

NASA satellite to map gypsy moth defoliation

UNIVERSITY PARK — NASA's earth-scanning satellite, passing over Pennsylvania this summer, will chart the defoliation of forests by gypsy moths. The new space-age technique will combine computer analysis with in-

formation from the Landsat satellite.

"Such scanning will gradually replace the present aerial sketch-mapping of damage by gypsy moth caterpillars," declared Brian J. Turner, co-director of the Office

for Remote Sensing of Earth Resources, at Penn State.

"Computer-generated maps can show two or three levels of defoliation in more detail, with greater consistency, and at least as accurately as those produced

currently," Turner affirmed.

Orbiting the earth from 600 miles up, the satellite encloses 13,000 square miles in a single image. This advantage is enhanced by the computer's ability to make unbiased decisions, thus decreasing human variations. The satellite will pass over central Pennsylvania on June 21. Overpasses occur every 16 days.

Turner and associates developed rules for a computer to follow in determining whether an area had been defoliated or not. Information from previous Landsat overpasses showing no defoliation will be matched against this summer's flights.

"Our first need was to develop a foolproof way of determining whether an area was forest or not," he said. "Defoliated forest in mid-summer looks remarkably like any other bare ground when seen from a satellite 600 miles up."

New information on magnetic tape will be acquired from Landsat passes occurring at the peak of defoliation. This information will be registered by a computer onto a forest map. Forested areas will then be analyzed by a computer to determine the extent of defoliation. The process will use rules set up by comparing ground observations with data from satellites.

Using green and red bands of the visible spectrum, and two in the infrared band, the Penn Staters overlay the images to create color-enhanced pictures of the state. Heavily defoliated areas show up in one color and healthy forests in another color.

"Maps can then be produced showing the extent of defoliation and corresponding acreages. Such maps can be produced by counties, forest districts, or by some map grid system," Turner commented.

The new remote sensing procedure grew out of a three-year project developed within the Penn State Office for Remote Sensing of Earth Resources. Cooperating were scientists from NASA's

Goddard Space Flight Center in Maryland and their Jet Propulsion Laboratory in California.

Involved at the state level were pest control officers of the Pennsylvania Department of Environmental Resources.

The first stage in developing a satellite-oriented mapping systems was to construct a forest map of Pennsylvania. This was begun with Landsat data showing no defoliation, acquired from 1976 through 1979.

Ten Landsat scenes or sequences were needed to get full coverage of Pennsylvania. Accordingly, techniques developed in lunar and planetary missions were used to form a composite map of digital computer data for the state.

Geographic distortions were corrected so that the resultant set of data conformed to a geographical grid known as Universal Transverse Mercator system. And finally, computer analysis of the information produced a forest-nonforest map of the Commonwealth.

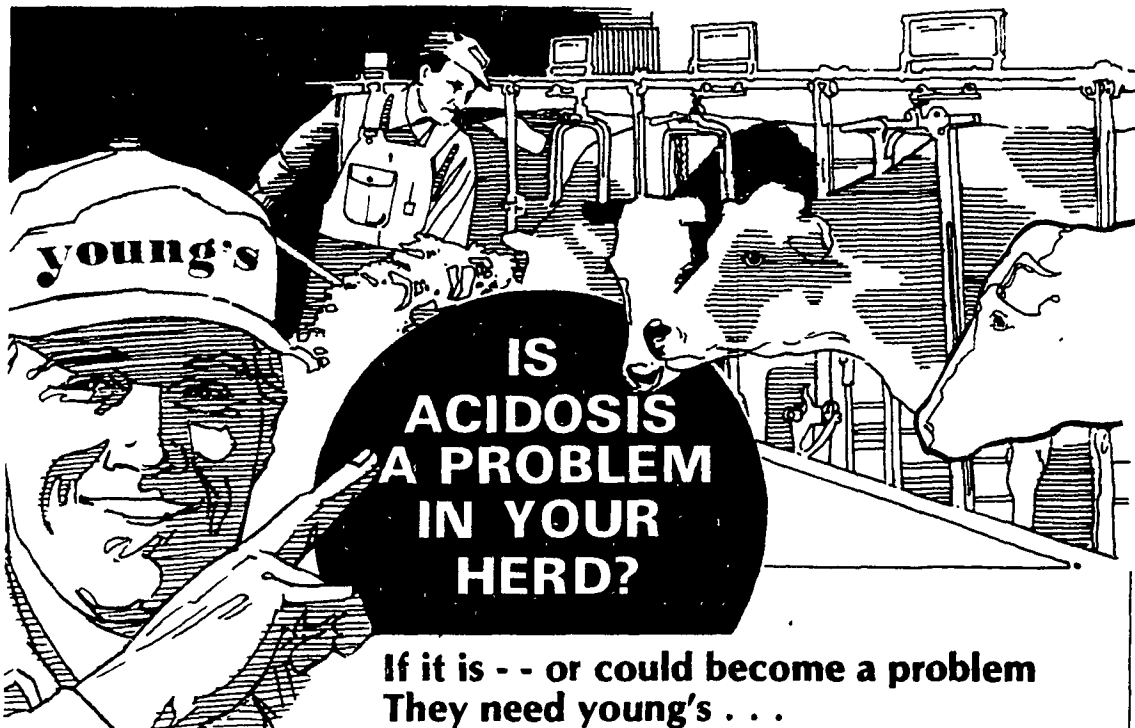
"The new collection system is not completely foolproof," Turner noted. "There is always the chance that clouds will obscure some part of the state for all peak-defoliation passes, made about once every two weeks. In such cases, the State Bureau of Forestry will fall back on the old method of aerial sketch-mapping," he added.

This year the Pennsylvania Bureau of Forestry is spraying a new bacterial insecticide known as Bt (*Bacillus thuringiensis*). Dr. Turner said the satellite's gathering of information could help to determine the effectiveness of the new insecticide.

Initially, Landsat analyses will be carried out by personnel in the State Department of Environmental Resources (DER), working in cooperation with scientists at Penn State. The university's computer and image-analysis facilities will be used. In time, Turner said, DER analysts will be able to conduct independent and routine defoliation assessments from satellite data.



Computer-printed map of Perry County, from 1981 Landsat data shows forests defoliated by gypsy moths in black areas with undefoliated forests in white. Gray areas are lands not covered by forests.



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