Gypsy Moth and the AIPM

The Final Environmental Impact Statement (FEIS) for the Appalachian Integrated Pest Management (AIPM) Gypsy Moth Demonstration Project was released in February. The EIS provides guidelines for future site-specific analysis required by the National Environmental Policy Act (NEPA) if control measures are applied to the gypsy moth population within the AIPM project area.

Fourteen alternatives for eradication and control were considered. Six (6) alternatives were studied in detail. The Forest Service's Northeastern Area Director, State and Private Forestry Division, prepared the study. Only one chemical pesticide is being considered for the non-wilderness areas, dithianon, trade name DIMILIN.

The proposal outlines forested suburban/urban area treatment using tactics designed to affect gypsy moth population and biological tactics on the gypsy moth. Gypsy moth specific tactics include dispersal (tape and flakes) release of sterile life stages, mass trapping, release of parasites that only affect gypsy moth, and the application of Gyphere (NPV). Biological tactics (continued on page 4)

Hearings On SMCA

Despite holding hearings on a weekday morning in cities far from most affected areas, hundreds of people turned out to testify at regional hearings on the Office of Surface Mining's (OSM) proposed amendment to the Surface Mining and Reclamation Act (SMCA) that would allow mining in our parks, wilderness areas, wildlife refuges, historic cultural sites, wild and scenic river corridors, and within the buffer zones around homes, churches, schools, cemeteries, roads, and other public buildings. These areas were provided specific protection when SMCA was passed in 1977. When staff at Save Our Cumberland Mountains asked for a night meeting, an OSM agency official said it would "cost a lot of money." In Knoxville, Tennessee, over 300 citizens attended the hearing. Congressman Jim Sasser vowed to fight the proposed amendment "to the end." Melinda Smiddly of Lick Creek, Tennessee, testified that "where I live people depend on springs and wells for water. If there is a strip mine nearby, people will lose their water. If OSM allows strip mining up to someone's back door ... the people who own the house wouldn't have a back door or a front door left." Smiddy added, "It's bad when they mine through a cemetery" as she talked about an operator who mined a cemetery near her home. "He dug up the graves, stacked up the caskets, and stripped it. That shouldn't be allowed.

Kentuckians from the coal fields traveled through snow to attend the Lexington hearing. Maynard Tetreault of the people who own the house wouldn't have a back door or a front door left." Smiddy added, "It's bad when they mine through a cemetery" as she talked about an operator who mined a cemetery near her home. "He dug up the graves, stacked up the caskets, and stripped it. That shouldn't be allowed.

Kentuckians from the coal fields traveled through snow to attend the Lexington hearing. Maynard Tetreault of the house, and the application of Gyphere (NPV). Biological tactics (continued on page 4)

Geology, Observations, and Floods

Steven McClelland, Coal Geologist

Predicting and preventing floods depends in part on a classic tool of geologists — observation.

Geology is everywhere under our feet. But in order to see it, we need to keep our eyes open. Because they have years of training in making observations, most geologists are quite familiar with the area in which they work and live, even if they are not actively studying it. When we came to work on the morning of November 4, 1985, the normally placid Cheat River, which flows in front of our Mont Chateau headquarters, was ominously high and fast-moving. This high water was part of one of the worst floods on record in northern West Virginia. As geologists, what observations can we make about this flood and floods in general?

Why Make Observations?

Geology is a descriptive science. Its core is a mass of observations about the world we live in. Progress in geology has come from using inductive reasoning to sift through this mass of data. It's the same way a detective thinks. Just as a detective cannot find a criminal without clues, the geologist cannot explain the physical world beneath him without observations. When a geologist makes observations, there is often a use already in mind for the data being gathered. An example is making observations in recent roadcuts through coal-bearing rocks, to help our re-vegetation program to repopulate the State's coal deposits.

But a geologist frequently sees something noteworthy that does not fit any current need. The observation is still made because the information may be needed in the future, or by someone who does not yet know its significance or cannot visit the site. While the November 4th flood was a disaster, it was also an opportunity for us to directly observe a major flood and study its effects.

Are observations about floods really needed? Isn't there a formula somewhere in which to plug a few numbers and get the answer? Consider what Lindley, Kohler, and Paulus say in their book, Hydrology for Engineers:

"The complexity and constant change of a river system and its floods would interest only a few specialists if people's lives were not intimately connected with them. People live, work, and play in, near, and on rivers. Most cities and towns are located on a body of water, often a river. Many rural people live near rivers, and normally it is advantageous; much productive agricultural land is located beside rivers. But when a river floods, people are injured or killed; property is damaged or destroyed; lives and economic patterns are disrupted. This disruption may continue long after the flood, and well outside the river's floodplain. For instance, the November 4th flood sank barges and damaged navigational facilities on the Monongahela River which affected coal mining; the mines were not directly damaged by flooding, but river transportation was interrupted, halting the movement of coal.

(continued on page 7)
Governor Opposes MRS In WV

Below is a copy of the letter sent to Alex Radin, Chairman of the Monitored Retrievable Storage Review Commission by Governor Caperton, and dated March 20, 1989.

I understand that the Monitored Retrievable Storage Review Commission has been charged by the Congress with the evaluation of various strategies for the storage and disposal of the Nation's nuclear waste. I am further advised that the Commission has held numerous public hearings and has solicited public comment for these purposes.

During your review process, some interests have suggested West Virginia as a potential site for such a monitored retrieval storage facility. While the Commission is not authorized to make such site recommendations, this process has clearly been adopted by some to advocate specific sites, and the suggestion of West Virginia in this regard compels me to respond.

