

# FOREST ECOSYSTEMS - Rebecca Daley

From a small frame...



to the big picture!



A large area of trees clumped together is called a **forest**. However, a forest is much more than this. Instead, let us define a forest as either a community or an ecosystem.

A forest *community* includes animals and plants in an area defined by trees and other woody vegetation.

A forest *ecosystem* encompasses not only these living components but also the physical components such as soil, water, and nutrients.

A forest ecosystem can be examined through the following levels of investigation:



**SPECIES:** The Animals, Plants, and Fungi of the Forest



**COMMUNITIES:** The Connections between all the Different **Species** in the Forest



**ECOSYSTEMS:** The Roles of **Communities** and their Interactions with the Physical Environment



**BIOSPHERE:** The Importance of Forest **Ecosystems** to the World



## SPECIES LEVEL

### What plants can you find in a Northeastern Temperate forest?

Temperate deciduous forests have a great variety of plant species. Most have three levels of plants.

- 1) Lichen, moss, ferns, wildflowers and other small plants can be found on the forest floor
- 2) Shrubs fill in the middle level
- 3) Hardwood trees like maple, oak, birch, magnolia, sweet gum and beech make up the third level

### What animals and fungi can you find in a Northeastern Temperate forest and where can you find them?

#### FOREST FLOOR

Fallen leaves create leaf litter. Inside and beneath this leaf litter, there are thousands of tiny animals, including many invertebrates like **beetles** and **millipedes**. Unseen microscopic **fungi** and live there as well. All of these organisms help break the leaf litter into nutrients other plants and animals can use.



[http://www.wildlifetrust.org.uk/cheshire/IMAGES/proj\\_dormouse\\_berries.jpg](http://www.wildlifetrust.org.uk/cheshire/IMAGES/proj_dormouse_berries.jpg)

During the autumn, the **dormouse** scans the ground for hazelnuts. As the weather becomes cooler, it makes a nest of leaves and grass then curls up to sleep until spring.

The **striped skunk** uses its long, sharp claws to dig into burrows and rotting wood for all sorts of food. If threatened, it aims a foul-smelling spray at its enemies.

As the **mole** moves quickly through its maze of underground tunnels it eats the earthworms and other animals that have fallen inside.

#### SHRUBS AND MEADOW



[http://www.firstpeople.us/pictures/bear/1600x1200/Black\\_Bear\\_Tennessee-1600x1200.jpg](http://www.firstpeople.us/pictures/bear/1600x1200/Black_Bear_Tennessee-1600x1200.jpg)

The **white-tailed deer** live mostly in the wooded meadows. They are herbivores that eat green plants, nuts, and twigs. Their young have spotted coats that blend into the speckled light filtering through the trees. This camouflage makes it harder for predators to find them.

The **red fox** eats a wide variety of foods. It is an omnivore and its diet includes fruits, berries and grasses. It also eats birds and small mammals like squirrels, rabbits and mice. A large part of the red fox's diet is made up invertebrates like crickets, caterpillars, grasshoppers, and beetles.

**Eastern Tiger Swallowtails**, a type of butterfly, have blue and black wings. They retrieve their nectar from cherry and lilac flowers.

The **black bear** prefers the shrubby areas of the forest where it feeds on twigs, berries, roots, and young buds. They hibernate during winter in hollowed-out dens in tree cavities.

## AMONG THE TREES

A single tree in a forest can be a home, a food source, or a shelter for a variety of animals. Often hidden from view, there is a world of wildlife activity.



<http://www.mooseycountrygarden.com/english-gardens/grey-squirrel-eating.jpg>

High up in the trees, a **gray squirrel**'s nests can be found hidden among the branches. After scurrying down to the ground to find fruits and stored nuts, squirrels return to there to rest. The squirrel uses its bushy tail to balance as it runs around and twitches it to communicate with other squirrels.

**Aphids** feed on the sap of plants. They produce a sticky liquid (honeydew) that **ants** eat. Often ants can be seen rubbing the aphids to squeeze out the honeydew. In return the ants protect the aphids from enemies.

After using its pointed beak to peck through the bark, a **pileated woodpecker** can reach into the tree with its long, sticky tongue to lick up any hidden insect larvae.

## STREAM AND STREAMBANKS



<http://www.culebraphotos.com/images/MudSalamander8x10.jpg>

At night, **American toads** emerge from their dark shelters in search of insects, larvae, spiders, slugs, and worms to catch on their sticky tongues.

The moist skin of the **Longtail salamander** is used for respiration and ties them to wet habitats. They eat insects and larvae, spiders, snails, and slugs.

