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THE PESTICIDE PROBLEM*

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That action generally precedes understanding in human affairs is well illustrated by the appearance of this small book—almost the first inquiry into the economics of pesticide use—more than twenty years after DDT and a host of other chemical pesticidal compounds were adopted enthusiastically for use in world agriculture and public health engineering with the blessing, encouragement and support of one of the American government's largest bureaucracies, the Department of Agriculture.

Every rationalization faces one of three futures: it is forgotten, or becomes the conventional wisdom of succeeding generations, or it sets the stage for a revolution in thought by questioning or articulating what was taken for granted. Although they tend to rationalize the status quo, the authors of *The Pesticide Problem* found so little economic evidence to sum up that they had to concentrate on constructing a conceptual framework for future data gathering and the testing of alternatives. Thus, the fate of this book is likely to be the more constructive one of fostering a change in public policy, and it therefore deserves thoughtful scrutiny.

The book opens with a brief discussion of the pesticide problem, an outline of pesticide production trends (to 1962-63 only), and what is perforce called "domestic disappearance" of these chemicals since data on their use are so scanty; and Part I ends with an interesting treatment of "spillover hazards" (diseconomies) that points up the conflict involved in individual decision-making where incremental costs of pesticide applications are low relative to the unit value of agricultural products. Adam Smith's still popular notion that private greed will foster public good thus encourages applications which are toxicologically excessive and also exceed the social optimum because they create disregarded diseconomies (spillover effects from chemical drift, washout, wildlife mortality, and undesirable human exposure). A 1965 President's Science Advisory Committee[1] suggested

* J. Headly & J. Lewis, The Pesticide Problem: An Economic Approach to Public Policy (1967).

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1. The White House, A Report of the Environmental Pollution Panel, President's Science Advisory Committee, Restoring the Quality of Our Environment 280 (1965). See also Himel and Moore, *Spruce Budworm Mortality as a Function of Aerial Spray Droplet Size,* 156 Science 1250 (1967).

that satisfactory insect control could be accomplished with 50% of the pesticides currently in use in this country.

Although this reviewer agrees that the solution to the pesticide problem "does not necessarily involve getting rid of all technological external diseconomies,"[2] it is nevertheless necessary to specify which spillover effects are socially acceptable, and this the authors are not equipped to do because (a) they entertain a typological concept of what constitutes a pest, and (b) they fail to appreciate the full implications of ecological cycling and magnification of certain of the long-lived chemical pesticides. There are no pests[3] per se, only organisms whose population levels exceed certain economic or infectious thresholds. These two errors lead to the assumption that "external economies" exist. This is arm-chair theorizing because all drift and washing of pesticides is much more likely to be deleterious than advantageous to neighbors. This is so because in the case of herbicides, "one man's weeds are another man's posies." With insecticides, even though the pest be common to the region involved (which is seldom the case except in forestry), drift dosages will quickly lose control effectiveness though they will be subject to magnification in non-target food chains if persistent, fat-soluble chlorinated hydrocarbon pesticides are used.

It is economic determinism to assume that "the so-called pesticide problem is largely and inescapably economic in nature."[4] The use of particular chemicals by individual agriculturists may be determined by economics in large part, but the extent to which this is so will be influenced by the economic sophistication of the farmer, the policy guidance he is provided and accepts from government, the sort of sales pressure the chemical industry brings to bear, and, ultimately, the ecological sophistication of the entire community. I would therefore restate the problem (which I consider real) as: largely economic but inescapably a result of our generation's lack of ecological sophistication in dealing with its so-called pest problems. This is not to say that the pest problem is unreal, but that it so often results from a disregard of the ecological principles affecting animal population levels. Further, to say that the "[c]reation of second-round problems is a general phenomenon inseparable from technological

2. J. Headly & J. Lewis, The Pesticide Problem: An Economic Approach to Public Policy 20 (1967).

3. Geier and Clark, An Ecological Approach to Pest Control, 10-18 IUCN Symposium, Eighth Technical Meeting, International Union for Conservation of Nature and Natural Resources, Warszawa 15-24. VII. (1960).

