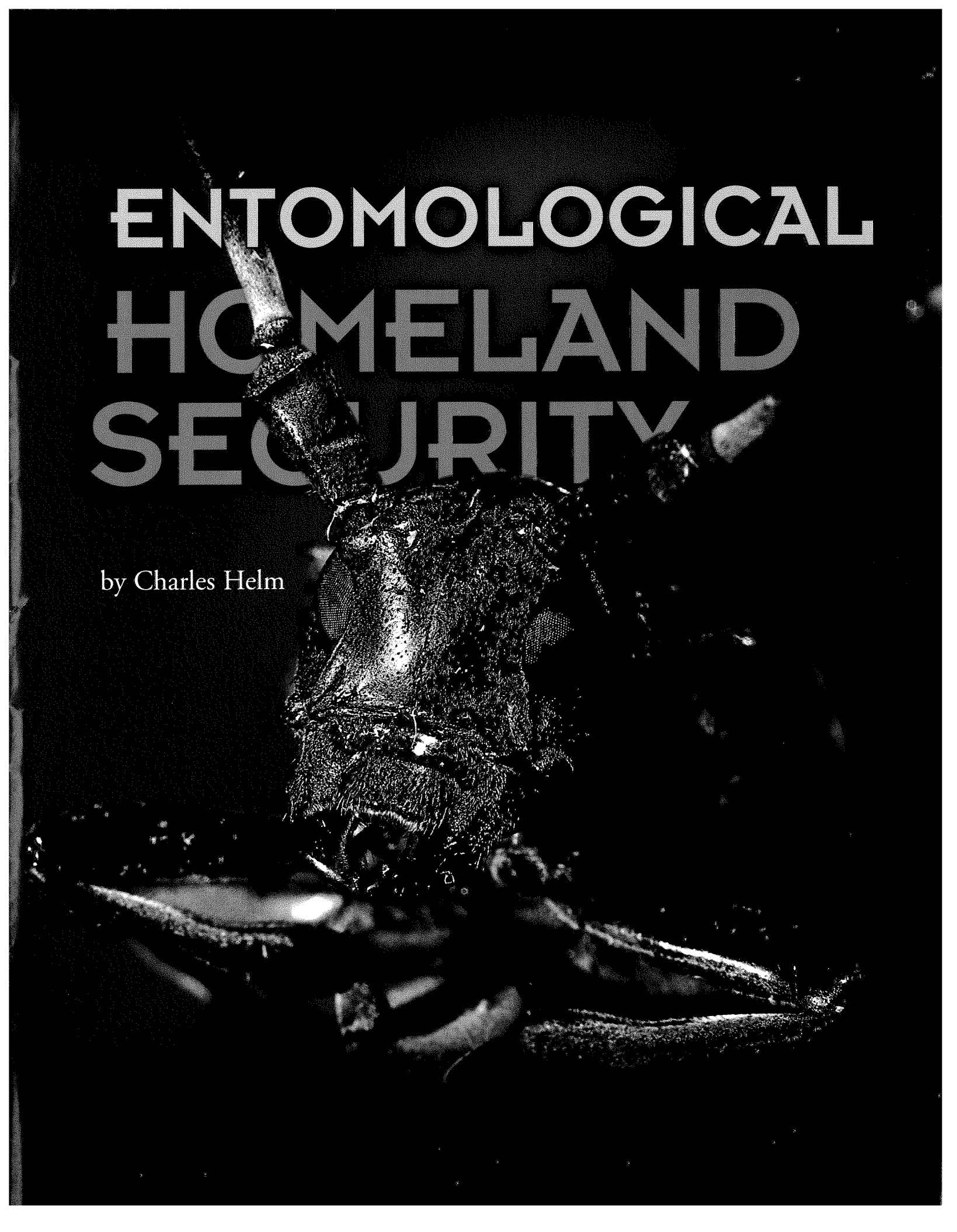


ENTOMOLOGICAL HOMELAND SECURITY



by Charles Helm

"A hundred years of faster and bigger transport has kept up and intensified this bombardment of every country by foreign species, brought accidentally or on purpose, by vessel and by air and overland from places that used to be isolated."

