</thead>
<tbody>
<tr>
<td>More Insects (and a Spider)</td>
<td>Common true katydid</td>
<td>Pterophylla camellifolia</td>
<td><strong>Food web role:</strong> Eats the leaves of most deciduous trees. Predators include bats, birds, spiders, frogs and snakes. <strong>Habitat:</strong> The canopies of deciduous forests. Nocturnal, it is often heard but seldom seen. Its “kat-y-did, kat-y-didn’t” song is a familiar sound on summer nights. <strong>Did you know?</strong> It is able to hide from enemies by mimicking leaves.</td>
</tr>
<tr>
<td></td>
<td>American hoverfly</td>
<td>Eupeodes americanus</td>
<td><strong>Food web role:</strong> The adult feeds on nectar. The larva feeds on aphids, which are harmful to many of our crop species. <strong>Habitat:</strong> Open meadows. It is found throughout the United States. <strong>Did you know?</strong> It mimics bees to scare its enemies but is not able to sting.</td>
</tr>
<tr>
<td></td>
<td>Eyed click beetle</td>
<td>Alaus oculatus</td>
<td><strong>Food web role:</strong> The larva eats other insects that can harm crops. The adult drinks nectar and plant juices. <strong>Habitat:</strong> Under logs, in leaf litter and in other damp, dark places. <strong>Did you know?</strong> Its false eyespots protect it from enemies that may be startled by the eyespots. Its “click” is the sound produced when the beetle is on its back and bends its head and body backwards then snaps forward.</td>
</tr>
<tr>
<td></td>
<td>Whitebanded crab spider</td>
<td>Misumenoides formosipes</td>
<td><strong>Food web role:</strong> An ambush predator, it waits on flowers and attacks almost any prey that comes close—even some that is larger than the spider itself. <strong>Habitat:</strong> Hunts in and around flowers so it is often found in meadows, fields, and gardens. <strong>Did you know?</strong> Female crab spiders are larger than the males and come in a variety of colors while males are mostly white or yellow.</td>
</tr>
<tr>
<td></td>
<td>Clearwing hawkmoth</td>
<td>Hemaris thysbe</td>
<td><strong>Food web role:</strong> Hovers like hummingbird to get nectar from flowers such as bergamot, thistles, milkweeds, and honeysuckles. Eaten by birds and insects such as praying mantises. <strong>Habitat:</strong> Open meadows, fields and gardens with many flowers. <strong>Did you know?</strong> It is one of the few moth species than can be observed during the day.</td>
</tr>
</tbody>
</table>

**Are spiders insects?**

Spiders are not actually insects. Insects have an exoskeleton, a three-part body (head, thorax, and abdomen), three pairs of jointed legs, compound eyes, and two antennae. Spiders have eight legs and softer, differently-shaped bodies. Spiders belong to the Class Arachnida.
Amphibians must live in moist environments because they absorb water and oxygen through their skin. Since chemicals can also be absorbed, amphibians are vulnerable to environmental pollutants. Because of this, amphibians are good indicators of water health. They also provide insect population control. Tadpoles are mostly herbivorous, while juvenile salamanders and adult frogs and salamanders are carnivorous. Habitat loss, pollution and non-native species threaten amphibian populations. The species found at Duke Farms are those most tolerant of human-altered environments.

**North American bull frog**  
*Rana catesbeiana*  
**Food web role:** Eats insects, earthworms, crustaceans, snakes, frogs, even birds and small mammals. Eaten by herons, turtles, water snakes, raccoons and humans.  
**Habitat:** Larger bodies of water such as lakes, ponds, and sluggish portions of streams.  
**Did you know?** The noxious taste of eggs and tadpoles discourages predators from eating them.

**American toad**  
*Bufo americanus*  
**Food web role:** Eats insects, especially beetles, ants, moths, snails and earthworms. Eaten by snakes, ducks, hawks and raccoons.  
**Habitat:** Anywhere from backyards to forests. Prefers shallow waters for breeding.  
**Did you know?** It inflates its body with air to make itself look bigger and prevent predators from swallowing it.

**Green frog**  
*Rana clamitans*  
**Food web role:** Eats beetles and other insects, snails, crustaceans, small snakes and other frogs. Eaten by larger frogs, snakes, herons, raccoons, and humans.  
**Habitat:** Shallow fresh water in brooks, ditches, edges of lakes and ponds.  
**Did you know?** The round tympanum behind the eye detects sound vibrations. It is larger in males than in females.