Therefore, please be advised that this administration is philosophically opposed to the siting of a monitored retrieval storage facility at any location within our state. Such a nuclear waste facility is simply incompatible with West Virginia's existing land use patterns, and would seriously impair the efforts of our state to build the tourism industry and further economic development.

Of course, West Virginia will continue to cooperate with our neighboring states through the Southern States Energy Board to properly dispose of our very small quantity of radioactive wastes generated by domestic sources. However, the nature and scope of nuclear waste disposal facilities which the Commission is reviewing obviously transcend our domestic waste disposal requirements.

For these reasons, the State of West Virginia must respectfully oppose the siting of a monitored retrieval storage facility at any location within our state. I request that this correspondence be entered into the record of your hearings in this matter.

Thank you for your consideration and attention to the concerns and position of this administration.

Device Detects Africanized Bees

Researchers have created a portable device that identifies aggressive Africanized bees by monitoring the sound made by the movement of their wings.

The researchers, at the Oak Ridge National Laboratory in Tennessee, said the device could provide a useful and cost-efficient method of detecting the presence of the disruptive bees in commercial hives.

The portable detector was developed by Howard T. Kerr and Michael E. Buchanan, engineers at Oak Ridge, and Kenneth H. Valentine, a former researcher at the laboratory. Mr. Kerr, an amateur beekeeper whose work on safety controls for nuclear reactors provided the technology for the device, was quick to point out that what he and his colleagues have come up with is simply a new use for an existing technology.

The bees are descendants of bees that escaped after being imported from Africa to Brazil in the 1950s for breeding experiments. They are expected to reach the southern United States in substantial numbers next year.

Mr. Kerr said he and the others began considering some type of noise analysis technique for monitoring the insects after a visiting scientist from Venezuela mentioned that these bees had a noticeably different buzz from bees kept for commercial purposes.

Using acoustic signal processing methods commonly employed to detect malfunctions in nuclear reactors, the team of engineers recorded colonies of Africanized bees in Venezuela and colonies of European honeybees in this country. They discovered that the two strains move their wings at different frequencies, a quality that makes them distinguishable from one another without costly and time-consuming collecting and dissecting procedures.

Mr. Kerr said that the device, which can be worn on a belt and flashes a green light when European bees are near and a red light if Africanized bees are in the vicinity, will be marketed by a private company that he has formed with his co-workers.

NYT, March 14, 1989
Book Review


If you are looking for answers this book is not for you. If you are interested in the unconventional, James Lovelock presents several coherent arguments that expand his unique view of life systems. The journey from ashes to star dust is a way strewn with all the powers of technology.

Precise observations about technological solutions in the context of the corporate economy of the world preclude interpreting the Gaia thesis as the ultimate rationalization for man's frenetic analysis and packaging of life. A convincing rebuttal to criticisms who dismiss the hypothesis as just another teleological argument is met with frank denial by the author. In fact, one gets the feeling that Lovelock will deny any attempts to present Gaia in formulated terms.

Describing Gaia in her own terms is the mission, and no less, that Lovelock determines for this summation of Gaia theory. Short of creating his own "decoder" is prepared to work through errors that have inevitably become a part of the language. Just as the the initiator of a whispered message recognizes only one or two phrases from the original thought finally unenunciated by the last person to receive the message.

"Not only has Gaia stayed alive from the beginning; she has also provided a noise-free channel of chemical messages about those ancient times . . . . There is every reason to believe that we share with the first ancient bacteria a common chemisty, and that the natural restrictions on the existence of those ancient bacteria tells us what the environment of the early Earth was like . . . life acts as a repeatar . . . ."

Other sources from astrophysics and geology are presented. Insights are deepened by schematics suggesting alternative ways to augment the Gaia hypothesis.

The additional confessions of the author expand the hypothesis. As a contemporary practitioner of planetary medicine, no exact duties, goals, or other conventional measures of human activity capture the scope or responsibilities of planetary practitioners. The author gives precedents from a traditional time-line of human history by citing the accidental fortuitous happenings that resulted in a pivotal discovery or intellectual breakthrough.

The concluding chapter offers the reader a paradigm for the Gaia hypothesis in terms of Lovelock's own life. Undoubtedly bursting with his own peculiar position within Gaia the tangible examples are presented to be inappropriate for extrapolation to any other's life. The strongest argument that can be presented by the author he feels to be not answers to the "whys" presented by modern sciences; but, an exploration of the dogma that provides context for contemporary sciences.

Convinced that a message describing Gaia is present from Gaia herself if the "decoder" is prepared to work through errors that have inevitably become a part of the language. Just as the the initiator of a whispered message recognizes only one or two phrases from the original thought finally unenunciated by the last person to receive the message.

"Not only has Gaia stayed alive from the beginning; she has also provided a noise-free channel of chemical messages about those ancient times . . . . There is every reason to believe that we share with the first ancient bacteria a common chemisty, and that the natural restrictions on the existence of those ancient bacteria tells us what the environment of the early Earth was like . . . life acts as a repeatar . . . ."

Other sources from astrophysics and geology are presented. Insights are deepened by schematics suggesting alternative ways to augment the Gaia hypothesis.

Forest Biology Research And The 21st Century

Stanley L. Kugman, staff director, and Stephen E. McDonald, research forester, Timber Management Research Staff, Forest Service.

The modern forest manager must be increasingly sensitive to society's changing view of the forest resource. As lands that were forest are devoted to other uses such as agriculture or roads, the forest land base grows smaller. Yet the outlook is not bleak. Much of our forested land is producing at only 30 percent of its capability. So even in the face of declining forest acreage, there is plenty of room for improvement in the use of the land now growing trees. New forest products, such as flakeboard, use trees or parts of them once thought of as waste. Possibly just as important, research is providing new tools that will increase the efficiency of forest management.

