

Benefit/Cost Analysis of Silvex Cancellation

EDWARD O. GANGSTAD

*Office of the Chief of Engineers
Washington, D.C. 20314*

ABSTRACT

Throughout the United States, obnoxious aquatic plants adversely affect all kinds of water-based activity. The most prevalent problem plants that are best controlled with 2-(2,4,5-trichlorophenoxy) propionic acid (silvex) are mixed populations of submersed aquatic plants, alligatorweed (*Alternanthera philoxeroides* [Mart.] Griseb) and other emersed plants, and saltcedar (*Tamarix pentandra* Pall.) and other phreatophytes and riparian vegetation. Whereas the present system of analysis by the Environmental Protection Agency in the Rebutable Presumption Against Reregistration (RPAR) of silvex, defines the conditions that charge the cost to agricultural production as benefits, the elimination of a herbicide such as silvex has costs beyond and above the costs to agriculture. The system of analysis should consider all benefits to the nation.

INTRODUCTION

It is estimated that the current annual use of silvex (1978) for control of weeds in aquatic areas in the United States is 300,000 lbs. About 100,000 lbs. are used for control of submersed plants, about 100,000 lbs. are used for control of marginal-herbaceous plants and about 100,000 lbs. are used for control of marginal-woody plants (21).

To date, silvex has been one of the most widely used herbicides for control of these particular plants. When immediate solutions are demanded by the public, silvex provides a predictable and timely control response. Integrated control techniques show promise in permitting control effectiveness, reduced costs, and environmental compatibility. However, with no exception, each of the present alternate herbicides and/or methods is not fully satisfactory for the control of these aquatic problem plants (1, 4, 9, 10, 11, 14, 15, 18, 19).

Herbicides which have been used to control phreatophytes on aquatic sites include 2,4,5-TP (silvex), 2,4-DP and 2,4-D. Of these, silvex is the herbicide particularly registered by EPA for use on saltcedar. In Arizona, it is applied at a rate of 3 pounds acid equivalent per acre, per year for several years or until control is obtained (2, 13, 14, 15, 16).

MANAGING THE ENVIRONMENT

From a comprehensive point of view, the economic model which balances the cost account of benefits against deterioration of the environment, is a part of the management system which every and all societies must deal with. The environment cannot be managed without due account of the input and output to the national economy. There-

fore, the cancellation of silvex cannot be judged on the costs of alternatives alone, without examining benefits to the whole system, including recreation, navigation, flood control and drainage, irrigation and agriculture, fish and wildlife, and public health (1, 3, 5, 6, 7, 8, 12, 24, 25, 26, 27, 28, 29).

A major objective of the programs of the Corps of Engineers has been the efficient utilization of resources in the resolution of problems and satisfaction of needs whether of a national, regional or local nature. The basic laws governing these programs, however, do not provide the specific standards and procedures, or other required details of conducting economic and environmental evaluation. Broad general policy has been provided legislatively throughout the long history of the water resource program by such legislation as P.L. 93-251, the Water Resources Development Act of 1974; P.L. 92-500, the Federal Water Pollution Control Act of 1972; P.L. 91-611, the Flood Control Act of 1970; P.L. 91-190, the National Environmental Policy Act of 1969 and P.L. 92-516 Federal Insecticide, Fungicide and Rodenticide Act of 1978.

It is obvious from these legislative directives and objectives that the process of project or program formulation necessarily must be a process of identifying, assessing, evaluating, and comparing alternative programs for meeting specific objectives to determine their relative merits in satisfying human needs. By this process of comparison the project program which provides for the needs in the most acceptable manner can be more realistically selected and tested for justification.