**Spring peeper**  
*Pseudacris crucifer*  
**Food web role:** Eats small invertebrates, especially spiders, and ants, beetles, flies and caterpillars. Eaten by predatory aquatic insects, salamanders, snakes and birds.  
**Habitat:** Lives in woodlands near small temporary ponds or swamps. Prefers ponds with no fish.  
**Did you know?** The cross on its back inspired its scientific name.

**Red-backed salamander**  
*Plethodon cinereus*  
**Food web role:** Eats invertebrates such as insects, spiders, snails, centipedes, and earthworms. Eaten by snakes, shrews, large frogs, raccoons and birds.  
**Habitat:** Dead wood, leaves, bark or stones in woodlands.  
**Did you know?** Eggs develop into small salamanders without an aquatic phase, unlike most other salamanders. Mothers guard the eggs until they hatch.
Reptiles play an important intermediate role in the food chain, feeding on insects, fish, small rodents, eggs and sometimes vegetation, and being eaten by larger vertebrate predators. Some species link the food webs of aquatic and terrestrial environments. Reptiles that eat insects can be indicators of pesticide levels. Habitat loss, illegal collection, and car collisions threaten many reptile species. Most reptiles do not produce their own body heat, but rely on external sources for warmth, so they are often seen at Duke Farms and elsewhere basking in the sunshine.

**Eastern box turtle**
*Terrapene carolina*

**Food web role:** Eats insects, slugs, fruits, fungi, vegetation, and occasionally carrion. Eaten by skunks, raccoons, minks, coyotes, dogs, rats, and some birds.

**Habitat:** Woods, thickets, fields, pastures, vegetated dunes, marshes and bogs. It is terrestrial, but requires access to water.

**Did you know?** Low reproductive rate, a slow maturity and habitat loss threaten their survival.

**Eastern painted turtle**
*Chrysemys picta*

**Food web role:** Eats insects, crayfish, vegetation, tadpoles, small fish and mollusks. Eaten by raccoons, river otters, minks, and red foxes.

**Habitat:** Rivers, lakes, ponds, and marshes. Basks on logs.

**Did you know?** Its small size and two bright yellow spots on either side of its head help distinguish it from the red-bellied turtle.

**Common snapping turtle**
*Chelydra serpentina*

**Food web role:** Eats vegetation, carrion, small animals. Herons, raccoons, skunks, largemouth bass, bullfrogs, water snakes, and crows eat the young and eggs. Adults are eaten by humans.

**Habitat:** Permanent fresh or brackish water bodies with mud bottoms.

**Did you know?** Its long neck allows it to breathe while buried in the mud.

**Northern black racer**
*Coluber constrictor constrictor*

**Food web role:** Eats insects, amphibians, rodents, reptiles, and bird eggs. Eaten by dogs, cats, coyotes and birds.

**Habitat:** Lives in open areas of grassland, fields, prairies, and along the edge of woodlands. Some can be found by railroads.

**Did you know?** Shrinking meadow and shrubland habitats are causing population declines in some Northeastern states.
Meadow mammals live in open areas and require special adaptations to avoid being eaten. Some are nocturnal and search for food at night when predators are fewer and darkness helps conceal their movements. Many live in underground tunnels or burrows where they can hide. Small- and medium-sized mammals are important links in the food chain, feeding many larger mammalian and reptilian predators, as well as birds of prey. Meadow mammals are threatened by land development and fragmentation, and non-native predators such as the red fox and feral cat.

### Meadow voles

**Food web role:** Eats grasses, sedges, and wildflowers. Eaten by cats, red foxes, snakes, coyotes, hawks and owls.

**Habitat:** Moist meadows, near streams and marshes, and orchards.

**Did you know?** It is mostly nocturnal and less active during the full moon when predators have a hunting advantage.

### Eastern cottonail rabbit

*Microtus pennsylvanicus*

**Food web role:** Eats herbaceous plants in summer and twigs, buds and bark in winter. Eaten by coyotes, hawks, red foxes, raccoon, cats and dogs.

**Habitat:** Meadows, swamps, farmland, and forest edges.

**Did you know?** It uses stillness and cover to escape predators. Its feet are not good luck!

### Woodchuck (Groundhog)

*Marmota monax*

**Food web role:** Eats primarily herbaceous vegetation, but also fruit, buds and bark. Eaten by red foxes, coyotes, bobcats, hawks, and humans.

**Habitat:** Meadows, open woods, and orchards, favoring the edge between open and wooded land.

**Did you know?** Woodchuck burrows provide other animals with shelter while helping to aerate and mix the soil.

### Red fox

*Vulpes vulpes*

**Food web role:** Eats rodents, rabbits, small birds, carrion, eggs, insects, fruit and garbage. Eaten by coyotes and bears. Humans hunt it for its fur and pest status.