**Dragonflies** leave near the streams and their larvae live in water. They are carnivorous and prey on small insects.

## ABOVE THE CANOPY



<http://www.nhptv.org/natureworks/graphics/cardinal6sm.jpg>

**Black-throated Green Warblers** typically feed high in the trees. They may be spotted more during migration, however, when this species will feed at any height where there are insects available.

The **Northern Cardinal**'s diet consists mainly of weed seeds, grains, and fruits. During the summer months, they show preference for seeds that are easily husked, but are less selective during winter, when food is scarce. They also will consume insects, and feed their young almost exclusively on insects

The **Red-shouldered Hawk** scans the surroundings below for prey such as large insects and a wide variety of rodents. [javascript:popImage\('/natureworks/graphics/cardinal6.jpg'\);](http://natureworks/graphics/cardinal6.jpg)

[Cardinal'\)](#)



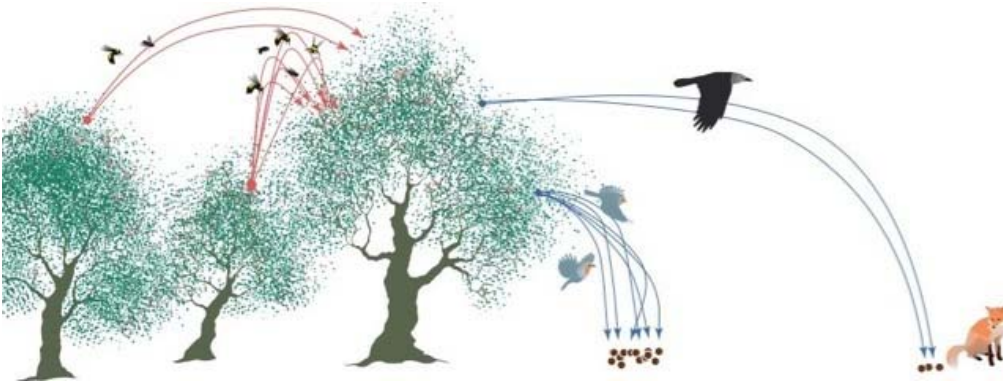
## COMMUNITY/ECOSYSTEM LEVEL

### How do plants and animals interact?

#### SEED DISPERSAL

Some animals eat berries and nuts. Most fleshy berries have lots of seeds. Nuts are actually just hard, dry fruits with just one seed inside. Each seed has a baby plant inside along with a supply of food enclosed inside a hard case. By eating fruits and nuts, some animals carry these seeds to where they have plenty of space, light, and food to grow.

*Example:* Gray squirrels bury acorns in the ground so they'll have food for winter. Often, they forget what they've done and the acorns grow into oak trees.



[http://ebd10.ebd.csic.es/Dispersal\\_and\\_gene\\_flow\\_files/shapeimage\\_2.jpg](http://ebd10.ebd.csic.es/Dispersal_and_gene_flow_files/shapeimage_2.jpg)

#### POLLINATION



[http://www.fierly-foods.com/images/ed/garden/pollination\\_hover.jpg](http://www.fierly-foods.com/images/ed/garden/pollination_hover.jpg)

Seeds can only be produced when pollen is transferred between flowers of the same species. Some fertilize plants by taking pollen from one flower to another. Flowers have bright petals and strong, sweet scents to attract insects. The pollinator is often eating or collecting pollen for its protein and other nutritional characteristics or it is sipping nectar from the flower when pollen grains attach themselves to the animal's body. When the animal visits another flower for the same reason, pollen can fall off onto the flower's stigma and may result in successful reproduction of the flower.

#### POLLINATION



FLOWER 1



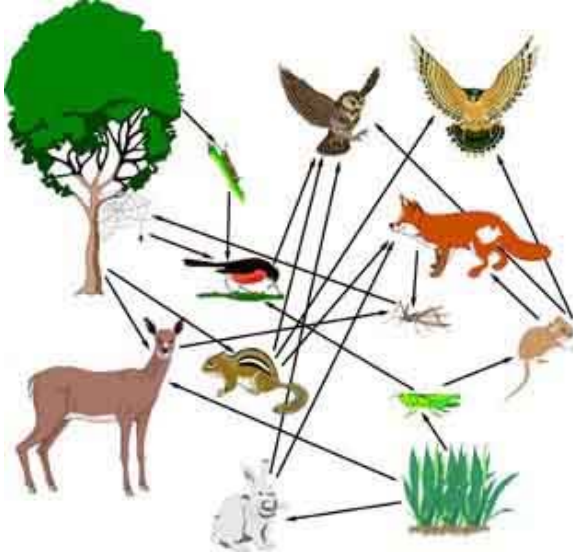
FLOWER 2

[http://www.fs.fed.us/wildflowers/pollinators/images/pollination\\_ani.gif](http://www.fs.fed.us/wildflowers/pollinators/images/pollination_ani.gif)

## How do animals interact with one another?

### FOOD WEBS

The forest is a massive food web. Parts of living and rotting plants are eaten by many tiny animals which are eaten by other animals that are hunted by other animals. Changes can affect the balance of the whole community.