4. J. Headly & J. Lewis, *supra* note 2, at XVII.

progress,"[5] is to overlook that this phenomenon inheres in our failure to provide adequate scientific discussion of alternatives and implications before application, rather than in technology itself.[6]

Science of course progresses by truncating reality and drawing tentative conclusions from its abstractions. A degree of oversimplification is thus necessary to the elucidation of analytical theories, and this the authors do very well in Parts II and II, wherein they assess the problems of decision-making, some alternative courses of action, valuation, and other conceptual and mensural difficulties.

This part of the book is the most rigorous. It recognizes that *none* of the significant parameters in resource allocation in pesticide use are known: the positive benefits of increments in farm and forest production are uncertain; the external costs (spillover effects) of pesticide use are not "quantified"; a means of pricing such non-market costs has not even been available (though one is suggested later); and the effects of substituting other inputs—land, labor, fertilizer—remain unexplored.[7]

Granted that each of these parameters merits economic analysis, the simplest alternative has been merely mentioned rather than explored:[8] the emphasis has been placed on substitution rates *between* pesticides and *other* inputs, but since no one has yet seriously proposed eliminating all pesticides, the first and easiest task is to measure the relative costs of substitution rates *among* various pesticides —the several chemical "families," as well as non-chemicals available to do the control job. The analysis could then more rationally be extended to more complex input substitutions, especially skilled labor. The British estimated that barring the use of aldrin, chlordane, dieldrin, DDT, endrin and heptachlor would increase agricultural production costs by about 3.5% and perhaps only for that period of time necessary to perfect alternative control measures.[9] In this country it has been suggested that the size of modern farm operations, and the magnitude of inputs, would soon make it economic to employ farm ecologists to study insect control needs.[10] This would minimize pesticide inputs, perhaps produce net internal economies and reduce

5. *Id.*. at 6.
6. Commoner, Science and Survival (1966).
7. J. Headly & J. Lewis, *supra* note 2, at 27.
8. *Id.* at 32.
9. Ministry of Agriculture, Fisheries and Food, (London), Report by the Advisory Committee on Poisonous Substances used in Agriculture and Food Storage, Review of the Persistent Organochlorine Pesticides 6 (1964).
10. DeBach, Biological Control of Insect Pests and Weeds 712-13 (1964).

external diseconomies. The fact that chemical control costs now average $12.00 per bale of cotton[11] would certainly seem to permit savings by such substitutions.

The discussion[12] of several traditionally proposed alternatives to pesticide use is simplistic and results in their dismissal because no one of them will do the whole job alone, as chemicals seem to do when we overlook the development of resistance in target species, spillover effects, and other social costs that have so far been justified as scattered costs of Progress.

The chief shortcoming, then, is the authors' failure to see that the application of scientific reasoning calls for developing an integrated pest control program, where as much of the job as possible is left to natural controls, and where cultural, selected chemical, and biological methods are combined to accomplish results with minimum disturbance to the biological systems affected, not only on farms but in large watersheds. Ideologically, the authors seem to consider production paramount, even though neither benefits nor social costs have as yet been measured; and they tend to see most diseconomies as "alleged diseconomies."[13]

Even so, Parts II and III help dissect the shaky economic justifications of present pesticide use, just as the biological justifications underlying government registration of these chemicals were dissected by a President's Science Advisory Committee in 1963.[14]

A most important contribution of the book is the suggestion that surrogate valuations can be developed for non-market values by measuring the sacrifices society will impose on agriculture, say, to protect wildlife, reduce human exposure, and so on. Such an imposition of constraints is a political intervention that provides "an implicit estimate of the value of the adverse effect" expected.[15] Surrogate measures thus help objectify the economic aspects of social indivisibilities involved in ecological judgments, and they also provide a measure of the roles of education and political activism in countering the excesses of individualism. Another such "interference" is judicial appeal.[16]

11. J. Headly & J. Lewis, *supra* note 2, at 63.
12. *Id.* at 28.
13. *Id.* at 33.
14. The White House, A Report of the President's Science Advisory Committee, Use of Pesticides (1963); Clement, Book Review, 4 Natural Resources J. 247 (1964).
15. J. Headly & J. Lewis, *supra* note 2, at 34.
16. N.Y.L.J. 1 (1966).