Benefit-cost analysis is the term given to the studies made by planners and decision-makers to assist in selecting the best course of action from an economic viewpoint among a number of alternatives. It differs from routine judgment and decision-making by making use of quantitative evaluation, in monetary terms, of the goods and services expected (i.e., benefits) of an action and the goods and services expended (costs) in undertaking an action. The benefit-cost ratio is the proportion, expressed as a simple numerical fraction, that the benefits bear to the costs. A benefit-cost ratio of 1.5:1.0 means that benefits are expected to be 1½ times or 150% of the costs, under the assumptions used for the study. A project having a B/C ratio of 1.0:1.0 means that benefits are expected to equal the costs under study assumptions. This is equivalent to saying that such a project will produce a rate of return equivalent to the interest or discount rate used in the benefit-cost evaluations.

A project is considered to be justified and properly formulated when (1) project benefits exceed project costs; (2) each separable increment or purpose provides benefits at least equal to its related incremental costs; (3) the scale of development is such as to provide maximum excess benefits over costs and (4) there is no more economical means of accomplishing the same purposes which would be precluded from development if the project were undertaken. The determination process, accordingly, entails the measurement of benefits and costs on a with and without project basis. The comparison of the differences in benefits and costs between these conditions is commonly referred to as the benefit-cost ratio. Since the derivation of this ratio

is not an exact science many contentions have been made in the past regarding its value in the decision process. Experience, however, demonstrates that it is a useful, realistic means of appraising quantifiable effects and further, of comparing those effects with subjective views pertaining to the unquantifiable effects. In this manner the tradeoffs between the beneficial and adverse effects can be identified. The analysis is considered to provide a logical framework for the evaluation of various courses of action (24, 25, 26, 27, 28, 29).

ESTIMATING BENEFITS

The Unit Day Value (UDV) method for estimating benefits at Federal or Federally assisted recreation resources may be used by applying a carefully conceived and adjusted unit day value to estimated use. This approximation may be used as an estimate of recreation benefit projections (29).

When the UDV method is used for economic evaluations, planners must select a specific value from the range of values provided in the most current published schedule. Application of the selected value to estimated annual use over the project life, in the context of the with and without-project framework of analysis, provides the estimate of recreation benefits.

Two categories of outdoor recreation man days, general and specialized, may be differentiated for evaluation purposes. "General" refers to a recreation day primarily involving those activities that are attractive to the majority of outdoor users and that generally require the development and maintenance of convenient access and adequate facilities. "Specialized" refers to a recreation day involving those activities for which general opportunities are limited, intensity of use is low, and a high degree of skill, knowledge, and appreciation of the activity by the user is involved.

Estimates of total recreation days of use for both categories, where applicable, is developed. The general category comprises the great majority of all recreation activities associated with water projects, including swimming, picnicking, boating, and most warm water fishing. Activities less often associated with the average water project, such as big game hunting and salmon fishing, are included in the specialized category. A separate range of values is provided for each category to facilitate adoption of a point system in determining the applicable unit values for each individual project.

AREAS OF ASSESSMENT

Water resource areas clogged with aquatic plants directly prevent or reduce use of recreational facilities in areas infested and also indirectly by denying access to adjoining areas less affected. The weeds harbor snakes and insects and accumulate unsightly trash and debris, undesirable for recreational activity.

The River and Harbor Act of 1899 provided for the initiation of a program for the removal of waterhyacinth (*Eichhornia crassipes* [Mart.] Griseb) from navigable waterways insofar as it constituted an obstruction to navigation and commerce. Without such maintenance, waterhyacinth

and other aquatic plants may grow sufficiently dense to block or impede boat traffic, damage propellers, and marine cooling systems, and increase navigation hazards in the vicinity of bridges, docks, piers, etc. Alligatorweed is also particularly difficult for boats to move through. The dense above water foliage is supported on thick underwater mats composed of the stems and laterals of the plant (24, 25, 26, 28).

Benefits from removal of blockages from streams and drainage canals are of particular significance in areas of flat slopes and shallow channels. Aquatic plant infestations can reduce discharge capacities as much as sixty percent in areas with floating mats and up to ninety percent by submersed weeds (9, 10, 11).

Aquatic plants cause serious losses to agriculture by obstructing the flow of water in drainage and irrigation canals, farm ditches, and streams. They waste water by transpiration and interfere with the use of water for irrigation and other farm uses (18, 19, 20, 22).