Charles Elton, 1958. *The Ecology of Invasion by Plants and Animals*



PREVIOUS PAGE: FACE OF ASIAN LONGHORNED BEETLE
ABOVE: NEWLY EMERGED ASIAN LONGHORNED BEETLE

As early European colonists settled along the eastern seaboard, the geographical and ecological barriers that had for so long virtually isolated North America were forever breached. Sailing ships and their human, agricultural, and livestock cargoes began the onslaught of foreign species described by Elton, and the more rapid transoceanic crossings allowed by steamships increased the pace of introductions. Plants and seeds from around the world were imported without regulation or consideration of the consequences to native habitats or species. While many purposeful introductions proved to become important food and fiber crops, too many pests of foreign origin accompanied the multitudes of commodities and crops purposefully introduced to feed the growing appetites of the American melting pot. Early settlers and government agencies paid little heed to the potential dangers of foreign pest introductions, many



ASIAN LONGHORNED PUPA IN MAPLE TREE

of which still plague agricultural production and natural ecosystems today.

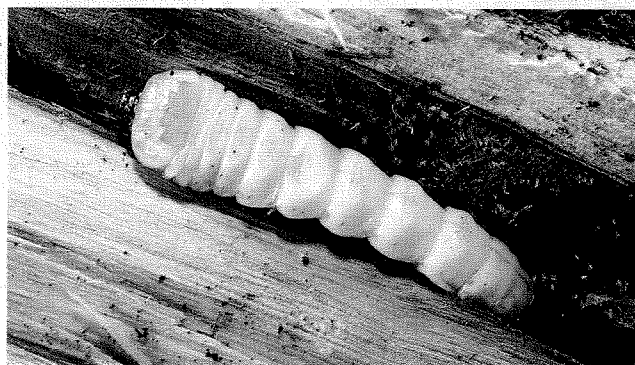
By the late 1800s, it was clear something had to be done to stem these steady, costly invasions of foreign pests. Crops new to North America were now commonly under attack by pests that were equally new to the continent. Hessian fly, wheat leaf rust, codling moth, San Jose scale, cotton boll weevil, gypsy moth, and chestnut blight were among the earliest exotic plant pests of major concern to American agriculture. The Plant Quarantine Act of 1912 authorized the U.S. Secretary of Agriculture to regulate the importation and interstate movement of nursery stock and other plants that may carry pests and diseases harmful to American agriculture. While this was a significant step toward preventing or limiting the spread of harmful invasive species, it would not altogether stem their flow.

Containerized Shipping

International trade barriers gradually relaxed following World War II and the U.S. was poised to become a powerhouse of international trade. Air travel dramatically increased, moving people and goods around the world in fractions of the time required during the previous century. The interstate highway system linked the continent, allowing trucks to transport foreign goods from ports to inland cities within hours or days. But it was containerized shipping that completely revolutionized international commerce and set the stage for rapid, efficient, worldwide movement of seaborne cargo—and the worldwide movement of plant pests.

First introduced in the late 1950s, these rectangular steel containers are now the norm for maritime shipments and can be easily off-loaded at ports of entry for rapid movement to inland destinations by rail or truck. Cargo shipped via containers can include almost any product imaginable from food-stuffs, clothing, and electronics to agricultural products and industrial goods. While shipping containers offer speed and efficiency to international trade, there is little doubt that they also increase the risk of foreign pest introductions. Containers provide an ideal, protected environment for the accidental movement of insects, snails, slugs, and other plant pests either on the cargo itself or attached and hidden within the container, living in the solid wood packing material (SWPM) that often accompanies international cargo. Faced with as many as 7 million containers pouring across our borders every year, agricultural inspectors charged with preventing the accidental introduction of foreign pests face a formidable challenge posed by the sheer volume of these sealed units.

Michael R. Jeffords



ASIAN LONGHORNED BEETLE LARVA IN MAPLE TREE

Worries with Wood

Furthermore, SWPM in the form of crates, boxes, pallets, and interior bracing is often associated with containerized cargo. SWPM has been identified as a major pathway for the entry of non-native bark beetles and other woodboring insects such as the Asian longhorned beetle and emerald ash borer. Although there are now specific federal regulations aimed at limiting the likelihood of the introduction of foreign pests in SWPM, up to 50% of the containers arriving in this country include SWPM, much of which is not readily accessible for inspection. Regardless of the commodity being shipped, this would suggest that 9,500 of the nearly 19,000 containers flowing into U.S. ports each day should be opened and unpacked just to inspect for evidence of insect contamination in SWPM. Unpacking containers requires an enormous amount of staff and time, far more space than is available at most port facilities, and can add several thousand dollars in importer costs to each container.

