COMMITTEE ON NATURAL RESOURCES

Legislative Council
107th Legislature
State House
Augusta, Maine 04330

Gentlemen:

In accordance with H.P. 1944 directing the Natural Resources Committee to study the Spruce budworm problem in Maine, I enclose herein the final report of the Committee.

Respectfully submitted,

T. Tarpy Schulten, Chairman
Committee on Natural Resources

REPORT OF THE COMMITTEE ON NATURAL RESOURCES

ON ITS STUDY OF THE

SPRUCE BUDWORM PROBLEM IN MAINE

January, 1975

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INTRODUCTION

Study Order

The Natural Resources Committee of the Maine Legislature was assigned to study joint order H.P. 1944 by the Legislative Council (Appendix O). In addition to a full review of the spruce budworm central problem, the specific reviews requested by the order included the following:

1. The overall direction of the program
2. The costs involved on behalf of the State
3. What progress has been made to date in bringing the infestation of spruce budworm under control, and
4. To what extent the Legislature can reasonably anticipate costs of protection and state participation in the future.

Committee Procedure

The Committee interviewed officials, educators, forestry experts and environmentalists to gain a working knowledge of the problem both past and present. Review of research papers specifically reporting on the safety and efficacy of particular insecticides and other agents on the spruce budworm were reviewed and summarized. A public hearing on the study was held in October, 1974, with all known interested parties personally invited. The Committee reviewed the information available and in executive session in December, 1974, based on its assessment of the problem and the control program, made the following

findings and recommendations.

Committee Findings

The Natural Resources Committee found that:

1. The overall direction of the program has been to apply a variety of sprays over infested areas of spruce-fir forests in Maine. The early purpose of measures taken was to control the larvae population of spruce budworm. In recent years, budworm control no longer describes the program of the Maine Forestry Department but rather foliage protection, by killing sufficient larvae to keep trees alive. As can be seen by accompanying charts and maps the acreage affected by spruce budworm has increased markedly, not only in Maine but in the entire Maine-Canadian epidemic area. Of 7.8 million acres of spruce-fir forests in Maine, 5.3 million acres are heavily infested and 3.5 million require spraying to prevent serious tree mortality. The most recent information on insecticides available is that sufficient chemicals are available to spray 1 million acres of forest considered in critical condition. There is a possibility that additional Sumithion might be manufactured to spray if chemicals can be transported to the United States in time for the spray operations, 1975. The future plans to "control" the problems do not vary from past practice.

2. The present estimate for spraying 1,000,000 acres is $3,750,000. 50% of that amount is the state's share, or $1,875,000 and that, at the date of this writing, will be the requested appropriation. On December 4, 1974, the Portland Press Herald reported that Morris Wing of International Paper Company stated to the Maine Congressional delegation in Washington that "the landowners had pledged $3.5 million of their own funds toward a joint federal-state effort to control the infestation". Those funds could be applied to the state's share making an appropriation unnecessary. Historically the "private" funds contributed toward the state's share have been raised by increasing the mil rate on all the unorganized territory.

3. No progress has been made to bring the spruce budworm under control. Short of natural control of the budworm population, i.e., unfavorable weather or loss of food source, reasonably anticipated costs of protection and state financed participation will increase in the forseeable future.

4. Maine infested spruce-fir forests comprise 4 - 5% of a combined Canadian-Maine infested acreage of over 100,000,000 acres. If the Canadian infestation is not brought under control there is no known way Maine can avoid a continued serious level of infestation. There is little likelihood that the Canadian epidemic will be brought under control except by natural causes. Research on the problem has not been adequately funded. The research, mostly Canadian, that has been done on spruce budworm control has not yet yielded successful results although some biological control agents show some promise. The landowners and wood products industries conduct little research on the spruce budworm, although silviculture efforts to reduce the proportion of fir in forest stands have been made. The U.S. Forest Service conducts no research on the spruce budworm problem.

Committee Recommendations

1. The forestry department should no longer attempt to protect and preserve foliage of all seriously infested acreage.

2. In the future the forestry department should spray only "critical" areas and consider a spraying program directed toward spacing out mortality to reduce the salvage operations to manageable proportions and to stagger forest age classes to assure continuous forest production.

3. Emergency powers may be required to allow implementation of a salvage plan.

4. The Maine Forestry Department, in cooperation with appropriate State agencies and landowners, should seek out and plan for alternative uses and markets for salvaged wood as traditional wood markets will almost certainly be unable to absorb the product of salvage operations. In particular, the conversion of wood into electric energy to relieve Maine's reliance on imported petroleum and nuclear fuels should be explored.

5. Public Lands and Recreation areas of the State of Maine should be given priority in the use of state funds.

6. State funds for research for alternative methods of control should be provided to the University of Maine Department of Entomology and be appropriated on the basis of up to one dollar for every four raised by industry and landowners for a commitment of five years at an annual combined total of $100,000.

7. A formal cooperative agreement should be made with Canadian counterparts and the Maine and United States Forestry Departments with the stipulation that each will accept research results of the other based on approved scientific research techniques acceptable to appropriate licensing agencies of both countries.

8. No state funds should be appropriated for the use of the insecticide known as D.D.T.

9. Representative Thomas Peterson recommends that any tax on forest lands to support a spruce budworm spraying program be apportioned on the basis of percentage of land owned by a particular landowner within the proposed spraying area and that the program not be supported by a general tax increase on all the unorganized territory as in former years.

10. Representative Thomas Peterson recommends that no appropriation of state funds be made subsequent to the year 1975, if a formal plan for salvage operations has not been presented to the legislature prior to request for funds.

11. Representative Ezra James Briggs recommends that no further spray operation be undertaken because they are totally ineffective to control the epidemic.

12. Representative Ezra James Briggs recommends that no public funds be used to spray private property.

BACKGROUND

Spruce Budworm is an insect native to Maine spruce-fir forests and normally exists in endemic status. Serious outbreaks have occured reaching epidemic proportions on five separate occasions in the northeast beginning in 1770. The outbreak of 1910-1918 is said to have killed approximately 27,500,000 cords of spruce and fir. In addition to economic losses associated with such extensive tree loss, danger of forest fires is cited as the greatest threat in subsequent years.

Early attempts to control the current outbreak which is said to have started in 1949-1950 were made by introducing a parasitic wasp. Parasites were released each year from 1950-1958. Results were disappointing and this kind of control was abandoned.

Beginning in 1954 and continuing until 1967 D.D.T. was used to control epidemics in areas where tree mortality was threatened. By 1967 most areas of infestation appeared to be declining in size and insect population excepting the Ox-bow--Carey-brook region. This area was experiencing a serious infestation and spraying with D.D.T. was recommended. The operation for that year was curtailed by public antipathy to that insecticide.

Substitutes for D.D.T. have been sought and used since

1950, Parasites (1950-58) Bacillus thuringiensis (1963); Malathion (1964); Zectran (1967); and Lumithion (fenithrosthion) (1968), fenithothion (1970); Zectran (1972); Zectran (1973); and Zectran (1974).

BIOLOGY

Egg masses laid during late June and July hatch in 8 to 12 days and winter over after spinning a hibernaculum in which they moult to the second instar (stage). In early May larvae become active and develop through several more instars during which they feed on developing foliage. Tree damage varies from light defoliation with retarded growth to severe defoliation and tree mortality. Worm populations of epidemic proportions are finally limited by destruction of food supply. This loss of food supply along with weather conditions seems to be a precursor to extensive moth flights some of which have been experienced this year.

Spruce bud worm infestations seem to reach epidemic proportions during periods of dry warm summers and decline during cool wet summers. Also infestations are more likely to be severe in even aged solid, continuous spruce-fir stands. Older, more mature trees are hardest hit, suggesting forest practices and management could be effective control measures. Depletion of white pine and spruce has probably contributed to

more intense infestations as these trees are more resistent and reilient; however, the predominant balsam fir is preferred by the paper industry. Tree death is normally expected about the fifth year of serious defoliation.

Public Hearing

A public hearing was held on October 23, 1974. A broad representation of Maine, United States and Candian Forestry experts were in attendance and offered their views on the problem and possible solutions. Director Holt of the Maine Department of Forestry outlined what he considered unacceptable alternatives to an extensive 3,500,000 acre spraying program in 1975. He stated salvage of such vast acreages of dead and dying trees was impossible. Fir is commercially usable only for two years after death of the tree, spruce up to five years. In addition, he pointed out the serious fire hazard from such extensive acreage of dead and fallen trees. He indicated that other hardwood species would be adversely affected by the absence of fir and spruce cover. Large openings in the forest result in increased water temperature in streams and exposed deer yards. The best estimate of mortality, in the event treatment was not carried out, would range from 10-15%---3 million cords of wood, the current annual rate of removal.

The policy of spraying was outlined by Mr. Holt as follows:

1. spraying is delayed until stands are considered unable to survive another serious infestation. Determinations are based on extensive field surveys (both ground and aerial) by experienced staff using "statistically sound methods to enable coverage of the acreage."
2. spraying is carried out for tree protection
3. spraying is most effective on heavily infested-heavily defoliated trees.

4. getting as much acreage protected as possible for the funds expended.
5. Benefit cost ratio based upon stumpage value and fire protection cost savings. 2.17:1
   Benefit-cost ratio based upon mill product value (appendix B) 32.9:1

Attached is a schedule of the cost and extent of spray projects 1954-1974. The total cost of these eleven programs is $4,320,963.00. The state share has varied over the years between 1/5 and 1/2 of the total cost. In recent years (1973 and 1974) the state's share has been 1/2 and the federal government's share 1/2. The proposed expenditure for the state's share for the next biennium is $6,000,000.00 if sufficient insecticide for 5.5 million acres is found.

Staff entomologists, biologists, forest rangers, management and fire control personnel and assistants monitor budworm populations, stages of development, assess areas of infestation, compare post control populations to determine effectiveness of the measures taken and budworm parasites. Considerable Department of Forestry resources and personnel are devoted to the spruce budworm control program in addition to the expenses and numbers of personnel involved in the spraying of insecticides. Personnel donate much time to meetings, documentation of programs and results, contracting for spraying operators and notifying residents of proposed operations.

RECORD OF SPRUCE BUDWORM SPRAY PROJECTS

YEAR	LOCATION	ACREAGE	COST/ACRE	TOTAL COST	CHEMICAL	FUNDED Fed.	FUNDED State	FUNDED Private
1954	N. Aroostook Cty.	20,000	$1.54	$ 22,841.00	DDT	30%	20%	50%
1958	N. Aroostook Cty.	302,000	.78	234,936.00	DDT	1/4	3/8	3/8
1960	N. Aroostook Cty.	217,000	.97	191,335.00	DDT	1/4	3/8	3/8
1961	N. Aroostook Cty.	53,000	1.17	61,957.00	DDT	1/4	3/8	3/8
1963	N. Aroostook Cty.	479,000	1.06	489,135.00	DDT	1/4	3/8	3/8
1964	N. Aroostook Cty.	58,100	1.55	77,703.00	DDT	1/4	3/8	3/8
1967	N. Aroostook Cty.	92,000	1.60	117,861.00	DDT	1/3	1/3	1/3
1970	N. Aroostook Cty.	210,000	1.23	270,308.00	Accothion	1/3	1/3	1/3
1972	N. Aroostook Cty.	500,000	2.62	1,309,887.00	Zectran	40%	30%	30%
1973	N. Aroostook Cty.	450,000	2.61	589,000.00	Zectran	1/2	1/2	--
1974	N. Aroostook Cty. & N. Washington Cty.	420,000	2.37	976,000.00	Zectran	1/2	1/2	--

Taxes on Unorganized Territory

	6/30/70	6/30/71	6/30/72	73-74	74-75
Undedicated Revenue	1300,341	1376,338	2317,829		
Unorganized Terr. Sch. Fund	349,019	379,800	417,781	1431,195	1679,937
Unorganized Wkng. Cap. Fund	36,886	42,225	62,616	71,947	71,947
Maine Forestry District	1189,614	1340,761	1697,774	1363,603	1363,603
Counties	548,047	646,701	649,303	700,000	700,000
Total	3423,907	3,785,825	5,145,303	5,726,261	6,075,000

POSSIBLE SALVAGE OPERATIONS

Reference to the disaster plan for Mississippi following the hurricane Camille was made by several speakers. A report to Governor Williams from the Mississippi Governor's Forest Disaster Salvage Council by Warren A. Hood was made available to the committee. Some important points from that report emphasize some attitudes on the part of industry that are of interest. Forest industry did not alter their purchase and procurement practices and continued at the same ratio as was in effect before the hurricane. In effect, they shared the losses amongst themselves. Secondly, they continued to pay regular prices for the wood which they purchased. The Industry contributed immensely to price stability by maintaining pre-hurricane price levels for all timber purchased. In addition, the Mississippi industry opened temporary woodyards, installed spray storage areas to permit stockpiling of timber and revised shipping practices to ship the maximum amount of hurricane damaged wood as far as possible. Industry provided a full time executive secretary. No money was budgeted for the program. Office space was provided by the Mississippi Forestry Commission as well as insect and fire control plans. Two new plants were built in the disaster area to use the downed lumber. 1.9 million acres were estimated as damaged in varying degrees. In the 1 year period, during which the salvage council operated, 77 of 285 million cords of wood were salvaged.

