SCIENCE NEWS

OF THE WEEK

Science, ecology and war

Defoliation escalates scientists' public concern over environment

Since World War II, most international discussions concerning arms control and disarmament have dealt with nuclear weapons, the threatened use of which, all agree, represents an overshadowing and evershadowing danger to the future of mankind.

Scientists, individually and through their organized groups, have become increasingly concerned about how their discoveries are used. Before 1940, only a minority expressed their views strongly enough so that the public understood the potential applications, good or bad.

This situation has altered considerably in the last 20 years—more and more scientists join the ranks of those loudly urging caution, not only on nuclear weapons but about the use of chemical agents, whether as fertilizers, pesticides, herbicides or defoliants.

The last two months of 1967 bring a triple-barreled assault on the application of chemical and biological agents. In mid-November, SCIENTIST AND CITIZEN devoted an entire issue, nearly a year in preparation, to developments in chemical and biological warfare. Next week, the American Anthropological Association, meeting in Washington, is devoting an afternoon and evening plenary session to the topic of Anthropology and War.

And in late December the Committee on the Consequences of Environmental Alteration, set up a year ago by the American Association for the Advancement of Science, will make its first report on how man's chemical and biological tampering is altering the environment.

Concentration of past discussions on nuclear hazards has tended to "obscure the importance, and the dangers, of chemical and biological weapons, which cover a vast spectrum from the relatively mild to the highly lethal," Dr. John T. Edsall, professor of biological chemistry at Harvard University, charges in his introduction to the November SCIENTIST AND CITIZEN. The issue is based only on evidence publicly available, with particular emphasis on the unwonted, unwanted and unknown effects resulting from the vast destructive power of modern warfare.

Vietnam marks the first time when chemicals designed to damage or kill plants have been used in war, writes Dr. Arthur W. Galston, professor of biology at Yale University and president of the Botanical Society of America. Damaging or killing a plant may appear inconsequential compared to the maiming or death of humans. However, by interfering with the ecology of a region on a massive scale, it could set in motion an irreversible chain of events that would "continue to affect both the agriculture and the wildlife of the area—and therefore the people, also—long after the war is over."

Chemical spray on crop plants in Vietnam, he contends, is not only not accomplishing its aim of clearing jungle growth and reducing the hazards of ambush by Viet Cong, but is also a weapon of starvation that has "the peculiar property of inflicting suffering on civilians while doing little damage to the military."

Dr. Galston and Dr. Jean Mayer, professor of nutrition at Harvard, concur with others who have reached the same conclusion in the past that those suffering most from starvation are the weakest elements of the civilian population—first and hardest the children, the elderly, and pregnant and lactating women; last and least adult males, and least of all soldiers.

These two reports on Vietnam offer a glimpse into the world of chemical and biological weapons. In the same issue, other scientists explore the larger dimensions of these agents.

Some of the basic facts of the new nerve gases are set forth by two physicians, Drs. Victor W. Seidel and Robert M. Goldwyn of Harvard, who report that one of these odorless and colorless gases is produced in a plant at Newport, Ind., that has been operating 24 hours a day for more than three years, producing chemically filled

Spraying chemical defoliants "on the dense Vietnamese jungle."
Air Force

rockets, land mines and artillery shells.

They point out the difficulty of drawing a line between lethal and nonlethal chemical weapons since the incapacitating and presumably nonlethal gases, like all chemical and biological agents, are notoriously uneven in their dispersal and, therefore, in the amount absorbed by each recipient.

Equally deadly and far more difficult to control are the biological weapons now being tested, developed and stockpiled. Milton Leitenberg, scientific director of SCIENTIST AND CITIZEN, reports that men have "learned to produce them, to manipulate them, to disseminate them, but they have not learned to control them."

The issue also includes a review of the history of international control and U.S. policy; a discussion of the medical reports from Yemen, and problems in detecting biological weapons.

At the Anthropologists' meeting, Dr. Alexander Alland Jr. of Columbia University will stress the close link between warfare and disease. He chooses plague as an illustration because its occurrence is well documented, its cause is well known and it is a good illustration of a severe, highly contagious disease that is sensitive to ecological variation. It is endemic in Vietnam.

The agent of the plague is the bacillus Pasteurella pestis. It is a disease with a short incubation period and a high mortality rate. Wild rat populations normally harbor the fleas that spread the bacillus. Epidemics occur when the organism is passed on to domestic rodents that, because they are highly susceptible to the disease, rapidly die out. When this occurs, the fleas are forced to find new hosts, usually man.