Both photos: Charles Helm



SOLID WOOD PACKING MATERIAL OF FOREIGN ORIGIN MAY HARBOR LIVING INSECTS



LINDGREN FUNNEL TRAP USED IN EXOTIC FOREST PEST SURVEYS



Of course, the consumer can expect to cover these additional expenses. Even at huge container ports like Long Beach, CA, inspectors are only able to conduct thorough “devan” examinations (i.e., unloading all cargo from containers) on between 125 and 200 shipments per week. In reality, only 3% or less of all containers entering the country receive such in-depth screening. Add to this concerns related to the potential use of shipping containers as terrorist tools and the task of adequate inspection within a reasonable, cost-effective timeframe is even more daunting.

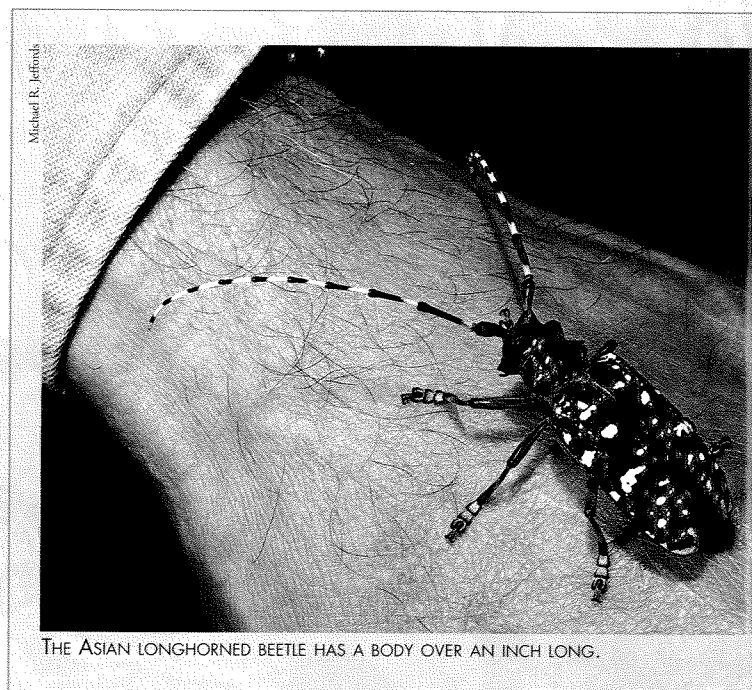
Security Breach

Despite the expertise and dedication of USDA agricultural inspectors, foreign plant pests are still entering the country at an alarming rate and the economic and environmental costs of these continued introductions are enormous. Estimates of damage, control, and restoration costs associated with exotic species are greater than \$130 billion every year. To understand why exotic pests are so costly, one needs to look no further than the estimated price tag associated with the ongoing eradication effort against even a single pest like the Asian longhorned beetle. Federal officials anticipate that the Chicago infestation, encompassing less than 35 square miles, will not be eradicated until 2008, fully 10 years after its initial detection and at a cost of up to \$90 million for surveys, tree removal, insecticide treatments, and replanting of devastated neighborhoods. Populations of Asian longhorned beetles in New York are proving even more resilient, and may require up to \$250 million and a total of 16 years of effort if eradication is possible at all. Costly as these programs may seem, if left completely unchecked to establish throughout