The response of industry in Mississippi contrasts with that of a representative of Maine's Great Northern Paper Company.

"We buy 60 percent of the wood Great Northern uses from independent landowners. But if we have wood on our own lands that is dead and needs to be salvaged, we won't be buying from other people." An additional point on salvage operations was raised by Joseph Lupsha at a public hearing on Environmental Laws, October 30, 1974. He stated the need for relaxation of Environmental Laws and Regulations. He particularly pointed to 38 M.R.S.A. §598, sub-§2.

> 2. Prohibition. No person shall emit or cause to be emitted any visible air contaminants from any emission source that exceeds a number 2 on the Ringleman Chart or an opacity of 40% except for periods of not exceeding 5 minutes in any one hour or 15 minutes in any continuous 3-hour period.

The storage or burning of by-products, sawdust and other residues, is a problem for lumber mills.

ENVIRONMENTALIST CONCERNS AND RECOMMENDATIONS

Representatives of two environmental groups, Maine Audubon Society and Natural Resources Council, and the Maine Department of Inland Fisheries and Game expressed their complete opposition to any use of D.D.T. in 1975. All reiterated the well known dangers inherent in the use of that insecticide which has been banned by the United States Department of Environmental Protection. Maine Audubon Society and the Natural Resources Council

emphasized the need for long range planning; formal cooperation with Canadian officials; greatly extended research efforts and financial support for the programs by the primary beneficiaries, the land owners.

FEDERAL LEVEL PARTICIPATION

The U.S. Forest Service has authority to provide technical and financial assistance to suppress periodic insect outbreaks where biological, benefit-cost and environmental evaluations demonstrate that the action was warranted to protect forest resources, under the Forest Pest Control Act of 1947. "The Forest Service recognizes the critical emergency in protecting forest resources...and supports the State's efforts to decrease losses which may occur." The Service will ask for a deficiency apportionment of funds for the federal share of the suppression project and will follow that up with a request for supplemental appropriations. If the deficiency apportionment is approved, federal funds would be available in time for project planning and implementation. Zectran, except for a small quantity held by the U.S. Forest Service, is not available. Fenitrothion has been used extensively in Canada and pilot tested in Maine. The United States Environmental Protection Agency has been petitioned by the Maine Department of Conservation under Section 18 of the Federal Insecticide, Fungicide and Rodenticide Act to use Sumithion in 1975 if available.

The United States Forest Service at the Hearing in Augusta on House Paper No. 1944 stated that "research results are presently lacking to provide the answers needed for the most effective, efficient and environmentally sound control program. Because of other pest problems judged to be of higher priority, there is no Forest Service research being conducted on the spruce budworm problem. (emphasis added) Upon questioning by the Committee, the Forest Service Representative admitted that $5,000,000.00 will be spent this bienium on "Gypsy Moth" research.

Their "priorities" can change according to the demand for service from allegedly lower priority programs. "Congressional, industrial and state level request for service will cause the service to look at the spruce bud worm problem more closely."

A statement introduced by U.S. Senator William D. Hathaway outlined his failure to get U.S. Forest Service matching funds committed for the program when the first supplemental appropriations bill was considered in October. He based the refusal for such funds on two clear points:

1. The lands are privately owned.
2. Maine has not made a commitment to match the funds.

LANDOWNERS CONCERNS

Mr. Morris Wing of International Paper Company expressed his assessment of the problem as "impending disaster". He stated that high mortality rates in the proposed spray area are evident and will increase "manifold" during 1975 and succeeding years. He stated that the economic consequences of no action are "incomprehensible" and that it will be "completely impossible" to salvage and utilize all dead and dying trees. He predicted that a salvage program would depress the market for independent pulpwood producers who now share 60% of $1,400,000 monthly payments for pulpwood at International Paper Company's Jay mill. New sawmills need greater amounts of raw materials as well as planned paper mill expansions.

A letter from C. Edwin Meadows of Seven Islands Land Company to the Natural Resources Committee mentions six points that can be summarized as follows:

1. State involvement on private land must be based on a cost-benefit study.

2. Impact on all wood land owners should be considered.

3. Epidemics of budworm attack all "age" levels of forest. Endemic levels are supported by mature and overmature stands. We are experiencing an epidemic.

Everyone agrees more research is needed. "Industry efforts were minute compared to the need."

4. The University of Maine is carrying on studies of complete forest utilization.

5. "For twenty years Seven Islands has had the benefit of Irving Pulp and Paper's three-quarter million dollar unsuccessful attempt to establish a Budworm proof spruce forest."

6. An emergency plan to get component chemicals for production of effective safe insecticide is necessary.

Mr. Bradford Wellman seeks a publicly supported State administered coordinated disaster plan to include the following:

1. research funds, federal, state and private;

2. forest practices and environmental law relaxation to permit cutting practices not currently permitted and storage of logs;

3. low cost loans to salvage operators and manufacturers; and

4. Federal Corporate organization to permit operators, contractors, landowners and manufacturers to cooperate in sound forestry and manufacturing activities without the threat of anti-trust laws.

PROBLEM REVIEW BY ENTOMOLOGISTS

Professor John Dimond, University of Maine at Orono entomologist, and his colleagues, Professor Gary Simmons and Professor David E, Leonard,acknowledge the "natural" occurence of spruce bud worm and describe the role of the insect as one of "harvesting" through defoliation and death, old and unproductive portions

of the forest. "Areas killed by the insect regenerate new, more productive efficient spruce fir forests. However, increased utilization of wood and pulp makes loss of acreage by insect infestation unacceptable. It does not eradicate the problem. In six years of control measures, the acreage affected has increased from 60,000 to 5.4 million in Maine; in Quebec and the Maritimes from 500,000 to 90-100 million acres. Maine's 10 million acres of susceptible spruce-fir forest are surrounded by 100 million acres of Canadian infested forests. This fact combined with the mobility (moth flights of several hundred miles) and the egg laying capacity of the female moth (200 within a 10-14 day life span) lead to the conclusion that Maine's forests are unquestionably due for infestation. Present control measures attempt to reduce budworm populations to insignificant numbers or spray sufficiently to keep the trees alive. The former measure is futile because of certain reinfestation from the north or northwest. The latter measure is the only one that is currently developed for practical use. Other alternatives -- Pathogens, sex attractants and moth control -- are under testing and consideration by Canadian investigators.

References and Notes

1. State-wide Pesticide Analysis of Fish and Associated Fish Mortality, Maine Department of Inland Fish and Game.

2. Short Term Effects of Accothion on Fish Populations in Northern Maine, 1970 - Peter Bourque and Steven D. Timpano, Maine Department of Inland Fish and Game.

3. Letter: dated November 18, 1974 in response to request for information by Helen T. Ginder from Dr. John B. Dimond.

4. Brook Trout Population Study on Zectran Sprayed Area, 1967, Kendall Warner, Maine Department of Inland Fish and Game.

5. The Effects of Zectran on Birds and other wildlife. Department of Inland Fish and Game, 1972.

Research on Insecticides in Maine

D.D.T.

In June 1958, 302,000 acres in Aroostook County were sprayed by air with D.D.T. at 1 lb/acre. The following chart demonstrates the mortality of a variety of fish in streams located in the spray area.

Mortality

	Trout	Suckers	Hunnous	Sticklebacks	Sculpins	Total
Before spraying	0	7	8	2	0	17
After spraying	216	1527	4400	2310	391	8844

D.D.T. Residue

"Chemical analyses revealed high amounts of D.D.T. present in tissues of several species of fish collected dead immediately after spraying and of live fish 3 months later. (Table 1) Almost without exception, D.D.T. residue is higher (up to 66 times) in tissues of trout collected in the spray area than outside (table 2). D.D.T. has been found to persist in fish tissues at concentrations higher than found in untreated areas up to 10 years after the last spraying. The chemical is found in all other species sampled. As with brook trout, D.D.T. in other species is generally higher in treated than in untreated areas (Table 3), higher in streams recently treated than not recently and highest in those treated several times as compared to once."[1]

Table 1. Mean ppm DDT contained in brook trout tissues from within the spruce budworm spray area in various years.

Stream	Year sprayed	DDT year collected 1958	1962	1968
Little Goddard	1958	5.1		1.3
Violette	1958	7.4*		
Gardner	1958	19.9		
Big Goddard	1958	198.0**		
Little Armstrong	1958	2.9		
Salmon	1958	13.7		
Carry	1958	8.0		1.9
Mud	1958	10.0		
Armstrong	1958		0.2	0.4
Unnamed (1)	1958			0.4
Unnamed (2)	1958			0.2
Halfway	1958	4.2	0.6	0.6
Beaver (1)	1958, 60, 64	16.5	2.6	1.1
Beaver (2)	Several			
Sterling	Several			3.7
Blake	Several			1.4
Uncolcus	1967		7.2	6.0
Smith	1967		9.2	

* Fat and stomach contents only

** Gonads only. Other values, whole fish.

Table 2. Mean ppm DDT contained in brook trout tissues from streams outside the spruce budworm area in various years

Stream	Year collected	DDT
Cold	1958	1.2*
Three	1958	0.3
Rivere des Chutes	1958	2.1*
Birch	1968	0.1
Weeks	1968	0.04
Flint	1968	0.09
McNally	1968	0.20
Daigle	1968	0.10
Unnamed	1968	0.06
Buggey	1968	0.06
Hale	1968	0.01

* Agricultural areas

Table 3. Range in ppm DDT contained in species other than trout within and outside the spruce budworm spray area. Preliminary data.

Species	DDT	
	Within spray area	Outside spray area
Salmon	2.6 - 4.1	--
Chubs	0.2 - 21.2	0.0 - 0.6
Dace	0.2 - 7.8	0.7 - 0.8
Sculpins	0.1 - 5.5	0.2 - 0.3

ACCOTHION

In 1970 the Maine Department of Forestry sprayed 210,000 acres in The Oxbow area of northern Maine with the insecticide Accothion*(a trade name for fenitkothion, active ingredient: O, O-dirsethyl O-p-nitro-in-tolzl plusphoro-thioate). Permission to use this chemical was provided by the United States Department of Agriculture by granting a temporary permit based on research studies completed by New Brunswick, Canada. A summary of the results of the program is as follows:

Men assigned to "hazardous" areas were monitored for exposure to the insecticide. The results showed no toxic exposure of any individual to the chemical.

A reduction of survival of larvae of 84% was attributed to the insecticide. This reduction was not sufficient to alter the course of the infestation in the treated area. Outside the treated area the epidemic bud worm infestation expanded in size and intensity. The treatment was successful in preserving much current foliage. The treatment area was sufficiently improved in condition that treatment was not recommended for 1971. When the prescribed dosage reached a target tree a substantial amount of current foliage is saved.

* other names are: Foliothion^{R}, MEP, Novathion^{R}, Nuvanol^{R} and Sumithion.^{R}

However, the dosage did not suppress populations but left sufficient survivors to produce generally heavy limits of new egg masses. A second application has a greater impact on population reduction.

Accothion is a broad spectrum insecticide evidenced by the "knockdown of predaceous and parasitic arthropods including spiders and perhaps parasitic (to the budworm) Diptera and Hymenoptera including Meteorus trackynoters and Glypta funifeianae."

"The impact of Accothion on aquatic invertebrates appear minor in comparison to some other pesticides, e.g. D.D.T. Accothion showed effects on some insects but no plants, birds minnows tadpoles, frogs, toads and salamanders. No significant short term changes in fish populations were observed.

Census of evening gross beaks attracted to the bud worm infested area as well as other animal life demonstrated no significant mortality.

Samples of grass forage, milk and soil were chemically analyzed and showed no presence in milk or soil but did show 1.1 ppm on grass.

Consideration certainly should be given that the use of such broad spectrum insecticides kills natural parasites of

of the spruce bud worm and although keeps the trees alive also keeps epidemic populations free from one of several important natural controls.

The studies conducted in 1970 on the effects of Accathion for Spruce Bud Worm control were inconclusive. However, the department of Inland Fish and Game recommended that Accathion not be registered for extensive use until long-term environmental effects can be determined.[2]

> "Sumithion is as broad in spectrum as other common insecticides. It will kill anything at appropriate dosages. Yet at the dosages used in the forest, it appears completely safe to mammals, quite safe for fish and buds. When it was first used in Canada, there was some bird mortality, which caused dosages to be reduced.
>
> Like other organic phosphorous insecticides, it is considered non-persistent. Residues last days or weeks depending on whether one is looking at soils or water or organisms. A recent report from Canada shows that some enters conifer foliage and remains there in small amounts for a year or more. It is possible that this could lead to troublesome accumulations over a period of years of successive applications. But at present, that is only a possibility and is being studied.
>
> Basically, Sumithion is generally accepted as one of the safer insecticides environmentally. One cannot be more assertive than that since we never know when some new study will demonstrate some unexpected bad feature. But right now it looks pretty good as insecticides go."[3]

Zectran

Available reports from the Maine Department of Inland Fish and Game indicate according to tests made on the effectiveness and toxicity of the insecticide Zectran that the application of Zectran at .15 pounds per acre appears to have no adverse effect on trout populations.[4] Zectran is not as effective as D.D.T., however an 82% reduction of population with a survival of .95 larvae per twig was effected with 75 pounds of Zectran dissolved in 50 gallons of DOW, TPM applied as a fine spray 13 oz/acre. Criteria of 95% reduction of population and .50 survivors per 15" twig were used to measure effectiveness. Zectran is very toxic to the budworm and the problem with the 1967 above described experiment appears to be the need for a consistent application of spray. Black flies and mosquitoes were not affected in the spray area. D.D.T. application in restricted areas the same year resulted in insect population of 86.6% and 1.59 larvae per 15" twig. This result was attributed to the necessity of avoiding areas near lakes, streams or ponds. No adverse effects were found on fish or bird populations.

