ECOLOGICAL RESEARCH BENEFITS

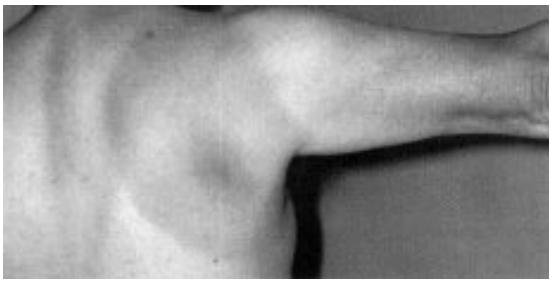
Lyme Disease Case Study

Though ecological research does not always show an immediate benefit, it does lead to important, and even life saving, applications. By giving us a better understanding of our environment, ecological data can help solve social and environmental problems effecting the United States today. For example, in the case of Lyme disease, extensive ecological research has revealed that the abundance and distribution of such seemingly inconsequential organisms as acorns, white-footed mice, and white-tailed deer may allow the risk of Lyme disease to be forecast one to two years in advance.

The History of Lyme Disease

In 1975, health specialists documented an unusual cluster of childhood arthritis in and around the coastal community of Lyme, Connecticut. Although first diagnosed as juvenile rheumatoid arthritis, the large number of regional cases led Yale University Medical Center physicians to doubt this prognosis.

Soon after an investigation began, researchers realized that the frequent occurrence of arthritis and an accompanying skin rash in otherwise healthy people represented a previously unknown disease which was increasing to epidemic proportions. Labeled Lyme arthritis in early reports, it has since been recognized that arthritic symptoms do not occur in all cases. Subsequently, the infection, with its flu-like symptoms, was called Lyme disease.



Today, Lyme disease is prevalent in the U.S., where it has spread throughout the entire country with as many as 14,000 cases reported in a single year. It is also common in Europe and Asia.

The rising incidence and broadening geographic spread of this treatable disease have attracted the attention of the general public. Lyme disease probably ranks only behind AIDS in media coverage of infectious diseases in the U.S. over the last decade.

The Cause of Lyme Disease

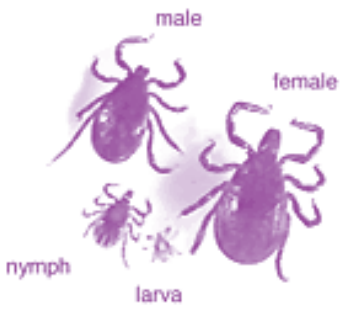
Lyme disease in humans is caused by the invasion of a spirochete bacterium. The spirochete is transmitted by the deer tick, which reaches only two millimeters in length in adulthood.

Though the cause of Lyme disease was identified within months, other aspects of the emergence of the disease have eluded scientists for two decades. However, a recent study conducted at the Institute of Ecosystem Studies (IES) shows that ecological changes in the northeastern and midwestern United States during this century are responsible for the advent of Lyme disease as a public health problem.

IES scientists discovered that heavy acorn production, which occurs every two to six years in oak forests, sets off an ecological chain reaction that regulates Lyme disease. Research shows that heavy crops of acorns attract deer to oak-dominated forests in autumn. Deer are the preferred host for adult deer ticks, which lurk in shrubs and seedlings, waiting to attach to a passing deer so they can take a blood meal. While on the deer, the ticks mate, then drop off.

In years when acorns are plentiful and deer gather in great numbers in oak forests, deer ticks lay their eggs in leaf litter on the forest floor. The result is an outbreak of larval ticks in the summer following heavy acorn production.

Heavy acorn production also strongly affects the size of white-footed mouse populations. In an abundant acorn year, the mice grow fat and breed in the dead of winter. The result is that mice populations grow to a peak level during the summer following a plentiful acorn year. So, just at the time that larval ticks are hatching from eggs and crawling about, they encounter enormous numbers of their favorite host, the white-footed mouse.



Not only are the mice the preferred host for larval ticks, they carry the Lyme disease microbe in their blood and infect feeding ticks with the spirochete microbe. Without mice, the ticks would be a nuisance but would not transmit Lyme disease.