**Habitat:** Forests, fields, suburban and urban areas. Prefers edges and mixed vegetation.

**Did you know?** Local foxes descend from European foxes colonists introduced for hunting.

### Feral house cat

*Felis catus*

**Food web role:** Eats birds, mammals, reptiles, amphibians, fish and insects. Eaten by coyotes.

**Habitat:** Urban and suburban areas, agricultural lands, forests, grasslands, scrublands, and wetlands.

**Did you know?** It is adept at hunting and is a big factor in the decline of native wildlife. Keep cats indoors for the safety of native animals.
Woodland mammals provide a variety of services for both the environment and humans. Rodents disperse tree seeds; bats, shrews, and opossums regulate populations of harmful insects; and opossums and raccoons remove and recycle nutrients from carrion on the forest floor. Eastern woodlands are home to unique mammals, including the only marsupial of North America, the opossum, and one of the few flying mammals, the little brown bat. Here are some of the woodland mammals you may see at Duke Farms.

### Opossum
*Peromyscus leucopus*

**Food web role:** Eats carrion, seeds, fruit, mice, snakes, insects, birds, worms, frogs, and garbage. Eaten by bobcats, foxes, owls, coyotes, dogs, and humans.

**Habitat:** Wooded areas, swamps and streams, and suburban areas.

**Did you know?** Its range is expanding north, possibly due to milder winters or increased human crops and garbage.

### Eastern chipmunk
*Tamias striatus*

**Food web role:** Eats seeds, nuts, fruit, insects, mushrooms and eggs. Eaten by coyotes, foxes, raccoons, snakes, cats, owls and hawks.

**Habitat:** Deciduous or mixed forests, edges, hedgerows, and urban and suburban areas.

**Did you know?** It caches the nuts and seeds that it collects. This act serves as a dispersal agent.

### White-footed mouse
*Peromyscus leucopus*

**Food web role:** Eats seeds, nuts, and occasionally fruit, insects, vegetation. Eaten by snakes, weasels, owls, cats, and many other predators.

**Habitat:** Deciduous to coniferous forests, grassy fields with brush, and edges of swamps and bogs.

**Did you know?** It can easily locate seeds buried underground with its acute sense of smell.

### White-tailed deer
*Odocoileus virginianus*

**Food web role:** Eats green shoots, buds, twigs, bark, nuts, berries, fungi, lichens, and moss. Eaten by coyotes, bobcats, and humans.

**Habitat:** Deciduous to coniferous forests, at the edges of wetlands, and open brushy areas.

**Did you know?** Overpopulation of deer contributes to huge loss of habitat needed by many small birds and for tree regeneration.

### Little brown bat
*Myotis lucifugus*

**Food web role:** Eats many flying adult insects. Eaten by hawks, owls, common grackles, weasels, mink, raccoons, rodents, snakes, fish, and sometimes bullfrogs.

**Habitat:** Hollow trees, caves, mines and buildings, close to streams and lakes.

**Did you know?** It can eat up to 1,200 insects in an hour, which is half its body weight each night.
Green Initiatives

Duke Farms has an expansive and bold vision for the 2,742-acre property, serving as an environmental showcase and learning center.

The buildings and landscapes at Duke Farms have been designed to be sustainable. This means that they place minimal demands on non-renewable energy resources and reduce pollution and waste, creating healthier indoor and outdoor environments.

Large areas that were once lawns are now meadows planted with native wildflowers and grasses that require little maintenance and no water. In many of the woodlands, non-native and invasive tree are being replaced with native species. Seeds are being harvested from plants at Duke Farms and cultivated in the native nurseries before they are introduced into the regenerated habitats.

The infrastructure that supports the buildings at Duke Farms uses green technologies such as a solar array, geothermal wells, and a constructed wastewater wetlands to maximize energy efficiency. Renovation of existing structures minimizes the need for new materials and interior spaces are designed with human health and well being in mind by maximizing air flow and providing abundant natural light.
As a LEED® Platinum certified building, the renovated Farm Barn—now the Orientation Center—is a model of energy efficiency and environmental building practices. Connected to a solar array, geothermal wells and a constructed wetland, the building places fewer demands on non-renewable energy resources, minimizes pollution and waste, and creates a healthier indoor and outdoor environment. This diagram highlights a few of the many improvements made to the Farm Barn.

1. **Treating Wastewater**
   Constructed wetlands clean waste water from the building, discharging it back into the groundwater. Constructed wetlands mimic functions of naturally-occurring wetlands using human-made technology.