In June 1972 the Department of Inland Fish and Game conducted tests to evaluate the effects of Zectran on birds and other wildlife. Tests were made to determine sub lethal behavioral effects on birds and mammals by comparing pre and past spray ban cholinesterase activity. There was no evidence

of bird or mammal kill. There was loss in cholinesterase activity. Changes in behavior resulting could make affected birds more susceptible to predation weather and disturbed existing instincts. The recommendation was made that the application rate of Zectran not exceed .15 lbs per acre.[5]

BENEFIT - COST ANALYSIS

This cost-benefit analysis was prepared for the Department of Forestry by Joseph M. Lupsha, executive director of the Maine Forest Products Council.

The author of this report has been requested to compute such benefits on the basis of stumpage value; stumpage value plus recreational value saved plus fire prevention costs saved if the fire hazard is modified through retention of live timber; and also on the basis of product value.

The estimated cost of the proposed project is given as $3.75 per Acre.

Necessary statistical data was obtained for the analyses from the Maine Forest Service, the U. S. Forest Service, forest products manufacturers using spruce and fir, the Bureau of Labor Statistics of the Maine Dept. of Manpower Affairs, the Baxter State Park Authority, the Bureau of Parks and Recreation, of the Maine Dept. of Conservation, the Maine Land Use Regulation Commission, the Maine Dept. of Commerce and Industry, and private forest landowners owning spruce and fir timber but not having primary processing facilities.

Stumpage price information was obtained from hundreds of landowner reports of "arms length transactions" involving the sale of spruce and fir log and pulpwood stumpage in the townships involved in the proposed 1975 project. Since the data was actually collected for purposes of the Maine Tree Growth Tax Law, and before the project boundaries were deliniated, it can be fairly stated that there is no bias involved in the values given because of the Budworm project.

BENEFIT - COST ANALYSIS USING STUMPAGE VALUES ALONE

Under Maine conditions of ownership, stumpage values were judged to be the residual value remaining after deducting all costs of harvesting and delivery of the raw materials to mills including loggers' operating profits.

Mathematical formulas were supplied the author for use in determining present worth of the affected spruce-fir resource in the project area. Taken into account is the assumption of sustained yield production of spruce-fir; a timber rotation age of 60 years; a $3.75 per Acre treatment cost; a 10% discount rate; a national stumpage value price increase averaging 1.7%; and an average five year interval between control projects.

Benefit-Cost Ratios computed do not take into account any improvement in growth rate over that reported by the U. S. Forest Service Timber Survey Report for Maine for the period 1958 to the end of 1970; no protection of immature (non-commercial) size trees; nor maintenance of wildlife or water values.

Weighted Average Stumpage Prices for spruce-fir logs and pulpwood were determined for the project area in each of the five Maine Counties, and they are shown below. (Log volumes were converted to Cords at a standard conversion rate of two (2) Cords= 1,000 board feet.)

	Stumpage Price (1973)
Aroostook County	$8.34 per Cord
Penobscot County	7.49 per Cord
Piscataquis County	7.89 per Cord
Somerset County	8.95 per Cord
Washington County	5.62 per Cord
TOTAL PROJECT AREA	$8.05 per Cord (weighted Average)

Sustained yield determinations were made for the spruce-fir timber volume on the 3' million acre project area, using as a basis the January 1, 1971 spruce-fir volumes by County as reported by the U. S. Forest Service, with adjustment for minor spruce-fir volumes in other Timber Types and an additional 30% discount for extractability problems, such as low volumes in an area, and present State rules and regulations affecting harvesting as promulgated aby the Maine Land Use Regulation Commission.

	Annual Sustained Yield
Aroostook County	692,930 Cords
Penobscot County	68,250 Cords
Piscataquis County	384,300 Cords
Somerset County	90,510 Cords
Washington County	27,020 Cords
Total Project Area	1,263,010 Cords to 5" dia.breast high min.
	OR
	824,750 Cords to 7" " " " min.

(In general the current practise is to 7" minimum diameter breast high)

Benefit - Cost Ratios determined using formulas, weighted average stumpage prices, discount rate of 10%, and other assumptions previously noted.

	Benefit - Cost Ratios
Aroostook County	2.14:1
Penobscot County	1.92:1
Piscataquis County	2.03:1
Somerset County	2.30:1
Washington County	1.44:1
Total Project Area	2.09:1 STUMPAGE VALUE ALONE WEIGHTED

BENEFIT - COST ANALYSIS USING STUMPAGE VALUES + RECREATION VALUES+ FIRE PREVENTION COST SAVINGS

It seems imperative that if the Spruce Budworm control program is not carried out that recreational travel will have to be restricted or completely banned from the infested acreage and from roads and waterways traversing the area.

In 1973, 20,000 people were checked through gates operated by private landowners in a 2¼ million acre section in northern Maine. A cooperative organization of landowners, called "North Maine Woods" was formed because of increased public demand for recreation land and desire to travel the vastly expanded private road network found in this northern area of Maine. Approximately 2 million of the 2¼ million acres in "North Maine Woods" is within the proposed Budworm control project. Gate tallies indicate that in 1973 of the 20,000 persons registered to enter the area; 75% were residents, 25% non-residents, and 95% were hunters and fishermen. A Maine Department of Commerce and Industry funded survey revealed that in 1972 the expenditures per day by resident hunters and fishermen averaged $4.21 and for non-residents $15.12. The average non-resident spent seven days on his hunting or fishing trip, while the resident spent 1½ days . Total expenditures for recreational pursuits via "North Maine Woods" gates is estimated to be $600,000.

Access to Baxter State Park, may also be curtailed, particularly in access to the Northwest section of the Park. In 1973 over 68,000 "camper days" were spent by visitors to this Park. It is estimated that the closure of several campgrounds would occur because of the fire hazard. Reduction in "camper-day" use in the Park would be about 30% or 21,000 "camper-days" Anticipated decrease in camper expenditures would be $122,850. (camper-day expenditures in 1973, as determined by a Park survey, was $5.85.)

The Allagash Wilderness Waterway is a major recreational area located within the"North Maine Woods" section of Maine and is entirely in the Budworm project area. Forty-seven percent of the visitors to the Waterway were Maine residents out of a total of 8,337 persons who utilized the Waterway in 1973. The total "visitor-days" was 50,361. Estimated expenditure is $9.00 per visitor-day, or a total of $453,249. Curtailment of use because of fire hazard would be

approximately 80%. However, in determining recreational value, there is a strong possibility that "North Maine Woods" tally of visitors includes most of not all of those in the Allagash Wilderness Waterway Survey, because "North Maine Woods" registration gates are on the access roads to the Waterway. Therefore, net recreational value loss is estimated to be only $100,000 for purposes of this computation, at 80% curtailment level.

RECREATIONAL VALUE LOSS IN A YEAR

North Maine Woods @100% -	$600,000
Baxter Park Data @30% -	122,850
Allagash Waterway @80% -	100,000
SUB-TOTAL	$822,850

Some recreational value losses would also occur in the Somerset and Washington County Budworm areas, which are not included in the above. Estimated recreational loss is $80,000 for Somerset plus Washington County.

TOTAL RECREATIONAL LOSS PER YEAR

$902,850

FIRE PROTECTION COST SAVINGS

Without a 1975 Budworm control program on the 3½ million acres, it will be absolutely necessary to increase Maine Forest Service fire staffing for the purpose of increased fire prevention activities in the infested area.

The Maine Forest Service has determined that the added cost for such a program would be $127,300 for personnel, and $23,160 for equipment, or a total annual expenditure of $150,460.

SUMMARY OF RECREATIONAL VALUE LOSS + FIRE PREVENTION COST

Recreation Value Loss	$902,850	0.26
Fire Prevention Added Cost	150,460	0.04
TOTAL	$1,053,310 or $0.30 per Project Acre	

Benefit-Cost Ratio for Project Area Using Stumpage Value Discounted + Recreational Value Loss + Fire Prevention Cost Savings

Stumpage Value Ratio	2.09:1
Recreational Value	0.07:1
Fire Prevention Saving	0.01:1
BENEFIT - COST RATIO TOTAL	2:17:1

BENEFIT - COST ANALYSIS BASED UPON PRODUCT VALUE INCOME TO MAINE ECONOMY

In varying degrees, sixteen important forest products manufacturers obtained spruce-fir timber from the proposed project area. Five are pulp and paper mills, ten long-lumber sawmills, and one rustic fence manufacturer. An estimated six other Maine mills received modest quantities.

Based upon this author's calculations, using data obtained from various State Agencies, and reports from the sixteen forest products manufacturers, it was determined that in 1973 the five pulp and paper companies obtained 744,667 cords of pulpwood from the area. The eleven other manufacturers obtained a total of 64,452,000 board feet of logs equal to 128,904 cords equivalent. The sixteen companies produced $124,241,000 of manufactured products from 873,571 cords. The estimated gross wages paid to workers for processing this volume into paper and lumber products was $36,162,000. Some 4,750 workers were directly involved in the harvesting, transport and manufacture of products from this timber volume. The products were shipped to a total of 21 States, the District of Columbia and five foreign countries. The FOB mill product value equaled $142 per cord. In addition, some 212,420 cords equivalent of logs were shipped to Canadian mills from the proposed project area. The Maine Port of Exit value of the logs destined for Canada was approximately $9,559,000 or $45 per cord.

BENEFIT - COST ANALYSIS BASED UPON PRODUCT VALUE INCOME TO MAINE ECONOMY

(From 1973 Harvest In Proposed Project Area)

	Spruce-Fir Volume Cut	Direct Income to Maine Economy
Maine Pulp & Paper Manufacture Income	744,667 cords	$113,008,000
Maine Lumber Manufacture Income	128,904 cords	11,233,000
Maine Log Export Income	212,420 cords	2,559,000
	1,085,991 cords	$133,800.000

Weighted average total Maine Income - $123.20 per cord.

BENEFIT -COST RATIO BASED UPON PRODUCT VALUE

32.9:1

SUMMARY

The spruce-fir timber resource of Maine is a most important part of the economic base of the State of Maine.

Through an unfortunate set of circumstances, a native cyclic insect is epidemic.

An area of 3¼ million acres is so badly infested that there is a great danger of mass timber mortality unless a control program is carried out - June 1975.

The ramifications of no control could mean a drastic economic problem for Maine for 25 to 30 years.

In order to determine the benefits this resource contributes to the public, as compared to the expected cost of Budworm control to avoid mass spruce-fir timber mortality, several Benefit-Cost Ratios have been determined for the proposed project area, as follows:

Benefit-Cost Ratio Based on Stumpage Value.....2.09:1

Benefit-Cost Ratio Based upon Stumpage Value + Recreation Value + Fire Prevention Cost Savings.....2.17:1

Benefit-Cost Ratio Based Upon Mill Product Value.....32.9:1

* * * * * * * * * *

Prepared by:

Joseph M. Lupsha
Hallowell, Maine

December 1, 1974

QUEBEC PROGRAM

The Quebec Program has been ongoing since 1967. The history is similar to that of Maine -- increasing numbers of infected areas and increasing numbers of areas undergoing insecticide spraying. New Brunswick is experiencing the same spread of infestation with 6-7 million acres needing spraying in 1975. Attempts at control by spraying adult moths in 2 million acres, resulted in 87-97% reduction in numbers of moths with 50% reduction in eggs. A description of the Quebec Program is outlined in the following charts.