Some of the greatest benefits from control of aquatic plants are those affecting fish and wildlife. The annual benefits are based on creation of open waters and improved access to new and existing open waters for sport fishing, and hunting and commercial fishing (4, 24, 25, 26, 27, 28).

From a health aspect, water weed control is vital to insure a potable water supply for drinking purposes. Removal of dense aquatic weed growths to insure proper lake water circulation that inhibits coliform buildup around bathing areas and minimizes mosquito breeding in shallow zones, is a significant benefit (24, 25, 26, 27, 28).

CANCELLATION OF SILVEX

On February 28, 1979 the Administrator of the Environmental Protection Agency (EPA) ordered the emergency suspension of the use of two phenoxy herbicides, 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) and 2-(2,4,5-trichlorophenoxy) propionic acid (silvex) on forests, rights-of-way and pastures, home and garden, aquatic ditch bank/weed control, and commercial/ornamental turf uses of silvex (44 FR 15897, March 15, 1979).

The emergency suspension orders were based in part on data and information developed for and through the agency's rebuttable presumption against registration (RPAR) for herbicide products containing 2,4,5-T (43 FR 17166, April 21, 1978). Silvex was included in the suspension orders in part because 2,4,5-T and silvex both contain the contaminant 2,3,7,8-tetrachlorodibenzop-dioxin (TCDD), have comparable uses and correspondingly comparable exposure potential, and pose exposure risks which are similar in many ways.

Assessment teams under a cooperative agreement between the U.S. Department of Agriculture and the Environmental Protection Agency commonly evaluate the biologic and economic impacts of the RPAR process for presentation to the court for judicial review. For purposes of the review, however, the argument is presented that this narrow assessment is patently inadequate because cancellation for use in a water resource activity involves many different areas and the impact is certainly not limited to agriculture.

CONTROL PROGRAMS

A summary of the total acreage, acres controlled and the swimming, fishing and boating days for 1972 for the Pennsylvania State Park system is presented in table 1 for a total of 29,416 acres in 22 lakes which were treated. Benefits from the weed control operations are estimated @ \$107 per acre for swimming, \$100 per acre for fishing and \$73 per acre for boating (27). Extrapolating from the basis of 20,000 acres controlled in the United States (21) with silvex (Aquathol Plus®), the recreation benefits (table 2) are \$5,619,600. The total cost of application @ \$85 per acre is \$1,700,000, and the B/C ratio is 3.3 to 1.

TABLE 1. SUMMARY OF TOTAL ACREAGE, ACRES CONTROLLED AND SWIMMING, FISHING AND BOATING DAYS FOR PENNSYLVANIA STATE PARKS LAKES FOR 1972.

State park	Lake acreage	Acres treated	No. swim ^a rec days ^a	No. fish rec. days ^b	No. boat rec. days ^c
Black Moshannon	250	75	29,405	18,207	13,972
Bald Eagle	1,730	—	—	9,523	18,207
Codorus	1,275	100	—	96,102	69,415
Frances Slocum	165	—	—	8,721	3,308
Gifford Pinchot	340	110	173,315	55,144	44,437
Gouldsboro	255	15	65,005	6,445	12,850
Hills Creek	137	50	37,150	16,283	10,382
Kettle Creek	160	—	1,729	14,835	5,855
Little Pine	90	—	2,406	5,485	1,512
Lyman Run	40	10	14,865	4,026	1,362
M. K. Goddard	1,860	50	—	8,725	18,031
Moraine	3,200	100	261,151	212,151	226,884
Poe Valley	25	—	67,899	16,302	9,736
Prince Gallitzin	1,640	2	219,283	24,545	36,955
Promised Land	595	—	122,585	143,335	139,680
Pymatuning	16,420	400	118,152	197,386	99,547
R. B. Winter	7	—	24,839	14,513	—
Ricketts Glen	254	—	14,699	18,145	16,500
Ryerson Station	61	15	30,260	85,409	11,605
Shawnee	451	75	143,591	26,194	27,922
Tobyhanna	170	100	49,560	5,775	11,110
Roosevelt	291	45	—	31,640	156,685
TOTALS	29,416	1,147	1,375,894	1,019,657	935,910

From: U.S. Army Corps of Engineers, Aquatic Plant Control Programs for The Commonwealth of Pennsylvania, Philadelphia, 1974.