2. **Temperature Control**
   Fifty-six geothermal wells, each 400 feet deep, circulate water through a thermally-controlled piping loop. A constant underground temperature boosts efficiency and reduces heating and cooling costs.

3. **Adaptive Reuse**
   Limiting the use of virgin land and materials by adapting already used components is an important feature of sustainable design.

4. **Air flow and Insulation**
   Operable windows maximize energy-free ventilation. Insulation maintains a more constant temperature inside the building.

5. **Storing and Using Rainwater**
   Rainwater captured from the roof is collected in an underground cistern, filtered, and used in the building for all non-potable needs. Any excess of the 5,000 gallon capacity overflows into the rain garden.

6. **Capturing the Sun’s Energy**
   The 2.6 acres of solar panels provide 100% of the electricity required to power Duke Farms. The energy from the solar array that the property does not use gets transferred to the local public power grid.

*LEED is an internationally-recognized green building certification system developed by the U.S. Green Building Council.*
Solar Array

Comprised of 3,120 panels, the solar array at Duke Farms covers 2.6 acres. These panels require no fossil fuel, generate no pollution and provide 100 percent of the electricity for all the buildings and electric vehicles at Duke Farms.

The system is tied into the local utility grid for power storage. On sunny days, when the solar panels generate more energy than is needed, the additional power is redirected to the public power grid. On cloudy days or at night, when the solar panels are not producing enough energy, Duke Farms draws power from the grid.

The solar panels are arranged so that they are in perfect orientation to “solar south” which in New Jersey is about thirteen degrees west of compass south. They are tilted at twenty-five degrees. The orientation to the sun and the tilt of the panels is critical in optimizing the efficiency of how these solar panels collect the sun’s rays and convert it into energy. The panels are strategically positioned seventeen feet apart so that on the shortest day of the year, which is winter solstice, at noon, there is no shade created from one array shading the one in back of it.

The electricity generated by these panels is captured as direct current. In order to use this in the buildings and recharging stations for electric vehicles at Duke Farms, this current goes through a Solar Inverter which converts it to alternating current. This electricity can then be transmitted over long distances through electric lines.

It would take approximately 46 of these individual panels to power one typical three-bedroom home in New Jersey.

The entire solar array generates enough electricity to power approximately 76 average New Jersey residences.
Constructing Wastewater Wetlands

Designed to treat wastewater, or effluent, from the Farm Barn and cottages, the constructed wastewater wetlands system processes 12,000 gallons of wastewater per day and uses very little energy. Microorganisms and plants cleanse the nutrient-charged waste, resulting in clean water that can be reintroduced safely into the groundwater. Naturally treated water from the constructed wetlands is used for non-potable purposes such as sub-surface drip irrigation in the nearby Pollinator Meadow.

Native plants in the wetlands purify the waste with microorganisms that live on plant roots. Plastic liners held in place by gravel protect the groundwater and provide additional surfaces for bacteria colonies.
Restoring Natural Wetlands

As part of an environmental stewardship initiative, Duke Farms is working in partnership with the Natural Resources Conservation Service, a division of the U.S. Department of Agriculture, to restore and preserve more than 500 acres of wetlands along the Raritan River and other areas of the Duke Farms property.

Along the lowlands of the Raritan River, the wetland restoration efforts required disrupting the field drainage system installed by J.B. Duke to drain the wetlands.

Importance of Floodplains and Wetlands

- They help control flooding, conserve soil and promote plant biodiversity.
- They provide valuable habitat for wildlife.
- They help clean water before it re-enters the water supply.
- They lower flood heights and reduce erosion through water absorption and storage.
- They absorb surface-water runoff from urban and suburban areas.
Biodiverse meadows have many benefits, including erosion control, natural rainwater filtering, carbon sequestration, and food and shelter for wildlife, including pollinators vital to agriculture. Meadows are naturally sustainable over time because native plants require less watering and maintenance than mown lawns. In an effort to promote healthy living habitats, Duke Farms staff and volunteers are converting hundreds of acres of once-manicured lawns into meadows.

Mown Lawn

Mown lawns are expensive to maintain and are not useful habitats for wildlife. Eliminating the toxic chemicals used in lawn care protects the beneficial soil organisms that support the plants and animals that live in a meadow.

Seed Drilling and Planting

Once invasive plants are removed and the soil is healthy, planting a mix of native grasses and wildflowers creates a diverse, sustainable and beautiful meadow. Seeding is done by hand or with a seed drill, which drills directly into soil to ensure direct soil-to-seed contact.