S P R U C E B U D W O R M E P I D E M I C
I N Q U E B E C

History of the Epidemic

Beginning of the epidemic 1967

Infested areas

1968		375,000 acres
1969		2,000,000 "
1970		6,000,000 "
1971		13,000,000 "
1972		25,700,000 "
1973		28,200,000 "
	Light 9,000,000 acres	
	Moderate 8,000,000 "	
	Severe 10,600,000 "	
	Mortality 600,000 "	
1974		79,600,000 "
	Light 23,800,000 acres	
	Moderate 18,600,000 "	
	Severe 34,400,000 "	
	Mortality 2,800,000 "	

Treated areas

1970	28,800 acres
1971	2,146,780 "
1972	1,879,342 "
1973	9,727,030 "

The 1974 spraying operations

Area sprayed	6,350,000 acres
Pest control products used	
Fenitrothion	4,140,000 acres
Matacil	1,200,000 "
Zectran	1,000,000 "
Bacillus thuringiensis	10,000 "
Types of treatment	
Fenitrothion	
a) Two oil-base applications of 2 oz. in 16 oz. of mixture per acre	3,840,000 acres
b) Two oil-base applications of 2 oz. in 12 oz. of mixture per acre	120,000 "
c) One oil-base application of 3 oz. in 16 oz. of mixture per acre	180,000 "
Matacil	
Two oil-base applications of 3/4 oz. in 16 oz. of mixture per acre	1,200,000 "
Zectran	
Two oil-base applications of 3/4 oz. in 16 oz. of mixture per acre	1,000,000 "
Bacillus thuringiensis	
a) One application of 16 oz. of 3.25 BIU in 32 oz. of mixture (including Chitinase) per acre	5,000 "
b) One application of 32 oz. of 6.5 BIU in 64 oz. of mixture (including Chitinase) per acre	5,000 "
Bases of operations	
Lac des Loups	1,614,700 acres
La Macaza	1,722,000 "
Casey	3,013,300 "

Aircraft used

4 DC-6B

3 Super Constellation (L-1049)

1 Constellation (L-749)

2 CL-215

Characteristics of the aircraft used

a) DC-6B

Payload	3,600 USG
Swath width	3,000 feet
Speed	230 MPH

b) Super Constellation (L-1049)

Payload	4,400 USG
Swath width	3,000 feet
Speed	230 MPH

c) Constellation (L-749)

Payload	3,600 USG
Swath width	3,000 feet
Speed	230 MPH

d) CL-215

Payload	1,368 USG
Swath width	1,000 feet
Speed	150 MPH

Aircraft guidance system used

Litton LTN-51

Spraying Operations planned for 1972

Area to be treated (depending upon the availability of insecticides) 10,000,000 acres