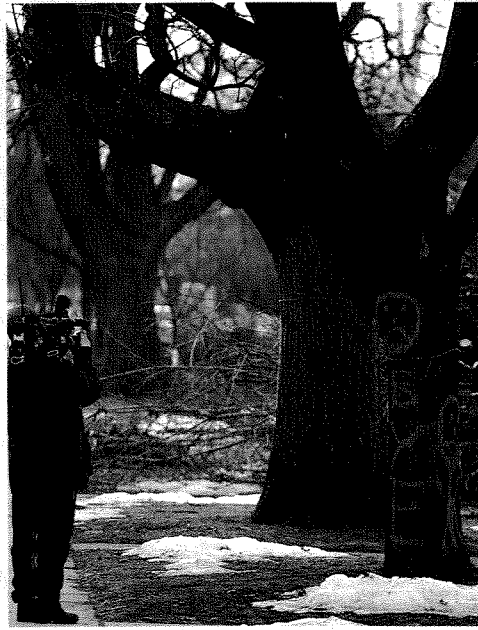
North America, some studies suggest Asian longhorned beetles could cause up to \$72 billion in losses to our urban forests.

Bioterrorism Tool

Although exotic species offer significant agricultural and environmental concerns, the possibility of an intentional deployment of a non-native species as a tool of bioterrorism must now also be considered. High profile arthropod-borne diseases such as West Nile virus or veterinary threats such as foot and mouth disease of livestock readily come to mind as potential agents. However, exotic species need not have direct human or



THE ASIAN LONGHORNED BEETLE HAS A BODY OVER AN INCH LONG.



TREE REMOVAL ACTIVITIES IN A CHICAGO NEIGHBORHOOD

livestock impact to disrupt agricultural production and cause severe economic losses. The recent detection of a widespread infestation of the emerald ash borer in Michigan is causing enormous economic disruption and loss and is having a direct impact on interstate commerce due to quarantine restrictions on ash products and nursery stock. This is not to suggest that the emerald ash borer was purposely introduced, but it does illustrate how an intentional, although limited, pest introduction affecting just one host species or commodity could result in tremendous survey and control costs and produce devastating trade and market consequences.

Early Detection Is Key

Faced with limited financial and human resources and the growing realization that perfect detection and prevention at ports of entry is impossible, increased emphasis is now being placed on early detection and rapid response to exotic pests that may have eluded frontline detection at ports of entry. The Cooperative Agricultural Pest Survey (CAPS) is a combined effort by federal and state agricultural organizations to conduct surveillance, detection, and monitoring of exotic plant pests with the hope that permanent establishment and spread of newly detected foreign pests can be averted. The U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine (USDA-APHIS-PPQ) is the lead federal agency in this cooperative program. The Illinois Natural History Survey (INHS), University of Illinois, and Illinois Department of Agriculture play vital roles in coordinating state pest survey needs

and activities within the umbrella of the federal program.

Regional pest detection committees within the CAPS program compile exotic pest lists based on interception records, pathway and risk analysis, and information provided by experts in various scientific disciplines. Survey targets include exotic weeds, plant diseases, insects, nematodes, and other invertebrate organisms such as snails and slugs. Funding provided through the CAPS program is used to enhance state pest survey and detection programs and to coordinate the activities of local, state, regional, and national agencies with responsibilities for exotic pest survey and detection.

Winning the War in Chicago

In most cases, once an exotic species becomes established, it is here to stay. However, occasionally, eradication programs are worthy of consideration in spite of many examples of very costly failures. Although not without significant cost and dramatic alteration of many beautiful, tree-lined streets, Chicago's war against the Asian longhorned beetle (ALB) provides an excellent example of a well-planned, well-executed program destined for a successful outcome. Following the initial detection of ALB in New York in 1996, another established population was discovered in 1998 in the

Ravenswood neighborhood of Chicago and in suburban Summit and Addison. City, state, and federal agencies formed a task force to assess the situation and quickly agreed on an extensive survey, eradication, and reforestation strategy. Regrettably, since the damaging larval stage lives deep inside infested trees during most of the year, removal and destruction of infested trees was the only recourse. Over 1,600 trees have fallen victim to ALB attack since the removal program began in early 1999. The spring of 2000 ushered in a new weapon in the ALB battle; insecticide

injections have now been applied to nearly 100,000 susceptible host trees. In 2003, intensive tree climber and bucket truck surveys detected only six infested trees within the core area of infestation, but an observant citizen spotted a lone beetle just outside the Ravenswood quarantine zone in late fall. However, even this minor disappointment is not an indicator that the battle is not being won. Quarantines may soon be lifted from outlying sites and, if the program continues as expected, Chicago may declare outright victory against ALB in 2008.