New management direction from an enlightened, concerned populace, new uses for forest products, and new management in the United States.

Selective Tree Breeding

For about 60 years scientists have been studying the genetic makeup of forest trees in the hope of learning how to breed them for faster growth, improved wood quality, species adaptability, and greater resistance to disease. Several breakthroughs have already occurred. In southern pines being grown for pulpwood, our scientists have charted growth rates 40 percent above normal in genetically improved stock. Pine strains with natural resistance to several native diseases, including fusiform rust, also have been located. But timber management is still hindered by both insect and disease pests and by the poor adaptation of forest trees to a particular growing site.

Now that genetics research has identified "super" trees in several commercially important species, breeding programs will enable the production of seed from these trees in quantity. Eventually all reforestation will be done with genetically superior stock. Growth gains of 60 to 70 percent should be possible, the forest of the 21st century will have increased resistance to pests.

The New Biotechnology

Trees are so big and take such a long time to reach reproductive maturity that improving their genetic makeup through conventional methods is time-consuming and expensive. Recent advances in genetic engineering — called the new biotechnology — will help short circuit the long breeding cycle of trees. Instead of relying on natural selection to improve the gene pool over centuries, they can isolate the genes that control desirable features in a superior tree and transfer that genetically coded material to ordinary trees.

One method for transferring desirable characteristics uses "Ti" plasmids from the soilborne bacterium Agrobacterium tumefaciens. The "Ti" plasmid is a natural carrier that routinely inserts new genetic material into plant cells and normally induces tumors in such plants. Through the new biotechnology, however, scientists can now insert useful genes into the "Ti" plasmid and have the plasmid transfer them into a forest tree. There is good evidence that herbicide tolerance can be incorporated into forest trees directly by using genetic engineering techniques such as the "Ti" plasmids. If our research is successful, trees will grow that can survive exposure to the herbicides used to control competing vegetation.

In the last few years, "osmoprotectant" genes have been identified and isolated in cells of bacteria. These osmoprotectant genes allow certain organisms to cope effectively with drought and cold stress. In the future, it will be feasible to transfer osmoprotectant genes into forest trees, making it possible to extend the commercial range of certain species into areas too dry or cold for them now.

Genetic engineering will help boost growth rates in pines and fir by tricking them into fixing their nitrogen requirements out of thin air! Some tree species can fix atmospheric nitrogen naturally, but this is not a characteristic of conifers. If scientists find a way to pass this capability to pines and firs from species that already possess the trait, they will be making an improvement on nature that would greatly reduce the cost of fertilization and forest management in general.

So soon it will be possible to identify the gene or genes responsible for resistance to certain forest tree diseases. Once identified, such genes can be isolated, reproduced, and transferred into nonresistant forest trees. The resulting decrease in the number of trees now lost to forest pathogens (disease-causing agents) will go a long way toward improving that 30 percent production capacity of our forested land.
Gypsy Moth and the AIPM

(continued from page 1)

include the use of Bt, release of parasites and predators, and the chemical insecticide difluenthion.

In general, the fifteen (15) wilderness areas within the project area will not be treated. A buffer zone of adjacent land will ensure protection of the wilderness. Specific conditions are required for undertaking control in the wilderness; gypsy moth will have an adverse effect on an endangered plant or animal species; a potential exists, based on gypsy moth populations, that significant defoliation and tree mortality is eminent; or, a unique or rare ecosystem is affected by the moth, e.g. a trout stream. Those miles of wilderness boundary adjacent to private land will receive intensive monitoring but will not be treated unless spread to private land.

At least 50% of the project area contain gypsy moth population which have the potential for increasing to defoliating levels within 3-5 years. Covering approximately 12.8 million acres in 18 Virginia counties and 20 West Virginia counties, the AIPM project is funded by the federal government and free to private landowners who wish to participate. (See Voice November 1988)

The projects main objectives include: slow the spread and reduce adverse effects of gypsy moth within the project area; develop and evaluate (integrated pest management IPM) methods of control; develop and evaluate intervention tactics for managing isolated populations of the gypsy moth; assess the feasibility of a coordinated county, state, and federal gypsy moth program over a large geographical area. BIOLOGY

Introduced by colonists in the 1860's to develop the silk worm industry, the gypsy moth (lymantria dispar L.) has defoliated forest and ornamental trees on over 93,000 square miles. The first outbreak occurred in 1889 about 20 years following introduc tion. Larvae often feed on a tree area forest, to all of New England, portions of southern Quebec, south to Delaware and Maryland, west through New York, Pennsylvania, northern Virginia and northeastern West Virginia. An isolated area in central Michigan is infested. Intermate movements have resulted in isolated infestations in Arkansas, California, North Carolina, Oregon, and Washington.

The preferred host of the gypsy moth is oak. Over 500 species of trees, shrubs, and vines are food for the larvae. Second to oak are apple, basswood, gray and red birch, sweet gum, hawthorn, aspen, maple, and willow. Less desired but still attacked are black birch, yellow birch, paper birch, cherry, cottonwood, elm, sassafras, spruce and pine. Older gypsy moth larvae feed on the foliage of several species that younger larvae normally avoid, particularly hemlock, pine and spruce. The gypsy moth avoids ash, balsam fir, butternut, black walnut, catalpa, red cedar, flowering dogwood, American holly, locust, sycamore, yellow poplar, and shrubs such as native laurel, rhododendron and viburnum. Despite outbreaks, however, gypsy moths will feed on almost all vegetation.