Part IV reviews the consequences of pesticide use in agricultural production. This is mostly a recitation of increased yields per acre, most of them impressive even when one remembers that improved plant varieties, fertilizers, and entrepreneurial skills are also due part of the credit. The upward climb of the agricultural production curve began in the 1930's, long before DDT, and the most that can be said for pesticides is that the steady rate of agricultural production increases might not have been maintained without them.

One wonders, however, if the "insurance function" of pesticides[17] is such an unmixed blessing when considered in a broader social context.

The geographical redistribution of production made possible by this technological circumvention of original ecological limits (climate and associated pests) has done much to destroy regional specialization—encouraging, for example, the production of low-protein soft wheats in non-prairie states—and allowed agriculture to overextend itself. It has also narrowed profit margins so that the rising curve of realized costs of agricultural production will soon intersect the falling curve of net profits in agriculture.[18]

Another overlooked consequence of the loudly-proclaimed "gains" of agriculture may be seen in the socio-political and economic effects of labor displacement, as measured by the increasing public welfare burden in urban centers, and the loss of jobs for those who cannot share in the agricultural revolution or join the technological society of the cities.

In Parts V and VI which deal with effects of pesticides use on human health, one is amazed to find according to these authors, that the best summary of the effect of insecticides in the war on disease is a 1950 paper! I know of no evidence, in 1950 or 1967, that DDT may be credited with controlling virus encephalitis or tularemia.[19] And since the most that can be claimed for DDT is a later, properly cautious statement that "DDT hastened the downward trend of malaria incidence and, superimposed on other factors occasioning

17. J. Headly & J. Lewis, *supra* note 2, at 74.

18. Clawson, Land for Americans 78 fig. 15 (1963).

19. In August, 1966, an encephalitis outbreak in Dallas, Texas, was apparently brought under control, i.e., aborted, by the spraying of the insecticide malathion. All prior outbreaks appeared to have run their course with or without spray programs. It is of course recognized that mosquitos are the principal vector of encephalitis, but control is complicated by a complex situation involving several strains of the virus and several different mosquitos, and is thus truly an ecological challenge.

the decline, led to its virtual disappearance,"[20] it is obvious that these desirable effects could have accrued to the reputation of any other effective insecticide chosen. What DDT did, because of its relative cheapness, was to speed the process by making up for the human deficiencies in willingness to invest in sanitation and alternative insect control. It suffices to point out that the recent attack on *Aedes aegypti* in the southeastern United States—a mosquito which is admittedly easier to control than most of its congeners—began with DDT as its chief tool but has now been converted to the use of malathion because of public objection.[21] This, indeed, is recognized when we are told that "it is likely that a substantial part of the effects of insecticides used in antimalarial operations accrued to society not as lower incidence of the disease but as lowered resource requirements for its control."[22] This would appear true only when we leave out of consideration such diseconomies as wildlife losses and other ecological upsets. One such upset, for example, occurred in Sardinia when *Anopheles labranchiae,* a vector of malaria, was eradicated, only to have part of its niche filled by *Anopheles sacharovi,* not troublesome heretofore, but thereupon as much a problem as the original mosquito.[23]

The theoretical discussion of valuation of human health in Part VI is a fascinating reflection of the academic attempt to be "objective" while neglecting to notice that the parameters of our social sciences are entombed in the political and economic theory of a possessive individualism that goes back nearly 300 years.[24] One position, we are told, is to avoid "overstraining the data with heroic valuations [of incommensurables]" and thus avoid "imparting a possibly spurious air of precision to essentially imprecise calculations."[25] Such "objective" analysts would append to the main analysis a discussion, qualitative or quasi-quantitative, of the incommensurables. But this would simply sacrifice economic objectivity on the altar of political expendiency, since the low level of sophistication—especially but not solely at the local and State level—now

20. J. Headly & J. Lewis, *supra* note 2, at 83.

21. Briggs, The Aedes Aegypti Eradication Program, 20 Atlantic Naturalist 192-204 (1965).

22. J. Headly & J. Lewis, *supra* note 2, at 107.

23. Aitken and Trapido, Replacement Phenomenon Observed Amongst Sardinian Anopheline Mosquitoes Following Eradication Measures, 106-114 IUCN Symposium, Eighth Technical Meeting, International Union for Conservation of Nature and Natural Resources, Warszawa 15-24. VII. (1960).