A Healthy Meadow

A diverse meadow is cost effective, binds the soil, supports wildlife, and is beautiful throughout the year.

Meadow Management

Meadows are managed by occasional mowing or burning to stop the natural progression of meadows into woodlands.
Regenerating Woodlands

Woodlands clean water and air, prevent soil erosion, regulate temperature, sequester carbon, and supply timber and other products. They provide a home for crop pollinators and the animals that control pest species. Duke Farms is regenerating its woodlands by removing invasive species and replacing them with native plants. This will ensure a healthy ecosystem that sustains wildlife and provides for human needs in the future.

### White-tailed Deer Management

Throughout the region, overabundant deer populations have destroyed the ability of woodland plants to function and reproduce for the health of future forests. Deer fences help manage the population and allow the woodlands to regenerate.

### Invasive Plant Management

Invasive species compete with native species for resources like water, nutrients and space. Invasive plants are the second most common cause of native plant loss, only slightly behind habitat loss due to human development. Removing invasive species helps native plants and animals flourish.

### Native Woodland Plants

After invasive plants have been removed and the deer population has been controlled, reintroducing a variety of native plants creates a biodiverse woodland that is sustainable for wildlife, the environment and humans.

### Woodland Management

Vigilant monitoring for re-invasion by non-native invasive plant species and nuisance wildlife such as the white-tailed deer is required to maintain healthy woodlands. Biodiverse woodlands are sustainable, offer great habitat for wildlife, and support our communities in many ways.
Rain, rivers, and underground aquifers provide water. Duke Farms uses native plantings as natural filtering systems, efficiently helping maintain water quality. Vegetation planted near paved areas soaks up water runoff and returns filtered water to the aquifers underground. Native plants are adapted to the climate of the area, so they require less water to thrive. Planting natives along waterways helps reduce minor flooding while providing food and shelter for wildlife.

**Vegetation Buffers**

Belts of dense vegetation along the property’s waterways help prevent flooding, act as biological filters for the stream, and serves as a rich habitat for wildlife. While naturally-occurring lakes have shoreline vegetation, staff and volunteers must recreate plant buffers for the engineered lakes. They also monitor and replant vegetation eaten by non-migratory Canada geese.

**Rain Gardens**

Rain gardens capture water in low areas where water can soak naturally into the soil. They protect lakes and streams from pollutants and provide habitat for birds, pollinators and beneficial insects.

**Bioswales**

Slicing through the parking lot, these landscape elements capture surface runoff water and naturally filter pollution and silt before the runoff enters the watershed.
Pumped in from the Raritan River, the water flowing through the lakes at Duke Farms has a high concentration of nutrients originating from fertilizer and other chemicals found in agricultural, municipal and suburban storm water runoff and other sources such as waste and pollutants from industry. While many water treatments are more effective in a closed-loop system, Duke farms is an open loop system: taking water from the Raritan River and returning the water to the river. The key to long-term lake management is working with neighbors in the region, and the State of New Jersey, to reduce the amount of nutrients and pollution in the watershed that feeds the Raritan River. This effort will improve aquatic systems throughout the region.

### Bacteria Treatments

Instead of relying on chemical treatments to reduce algae blooms, Duke Farms is increasing the quantity of already-present helpful bacteria that process excess nitrogen. This process deprives blue-green algae of nutrients and reduces the frequency and severity of algae blooms.

### Floating Islands

Floating Islands are small ecosystems that aid in the absorption of nutrients. Countless microorganisms adhere to the island’s floating base and plant roots. They absorb some of the nutrients before the water flows throughout the lake system. This technique is being implemented in Mermaid Pool.

### Planting the Buffer Zone

A careful selection of plants helps keep lake systems healthy. Native vegetation adapted to the damp soil along lakes works best for making self-sustaining buffer. These plantings provide a better food and nectar source for wildlife than mowed lawns and help deter non-migratory Canada geese.
Renovation of the Orchid Range

The Orchid Range commemorates Doris Duke’s life long interest in orchids. It was renovated to meet Leadership in Energy and Environmental Design (LEED)* Gold standards in 2012. The Orchid Range contains a tropical orchid display, a subtropical coastal display, orchid support houses and native nursery houses. Duke Farms still offers courses in orchid culture.

"1. Double-paned, insulated glass replaced the original single-pane glass.
2. A water capturing system offsets the demands watering the plants.
3. Solar water heaters run the boiler for the radiant heat system.
4. Transom windows allow for optimal air flow, contributing to passive cooling.