Outbreaks are defined as cyclic in that populations periodically build to epidemic levels and then collapse. The four phases or modes as given by USDA researchers: (1) Innocuous mode: Gypsy moth populations are stable as low levels. Predation by small mammals, birds, and arthropods, as well as insect parasitism, appears to play a major role in maintaining stable populations. (2) Release phase: The larval gypsy moth populations to begin building are not clearly understood. It is thought that populations build first in localized areas, having secure resting or hiding locations to escape enemies, adequate food and favorable climatic conditions before populations spread to adjacent areas. Favorable weather conditions, such as a mild winter followed by a warm dry spring and summer, increase larval survival and population expansion. (3) Outbreak mode: Gypsy moth populations build to high levels, and the larvae cause moderate to heavy defoliation of susceptible hosts caused by winds. Mortality caused by birds, mammals, arthropods, and parasites continue, but their impacts are minor. Toward the end of the outbreak, the gypsy moth virus (NPV) may begin to build in the population. (4) Decline phase: As gypsy moth populations begin to collapse as a result of over populations, characterized by gypsy moth virus, reduced production of offspring, and starvation. Parasites and predators apparently play a minor role in the decline of populations.

Feeding activity of light larvae populations causes little noticeable defoliation in a forested community environment. In comparison, defoliation by moderate populations is often evident in the upper crown portions of the tree or at the outer edges of the crown. Most defoliated trees will refoliate producing leaves that are smaller than normal and light green. Many hardwoods that have had two seasons of defoliation may die.

Factors triggering population growth are not completely understood. Weather patterns may greatly influence the RELEASE PHASE. Winter weather conditions characterized by constant snow cover for egg masses followed by a dry spring favor the survival of the larvae. Early warm temperatures on uncovered egg masses may cause mortality. Unseasonably warm days in winter followed by intense cold may also cause egg mortality. Cool wet spring weather that delays bud break and leaf expansion on host trees causes larvae mortality. Parasites and predators help control population within the early phases. About 38 species of butterflies are known to eat various stages of the gypsy moth and 15 species of forest mammals and many species of forest birds feed on various stages of the gypsy moth and 15 species of forest mammals. Natural parasites and predators apparently play a minor role in the decline of populations.

The preferred sex attractant pheromone and captured before mating. The catch is periodically counted and evaluated to establish the growth potential for that site. Once the sex attractant pheromone is released, the attacker is slowly released from a strip mass trapping. Resembling a milk carton, male moths are lured by the sex attractant pheromone and captured before mating. The catch is periodically counted and evaluated to establish the growth potential for that site. Release of sterile males is also a tactic for the 1-10 egg mass per acre level. A third tactic for this population level is mass trapping. Releasing a milk carton, male moths are lured by the sex attractant pheromone and captured before mating. The catch is periodically counted and evaluated to establish the growth potential for that site. Using site specific information will allow the most effective application of tactics or combination of tactics.

Disparure is a gypsy moth specific tactic. A synthetic formula of the female sex attractant pheromone has been developed. A trap containing this chemical is set out in an area the larvae are expected to inhabit. The pheromone is applied to a smooth, nontoxic, and water resistant substance, such as paper, plastic or cloth. It is generally used in areas of 1-10 egg masses per acre. Release of sterile males is also a tactic for the 1-10 egg mass per acre level. A third tactic for this population level is mass trapping. Releasing a milk carton, male moths are lured by the sex attractant pheromone and captured before mating. The catch is periodically counted and evaluated to establish the growth potential for that site. Using site specific information will allow the most effective application of tactics or combination of tactics.

Insecticides considered include NPV (gypsy moth nucleopolyhedrosis virus), Bt (bacillus thuringiensis) and diflubenzuron. These are applied to hatched caterpillars as foliage expands. Gypsy moth NPV, Gyychek, was registered by the EPA in 1978. A protein particle, the chemical must be ingested by the larvae in first of second instar. After injection, the virus attacks internal organs and muscles causing disintegration and death. Referred to as "wilt" disease, the process takes ten to fourteen days. It is used for populations greater than 250 egg masses per acre. It is used in many varieties. The Berliner, variety Kurstaki, strain NRZ-12 is for gypsy moth. Generally used in first or second instar only for areas with 250 egg mass per acre. Death occurs within 7-10 days following injection. The protein, toxic to many Lepidoptera, easily dissolves the gut causing the insect to stop feeding. Infection then spreads to other body parts. The fatal to the gypsy moth, diflubenzuron, also has the most potential for effecting the (continued on page 6)
Endangered Species Need More Help

The 15-year-old Endangered Species Act requires the Interior Department's Fish and Wildlife Service and the Commerce Department's National Marine Fisheries Service (NMFS) to develop and implement specific plans to aid all U.S. species listed as "endangered" (facing imminent extinction) or "threatened" (likely to become endangered soon). However, two new reports indicate that these plans aimed at conserving those species — returning them to a non-threatened status — fall far short of what the law mandates.

According to a report issued Jan. 18 by the General Accounting Office (GAO), while it’s not possible to save all species threatened with extinction, "biologists we interviewed suggested that recovery is possible for nearly 70 percent of the listed domestic species" — if appropriate recovery plans are enacted. However, as of May 1983, no recovery plans had been developed for 113 U.S. species — 26 percent of those listed at that time. Meanwhile, GAO found, even for those 113 species having recovery plans, completion of recovery activities — such as creating a captive breeding program, monitoring population changes or obtaining critical habitat — averaged 6.5 years.