The spread of plague in England, Dr. Alland notes, was facilitated by the destruction of woodland that was converted for agricultural purposes to feed a burgeoning population. The human invasion of the native habitat of wild rats brought the rodents into closer contact with domestic rats.

"The parallel between this situation and Southeast Asia is quite striking," Dr. Alland, one of the eight panel members, will state. The flood plains of the Mekong delta support one of the highest population densities in the world. Although epidemics of plague have not occurred for some time, the number of cases in Vietnam has mounted steadily during the past three years—from 119 to 4,453.

Dr. Alland suggests that defoliation and extensive napalm attacks have produced disturbances sufficient to increase the contact between wild and domestic rats. Although this is a conjectural theory, he says that such an explanation "fits well with current theories of plague epidemiology."

One major difference, however, exists, and one that Dr. Alland considers most important: In England, it was the English who changed their environment; in Vietnam, the United States is changing the environment.

"We are therefore largely responsible for the potential consequences," Dr. Alland concludes.

Dr. Alland uses plague only as a model for what can happen when a natural setting is disturbed. Such waterborne diseases as typhoid and cholera constitute a constant danger, as do various forms of dysentery and other intestinal diseases. Even malaria is sensitive to environmental changes that affect the breeding grounds of the mosquitoes spreading it.

Dr. Alland will conclude by stressing that the kind of "conventional" warfare of the past three years is, "in fact, intentionally or not, a kind of covert biological warfare," although he does not believe the U.S. has used or intends to use biological weapons as such.

The AAAS committee, appointed last December, will this year recommend its continuation as a commission "to facilitate the development of disciplined means of collecting information, planning, studying and controlling large-scale technological interventions into natural systems."

The committee recommends studies of the consequences of chemical use "in selected areas where massive programs are in progress." Besides Vietnam, "a region where the ecological effects may be expected to be most marked," the committee also suggests the northern Rocky Mountain region, where herbicides and pesticides are being applied on a large scale. ◈

HIGH ALTITUDE RESEARCH

I B P: Setting the Stage

From the Himalayas to the Andes to the Rocky Mountain town of Leadville, Colo., some 25 million persons live at high altitudes where the air has only two-thirds as much oxygen as at sea level. These individuals have thicker blood and larger hearts and lungs than their lowland counterparts. Their hearts beat faster, but the output is less, reducing their capacity for work. Their growth is retarded—Andean men average only five feet, one inch in height—their children reach adolescence later and, though it is a matter of controversy, some scientists think they are less fertile.

Spanish settlers in the Andean highlands were perhaps the first to record the effects of high altitudes on human physiology. Sixteenth century chronicles tell that for almost 50 years no child of pure Spanish blood was born to the men and women who migrated from Spain to the mountain town of Potosi, 14,000 feet above sea level. To preserve their race, these Spaniards moved their capital to the seacoast town of Lima, where they recovered normal fertility.

Scientific studies of the physiological effects of high altitude on highland natives and on lowlanders traveling or living more than 10,000 feet above sea level have only recently begun. Last week, under sponsorship of the World Health Organization and the U.S. International Biological Program, 60 scientists from 13 nations met in Washington to review what has been done and map plans for future research. Their work ranges from fundamental studies of the effects of environment on man to solutions to the practical health problems soldiers, athletes and travelers face if they move quickly from sea level to high altitudes. Of much immediate concern is the effect Mexico City's altitude—8,200 feet—will have on the health and performance of the hundreds of athletes who will fly there for the 1968 Olympics. Three or four weeks of training at similar altitudes is recommended.

According to Dr. Alberto Hurtado of Cayetano Heredia University, Lima, Peru, high altitude may contribute to the incidence of certain diseases. Lowlanders traveling rapidly to high altitudes are almost certain to get mountain sickness, characterized by severe headache, nausea and vomiting, fatigue, mental exhaustion, indifference to work and loss of appetite. Although recovery usually comes within a week, the effects on soldiers can be disastrous if they are moved into high altitudes and expected to fight immediately, says Dr. Frank Consolazio of Fitzsimons General Hospital, Denver. In studies of young American soldiers, he and his co-workers found high carbohydrate diets tend to reduce symptoms of mountain sickness. Carbohydrates increase carbon dioxide production which stimulates the respiratory system and raises oxygen content in the lungs in low-oxygen atmospheres. But the only real answer is to move troops from sea level to higher altitudes gradually during the course of a week or so to prevent the disease.

In spite of possible adverse effects of high altitude, natives of these mountainous regions adapt through natural acclimatization, though it takes hundreds of years for the process to complete itself. "In the Andes," Dr. Robert F. Grover of the University of Colorado says, "an Indian population has evolved which undoubtedly represents the most complete acclimatization to