24. MacPherson, The Political Theory of Possessive Individualism (1962).

25. J. Headly & J. Lewis, *supra* note 2, at 103.

gives little encouragement that these qualifications would be weighed at all. This is because in a positivistic society, commensurables are automatically "valued" above incommensurables. This tendency has been the chief stumbling block to the exercise of reason in pesticide policy, and the scientist must constantly beware of having his reports of "no scientific evidence" interpreted as negative evidence. This is the "positivist option." That is, stating what we see and only what we see (positively) is seeming modesty, but buried in it is the seed of an arrogance, difficult to resist, that what we have not seen does not exist, especially when non-scientists press the scientist for clear alternatives.

It is unfortunate that, since the chief conflicts of interest in pesticide use arose from spillover effects on wildlife, a mere six pages are devoted to their discussion, whereas the other chapters average twelve pages each.

It seems evident that the authors were misled by the G. C. Decker-dominated pesticides committee of the National Academy of Sciences-National Resources Council,[26] and failed to heed the several published warnings about the shortcomings of these reports.[27] It is puzzling, also, that the authors should have "discussed" the problem with Robert L. Rudd but failed to cite his essential writings,[28] and failed, likewise, to cite the well documented studies of Bernard, Hickey and Hunt, and Wurster.[29] One cannot escape the suspicion that these failures are an outcome of the positivism evinced in the early commitment to the notion that most wildlife losses are "alleged,"[30] and the "problem" is essentially "economic." This is a rationality of quantities and non-market values have little standing in such an accounting, even when as here, the authors recognize a need to be open to them.

The result is a failure to distinguish those groups of insecticides and herbicides ecologists will accept, from those they reject as en-

26. Pest Control and Wildlife Relationships, Pub. 920-A, 920-B, 920-C, Nat. Academy of Sciences—Nat. Research Council (1962, 1963).

27. Clement, Book Review, Audubon Mag., Nov.-Dec., 1962, at 356; Jan.-Feb., 1963, 58, 60. Egler, Book Review, 17 Atlantic Naturalist 267-71 (1962). Cottam and Scott Book Review, 27 J. Wildl. Mgmt. 151-55 (1963).

28. Rudd, Pesticides and the Living Landscape (1964).

29. Bernard, Studies on the Effects of DDT on Birds, 2 Publ. Mus. Michigan State Univ. (Biol. Series) 155-92 (1963). Hickey and Hunt, Initial Songbird Mortality Following a Dutch Elm Disease Control Program, 24 J. Wildl. Mgmt. 259-65 (1960). Wurster, Wurster and Strickland, Bird Mortality Following DDT Spray for Dutch Elm Disease, 46 Ecology 488-99 (1965).

30. J. Headly & J. Lewis, *supra* note 2, at 33.

vironmental poisons, and thus to fail to deal with the alternatives we may and must weigh.

Such biological myopia leads to the uncritical acceptance of the notion that the control of disease vectors like mosquitoes has "frequently conferred health benefits on birds" and that "some kinds of faunal displacement due to pesticides may lead to more numerous and more vigorous wildlife populations."[31] One wishes the authors had cited their sources of information on this esoteric question because it reveals some interesting assumptions about population dynamics.

Despite this chapter's general weakness, the authors deserve praise for avoiding the trap involved in drawing over-optimistic conclusions from crude summations of Audubon Christmas Bird Count data so uncritically analyzed and publicized by Marvin, Jukes,[32] and their colleagues in the agribusiness community.

Part VIII draws conclusions and outlines public policy and research needs. The authors unfortunately open this section by telling us that, in their view, a pesticide problem exists only when "spillover effects are of such magnitude and distribution that the market place cannot adjust the values."[33] Such a problem would then call for public policy in reallocating resources in the public interest.

It is depressingly old-fashioned adherence to laissez-faire economic theory to believe that the market place adjustments will solve resource allocations and resolve conflicts between the private advantage to be derived from the application of technology and the long-run social interest, particularly where environmental contaminants are involved. The crises in air and water pollution have made this obvious for some time, and it is plain that the competitive disadvantage of unilateral clean-up, in the absence of uniform national standards, is a principal stumbling block to action. The authors seem to equate private advantage with social welfare, since it increases production and seem to view public interest merely as an effect of political judgment. It is that, of course, but laissez-faire policies have never given it much credence.