Although FWS has jurisdiction over 96.3 percent of the listed species, NMFS has the poorer track record. NMFS had no recovery plans for 61 percent of its listed species, compared with 40 percent of species covered by FWS. Moreover, NMFS has taken far longer to begin developing those plans — averaged 13.8 years, compared with 2.8 at FWS.

GAO reports that both agencies told GAO tight budgets were the primary reason they had not completed recovery plans for listed U.S. species. And a December analysis of FWS programs by the National Fish and Wildlife Foundation — an independent organization set up by Congress in 1984 —agrees that "the endangered species program is seriously underfunded and understaffed given the scope of its legally mandated duties. To date, the foundation charges, is FWS’s failure to let Congress — which sets its budget — know exactly how many species need "emergency" help.

And there are many. Roughly 4,600 species have been proposed for listing. FWS estimates about 1,000 of these will warrant immediate listing — and therefore protection. But under its current budget, FWS can list only about 60 species a year, the foundation notes, suggesting that even the most endangered may await federal protection for at least 16 years.

Funding doesn’t explain the whole problem, however. When time and money are short, both agencies must adopt a triage approach for crisis management, GAO says. NMFS has no such system for identifying which species would benefit from the quickest attention or most money, although one is under development. While FWS does have such a system, GAO found the agency generally ignored most species highest on the priority list, concentrating instead on those with "high "public appeal" or facing imminent recovery.

For example, in 1986 FWS directed 25 percent of all recovery funds not congressionally earmarked for specific species to just four animals — the American peregrine falcon, southern sea otter, gray wolf and whooping crane. In Canada, a species listed as endangered, GAO notes, is or even highly threatened throughout most of its range.

GAO recommends that in addition to making better use of a triage system for listing endangered species and periodically assessing whether species-recovery plans need changing, each agency should develop computerized files on the status of listed species. "[C]entralized information on the status of all listed domestic species would be beneficial," agrees Commerce Under Secretary William Evans, who says NMFS will consider developing such a file. FWS is now field-testing its own system to track a species' status.

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Forest Biology Research And The 21st Century

(continued from page 3)

Understanding Tree Physiology

Advances in the science of stress physiology are changing our understanding of how trees resist cold, drought, and disease and insect attack. Such knowledge helps us understand not only how plants function but also why certain plants grow where they do and why they respond to different environments as they do. That information, in turn, helps in the selection and development of trees that are resistant to drought, cold, insects, and diseases.

Stress physiology is related to the broader field of ecophysiology of trees — the study of the interactive relationship between trees and their environment. In other words, ecophysiologists try to determine how the environment influences the placement, nature, and function of the plants in it. Forest scientists are only beginning to understand these complex relationships and how they alter them when they manipulate forest stands, for example, by thinning or fertilization. The operating procedure in the past has been primarily to change the forest environment through vegetation manipulation and then observe the reaction of the vegetation.

Ecophysiology examines the direct effects of the manipulation — changes in water relations, energy balances, temperature, air movement — and relates these factors to the response of the vegetation. Through ecophysiology, forest managers can expect to accurately predict how plant life will react to treatments on specific sites. Knowing those reactions in advance will help in choosing management alternatives that precisely match objectives.

New Research Trend

Forest biology research is advancing rapidly along several fronts in the late 20th century. However, the trend is definitely away from research that concentrates on specific treatments at a specific site with extrapolation of results to the whole area, type, or habitat.

Instead, modern measurement, analysis, and the use of computer modeling are enabling forest biologists to measure basic physical factors that control or prompt changes in the forest. Through ecophysiology, forest managers can expect to accurately predict how plant life will react to treatments on specific sites. Knowing those reactions in advance will help in choosing management alternatives that precisely match objectives.

From — 1986 Yearbook of Agriculture.
Gypsy Moth and the AIPM (continued from page 4)
environment. Sold and manufactured under the trade name Dimilin, it is a benzoylphenyleurea based chemical insecticide. It is fatal at any stage but generally applied in the first to third instar.
When ingested by larvae, it caused rupture during the molt.

The half-life of diflubenzuron is shown by laboratory experiments to be 3-7 days in soil and 1-2 days in water. In water with a pH less than 4.0, persistence and accumulation is observed. Field tests give a half life of 1-4 days in soil and less than 24 hours in water. Diflubenzuron may remain on leaf surfaces for up to 60 days following an application.

The classical biological control of importing and establishing predators and augmentation of natural predators may also be considered. In general, most established arthropod predators and parasites move with gypsy moth populations and are only effective at low population levels. Known predators include cotesia melanocerus, phobocampe disparis, coencyrtus kuvanae, anastatus japonicus, blepharipa pratensis, paraeugamia silvestris and AIPM project cooperating agencies.

A FEE report entitled "Gypsy Moth Suppression and Eradications Projects" was a major source of information for the eradication techniques studied by AIPM.

Taming Our Fear Of Predators

Ever since the Massachusetts Bay Colony began paying a bounty on wolves in 1630, we’ve poisoned predators, shot them, and trapped them at every opportunity. In the 1930s, wolves and coyotes were being shot and poisoned throughout our national parks. Between 1917 and 1952, Alaska paid bounties on 128,273 bald eagles.

In the past two decades, however, something has happened, according to National Wildlife magazine. As a nation, we have generally gone from persecuting predators to encouraging their survival, from loathing them to, in many cases, loving them. Conservationists have gained a certain respectability from fabled Indian lore to western ranchers’ tales.

Recent public opinion surveys reveal support, even in western states, for reintroduction of wolves and grizzlies.

To stop direct attempts to eliminate an animal that has gained charisma in the public eye certainly has an important place in preserving certain species. The next question, however, is whether the same public realizes the need to protect less-glamorous predators. Examples are animals we all know and take for granted, such as song birds and pond frogs that uher in our spring. Direct as well as indirect actions by humans can have a tremendous impact on these species.

