

# RESEARCH NEWS

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## Forest protection

### Automated Pheromone Traps for Forest Pest Moths

Despite being widely popular, moths, and their larvae in particular, are not always welcome in forests, parks and gardens. Some moth species constitute a real threat to forests when they appear *en masse*. In the past, they have stripped entire deciduous and coniferous stands bare in many places in Germany. Forest pest monitoring is consequently particularly important to track their reproduction and to protect forests from greater damage. Research scientist from the Fraunhofer Institute for Factory Operation and Automation IFF are developing a digital, automated pheromone trap together with the Nordwestdeutsche Forstliche Versuchsanstalt in the DiMoTrap project which could significantly reduce the labor of hitherto complex manual monitoring for forest protection.

Fraunhofer IFF research scientists and the Nordwestdeutsche Forstliche Versuchsanstalt's forest protection division are particularly interested in gypsy, nun, pine beauty, pinetree lappet, winter and spring usher species of moths in the project DiMoTrap (short for Digital Moth Trap). Sensitive forest ecosystems become more vulnerable particularly when the sun shines and it does not rain — pest insects, such as gypsy moths and the like, can proliferate in the forest and cause tremendous damage. Nun moth larvae, for instance, eat the needles or leaves of infested trees and strip them bare when they appear *en masse*. A reliable forecast of mass reproduction makes it possible to take suitable actions to protect forests from greater damage in good time.

Insect monitoring with pheromone traps has proven particularly effective. Conventional trap systems are not optimal for monitoring, though, since their maintenance is very labor-intensive. This is why research scientists are developing automated pheromone traps in the DiMoTrap project that monitor pest moth species. The goal is to simplify large-area monitoring substantially and to reduce the labor significantly. The Federal Ministry of Food and Agriculture and the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection are funding the project. The Fachagentur Nachwachsende Rohstoffe e.V. (FNR) is the funding agency.

#### A new system intended to replace standard pheromone traps

“The Nordwestdeutsche Forstliche Versuchsanstalt manages some 400 monitoring stations for the nun and pine beauty moth alone. Every year, they are each equipped with three pheromone traps from April to May (pine beauty) and from July to September (nun moth). They are hung for periods of up to three months and have to be serviced

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by hand and the pests counted once a week,” says Dr. Ina Ehrhardt, research scientist at Fraunhofer IFF in Magdeburg. “Climate change, which is exacerbating the proliferation of pest insects, is making monitoring increasingly more complex.” Another problem: The pheromone bait used, which attracts the moths and varies depending on the species, does not release a constant level of pheromones over the entire period.

The new DiMoTrap system is intended to resolve these problems and make pest monitoring significantly more efficient. DiMoTrap will replace time-consuming manual servicing and perform the jobs of pest counting, bait replacement and trap assembly. Automated data acquisition will continuously record and transmit catch data directly to a central location. This would reduce manual labor substantially and enable a rapid response to pest proliferation. “The digital, modular trap, which runs self-sufficiently over up to three months thanks to its integrated power supply, systematically attracts, catches and digitally counts moths. What is more, the trap empties itself at regular intervals and ensures that untargeted organisms can escape the trap alive. A microcontroller, the centerpiece of the trap, controls all the electronics,” says the engineer, explaining how the digital trap works. A component, which contains a reservoir filled with several baits, was developed to release pheromones continuously. A digitally controlled mechanism replaces pheromone baits at user-defined intervals. The research scientists are additionally working on the release of liquid pheromone solutions by a micropump. Both models have been field tested.

The current version still transmits data on counts, date, operating time, trap condition and other parameters to an interpretation software by cable but a Bluetooth connection is planned. In the future, the research scientists also want to implement remote data transmission, for instance, over suitable sensor networks that wirelessly transmit by cell phone the collected data recorded by many single traps over a defined period.

### **Long-term tests with gypsy moths and nun moths**

Different versions of the trap are currently being tested for gypsy and nun moths over three months at locations in Saxony-Anhalt and Hesse. Among other things, the research scientists are testing the prototype test models’ component interaction and counts. In the next step, the prototypes will be developed. “Our traps have potential for use in agriculture too, specifically in fruit farming. Their modularity enables customers to customize the range of functions for their needs and to opt for just certain components,” says the research scientist.

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**Picture 1: Male gypsy moth**

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**Picture 2: Research scientists during the field test**

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**Picture 3: Outdoor tests in the forest near Wetzlar (Hessen)**

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