



Gypsy Moth Supplemental Environmental Impact Statement Project

Monitoring and Methods Development Research

The first milk carton and delta traps used in gypsy moth management projects were developed at the APHIS lab. Other research includes improving monitoring and trapping technology for the gypsy moth (developing an automated data-logging trap) and other pests and conducting applied and basic biology research on the gypsy moth that is associated with monitoring (such as male gypsy moth antenna response to pheromones).



Experimental data logger traps.



A milk carton trap used to sample male response to the gypsy moth female sex attractant (pheromone).

Rearing Technology Research

Personnel at the APHIS laboratory at Otis Air National Guard Base (ANGB), MA, are working to improve rearing techniques for the gypsy moth. This lab produces millions of gypsy moth larvae, pupae, and adults every year for researchers throughout the United States.



A mass rearing operation at the USDA APHIS Otis laboratory — a container of late instar larvae are being raised on artificial diet in an environmental chamber.

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Images courtesy of USDA Forest Service and APHIS PPQ Archives, www.invasive.org.

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This brochure mentions pesticides; however, it does not recommend their use or imply that the uses described have been registered. All uses of pesticides must be registered by appropriate State or Federal agencies, or both, before they can be recommended.

The Supplemental Environmental Impact Statement [SEIS] augments the analysis and documentation of "Gypsy Moth Management in the United States: a cooperative approach," Final Environmental Impact Statement, 5 vols. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Area State and Private Forestry, November 1995.

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Historic picture of experiment station and insectary, Madden, MA.

Gypsy Moth Research



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Gypsy moth research is an essential element of a long-term management strategy for this pest. The USDA Forest Service, Animal and Plant Health Inspection Service (APHIS), and Agricultural Research Service (ARS) collaborate to provide vital biological information about the gypsy moth, in addition to developing tools, techniques, and new or improved management strategies.

Nucleopolyhedrosis Virus Research

The naturally occurring nucleopolyhedrosis virus (NPV) is mass-produced by the Forest Service and APHIS as a product called Gypchek® for controlling gypsy moth larvae. The virus infects only gypsy moth larvae. Gypchek® production involves raising millions of gypsy moth caterpillars, inoculating them with NPV, and processing the infected caterpillars at the appropriate time. The process is labor intensive, which is both expensive and limits the volume of Gypchek® produced. Ongoing research at the Forest Service laboratory in Delaware, OH, may result in more efficient methods of using bioreactors, thus avoiding the higher costs and difficulty of producing the virus in caterpillars.



Gypsy moth virus polyhedra that protect the virus particles cut in half and photographed with a transmission electron microscope. The rod-shaped black objects are virus particles that infect and kill gypsy moth larvae.

Bacillus thuringiensis var. kurstaki (B.t.k.) Research

Researchers in Delaware, OH, are studying the *B.t.k.* bacterium at the molecular level to improve its ability to target and kill only gypsy moth caterpillars.

Microsporidia Research

Microsporidia are microscopic, single-celled, parasitic animals that must invade cells to live. Six species of microsporidia have been described from gypsy moth populations in Europe; however, none are reported from gypsy moth populations in North America.

Strong evidence suggesting that microsporidia cause significant mortality to gypsy moth populations in central Europe led the Forest Service to initiate a foreign exploration program in 1993 to search for microsporidia in gypsy moth populations. Microsporidia might enhance the biological control of the gypsy moth in North America.



Microsporidia

Disturbance Ecology and Management of Oak-dominated Forests Research



Historic (undated) defoliation in Princeton, MA.

Forest Service researchers at the Forestry Sciences Laboratory in Morgantown, WV, provide methods for creating and maintaining healthy and sustainable oak-dominated forests based on ecological relationships, landscape ecology principles, silvicultural management, and gypsy moth population dynamics. Research personnel are exploring ways that defoliation by gypsy moth and other established exotic organisms interacts with other forms of disturbance in influencing forest dynamics, successional patterns, and other ecological processes over time.

Researchers in the Morgantown laboratory also conduct research on:

- Population dynamics of the gypsy moth and other introduced pests at the landscape scale, including spatial and temporal dynamics of gypsy moth population outbreaks and gypsy moth spatial ecology over time.
- Biologically and economically effective silvicultural treatments for rehabilitating and regenerating oak forests to minimize gypsy moth impacts.
- Decision-support tools and models that integrate results from studies of forest disturbance effects and resulting forest dynamics through time and over landscape ecology scales.

Mating Disruption Research

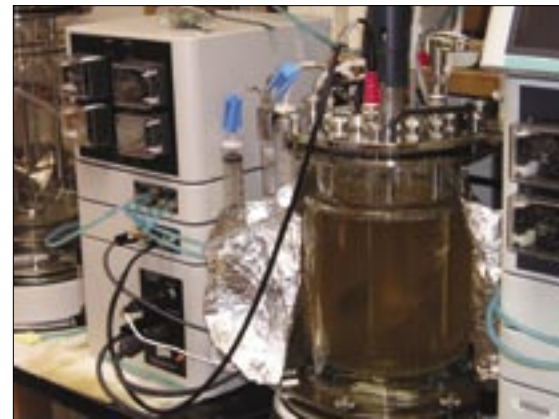
The female gypsy moth releases a sex lure called a pheromone to attract male moths. By applying artificial pheromone to areas infested by the gypsy moth, males are unable to find females and mating is prevented. The USDA Agricultural Research Service, Insect Biocontrol Laboratory in Beltsville, MD, conducts research to find better ways of applying different formulations of pheromone and better understand how mating is disrupted.



Female gypsy moths, emerged from pupae, are ready for use in field evaluations of mating disruption treatments.



Female gypsy moth used to evaluate the effectiveness of pheromone applications to manage male gypsy moth populations by preventing mating.



Bioreactor. Photograph taken at the USDA Forest Service lab in Delaware, OH.

The Northeastern Center for Forest Health Research laboratory in Hamden, CT, develops and tests improved Gypchek formulations and methods for using them in treatments.