Pest control products to be used

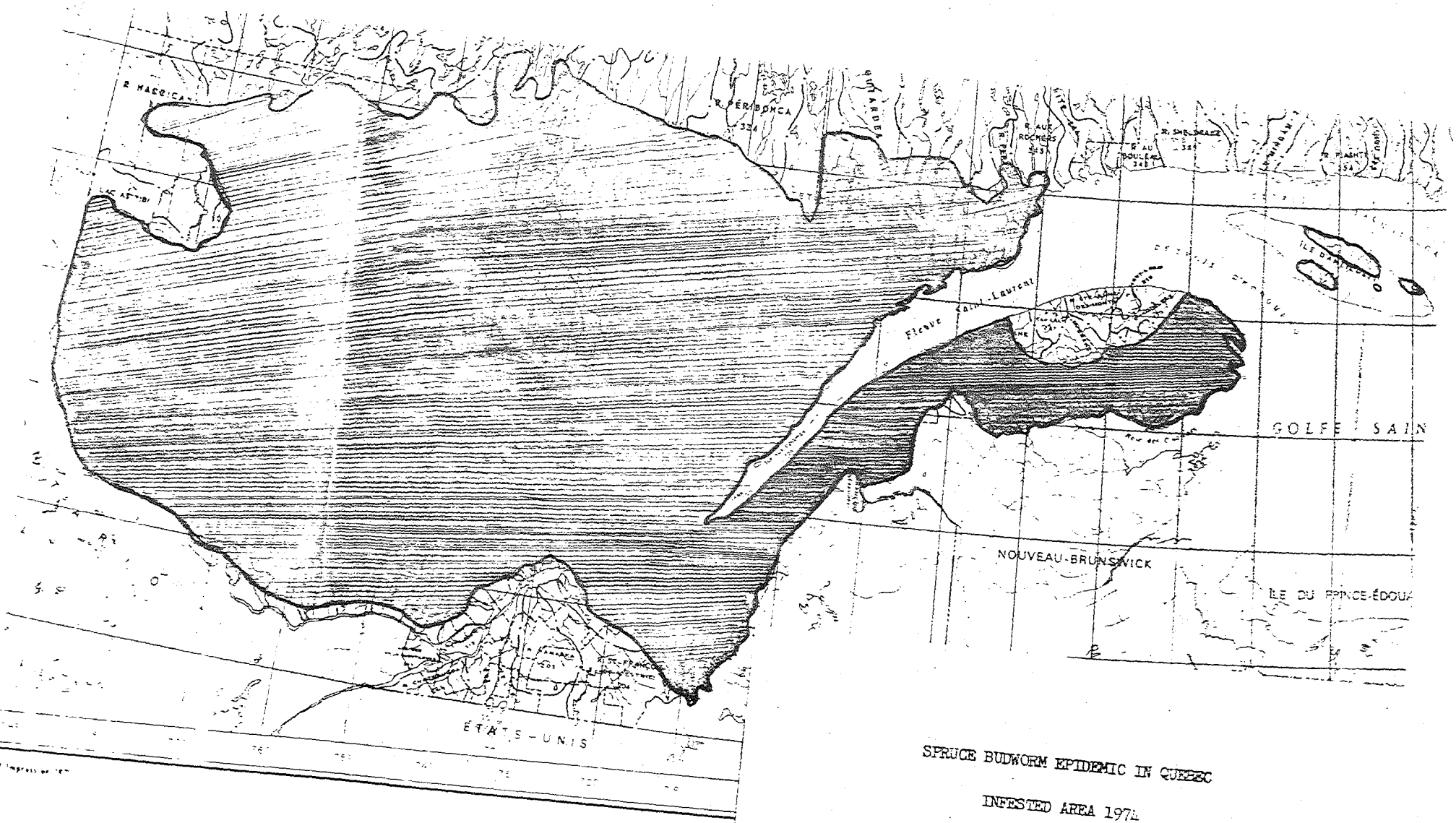
Fenitrothion

Matacil

Zectran

Bacillus thuringiensis

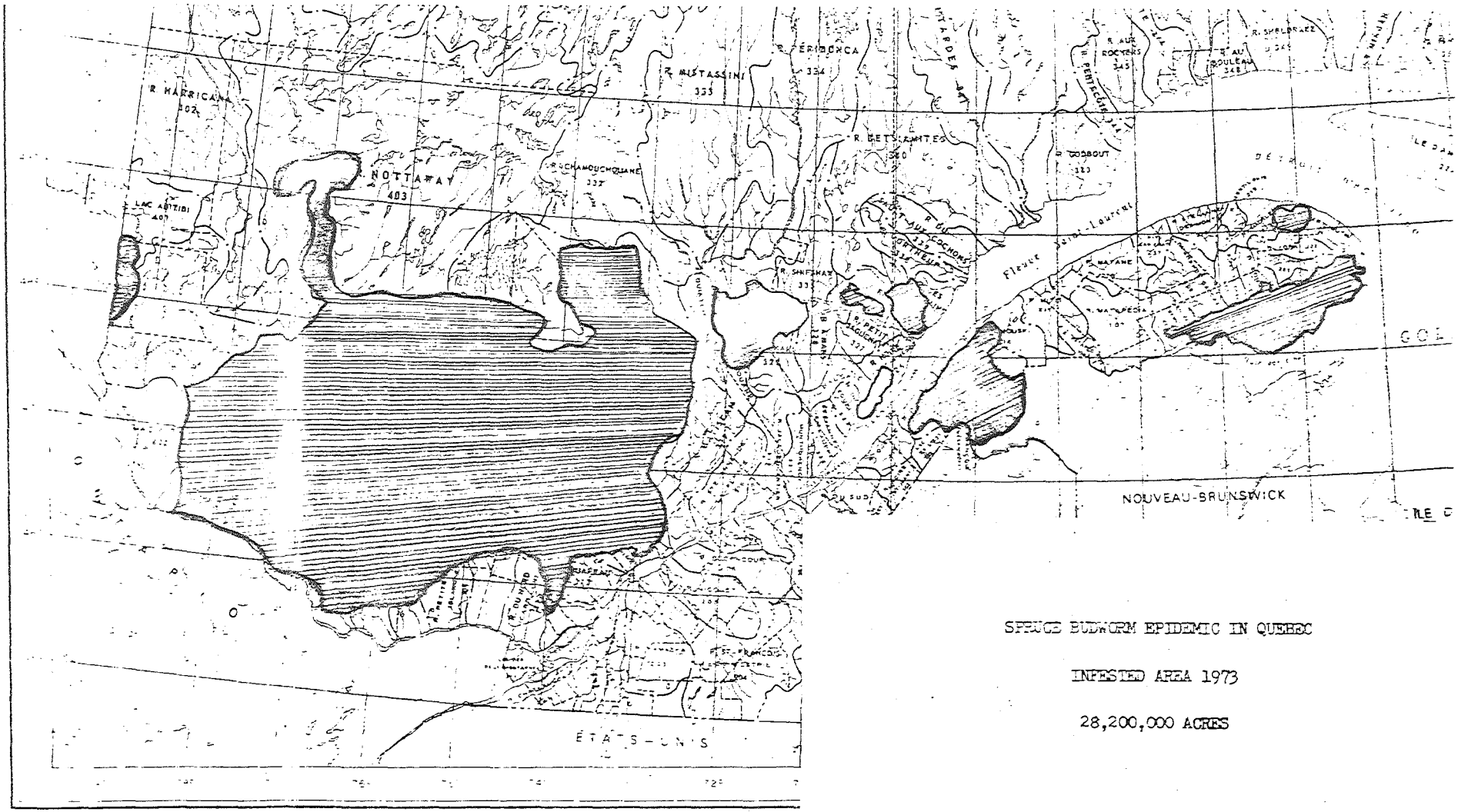
Possibly other chemical insecticides



SPRUCE BUDWORM EPIDEMIC IN QUEBEC

INFESTED AREA 1974

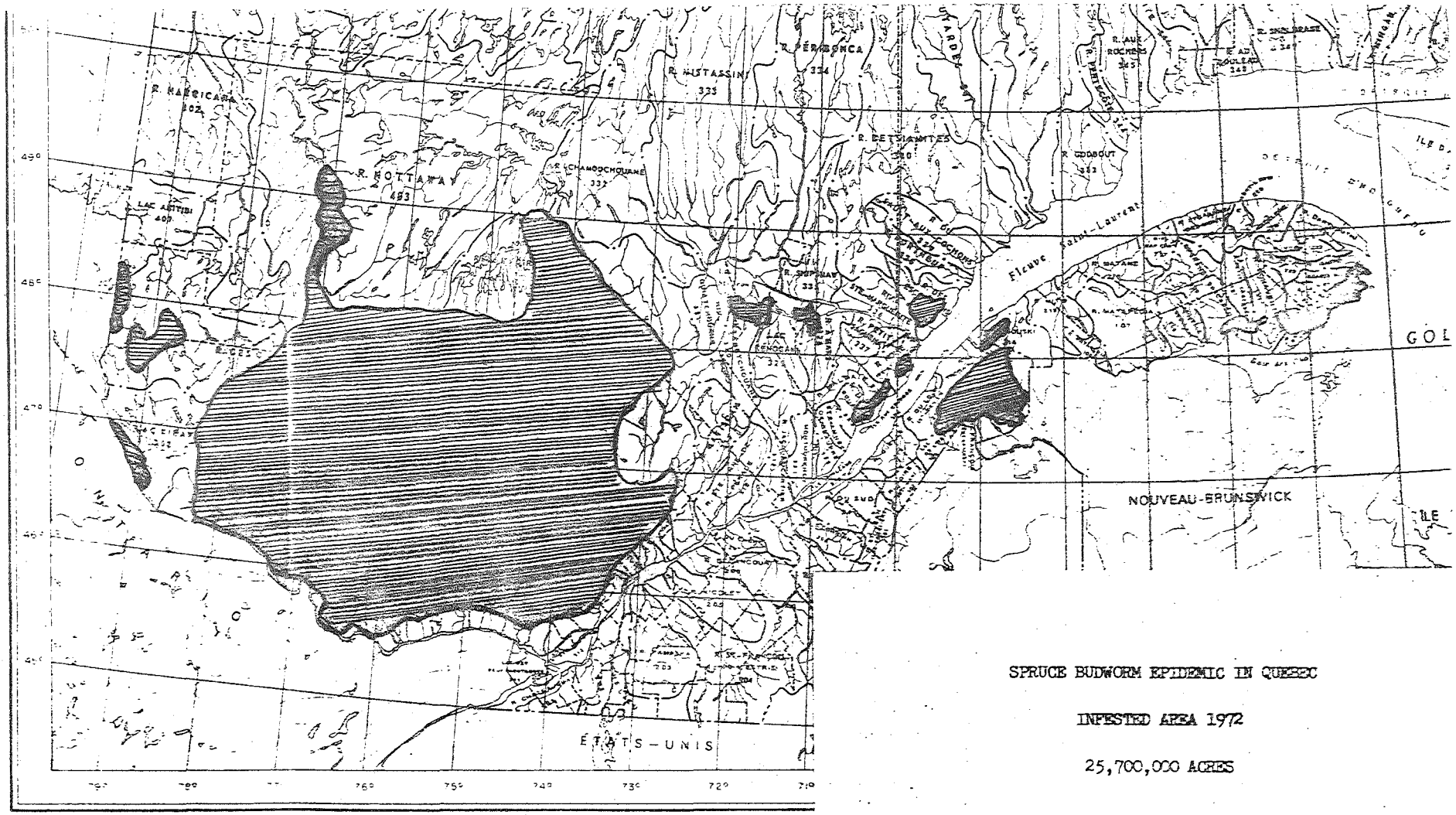
79,600,000 ACRES



SPRUCE BUDWORM EPIDEMIC IN QUEBEC

INFESTED AREA 1973

28,200,000 ACRES

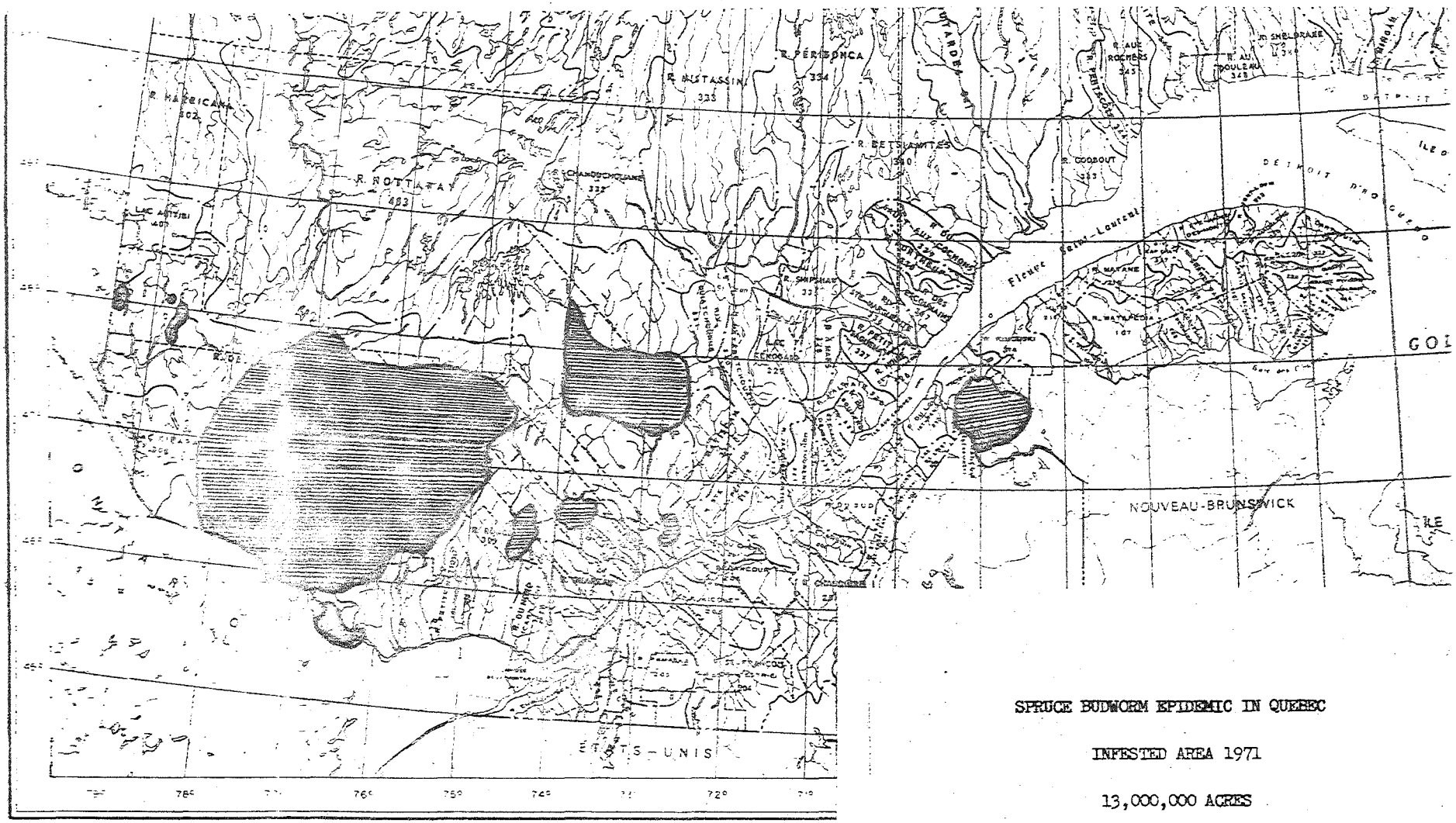


SPRUCE BUDWORM EPIDEMIC IN QUEBEC

INFESTED AREA 1972

25,700,000 ACRES

2e Impression 1971

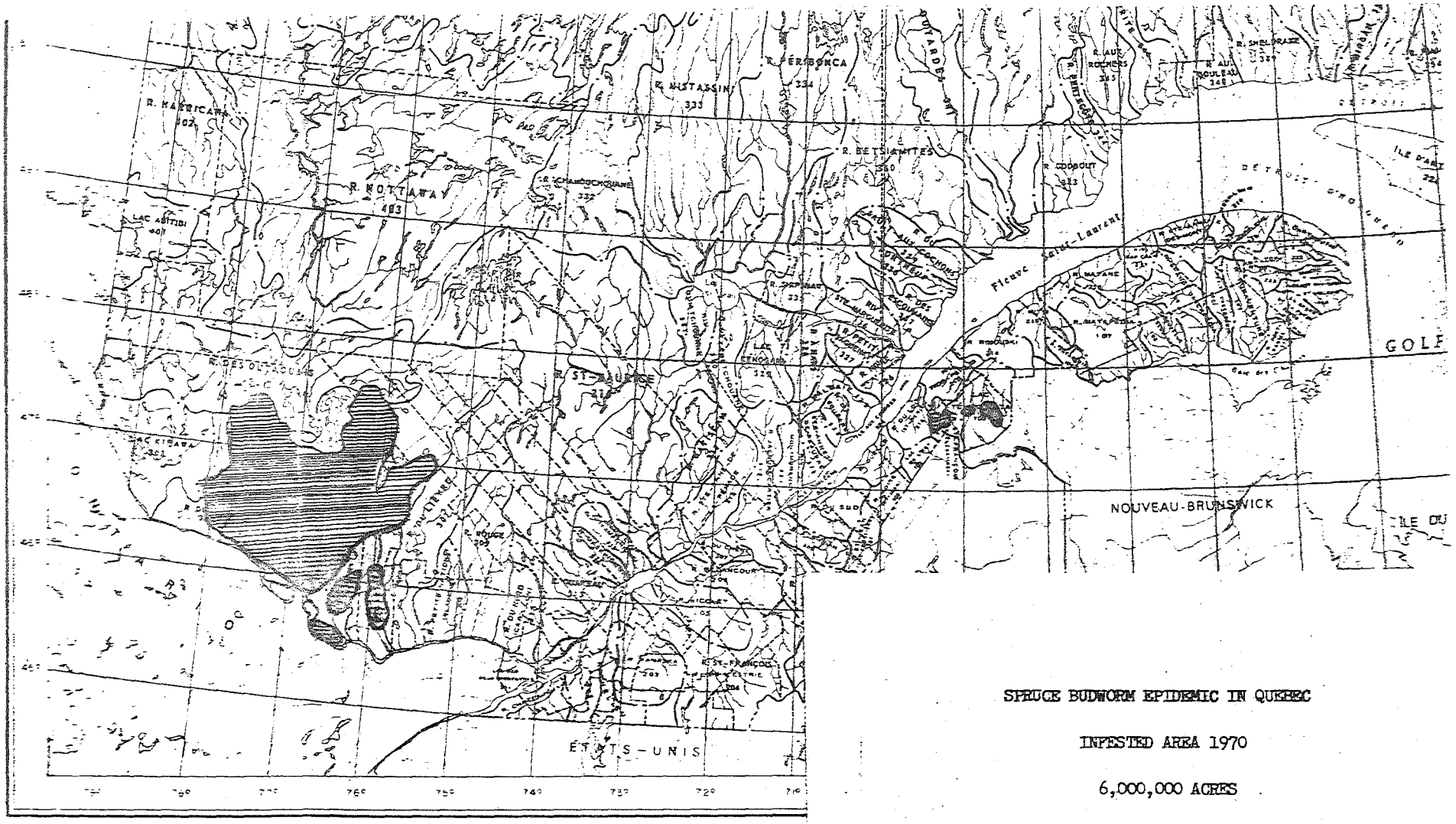