^aValue of swimming days @ \$2.30 per day is \$3,154,556.

^bValue of fishing days @ \$2.50 per day is \$2,549,140.

^cValue of boating days @ \$2.30 per day is \$2,152,593.

Benefits for marginal-herbaceous weed control from different sources vary widely with geographic locality according to particular conditions. They are summarized in table 2, as the overall average of the United States for navigation benefits (\$7,029,800), are estimated at 25% of the operating cost of river and barge traffic for the acres controlled. Public health benefits (\$5,183,100) are the estimated level of cash savings for public health, water supply and pollution control for the acres controlled. Agricultural benefits (\$4,861,937) are the estimated value at 2 percent of the cost of farm products sold in the area of control. In this assessment recreation benefits (\$4,099,019) are estimated at \$0.50 per visitor day in the area of weeds controlled. Fish and wildlife benefits (\$2,395,700) are estimated at \$0.50 per fishing day, \$1.15 per day for small game hunting and \$2.50 per day for large game hunting in the area where weeds are controlled. Other benefits are estimated at \$5,460,000 for a total of \$28,969,556 and a cost of application @ \$70.00

TABLE 2. BENEFIT/COST ANALYSIS OF AQUATIC WEED CONTROL WITH SILVEX.

Item	Benefit	B/C Ratio
Submersed aquatic plants		
Recreation	\$3,614,600	
Fish & wildlife	2,005,000	
Total	\$5,619,600	
Costs ^a	1,700,000	3.3
Marginal-herbaceous plants		
Recreation	4,099,019	
Navigation	7,029,800	
Public Health	5,183,100	
Agriculture	4,861,937	
Fish & wildlife	2,395,556	
Other ^b	5,460,000	
Total	28,969,556	
Costs ^c	1,440,592	20.1
Marginal-woody plants		
Recreation	83,600	
Fish & wildlife	1,663,760	
Flood control	674,000	
Agriculture	119,600	
Other ^d	2,540,960	
Total	5,441,920	
Costs ^e	440,000	12.4
Sum total-benefits	\$40,031,076	
Sum total-costs	3,580,592	11.2

^a20,000 acres per year @ \$85 per acre.

^bBenefits of control of marginal-herbaceous plants other than alligator weed.

^c20,656 acres per year @ \$70 per acre.

^dBenefits of control of marginal-woody plants other than salt cedar.

^e20,000 acres per year @ \$22 per acre.

per acre of \$1,400,592, for a benefit/cost ration of 20.1 to 1 (21, 22, 24, 25, 26, 28).

Benefits from different sources relating to control of marginal-woody plants vary with specific conditions of application. The related values for the estimated use in the United States are also given in table 2. Fish and wildlife benefits are estimated at \$1,663,760, using a special day value of 11.50 for fishing and 12.20 for hunting. Flood control benefits are estimated at \$674,000 and agricultural benefits at \$119,600. Other benefits outside the saltcedar area are estimated at \$2,540,960 for a total of \$5,441,920 benefits and a benefit/cost ratio of 12.7 to 1 (13, 14, 16, 17, 21).

The overall benefits that are apparent from this brief analysis total to more than 40 million dollars. The cost of this program is approximately 3.5 million dollars. Thus the overall benefit/cost ratio is approximately 11 to 1.

SUMMARY AND CONCLUSIONS

Whereas the present system of analysis by the Environmental Protection Agency in the Rebutable Presumption Against Reregistration (RPAR) of silvex, defines the conditions that charge the cost of agricultural production as benefits. The elimination of a herbicide such as silvex, has costs beyond and above the costs to agriculture. The system of analysis should consider all benefits to the nation. It is

the total economy of the nation that must be taken into account.

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