*LEED is an internationally-recognized green building certification system developed by the U.S. Green Building Council.

Sub-Tropical Display
This display is a re-creation of an American Southeast coastal plain environment, showing the diversity of plants found in this environment.

Tropical Orchid Display
This display is filled with a wide variety of orchid species from tropical and subtropical regions, which are renown for their adaptability.

Orchid Support Houses
Support greenhouses hold orchid plants in various stages of growth and bloom in preparation for orchid programs, demonstrations, and presentation in the Tropical Orchid Display.

Native Nursery Houses
Attached to the Orchid Support Houses are six other greenhouses at the Orchid Range. These are used for propagating native species of flowers, grasses, forbs, and other flora."
Section 2: Green Initiatives

The Native Nursery

The Native Nursery is where native plant seeds collected on the property are processed and grown in support of habitat regeneration efforts.

Seed collecting and Processing
Native plant seed is collected and prepared by a team of experts, separated from debris, then labeled for identification. Many seeds require special attention where they go through alternating periods of hot and cold in the greenhouse before germinating.

Sowing and Propagating
Seeds are sown into flats after being treated to hot and cold conditions. Timing is vital: plants should germinate in the spring as most would in nature. Seedlings are raised in the nursery until they are mature enough to be transplanted into larger trays.

Growing Outside
In early spring, plants are moved out of the greenhouses to grow as they would naturally. Plants are watered, weeded, and transplanted until they are mature enough to be used in habitat regeneration projects.
Native American Land Use
Prior to the arrival of Europeans to North America, Native Americans inhabited the continent and evolved many practices that altered the landscape significantly. With the use of fire, they created large expanses of open grasslands. Recent studies suggest that the “wild, untamed landscape” we imagined the early colonists found was in fact strongly influenced by humans. In addition to influencing the land through agriculture, the Native Americans managed forests to increase and diversify their food supply, and to improve their living conditions in general.

Environment in the 1800s
In the 1800s, a wave of deforestation moved across the Appalachian Mountains into Ohio and the Mississippi River valleys. The East then began undergoing succession, which is a process by which plant communities successively change from field back to mature forest.

Industry and the Environment
Industrial growth in the United States contributed greatly to the altering of the landscape and ecosystems on which we depend. The advent of steam engine and the railroad improved technology for large-scale exploitation of the natural resources on which we depend: fossil fuels, coal, ores, timber, and even animals and plants.

J.B. Duke and Duke Farms
In the early years of Duke Farms, J.B. Duke explored life as a gentleman farmer, raising and breeding cattle and horses and operating a race track on the property. By 1893, Duke began inviting New York friends to the estate, which he initially called Raritan Valley Farms. By the end of the 19th century, Duke abandoned farming and proceeded to construct a great public park on his estate.

His estate, modeled after many of the great “picturesque” estates of Europe and America, represented a kind of land stewardship by altering the landscape for the purpose of enjoyment and aesthetic pleasure. To achieve his goals, he acquired over 2000 acres of farmland and wood lots and preserved this land for his estate.
James Buchanan Duke, also known as “J.B.” or “Buck” Duke, was born near Hillsborough, North Carolina, on December 23, 1856 to Washington Duke and his second wife, Artelia Roney Duke. J.B. Duke briefly attended the New Garden School in Greensboro, North Carolina (now Guilford College), and the Eastman Business College in Poughkeepsie, New York. The family’s business provided his most practical education—first farming and then tobacco production.

Establishing Duke Farms in idyllic rural New Jersey was one of J.B. Duke’s consuming passions. In 1893, he bought his first farm. By 1905, Duke had assembled 40 farmsteads into a grand estate. It served as a working farm for several years. By the end of the 19th century, Duke envisioned Duke Farms as a great public park.

Giving back to the community was a value instilled in J.B. Duke by his father. In 1896, Washington Duke pledged an endowment of $100,000 to Trinity College provided it “will open its doors to women placing them on equal footing with men.” Following suit, in 1924, J.B. Duke established the $40 million Duke Endowment, a permanent trust to support a number of worthy causes in the Carolinas, including Trinity College. In recognition of the Duke family’s generosity, the institution was renamed Duke University.

J.B. Duke died in New York City on October 10, 1925, and is interred with his father and brother in the Memorial Chapel on the campus of Duke University. Upon his death, the Duke Endowment was expanded with an additional $67 million from J.B. Duke’s estate.
Doris Duke
A Lifelong Philanthropist

Born into one of the wealthiest families in America on November 22, 1912, Doris Duke was the only child of J.B. and Nanaline Holt Inman Duke. Doris spent her early years in New York. When her father died in 1925, she inherited most of his considerable fortune.