To help the public better understand predators, the National Wildlife Federation chose the theme "Predators: They’re Part of the Picture" for National Wildlife Week, March 19-25.

One of the Federation’s messages year round is that habitat destruction and pollution are certain to lead to species loss. Predators on the brink of extinction should be reminders to us of our own vulnerability. After all, man is considered the ultimate predator.

That vulnerability lies in the fact that in our complex ecosystem, delicate balances must be maintained. The unnatural loss of any species, predators included, leads to a disruption that could have grave consequences.

One conservationist uses an analogy to get the point across. “Rivet taker” is the label he applies to those who remove predators, and he claims that will make no difference to wipe out a few species, or fill in a few wetlands. He then notes how when one or two predators are removed from the support structure of an airplane, it could still manage to fly. But when the wrong rivet, or one too many is removed, it will be a disaster.

Predators, just as any other species in the global biological structure, help keep our ecosystem from crashing. While the early settlers can be excused for not realizing that today we must ensure that all wildlife, including predators, remain part of the picture.
Geology, Observations, and Floods (continued from page 1)

River Systems

Rivers have been studied from numerous points of view. Sedimentologists have looked at the sediments rivers carry, how they move, and how they are eventually deposited somewhere. Fluvial geomorphologists study the shapes of rivers and their influence on the shape of the land, through erosion and deposition. Hydrologists are interested in the behavior of the water itself. Engineers are interested in using, taming, damming, or bridging, or other practical control of the river, usually working through experience and mathematical modeling.

What picture emerges from these studies? Rivers are dynamic systems, everchanging in form. They change in response to both internal and external forces, and are so individual that knowing one river usually cannot be and should not be applied to another. Because rivers are most useful viewed as systems, real understanding involves understanding the headwaters, the channel, the floodplain, and the mouth, rather than just one of these parts in isolation.

When rain falls, the water that does not evaporate or percolate into the soil is taken downslope by gravity into creeks. Creeks are the river's headwaters; the source of a river. Single creeks are eventually joined by others to form one larger river channel. During low-water flow, the channel will not be filled and the banks on either side may be visible. It is when the channel is brimming with water from bank to bank, that a fluvial geomorphologist considers the river to be starting to flood. On the average this bankfull flow can be expected every year or two. On either side of the channel in most river systems is the floodplain. It is the relatively flat part of the valley floor next to the river. It is a area, composed of sediments deposited by the river, which is covered by water during a large flood. The floodplain is the part of the system that is attractive for building and agriculture. But it is also the part which changes rapidly and is hazardous.

As the downstream end of a river is its mouth. If the river's mouth opens into a relatively quiet body of water, such as a bay or lake, it may form a delta when the sediments "drop out" or can no longer be suspended and carried by the slow-moving water. Or the river may flow into another river; "est" is more of a name change than a physical change.

Studying the Effects of Flooding

Geologists look at several key pieces of data when studying a river's behavior during flood: crest, flow, capacity, competence, erosion, and deposition. One of the most useful tools in studying flooding is the hydrograph of a flood. This is a graph showing the amount of water flowing past a point each day. A river which has sharp, sudden floods is said to be "flashy".

Not all river flooding is so flashy. Flooding of large streams in the upper midwestern United States is not the type of flooding associated with most of the great floods in history. But the flashiness of water moving in a river can vary widely. Downstream towns are usually warned when the river will crest and what stage (height) there is often time to build sandbags dikes to protect low-lying areas.

More than on our observations of the Cheat River on the morning of November 4, 1985; is it a flashy river? Between 9 and 10 a.m. the water rose and covered the access road to our offices at Mont Chateau. By about 4 p.m. the water subsided, and the next morning the Cheat River remained swollen, but was no longer a raging torrent. These observations show the Cheat to be, as in 1936, a "flashy" river.

How high did the water get? Standing at the low point on the road, the water level came to a person's mid-thigh, or near the tops of the road's guard rails. This basic observation is useful if someone needed to know the elevation of the crest at that point along the Cheat River. Another method of fixing the elevation of the crest is to record the height to which debris came on the banks. Such observations must be made soon after the flood or they are lost.

Competence and Capacity

With an increased water velocity, a flooding river has a much greater ability to move objects. A small increase in water velocity greatly increases the size of objects a stream can carry. This ability to carry objects is a stream's competence.

Another measure is the stream's capacity, the total load that the stream can carry. Capacity depends on both the velocity and volume of the stream. The stretch of Cheat River flowing past Mont Chateau is usually slow-moving, since it is near the point where the river widens out into Cheat Lake. During the flood, however, the greater velocity and volume were obvious. The increased capacity could be seen in the muddiness of the water and the large amount of debris being carried, such as trees, oil drums, and pylons.

Flow

The flow of water in a river is not simple. It is turbulent — full of swirls and eddies. In a backwater, the water, as the term implies, may actually be flowing backwards. Velocity is usually greatest over the deepest part of the channel, and on the outside of bends. The water nearest the bank may be moving against the current. During flooding, in fact, the high water may back up tributaries and temporarily drowns their mouths. This water is "slack", flowing slowly if at all.

With little velocity, the stream's competence is low, and material in suspension settles out. As the flow waters recede, these fine-grained sediments are left behind, forming a valuable deposit. Another type of deposit the Cheat River left behind is within the lake itself. Cheat Lake was formed in 1926 after the Lake Lynn Dam was constructed on the river near the Pennsylvania/West Virginia line. The shallow bay and decreased velocity of the current changed the area behind the dam; where sediment was being carried through, deposition now took place.