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31. *Id.* at 115.

32. Marvin, Birds on the Rise, 10 Bull. Ent. Soc. Amer. 194-96 (1964). Jukes, People and Pesticides, 51 Am. Sci. 355-61 (1963). This question remains poorly analyzed by ornithologists, but for preliminary warnings of the complexities involved, see Kenaga, Are Birds Increasing in Numbers? 11 Bull. Ent. Soc. Am. 81-83 (1965); and Robbins, The Christmas Count, 154-63 in Birds in Our Lives, U.S. Dept. Interior (1966).

33. J. Headly & J. Lewis, *supra* note 2, at 129.

There is a puzzling ambivalence to the whole discussion of this summary chapter:

A. We are first told that the only basis for concluding that a problem exists is inherent in the evidence for a degree of wildlife kills, but that such evidence is a "partialization of the more general problem that involves social welfare" (production again); and this more general problem is that "of maintaining an environment in which the goals of society tend to be achieved."[34] It is obvious that the chief environmental goals the authors recognize are the maximization of production, and they are not yet aware that the environment man has built (the one our authors know about) is dependent on the environment that nature has built, because it is the substrate of our culture.

B. We are then told that although the technical literature does suggest the existence of a problem, the best way to cope with spillover effects may be to internalize such externalities by enlarging the decision-making unit and "compensate the victims of adverse effects resulting from pesticide use."[35] The State Pesticide Control Board is such an ineffective supercommittee at present.[36] This is the typological problem again: all adverse effects are assumed to be local and specific, or "accidental" as many others say. Nothing is said about the fact that farmers are already heavily subsidized and that it might be cheaper to subsidize them a little more in coping with pest problems rather than to try to compensate those who are damaged. If the ecologists are correct, there is no compensating individuals or society for the degradation of ecosystems which are the backdrop if not actually the matrix of our lives.

C. We are warned that special interest groups (pro and con, one may assume) can skew optimization of investments, but are immediately reminded that pesticide technology is, hypothetically at least, an integral function of the economic organization of American agriculture, and that any drastic policy changes "could rescind recent advances;" and, finally, that changes "should not be initiated by policies based on guesses."[37]

In short, the apparent gains of pesticide use—although admittedly not documented with any objective economic rigor, nor analyzed as

34. *Id.* at 129-30.

35. *Id.* at 131.

36. Graham, The Uncertain Defenders, Audubon Mag., May-June, July-Aug., 1967, at 28-37, 54-62.

37. J. Headly & J. Lewis, *supra* note 2, at 131.

to component—impress the authors as almost sacrosanct, and cause them to forget that the whole system of pesticide use was built on empirical guesswork, and that our agricultural policy, like our whole technological civilization, may properly be termed "accidental" because, as Michael Harrington pointed out,[38] it involves a revolution without revolutionaries in which both the benefits and burdens are the happenstance results of the uncoordinated decisions of conservative businessmen in search of security, autonomy and a higher return on their capital.

The authors modestly disclaim recommending any explicit adjustments in public policy,[39] but the emphasis they have placed on our alleged economic dependence on pesticides, and their downgrading of environmental concerns, are certain to be taken as implicit endorsement of the status quo by non-scientific policy makers who may look to this well-born Resources for the Future book for guidance. In fact, the book, despite its interesting questions, might easily be interpreted as an endorsement of raw individualism[40] since it sees no hope of achieving a *Pareto optimum* in pesticide use (where part of society is better off and no one is worse off). Such an outlook pictures the agriculturist (who uses 60% of all pesticides) as a breed apart, with different interests, rather than as member of the same human community dependent on a clean environment and viable ecosystem.

The analysis is offered as "an accurate representation of the world,"[41] but it is more nearly a possessive individualist representation which "lumps" pesticides as a generic tool instead of more objectively distinguishing them specifically and thus allowing us to weigh their advantages and disadvantages, and evaluate the opportunities for substitutions; and it is consequently a representation which relegates environmental (ecosystem) concern to the realm of improbabilities even while including the possibility of such concerns in order, one feels, to demonstrate full coverage of the data that should characterize proper scientific analysis.

