their work around problems that had been ignored for years," Parmeter says. "There are deficiencies and, as in any group, some dead wood, but by and large the Forest Service program has been very good."

A rather different opinion of Forest Service research is held by Ronald W. Stark, a forester and forest entomologist who is dean of the graduate school at the University of Idaho. Metcalf's observation of the emphasis on traditional research is likely to be absolutely true, Stark believes. "The biggest fault I would find with the Forest Service is that, historically, they have just not kept up with current trends." As an example, he cites the way in which the Service has for years used pesticides to control the bark beetle, even though this method has long been known to be largely ineffective.

The pest control arm of the Forest Service is separate from the research arm and often goes its own way. Many of the control programs are politically oriented, Stark believes, in the sense that they are carried out over the objections of Forest Service scientists in order to appease some pressure group demanding action. Spraying bark beetles is one example; another is the Forest Service's attempt (vetoed last week by the Environmental Protection Agency) to resurrect DDT for use against the tussock moth, even though their own scientists have shown that the moth populations collapse naturally after 3 years or so from the attack of a virus.

The regional administration of the Forest Service tends to dominate research policy, and scientists, far from having a viable input, are pretty much told what to do. "As a result," Stark says, "some of the creative and innovative people have been driven out." An instance of the way in which scientists are treated is that travel allowances and technical help were so much reduced last year that some researchers "literally could not work. They just sat on their butts and read scientific magazines."

But the situation is not all black. Stark thinks there have been signs of change in the last 2 to 3 years and that Arnold, the deputy chief for research, has been trying to tackle some of the problems described and to institute new ideas. He has been hampered, however, by the "rigidity of the Forest Service structure," as well as by the tight budgets of the last few years.

Queried about some of these points, Arnold said it was possible that some scientists had been left with no travel money but that he had provided extra funds to all stations pleading hardship. He agreed that the use of pesticides against bark beetles was inefficient but said this was last done 10 years ago. It was "absolutely false" that the advice of Forest Service scientists had been ignored in the case of the tussock moth. Asked why the Forest Service was even considering the use of DDT if the moths would in any case succumb to a virus, Arnold said the inevitable population collapse might be delayed for a year and that meanwhile there were representations from state agencies and chambers of commerce in places where the timber supply was under threat.

Another criticism voiced by Stark is that Forest Service scientists often have difficulty in getting new ideas across to their regional foresters, some

Environmental Research Undirected

The Pound committee panel on environmental research had one of the more difficult fields to survey, and its findings, although generally critical of research in specific subject areas, do not add up to a conclusive verdict. The panel's approach was for individual members to survey particular aspects of environmental research. The following are among the conclusions reached.

► *Effect of fertilizers on water quality*: Of some 910 fertilizer studies undertaken by federal and state researchers, only 45 dealt with the effect of fertilizers on water quality, according to C. R. Frink of the Connecticut Agricultural Experiment Station. Frink rates 38 percent of these projects as being of good quality and the rest as routine (which, he points out, is not necessarily bad). Of the $90 million spent annually by the USDA and state stations on pollution research, only the "unjustifiably low" amount of $2 million is devoted to problems of fertilizer and water quality.

► *Air pollution and plants*: The quality of USDA research on this topic has, in general, been good—better than much of that in the universities, because the problem has been more clearly defined and the workers closer to the problem. Expansion of the USDA effort is not required, because air pollutants are expected to decrease, says A. Clyde Hill of the University of Utah.

► *Insect control*: State and federal agricultural entomologists have failed to recognize the critical need for developing insect control methods that are less prone to pollute than conventional pesticides, says L. D. Newsom of Louisiana State University. Far too much effort is still being devoted to the routine testing of conventional chemicals. There continues to be a serious lack of emphasis on ecological approaches to insect control—only 2 percent of the total research effort, and only 20 scientific man-years (as of 1968–69) are being devoted to such methods. Newsom did not try to evaluate the quality of research conducted by the various agencies, because in his view the CRIS reports did not provide enough information. Citing as an example the campaigns to eradicate the fire ant with heptachlor and now mirex, Newsom observes that far too much is spent on insect control programs that are not supported by a strong research base. "Many of these projects are initiated before need for the program, probability of success, and undesirable consequences have been evaluated by necessary research."

Newsom's findings are vigorously disputed, at least as far as the Agricultural Research Service is concerned, by E. F. Knipling, former chief of the service's entomology research division. Knipling, best known for his development of the sterile male technique to combat the screwworm fly, says that, as early as 1955, some 5 years before Rachel Carson's *Silent Spring*, the entomology research division had begun to reorient its programs toward more selective forms of insect control. By 1970, the division was spending 51 percent of its resources (measured in scientific man-years) on biological and selective means of control. Fundamental entomological research accounted for 34 percent of the division's effort, and conventional insecticides for only 15 percent.

In a summary of the various surveys of environmental research, Waggoner concludes that "a great deal of trivial research" takes place both in the USDA and at state stations, and that "failure to direct work toward significant societal needs is marked."—N.W.