Deposition and Erosion

Erosion of banks by flooding is also of interest. Eroding banks may impede structures near streams and rivers, while deposition can prevent access to the water or could make the body of water useless for some activities.

Using the Observations

What can be done with these types of observations? From observations come conclusions, a computer model of the system, and predictions. The ability of scientists to prevent or mitigate flooding is increasing as understanding—leading to technological progress in minimizing flood damage. This includes buildings strong enough to lead to the power of the flood waters, avoiding flood-prone areas, and building flood-control dams. Many specialists are involved in such an effort. Weathermen predict, observe, and record precipitation. Hydrologists (such as officials of the United States Geological Survey) record and interpret river stages and flow. Civil engineers use the data supplied by these specialists for designing structures in and near rivers. With such a diversity of people involved in studying rivers, progress is indeed being made. The specialists are the first step in understanding, and hopefully being able to do something about flooding.

The 100-Year Flood

Many people have the impression that a 100-year flood can only happen once in a century. In fact, there is one chance in four that 100-year floods will be less than 29 years apart, and one chance in four that they will be more than 139 years apart. The 100-year flood is really a flow of water which has a probability of 1% of being equalled or exceeded in any year.

Even so, this probability must be viewed with caution. One hundred-year floods are derived by using sophisticated statistical methods on streamflow records. This yields statistical probability, not as absolute prediction. Furthermore, good flow records for periods as long as 100 years exist for few streams, so trends must be extrapolated. Predicting the 25-year flood is much more accurate; predicting the 500-year flood is guesswork. Not only is 500 years longer than nearly any existing records of streamflow, but we know from historical records that there are significant climate changes in that length of time, and these change precipitation patterns, and hence stream flows.

Predicting and Preventing

Can floods be predicted? Yes, in two ways. One way is general: a given piece of ground can be evaluated for the possibility of flooding. By comparing the elevation of the ground to the elevation of recorded flood crests (as seen on river stage records), one can see if the ground has ever been flooded, and how severely. By knowing the probability of a flood of a given size, the probability that the ground will be flooded can be determined.

The other way of predicting a flood is specific, that is, giving warning of an impending event. This requires a flood warning system. The four components of such a system are: collecting data (precipitation and river stage), transmitting data, forecasting the flood, and spreading the warning. By knowing the amount of precipitation and river stages (levels) upstream, by knowing the amount of moisture in the soil (to get an idea of how much of the rain will run off), and by knowing the hydrologic behavior of the particular river basin being studied, a flood prediction can be made. The system can be manual or automatic, or a combination. Many attempts are simple and inexpensive, but human vigilance is necessary. While automated systems do not suffer from boredom, equipment must be maintained, and is expensive to buy. The type of system installed will depend on the needs and resources of the community.

So, floods can be predicted. Can floods be prevented? Yes, but . . . As long as an area receives precipitation, and flooding is a natural process, floods cannot be completely prevented. One method of prevention is building dams, which prevent floods in certain areas at the cost of permanently flooding other areas (or having them reserved for flooding in case of emergency). Thus, flooding can be prevented in a valued area.

Another way around flooding is to avoid building in flood-prone areas. By not building in the area covered by, say, the 100-year flood, the probability of damage by high water becomes small. But what about the still flooding in the sense of high water, of course, but not flooding in the sense of damaging high water.

A third alternative is to build flood-resistant structures. By knowing the amount and velocity of water in a river's flood, a flood-resistant building could be built. So, although floods cannot be absolutely prevented, things can be done in such a way to minimize the damaging effects of flooding.

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"Obviously, a flood doesn't occur every time it rains. Among the important factors determin- ing whether a flood occurs or not are the capacity of soil to hold water and the amount of water in that soil as a sponge. Water dropping on a dry sponge will soak it up. Water dropping on a wet sponge will run off."

"The amount of water present in soil is dependent on several things including how much rain has recently fallen, and how much of the rainwater has been absorbed (soaked in) has evaporated in the meantime. Related to this evaporation is how much water has been taken up by plants."

"The rate at which water moves through soil is also important. For example, water moves quickly through sands and gravels, but slowly through clays."

"Soil surface topography also plays a role. Depressions, such as puddles formed from puddles to small pools or lakes, can stop and delay the flow of water on stream systems.

"When runoff does reach streams, timing becomes critical to the occurrence of a flood. Enough water must reach a stream to fill it off into flood stage. But, the water on headwater creeks combine to produce a flood when they flow together into a river.

"In effect, a flood is created when rain falls at the same time over much of an already saturated river basin. This produces large amounts of runoff, all channeled at about the same time into the river channel."
Clues To Allergy Emerge From New Cell Studies

Buoyed by a rush of research findings about the development of allergic reactions at the molecular level, scientists are now attempting to devise new ways to block allergies before they can ever begin.

Scientists have recently identified the complete structures of important cell receptors and gained new insights into the chemistry of the immune reactions involved in the allergic response. This new knowledge is allowing scientists to explore treatments that may block allergic processes at early stages instead of simply coping piece-meal with the debilitating symptoms they cause.

Researchers are already testing drugs intended to halt or modify the allergic process early in its development.

Their goal is to devise better treatments and prevention of symptoms for the millions of Americans afflicted with allergies. Among them are hay fever, many cases of asthma, particularly in children, reactions to certain drugs or foods as well as illnesses that seem much like the common cold.

“We are beginning to understand the biology and regulation of the cells that cause the clinical problem,” said Dr. K. Frank Austen of Harvard Medical School, an authority on allergic disease.