SPRUCE BUDWORM EPIDEMIC IN QUEBEC

INFESTED AREA 1971

13,000,000 ACRES

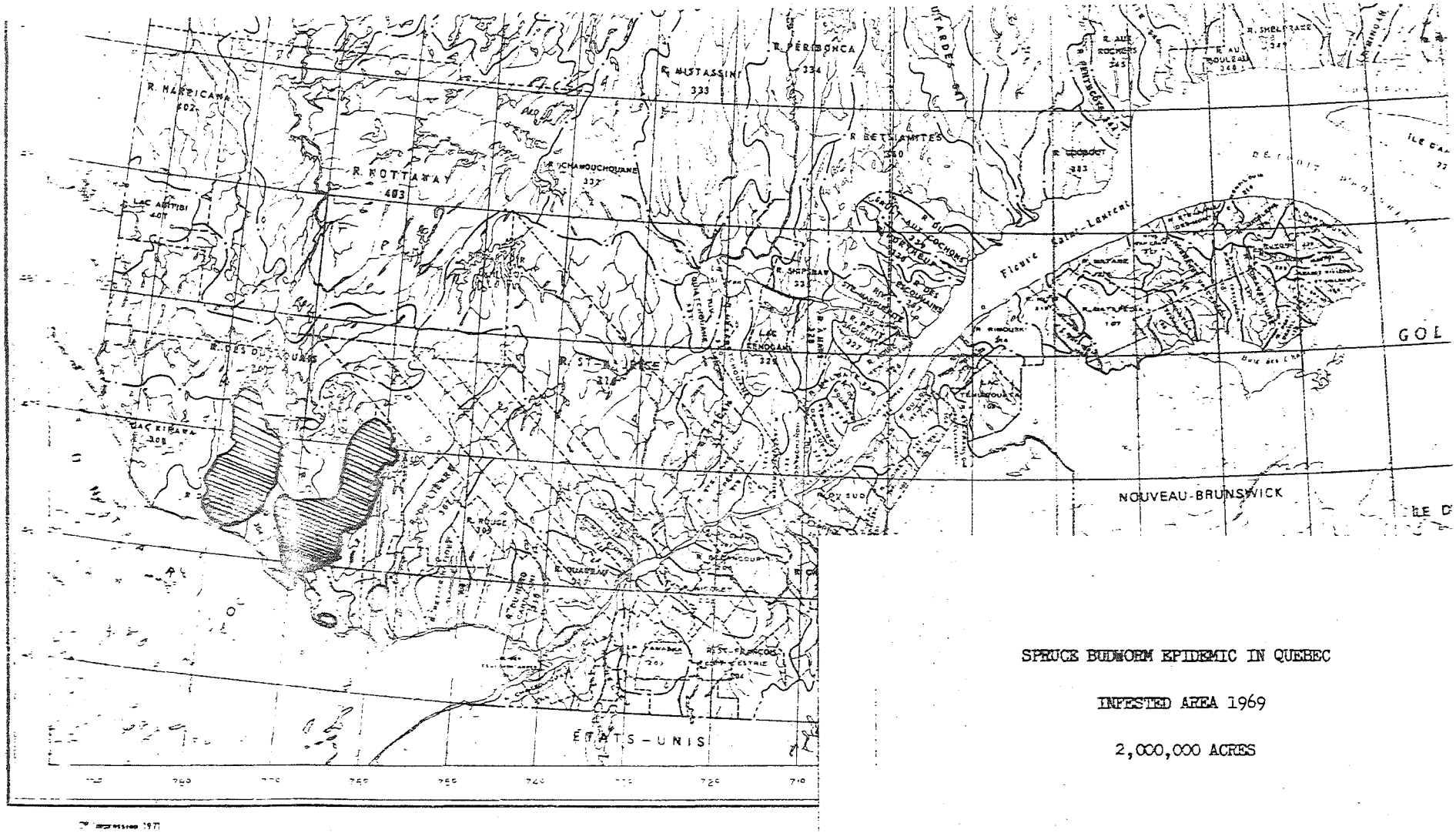
2e impression 1971



SPRUCE BUDWORM EPIDEMIC IN QUEBEC

INFESTED AREA 1970

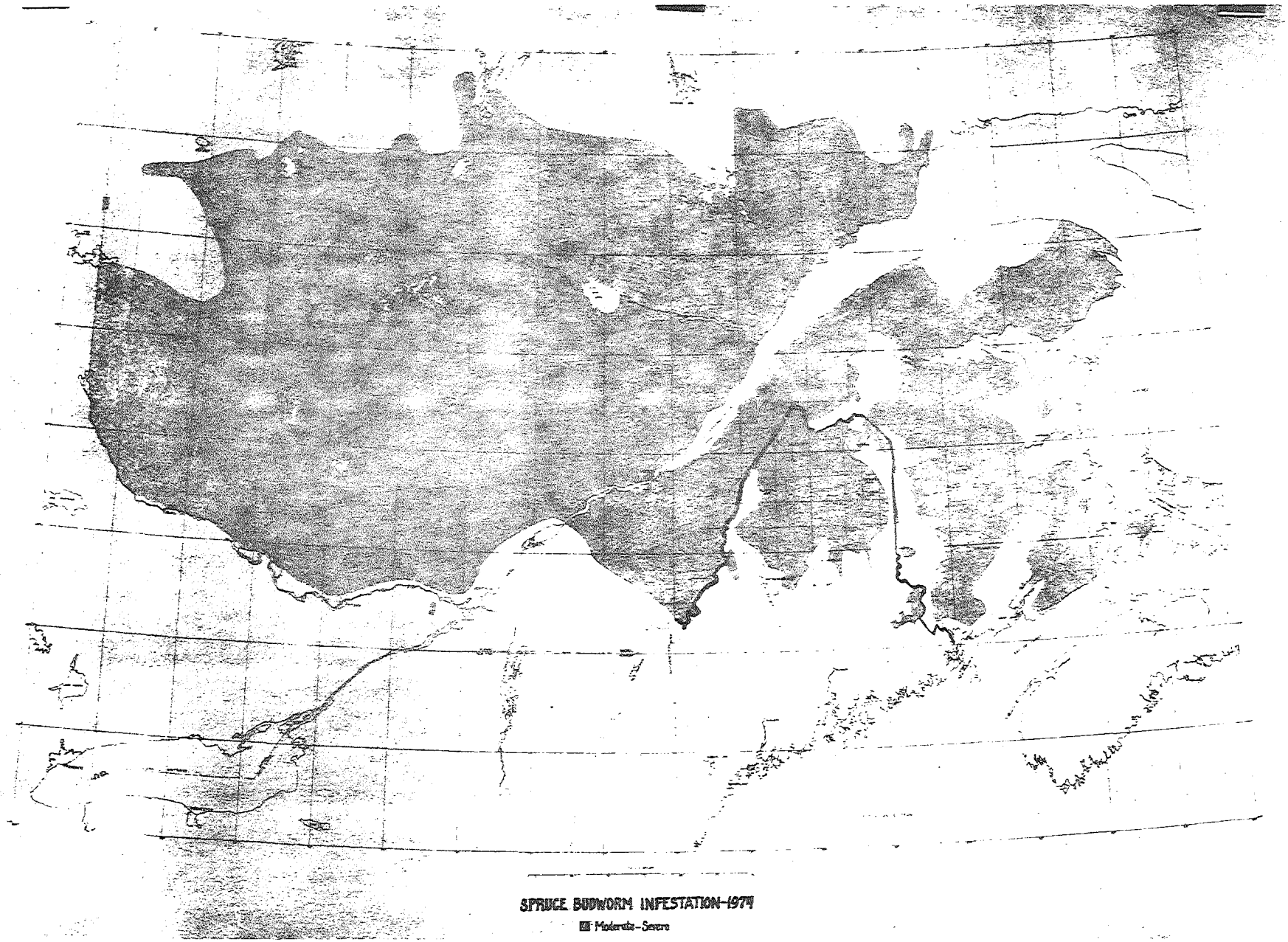
6,000,000 ACRES



SPRUCE BUDWORM EPIDEMIC IN QUEBEC

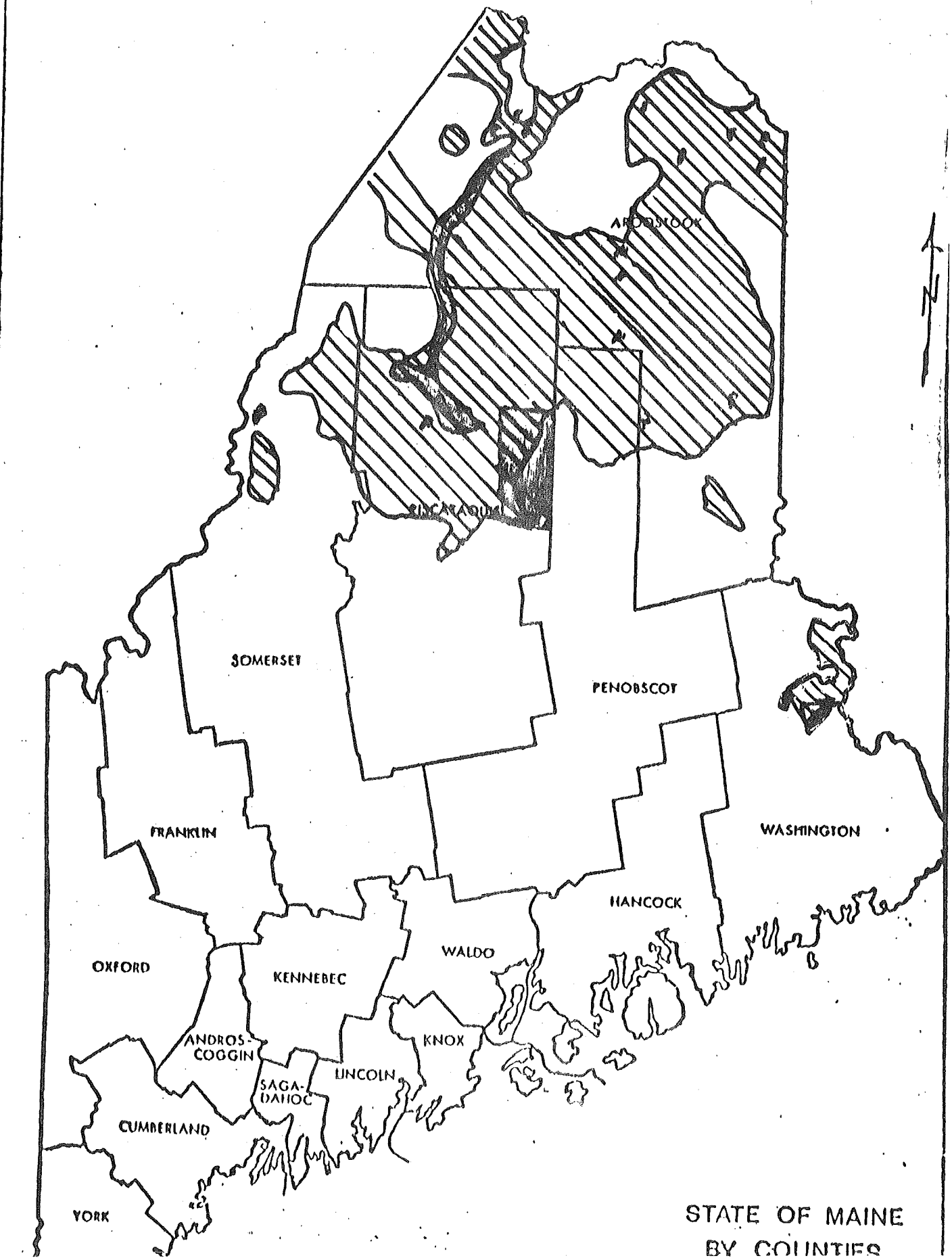
INFESTED AREA 1969

2,000,000 ACRES

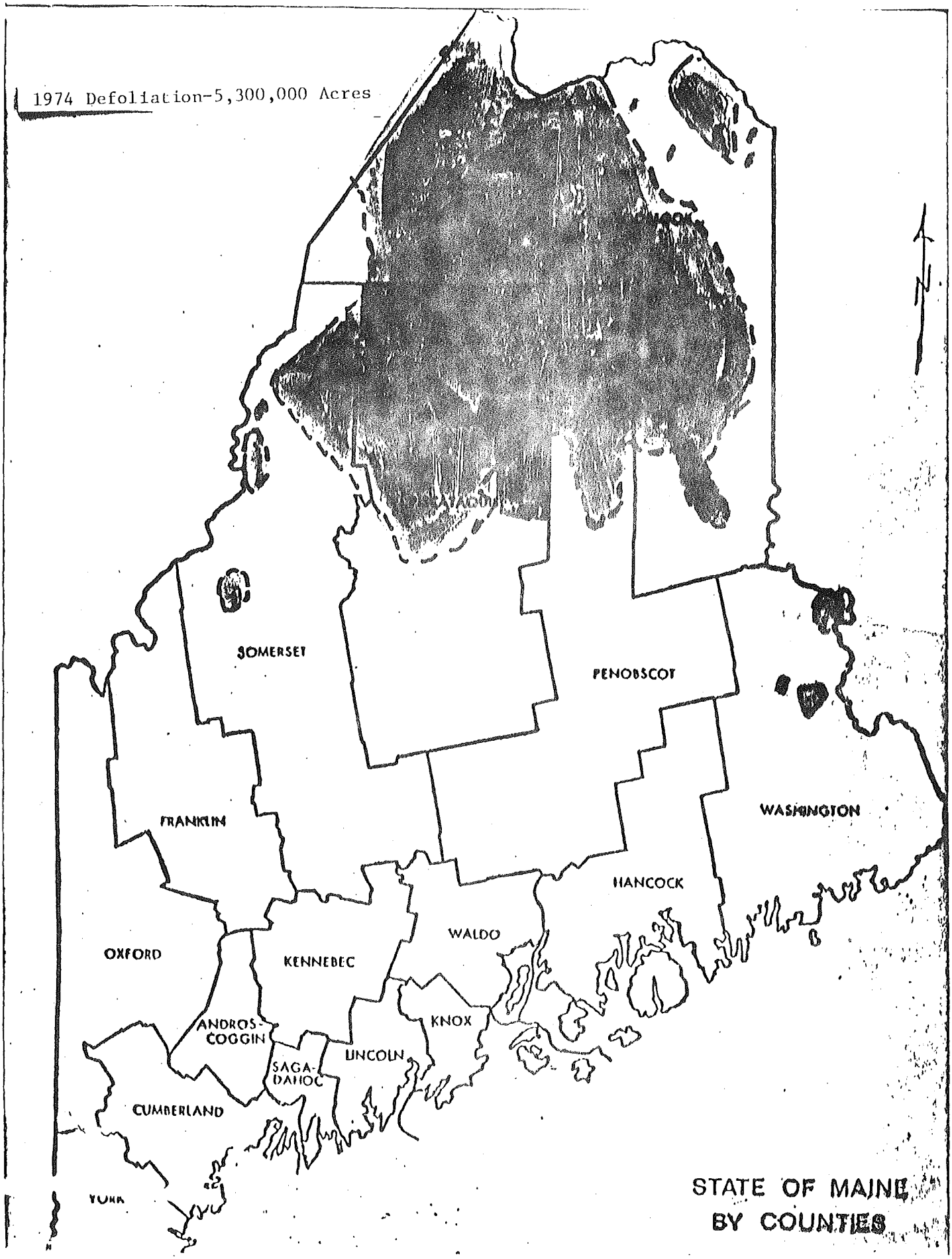

SPRUCE BUDWORM INFESTATION-1974
Moderate-Severe

APPENDIX D

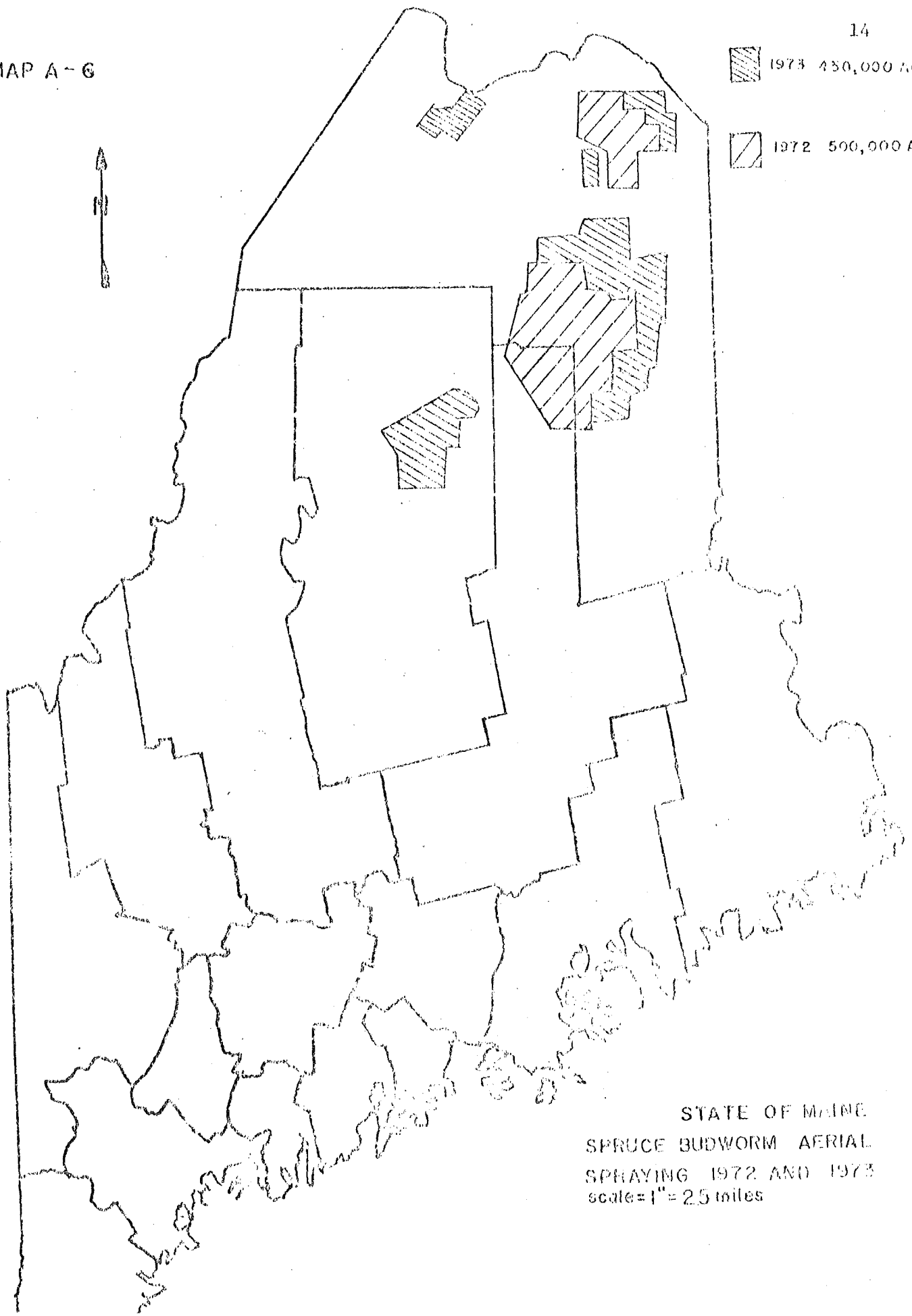
Proposed 1975 Spruce Budworm Spray Project 3,500,000 Acres