Containerized Shipping: A Revolution in International Commerce

In the mid-1950s, Malcolm McLean had a breakthrough idea that had a profound and lasting influence on international commerce and the global economy. Instead of packing cargo in crates, loading the crates in trucks for shipment to the docks, then unloading them from the truck to stow aboard the ship, why not take a fully loaded body of a tractor-trailer and place it directly on a ship or railroad car? Not only were handling costs lowered, but also the sealed containers protected cargo from the elements, breakage, and theft during its overseas journey. Depending on dimensions of the cartons, type of packing material, and experience of the stuffing crew, a standard 40-foot steel or aluminum container has an internal capacity of up to 2,380 cubic feet and can hold up to 63,500 pounds of cargo.

Today, nearly \$500 billion worth of goods is shuttled in and out of U.S. ports using McLean's simple concept. The speed and efficiency afforded by this system makes it possible to transport goods from an exporter in central China to an importer in suburban Chicago in a mere 19 to 23 days according to the Washington, DC-based World Shipping Council. Once the exporter places an order for an empty container, it is loaded at a factory in inland China and transported by truck to the Port of Shanghai. Here, huge cranes stack as many as 5,000 containers on the deck of a specialized container vessel bound for the ports of Long Beach or Los Angeles. Upon arrival in the U.S. port, towering container cranes

off-load and stack some units for trucking or place others directly onto railcars. The next stop is Chicago, where the container is placed onto a truck for delivery to the importer. Unless the container has been opened for inspection previously, it is here that the seal is broken and the merchandise inside is distributed to retail outlets.

Photo by Larry R. Barber, USDA Forest Service, www.livestate.org



On Guard in Illinois

Researchers at the INHS are collaborating with several federal agencies in the CAPS-sponsored National Exotic Woodborer/Bark Beetle Survey to conduct educational activities, inspections, and surveys at high-risk sites within Illinois to determine if undetected infestations of non-native forest pests exist. Traps were placed at 22 locations in 11 counties during 2002 and 2003. Sites included manufacturing facilities receiving components of foreign origin, warehouses receiving bulk cargoes of steel and heavy machinery, cargo handling and container de-stuffing facilities, barge services along the Mississippi and Illinois rivers, and state forests or private tree nurseries near any of these aforementioned locations.

None of the targeted exotic forest pests were detected in Illinois; however, the Asian ambrosia beetle (*Xylosandrus crassiuscullus*) and the banded elm bark beetle (*Scolytus schevyrewi*), two exotic forest pests not known to occur in the state, were discovered during the course of this survey. The Asian ambrosia beetle was first detected in the U.S. in South Carolina in 1974 and has gradually expanded its geographic range. The banded elm bark beetle was newly discovered in the U.S. in April 2003 in Utah and Colorado, but it has since been reported in at least nine other western and Great Plains states. The Illinois detection represents the easternmost edge of its current range. The impact of these exotic pests on Illinois forest resources is still unknown, although there have been reports of sporadic damage to nurseries and orchards from Asian ambrosia beetles in North Carolina and Tennessee.

Illinois and the nation have been under biological attack from pests of foreign origin for several hundred years and will continue to face this onslaught. The ever-increasing volume and speed of worldwide travel and trade have actually increased the probability of accidentally transporting exotic pests. The U.S. is the largest trading nation in the world for both imports and exports and rapid growth is expected to continue through the next decade. Highly trained experts, whose duty is to prevent the accidental introduction of foreign pests that might accompany any one of the myriad products consumers demand, staff more than 110 U.S. ports of entry and provide the first line of defense against exotic invaders. Improved X-ray technologies are currently aiding the cargo screening process, and precision sound devices are under development that might detect and even identify insects hidden in SWPM or fruits and vegetables. Still, it is likely that new pests will slip through our borders. Early detection and rapid response to new pest populations may be our best chance at preventing their establishment. Clearly, not every battle can be won, but we are in a war with exotic pests we cannot afford to lose. As Congress noted in adopting the Plant Quarantine Act in 1912, "The past cannot be altogether remedied, but the future can be safeguarded..."

Charles Helm is a senior research scientist for the Illinois Natural History Survey in Champaign, and serves as state coordinator for the Cooperative Agricultural Pest Survey.