Adventurous, intelligent and independent, Doris Duke used her wealth to pursue her many interests, which included travel, the arts, historic preservation, environmental conservation, preservation of wildlife and ornamental horticulture.

Doris Duke was an environmentalist long before it was fashionable. She demonstrated an especially keen interest in conservation and horticulture. In her will, she envisioned that Duke Farms should serve to protect wildlife, as well as be used for agriculture, horticulture and research, inspiring today’s mission of environmental stewardship.

In her Last Will and Testament, Doris Duke left her considerable fortune, her properties and her extensive collections of art to a foundation to be created in her name—the Doris Duke Charitable Foundation. The mission of the Doris Duke Charitable Foundation is to improve the quality of people’s lives through grants supporting the performing arts, wildlife conservation, medical research and the prevention of child maltreatment and through preservation of the cultural and environmental legacy of Doris Duke’s properties.
When James Buchanan Duke created this lagoon lake system of seven connected lakes covering approximately 75 acres he used steam-powered engines, shovels and an enormous crew of workers and mule teams, excavating one lake after another.

Robert F. Durden, Bold Entrepeneur

Creating the Lakes

Duke enjoyed water in action . . . flowing over boulder-made rapids, tumbling over craggy cliffs, and rising skyward in jet streams, falling in multiple arrangements . . .

Turbine and Pumping House
This power station is where the hydro-electric power for Duke Farms was generated. The pumping house had a capacity of one million gallons per day.

Filter House
The stone filter house received water from the adjacent brick pumping house. There, 10 large sand filters cleaned the canal and river water before it was pumped to the reservoir.
One million gallons of water per day were pumped from the canal above the Raritan River up to Duke Reservoir, where it would then be controllably released to flow by gravity through the seven-lake system and back into the Raritan River—cleaner than when it was initially removed. This system was used to supply potable water, a fire suppression system, irrigation and the fountains that enlivened the landscape. The lakes’ numbers in this diagram represent their relative elevation above the river. Lake 10 and Duke Brook are not directly connected to this system.
The Boston architectural firm Kendall, Taylor & Stevens designed the Farm Barn and the nearby cottages in the Jacobean Revival style that characterizes the early buildings at Duke Farms. Completed in 1906, the massive stone walls, expensive copper detailing and expansive slate roofs were reflections of J.B. Duke’s status, wealth and taste.

Dairy Barn

Originally, this long rectangular structure provided storage for wagons and equipment and stalls for Duke’s thoroughbred horses. The barn was converted for use as a dairy farm in the 1960s.

This image was taken where the exhibition gallery is now located.

Farming Operation

An aerial view circa 1970 shows the Farm Barn with silos, storage sheds and shelters for the cows in the area that is now the parking lot. Prompted by concerns for sanitation, dairy farming was discontinued in the late 1990s.
In 1909, final plans were drawn up for a country mansion that would befit the grandeur of J.B. Duke’s estate and his family’s role in society. In 1911, construction was substantially completed on the two-level basement and service court for the mansion, including a tunnel from the approach road and the supports for the first floor.

However, construction was abruptly halted after the landscaping was completed and the foundation was laid. The reason for this is not known for certain, however, Duke had shifted many of his business affairs to Europe and spent less time at Duke Farms after the court-ordered dissolution of the American Tobacco Company in 1911. Steel used in the Old Foundation was removed from the site and donated to the Allied war effort.

Plan for the Mansion

This rendering, drawn by architect Horace Trumbauer, shows what the mansion was to look like. It also shows the terraces to the Great Lawn (now the Great Meadow) and the extensive landscape that Buck Duke was engineering around his future house.
Built between 1899 and 1901 and originally called the Orchid House, the Orchid Range was one of the first buildings constructed at Duke Farms. Its proximity to the railway allowed for large quantities of plants and gardening materials to be easily shipped here. The building was modeled after early English greenhouses and designed to allow for the great height of palms, whose fronds could be seen through the clear glass domes at the top. The utilitarian greenhouses in the back were used to cultivate the plants.
1917 Conservatory

Designed by Horace Trumbauer, the 1917 Conservatory was the center of horticultural production at Duke Farms, serving household needs, the requirements of the park, and the marketplace. Throughout the first half of the 20th century, the greenhouses at Duke Farms were used for commercial production of orchids and flowers for the New York market.