This study shows how long-term research in ecology can reveal complex connections that affect both human health and forests. The knowledge gained from this study is consistent with the notion that deforestation of the Northeast during the 18th and 19th centuries resulted in the near elimination of deer, and presumably also of deer ticks. However, the more recent abandonment of farms in New England and other rural areas of the Northeast has transformed the landscape from open fields to eastern deciduous forests. The invasion by the deer tick of this increasingly reforested region initiated the current epidemic of Lyme disease in the Northeast.

Prevention of Lyme Disease

Lyme disease is now one of the fastest growing diseases in the U.S. Although most common in the Northeast, the potential for infection is increasing throughout the country. Cases have been reported in at least 49 states.

The tiny deer tick, reaching only two millimeters in length when mature, is the transmitter of the bacterium that causes Lyme disease. The tick is found in forests, thick brush, meadows, and even lawns and gardens. The time to be particularly alert is from April through November, when ticks feed and may bite humans for a blood meal.

In the U.S., Lyme disease occurs primarily in suburban and rural areas. Early infection in humans usually results in a flu-like illness with a skin rash where the tick was imbedded. After a few weeks to several months, as many as 70% of untreated patients suffer from a bacterial invasion of one or more distant organs or systems, including the brain, joints, and heart. These manifestations, particularly the dysfunction of the central nervous system and chronic arthritis, are disabling but rarely fatal.

Lyme disease in its early stages can be treated with antibiotics. Those living in disease prone areas should take precautions to prevent infection, know the symptoms, and seek immediate treatment if the symptoms appear.

Precautions:

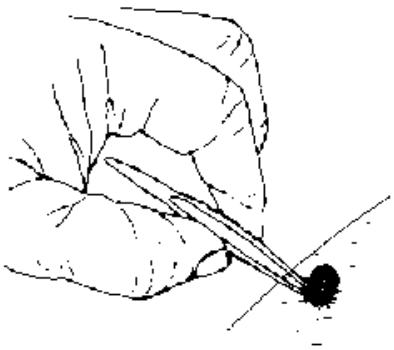
- Stay on trails, away from branches, brush, and tall grass.
- Wear a long-sleeved shirt tucked into long pants with cuffs tucked into socks, closed shoes, and light-colored clothing to make it easier to spot ticks.
- A commercial tick/insect spray with 25-30% DEET content may provide some protection. Spray clothing, especially from knees to cuffs, being careful not to get repellent on skin.
- Use tick and flea repellent collars on your dogs and cats, and brush off and check the animals after they have been outdoors. Though ticks do not jump, ticks on pets can be transferred to people by crawling.
- Brush off clothing after returning from the out-of-doors. At home, check for ticks immediately. Ticks commonly attach at the back of the neck, on the scalp, in the arm pits, in the groin area, and behind the knees. However, all areas should be checked.
- If you find a tick that is attached, you might want to consult a physician. If this is not possible, the tick should be removed carefully. Grasp it with tweezers by the head, not the body, and gently pull it straight out. Try not to crush the body or cause the tiny mouthparts to break off, which might result in an “injection” of bacteria or in infection at the site.

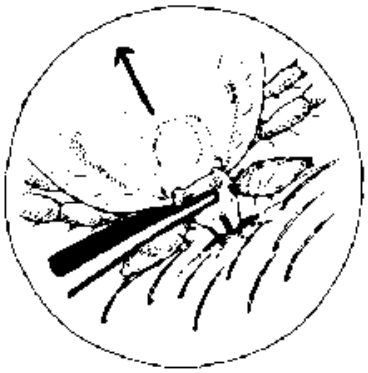
Symptoms:

- Early symptoms may resemble the flu, as follows: fatigue, headache, fever, chills, nausea, vomiting, diarrhea, sore throat, dry cough, stiff neck, chest, ear, back pains, pain in muscles and joints, recurrent joint swelling, swollen lymph glands and spleen, dizziness, and sun sensitivity.
- Later symptoms may include neurological and heart problems, and joint problems that can be confused with arthritis.
- Some who have Lyme disease exhibit a red, circular rash appearing from three days to a month after the bite. This rash usually begins with a small red spot that expands to a diameter of one to 18 inches. The expanded rash may have a bright red border and a hard, pale central area which is warm to the touch. Similar rashes may appear elsewhere on the body.

Treatment:

- Treatment is most effective in the early stages of Lyme disease. See your physician if you suspect you might have the disease.
- Later symptoms are also treatable with antibiotics.





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For more information on the scientific research related to this issue, please contact the Ecological Society of America at the address listed below.

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