[http://cmore.soest.hawaii.edu/cruises/operex/images/terrestrial\\_food\\_web\\_full.jpg](http://cmore.soest.hawaii.edu/cruises/operex/images/terrestrial_food_web_full.jpg)

### COMPETITION

Competition between species for food, space, and light is an important factor in the structuring of ecosystems. Competition may occur when two individuals coexist within a given forest stand and require the same resource.

*Example:* Natural cavities are a limiting resource for cavity-nesting birds. The red-bellied woodpeckers excavate tree cavities for nesting, but this woodpecker is less aggressive than the red-headed woodpecker. As a result, the red-bellied woodpecker populations are declining where the red-headed woodpeckers are present.

### MUTUALISM

A mutualism is a positive reciprocal relationship between two species. Through this relationship both species enhance their survival, growth or fitness.

*Example:* Aphids are protected by ants and ants get sweet plant sap from aphids. The ants herd the aphids from place to place on the tree to take advantage of where sap is available.



[http://bp0.blogger.com/\\_uu7CUsqiL24/R5d7MpotP6I/AAAAAAAAABms/gzZM4\\_8IV08/s400/insect\\_ant\\_aphid\\_DSC7201.jpg](http://bp0.blogger.com/_uu7CUsqiL24/R5d7MpotP6I/AAAAAAAAABms/gzZM4_8IV08/s400/insect_ant_aphid_DSC7201.jpg)



## BIOSPHERE LEVEL

### What role do forests play in the world?

Temperate forests provide people with many more resources than just wood and farmland. Clean air and clean water are direct benefits of a healthy forest. Certain habitats that are critical for the survival of many species are only found in forest ecosystems. In this way, forests preserve and promote biodiversity. Also, trees absorb carbon which may help slow down global warming.

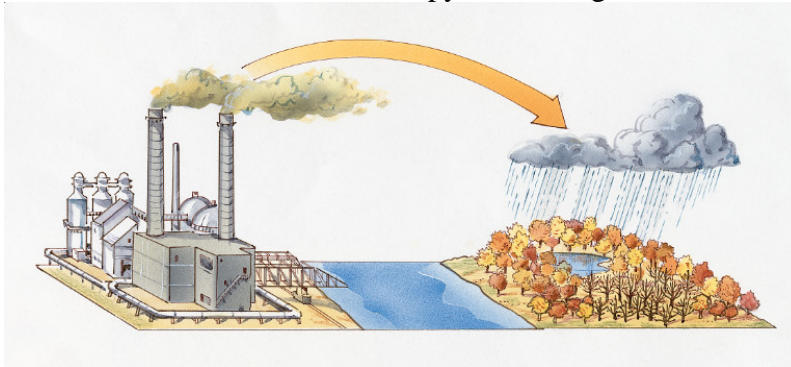
### What are the threats facing today's forests?

#### CLEAR-CUTTING

In areas where the forest has been clear cut, the soil loses its nutrients and may wash away. Over time, few plants can grow anymore and the land looks like a desert.

#### ACID RAIN

Factories, power stations, and cars are involved in the burning of gasoline, oil, or coal. Whenever this happens, chemicals (sulfur, nitrogen) are released into the air. In the clouds, the chemicals mix with water vapor and turn into acids the clouds sweep across to forests. Then the acids fall into the canopy and damage the trees.



<http://www.dkimages.com/discover/previews/786/564281.JPG>

#### CLIMATE CHANGE

Forest ecosystems are highly vulnerable to climate change. Even with a modest global warming of 1-2° C, most forest ecosystems will be impacted through changes in forest species composition, biodiversity, and plant productivity. Many scientists believe the warming observed in the recent decades has already made an impact on forest ecosystems such as a pole-ward and an upward shift in ranges of plant, insect, bird, and fish species. Further, plant flowering, bird arrival and dates of breeding and flowering are observed to be occurring earlier than before in the seasons.

#### LINKS:

*A description of the plant life, animal life, climate, and seasonality of the temperate deciduous forest.*

<http://www.nhptv.org/natureworks/nwep8c.htm>

*A tour of the climate, vegetation, and vast organismal diversity of a temperate deciduous forest.*

<http://www.marietta.edu/~biol/biomes/tempded.htm>

