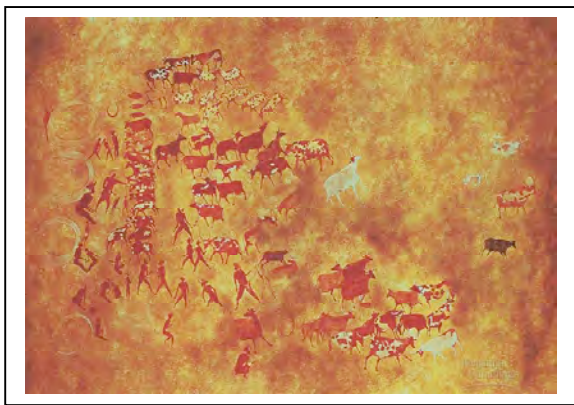


## Module 6 Lesson 1: The Science of Biodiversity

Scientists define **biodiversity** as the variety of life at every scale of biological organization. Biodiversity includes genes within populations, species within communities, communities within landscapes, landscapes within biomes, and biomes within the biosphere. From all that we currently know, the more biodiversity within a community, the healthier and more stable that community is over long periods of time. Humans depend on biodiversity at all levels, from the birds in our community to the crops that we grow for our food.

People have been dependent on healthy biodiversity since the earliest humans evolved. The picture below is of an ancient rock painting from Africa that dates back over 5000 years and depicts both wild and domestic cattle that existed in that community. To the people that lived in that neighborhood, those animals were their source of food and materials.



Modern scientists have counted over 1.4 million species of organisms on the earth. As large as this number may seem, we are still counting. It may represent as little as 10% of the actual species on the planet. Some species can be very hard to count. This all means that there are probably in excess of 15 million species on the planet.

When scientists measure biodiversity, they are actually taking a sample of the different species in the community. It is not possible to count them all. Instead, scientists create a sampling plan that can be repeated over many years. In that way, they can gather biodiversity data from the same sample area each time they collect data. The key component of the sample is the **transect**. A transect is a physical path that is laid out at a sampling site, so that researchers will use exactly the same locations each time they gather data. Pictured below is transect that has been put down in a forest.



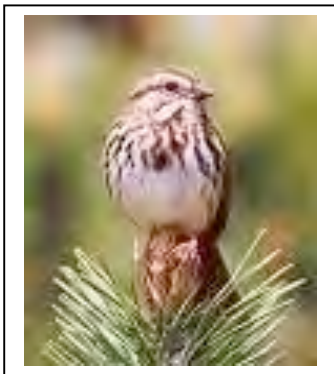
Birds are especially useful in the study of biodiversity because they are sensitive indicators of ecological health. Birds need clean air and water, places to build their nests and a reliable food supply. Birds are mobile so they can just leave if the natural conditions deteriorate. Therefore, bird population data provide a snapshot of the health of a natural community. When these data are gathered over the span of a few years, we can monitor changes in the community and correct problems that we discover. Scientists who explore biodiversity are just beginning to gather data from cities, but it is clear that healthy cities are also diverse.

## ***Closer to Home - Boston Metropolitan Area: Song Sparrows in your neighborhood***

Healthy neighborhoods are filled with many species of birds, each with unique characteristics. Each species is adapted to their local surroundings and solves the problems of life in different ways. They eat different foods, nest in different locations and use different resources within the neighborhood. These unique traits are what scientists call *life history patterns*. A bird's life history patterns include when and where it nests, how many offspring it has, its migratory patterns and how many years it lives. In fact, even different individuals of the same species show considerable variation in their behavior.

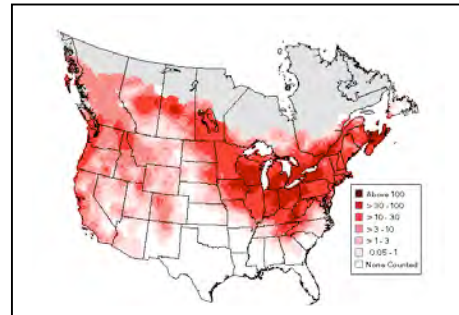
In order to better understand this idea of biodiversity, let's investigate an example; a little brown songbird found in Boston and nearly everywhere else in the United States.

Song sparrows (*Melospiza melodia*) are small birds with a big voice. The males, one of which is pictured below, weighs only 1.5 ounces and sings a beautiful, complicated song that attracts females to their territory and defends their space from other males.



They learn these calls from their fathers and go on to teach them to their sons. They eat

primarily seeds and insects. Their foraging behavior is important in limiting local insect populations and in helping to spread seeds around the community. Depending on where you live, song sparrows may be in your neighborhood year-round, or just for the winter months. The map below shows the distribution of song sparrows across North America. The darker red areas have higher densities of the sparrows.



These birds, and species like them, are a critical part of your natural environment. The presence of song sparrows in your neighborhood is an indication that the ecological health of your community is probably pretty good. But, song sparrows are just one species in a healthy neighborhood. They are part of a complex community of birds.

Measuring biodiversity in your neighborhood is a project that you can do with your fellow students. By measuring and recording the number of species of birds in your neighborhood, you can develop an inventory of species that will serve as an indicator of your neighborhood's ecological health. A high diversity of species increases the chance that at least some of the species will survive large changes in the local environment. In other words, healthy cities need to protect and enhance the biodiversity of their resident species. This effort begins with an analysis of the existing biodiversity using the tools of science.