Another pseudo-scientific notion is that "research showing the effects of pesticides on fish and wildlife in the Chesapeake Bay cannot be applied to fish and wildlife generally."[42] If this is a scientific imperative, the agribusiness community should be asked to apply chem-

38. Harrington, The Accidental Century (1965).
39. J. Headly & J. Lewis, *supra* note 2, at 132.
40. *Id.* at 134.
41. *Id.*
42. *Id.* at 135.

icals only after a farm-by-farm study of externalities. It is true that the maximization of net returns in pesticide use on cotton requires different resource allocations in Alabama than in California, but this is so precisely because maximization is sought despite differing profit margins. On the other hand, long-lived, fat-soluble hydrocarbon insecticides tend to be magnified in food webs in both Alabama and California because the natural mechanisms responsible for this magnification of barely perceptible quantities (DDT in water, for example) to acutely toxic levels after four or five transfers through trophic levels are functionally similar (though they involve different species).[43] The end result of this process is the maximization of biological insult, resulting in death, and is objectionable whether it happens to Connecticut ospreys or California's western grebes, both species at the ends of contaminated food chains.

One reason the pesticide controversy has continued for twenty years is that the apologists for the status quo in pesticide use have failed to keep up with the avalanche of evidence of biological damage in natural environments and continue to equate private monetary gain with social welfare. There is no way of correcting this problem by juggling incremental costs and benefits. The recognition of ecosystematic pollution requires an intellectual quantum jump involving the acceptance of responsibility for the repercussions of one's actions in areas outside the market place. Headly and Lewis know this, in an academic sense, but they have not accepted it as operational policy, and therefore, more often than not, when they leave the economic theory of Parts II and III, they obfuscate issues more than they clarify them.

The book's last sentence warns us that "plenty of panaceas (are) being hawked around the policy arena,"[44] and pleads for more economic analysis to expose their limitations.

One hopes that the authors, obviously competent in their own area, will apply their methodology to a continuing exploration of the pesticide problem they grudgingly allow to exist.

They might, for example, explore the question of whether DDT, developed at public expense as part of World War II government policy—and highly useful, especially as a dust—but then turned over to private enterprise without patent restrictions, has not actually provided a twenty year headstart for this one pesticide, and acted as

43. Woodwell, Toxic Substances and Ecological Cycles, Sc. Amer., March, 1967, at 24-31.

44. J. Headly & J. Lewis, *supra* note 2, at 141.

a quasi-official restraint on trade and technological innovation by inhibiting, or slowing, investment in chemicals that would be more specific in their action and less subject to cycling and magnification in nature.

DDT has been the greatest technological panacea ever foisted on an unsuspecting public by the biologically illiterate and unscrupulous genius of American salesmanship.

In short, is it not "economic" to bar polluter pesticides so as to force (encourage) the production of more acceptable alternative chemicals and practices? And is not an expanding market situation, such as ours, the most "painless" time for a change-over to a better-balanced chemical arsenal and culture?

Society is being changed, willy-nilly, by every technological innovation we implement. Since at least 1890,[45] corporate and private gain has been our one criterion for applying technology. The environmental pollution crisis of our day is the result of this social irresponsibility. The chemical industry boasts of having contributed a lion's share of this "accidental century's" changes; is it not time to ask it to take some of its own medicine by imposing legislative, administrative and judicial restraints on those chemical pesticide uses we know contaminate the landscape? Since all costs of production are ultimately born by the consumer, a clean environment and the modest costs of updated pest control methods would indeed approach a *Pareto optimum*.

The final verdict on this small book, in my view at least, is that the economist, like the chemist and the control entomologist, cannot make his best scientific contribution to society except by enlarging his view to include the dynamic hierarchies of physical, chemical and biological organization involved in ecosystematic science,[46] a new science that the misapplications of our hasty technology have forced upon us.

45. Lichtman, Toward Community, Center for the Study of Democratic Institutions 21 (1966).

46. Simpson, Biology and the Public Good 55 Am. Sci., 161-75 (1967).