In 1958 Doris Duke transformed the buildings into 11 thematic gardens from around the world. They opened to the public in 1964. In 2008, the transition from a formal display garden into a sustainable native nursery began when the exotic and non-native plants were donated to interested botanical gardens and the buildings were converted for use in cultivating and propagating native species.
Coach Barn

The Coach Barn, with its distinctive clock tower and rustic walls made from fieldstone gathered from local quarries, set the architectural tone for many subsequent buildings at Duke Farms. The Boston architectural firm of Kendall, Taylor & Stevens designed the Coach Barn. Completed in 1903, it contained stables for horses on one end and office space for J.B. Duke and his estate manager at the other. On the second floor, there was an apartment originally for a carriage coachman, and later an automobile chauffeur.
Hay Barn

Built in 1905, the Hay Barn was at the hub of farming activity. It originally housed a hay press, a tool that baled hay into compact squares and was important to early agriculture at Duke Farms. The Boston architectural firm of Kendall, Taylor & Stevens designed the 140 foot long by 64 foot wide stone barn. With its gabled roof, spires and buttresses, it mirrored the architectural style of the earlier Coach Barn. That same style would later be used for the Farm Barn. In 1915, a fire destroyed all but the stonework. Doris Duke used the remaining shell as a sculpture garden, which remains today.
Landscape Features

Designed Landscape

The landscape elements at Duke Farms were all designed, just like the buildings. This was common for great estates and parks at the time, including Central Park in New York City, from which J.B. Duke derived some of the inspiration for his estate. The landscape architecture took elements of nature and molded them to fit Duke’s vision of both a functional farm and a beautiful estate. From trees to water and even to hillsides, the landscape on the property was meticulously designed and carefully monitored to fit a particular aesthetic ideal. Today, the landscape at Duke Farms is being regenerated to fit a new aesthetic that is beneficial for native plants and animals.

Bridges and Roads

J.B. Duke constructed more than 18 miles of roads on the property. Bridges and roads were necessary infrastructure elements because they provided pathways for visitors, but in addition they contributed to the grand aesthetic of the estate with balustrades and arches that framed the landscape.

Planted Trees

While many of the trees on the property have grown wild over time, forests on site were originally meticulously planned and planted. Allées of trees framed roads and the Spruce Forest is one example of a planted forest. The turn of the century and provides nesting opportunities for a variety of birds.

Statuary

J.B. Duke sought the finest craftsmen to make statuary for his estate. Duke commissioned bronze, marble and stone reproductions in the first decade of the 20th century, mostly from French and Italian firms that specialized in casting Classical and Renaissance-style reproductions for museums and private collectors.
Landscape Features

Stone Work

As you explore Duke Farms you will see carefully placed stone work. Bridges across small streams, well houses, fountains, benches and bridges all made of rustic stone. A local quarry, originally owned by J.B. Duke supplied the stone for most of these structures.

Fountains

Duke began installing fountains at Duke Farms as early as 1895, only two years after he purchased his first tract. When Duke Farms was open to the public in the early days of the estate, the fountains only operated on certain days of the week, typically weekends and Tuesdays. Today, seven of the 35 original fountains remain.

Well Houses

As public visitation at Duke Farms increased, complaints about the absence of resting places and lack of water arose. In 1903, J.B. Duke began the first of two campaigns to dig wells and construct well houses. A second campaign to construct well houses began in 1906.

Waterfalls

J.B. Duke enjoyed water in action. The water he pumped from the Raritan River to supply the lakes also flowed from the many cascades and falls that linked the lakes. Though many of the waterfalls have been decommissioned, the Great Falls is still in operation today.
Please return this Guide to Duke Farms to the Orientation Center when you are finished with your exploration so that the next visitor can use it. If you would like a copy of your own it is available for free as a PDF download on the Duke Farms website: www.dukefarms.org or can be purchased in book form through Lulu press at (include link here).

Photo Credits:

Historical photos:
Doris Duke Charitable Foundation Historical Archives, David M. Rubenstein Rare Book & Manuscript Library, Duke University, Durham, North Carolina

Landscapes and wildlife photos:
Duke Farms Foundation: Thom Almendinger, Charles Barreca, Holly Jean Dunbar, Nora Wagner
Whirlwind Creative: Terren Baker, David Lackey

Buildings:
Duke Farms Foundation: Charles Barreca, Holly Jean Dunbar
Irwin & Leighton
Whirlwind Creative: Terren Baker, David Lackey
Vitetta

Photographers credited next to their image have given permission to use their images in this guide.

Copyright 2012 Duke Farms Foundation
First edition

Duke Farms is owned and operated by the Duke Farms Foundation, tan operating foundation of the Doris Duke Charitable Foundation.