Scientists believe allergy is fundamentally a harmful mobilization of body processes that evolved to attack and destroy parasites. The main cells involved in the mobilization are mast cells and eosinophils. They originate in the bone marrow, migrate to tissues like the mucous membranes of the air passages from nose to lungs as well as the digestive and reproductive tracts. They contain granules filled with substances that can have powerful destructive effects when released abnormally in the body's allergic response.

“In my judgment there is no evidence in allergy,” said Dr. Gerald J. Gleich, of the Mayo Medical School, Mayo Clinic and Foundation in Rochester, Minn., who has contributed much to the understanding of the functions of eosinophils.

Just why the defensive process goes askew is not known, but an early stage begins when certain antibodies, called immunoglobulin E, or IgE, that are anchored to mast cells, come in contact with a substance — the allergen — that provokes the allergic reaction. The mast cells may attract eosinophils and both may release the destructive substances from their granules. The process can cause airways to constrict and blood vessels to dilate and become leaky and can prompt the production of mucus.

Until now, therapy has been limited to counteracting these effects. For example, antihistamines counter histamine, one of the destructive substances. But advances in molecular and cell biology have given scientists powerful new tools.

Dr. Gleich has analyzed the contents of eosinophil granules in great detail. In one set of experiments described last year in Hospital Practice magazine, Dr. Gleich and his colleagues tested the effects of major basic protein (MBP), which constitutes most of the protein in eosinophil granules. The scientists exposed tissues of animal airways to the protein and found much changes much like those seen in asthma patients. Interior surface cells of the bronchial passages were destroyed and the airways became hyper-reactive to outside stimuli.

Multiple Effects In The Body

Dr. Gleich said the results suggested that intact bronchial passages produce a substance that tends to make the airways relax, keeping them open when other influences would make them contract. His studies suggest that MBP released by improperly activated eosinophil cells may be one avenue of this defense, setting the stage for others to take as tissue cells or mucous membranes or eosinophilic granules. The scientists exposed tissues of animal airways to the protein and found much changes much like those seen in asthma patients. Interior surface cells of the bronchial passages were destroyed and the airways became hyper-reactive to outside stimuli.

Recent years scientists have discovered many substances, called lymphokines, that are produced by white blood cells and have multiple, only partially understood, effects in the human body. Some of these substances may also come into use against allergy. Antibodies designed to block one such substance, interleukin-5, have been shown to interfere with eosinophils' destructive effects against parasites, suggesting that such substances might be developed into anti-allergy drugs. Much the same is true of another lymphokine, interleukin 4. Antibodies that block its action appear to shut off the production of the allergy-related IgE antibodies. Recently, scientists at the National Institute of Arthritis and Musculoskeletal and Skin Diseases reported in the journal Nature that they had successfully cloned an important cell surface receptor in rodents for IgE. Part of the complete human receptor has also been cloned and the rest is expected within weeks, the scientists say.

New Class Of Drugs

“The discovery of the receptor structure allows us to search for a new class of anti-allergy drugs, said Dr. Jean-Pierre Kinet, one of the leaders of the research team. His co-authors were Drs. Ulrich Blank, Chsei Ra, Laurence Miller, Kenneth White and Henry Metzger, the institute's scientific director.

New treatment strategies that scientists are thinking about today include interfering with IgE antibodies in various ways or even arming the antibodies with toxins and using them as biological guided missiles to inactivate mast cells. Attempts are already being made to use such drugs, substances designed to inactivate some of the products of eosinophils or mast cells, like the substances called leukotrienes. Another strategy being explored is to inactivate a substance that itself can set off allergic reactions. The mast cell activating protein, MBP, even though it is not a true mast cell product, when bound to mast cells can set off allergic reactions. The MBP has been shown to activate platelets, the particles that contribute to blood clotting. The platelet activating factor is capable of producing some of the effects of allergy.

Dr. Michael A. Kaliner, of the National Institute of Allergy and Infectious Diseases, said at least a half dozen clinical trials are under way on different experimental drugs to achieve these effects. Other trials are exploring the value of the anti-cancer drug methotrexate as an anti-allergy medicine because it acts against immune defense cells and the inflammatory process that contributes to the effects of allergy. Methotrexate was recently approved by the Food and Drug Administration for use against the inflammatory effects of rheumatoid arthritis.

Dr. Austen said he hopes that the future will also show ways of attacking an even earlier and more fundamental stage of the allergic process by reducing the numbers of mast cells or eosinophils or manipulating their ability to function. Success in these efforts might substantially reduce reliance on antihistamines, steroid drugs and "desensitizing" regimes in which skin tests identify the particular substance to which a patient is allergic and the patient is given repeated injections of it.

Today, scientists understand allergy much better than ever before, said Dr. Kaliner, an expert on asthma and other allergic diseases at the National Institute of Allergy and Infectious Diseases. The institute is a major unit of the N.I.H. His current research is on the biology of the mucous membranes that line air passages from nose to lungs, seeking to understand the details of how those membranes act in asthma, hay fever and the common cold.

"Ive been in this field for almost 20 years and the difference is like night and day," said Dr. Kaliner.

Dr. Austen, chairman of the department of rheumatology and immunology of Brigham and Women's Hospital in Boston, said most of the current experimental drug strategies represent only intermediate steps against allergy. The future, he believes, will see strategies, yet to be developed, that will allow doctors to use drugs to regulate the numbers and activities of the mast cells and eosinophils themselves.

Dr. Austen thinks the future of allergy research and treatment is particularly bright, because the new tools of molecular and cell biology give scientists powerful new ways of studying the allergic process.

"I'm very optimistic about where we are," Dr. Austen said, "because with molecular biology we can now answer in a year, questions that used to take a decade."