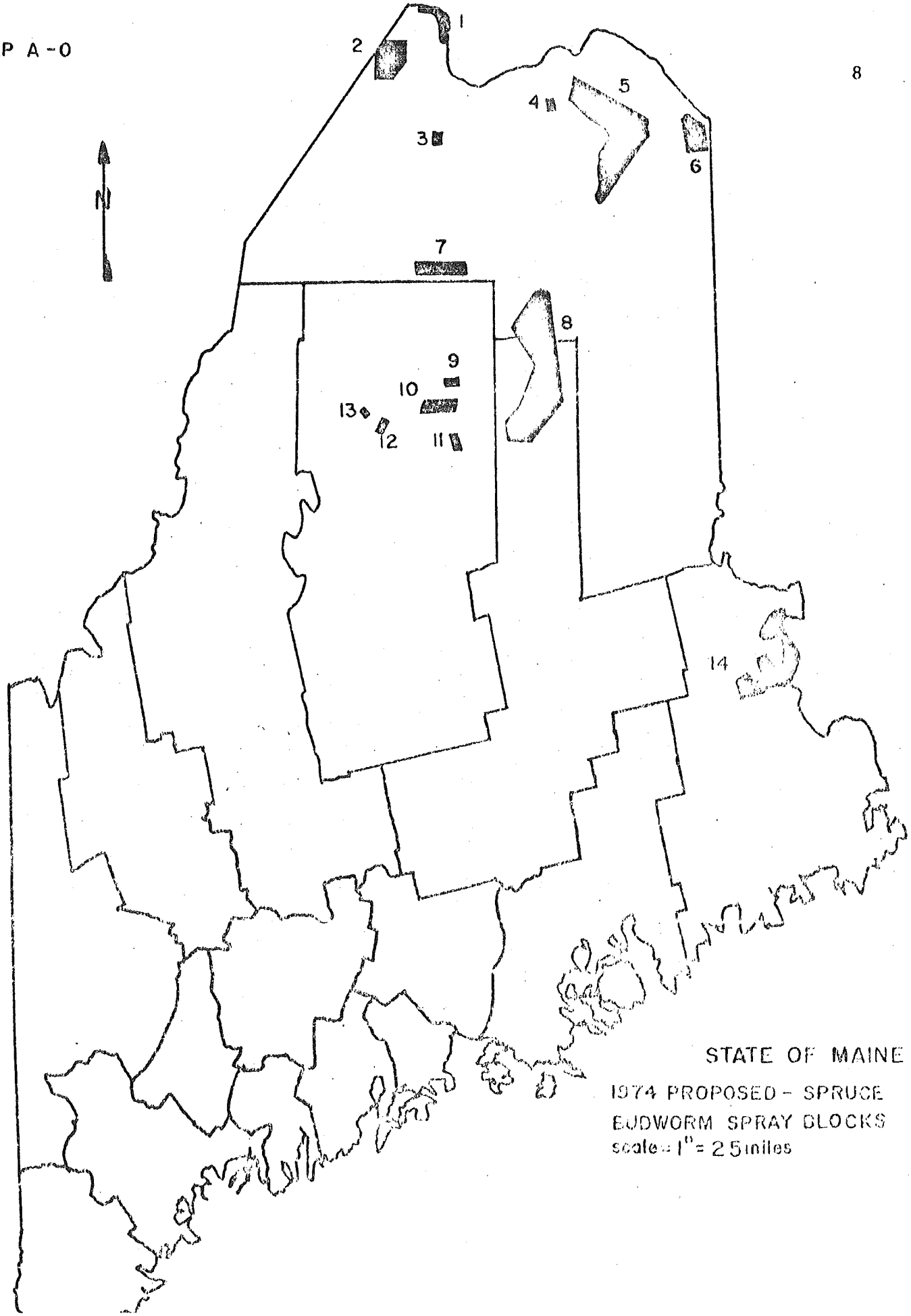
STATE OF MAINE
BY COUNTIES


1974 Defoliation-5,300,000 Acres
SOMERSET
PENOBSCOT
FRANKLIN
WASHINGTON
HANCOCK
WALDO
OXFORD
KENNEBEC
KNOX
ANDROS-
COGGIN
LINCOLN
SAGA-
DAHOC
CUMBERLAND
YORK
STATE OF MAINE
BY COUNTIES

MAP A - 6


1973 450,000 ACRES
1972 500,000 ACRES
N
STATE OF MAINE
SPRUCE BUDWORM AERIAL
SPRAYING 1972 AND 1973
scale = 1" = 25 miles

MAP A-0



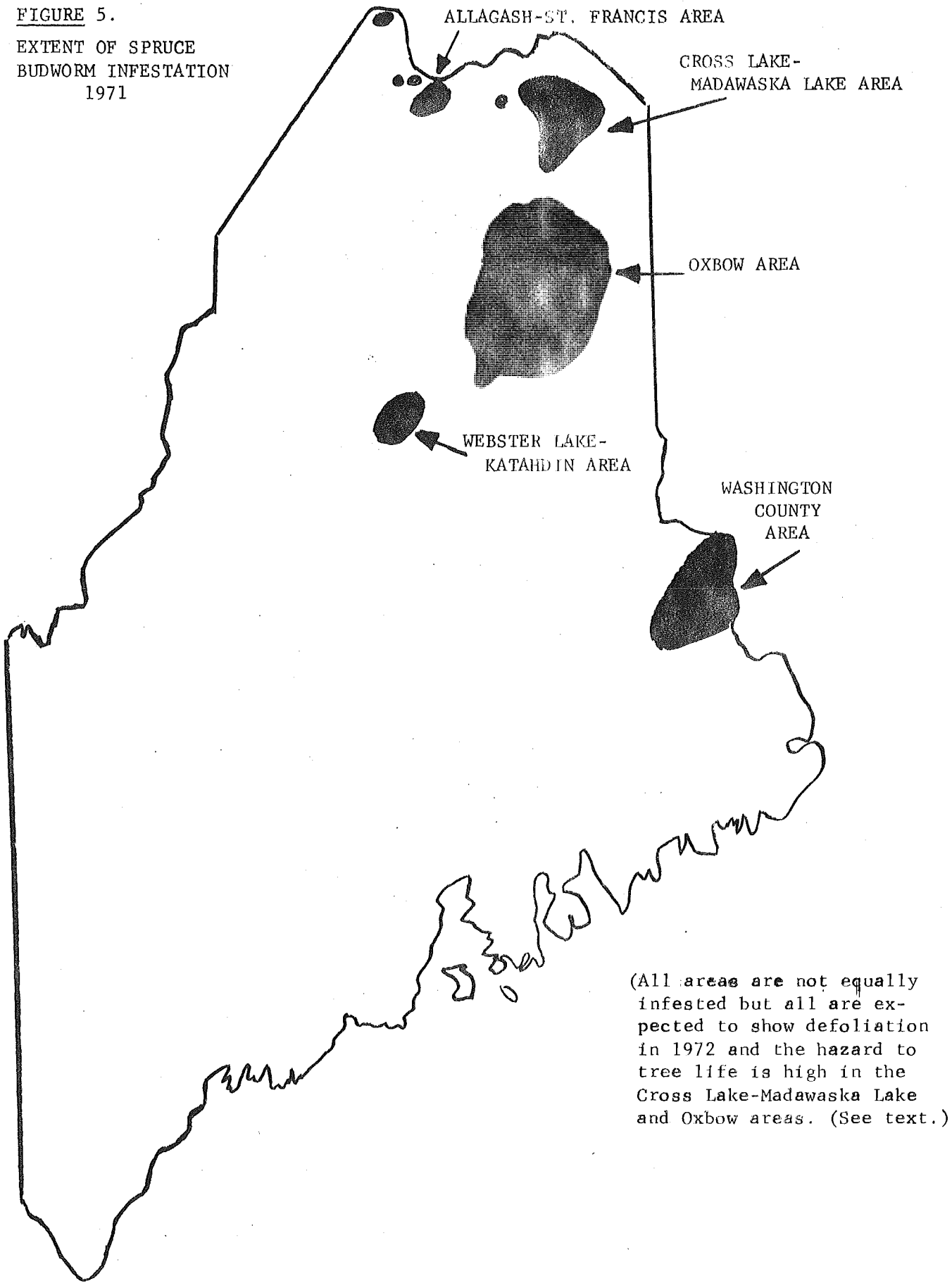
STATE OF MAINE

1974 PROPOSED - SPRUCE BUDWORM SPRAY BLOCKS

scale - 1" = 25 miles

FIGURE 5.

EXTENT OF SPRUCE BUDWORM INFESTATION 1971



(All areas are not equally infested but all are expected to show defoliation in 1972 and the hazard to tree life is high in the Cross Lake-Madawaska Lake and Oxbow areas. (See text.)

APPENDIX I

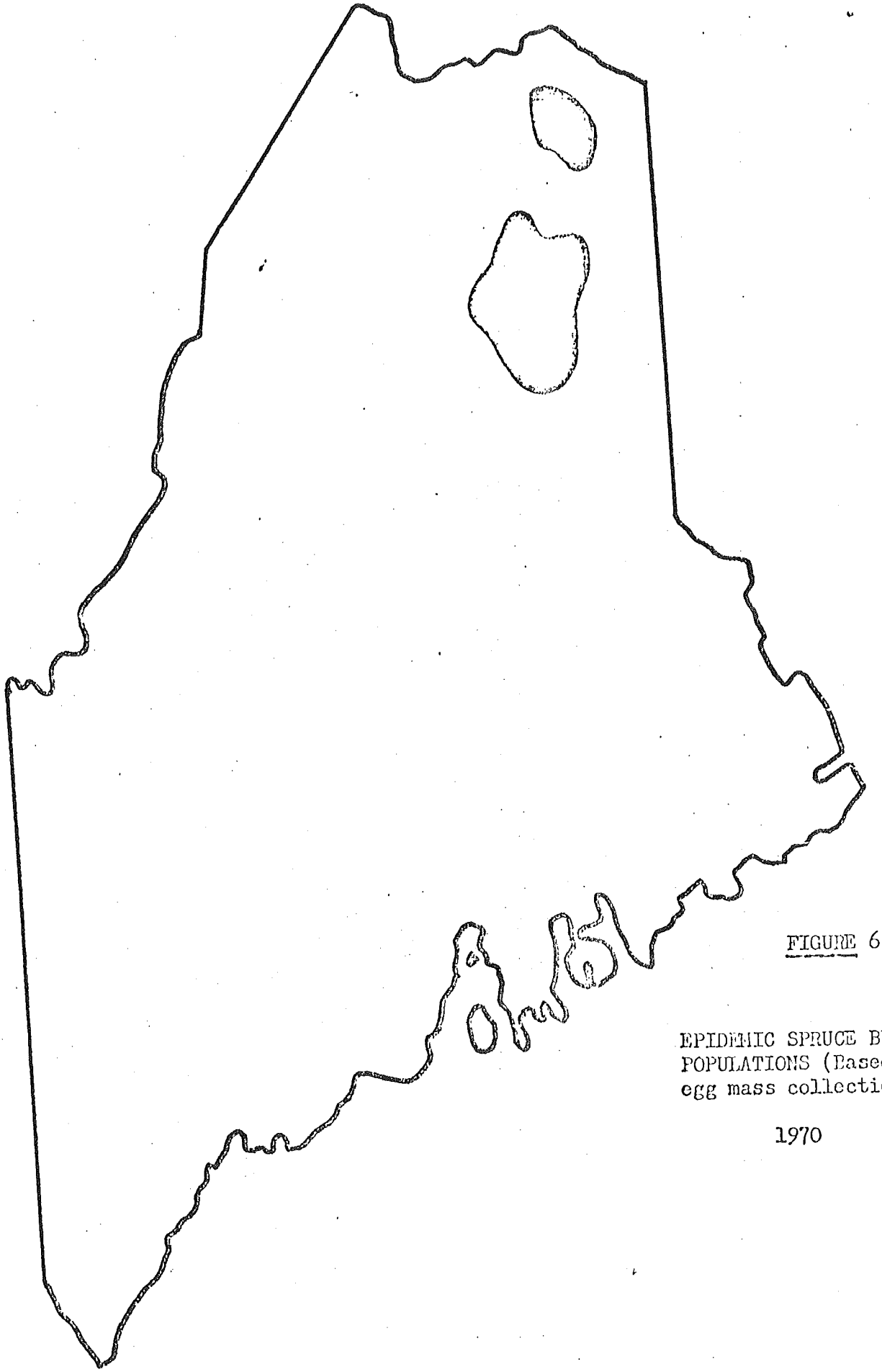


FIGURE 6.

EPIDEMIC SPRUCE BUDWORM POPULATIONS (Based on egg mass collections)

1970

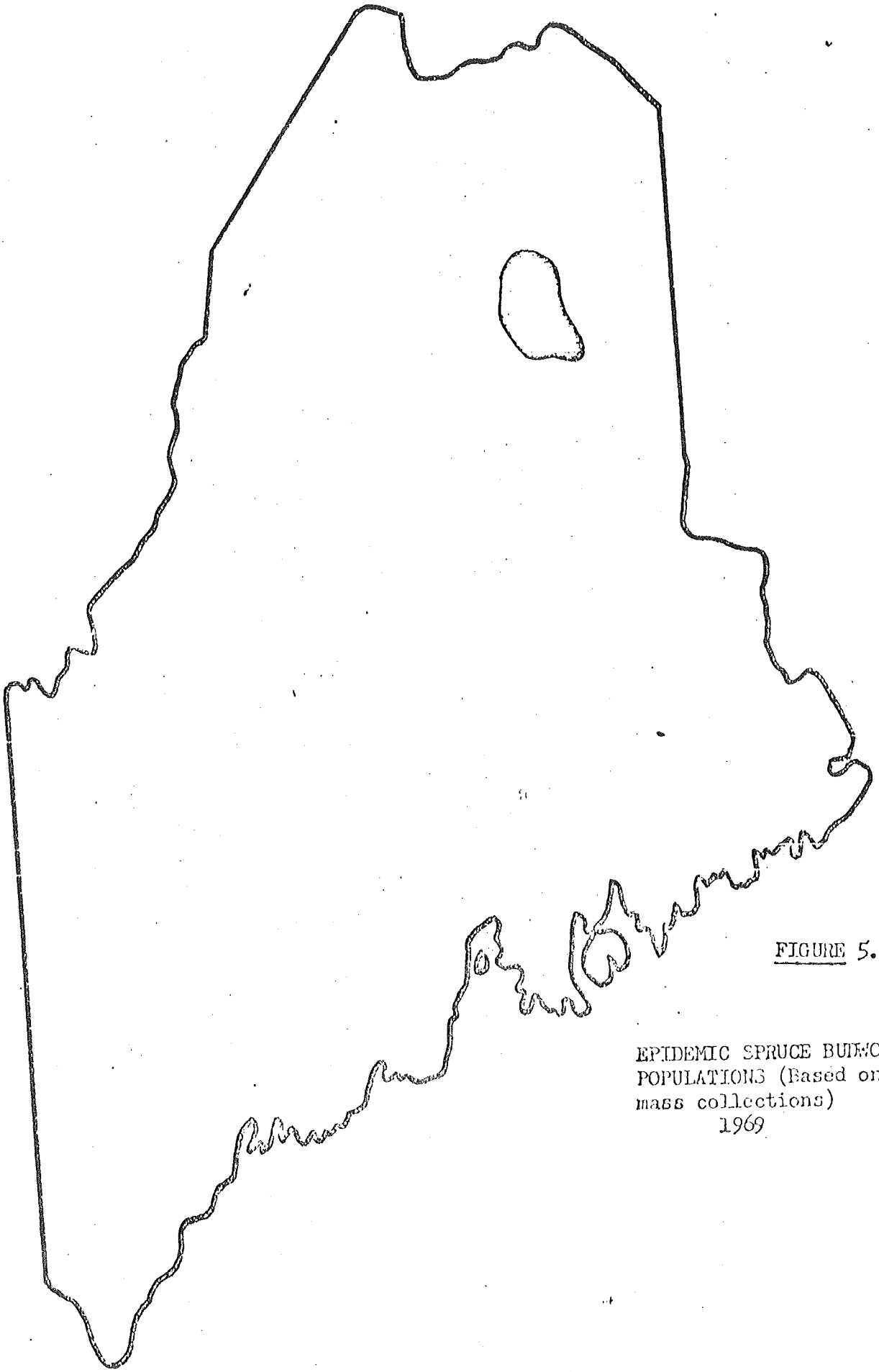
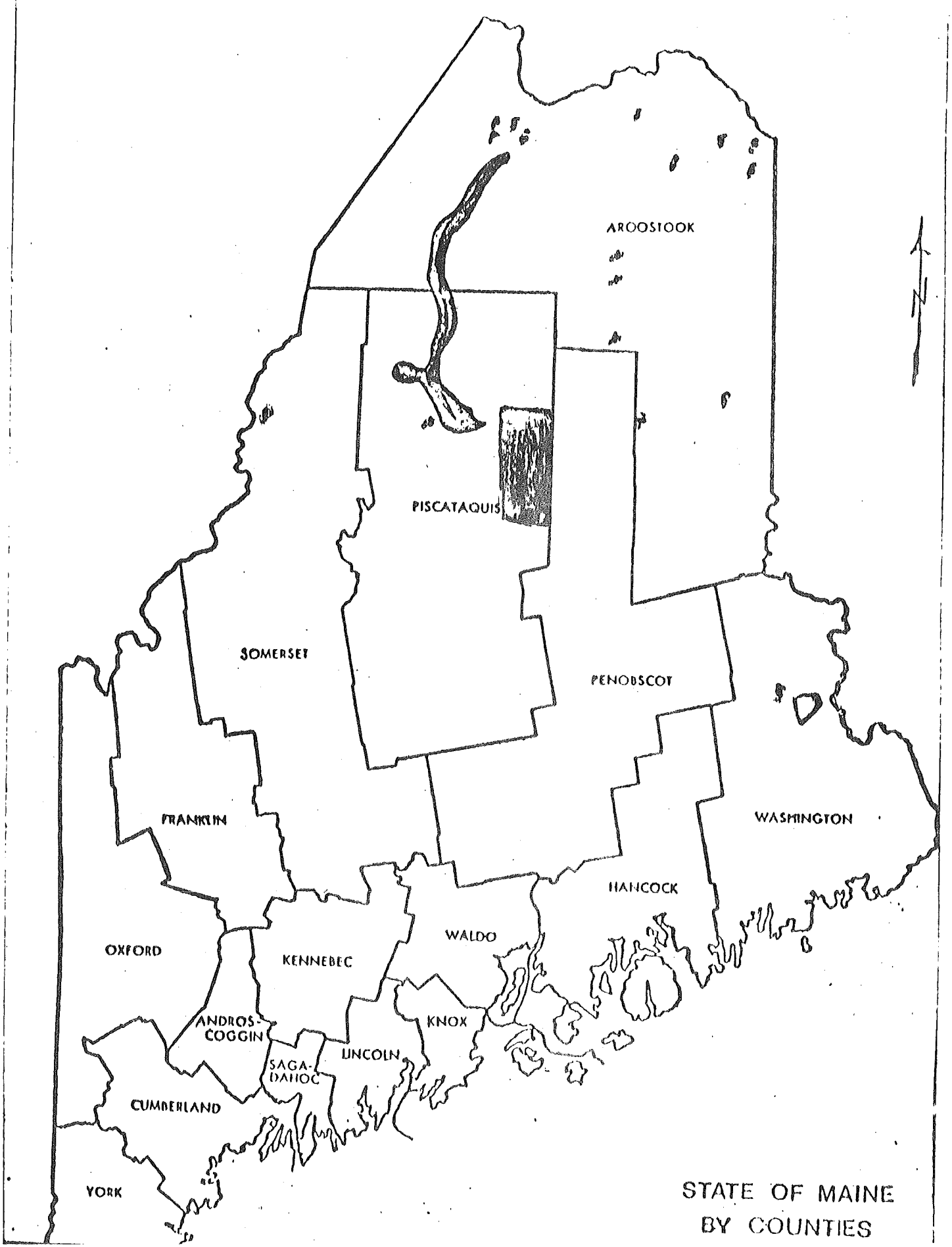


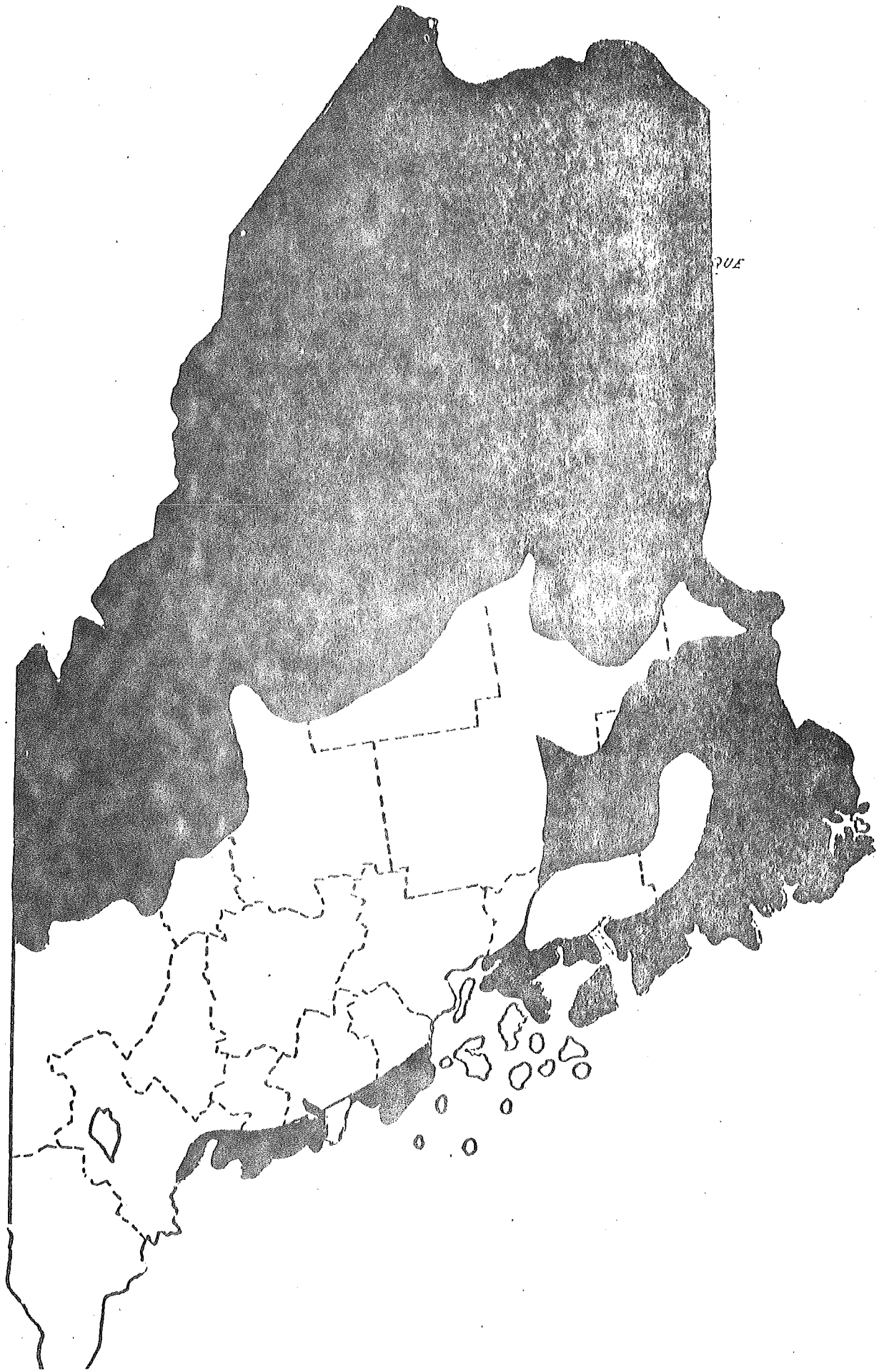
FIGURE 5.

EPIDEMIC SPRUCE BUDWORM POPULATIONS (Based on egg mass collections)
1969

Public Lands within Proposed Spray Areas



SPRUCE-FIR AREA APPENDIX L



APPENDIX M

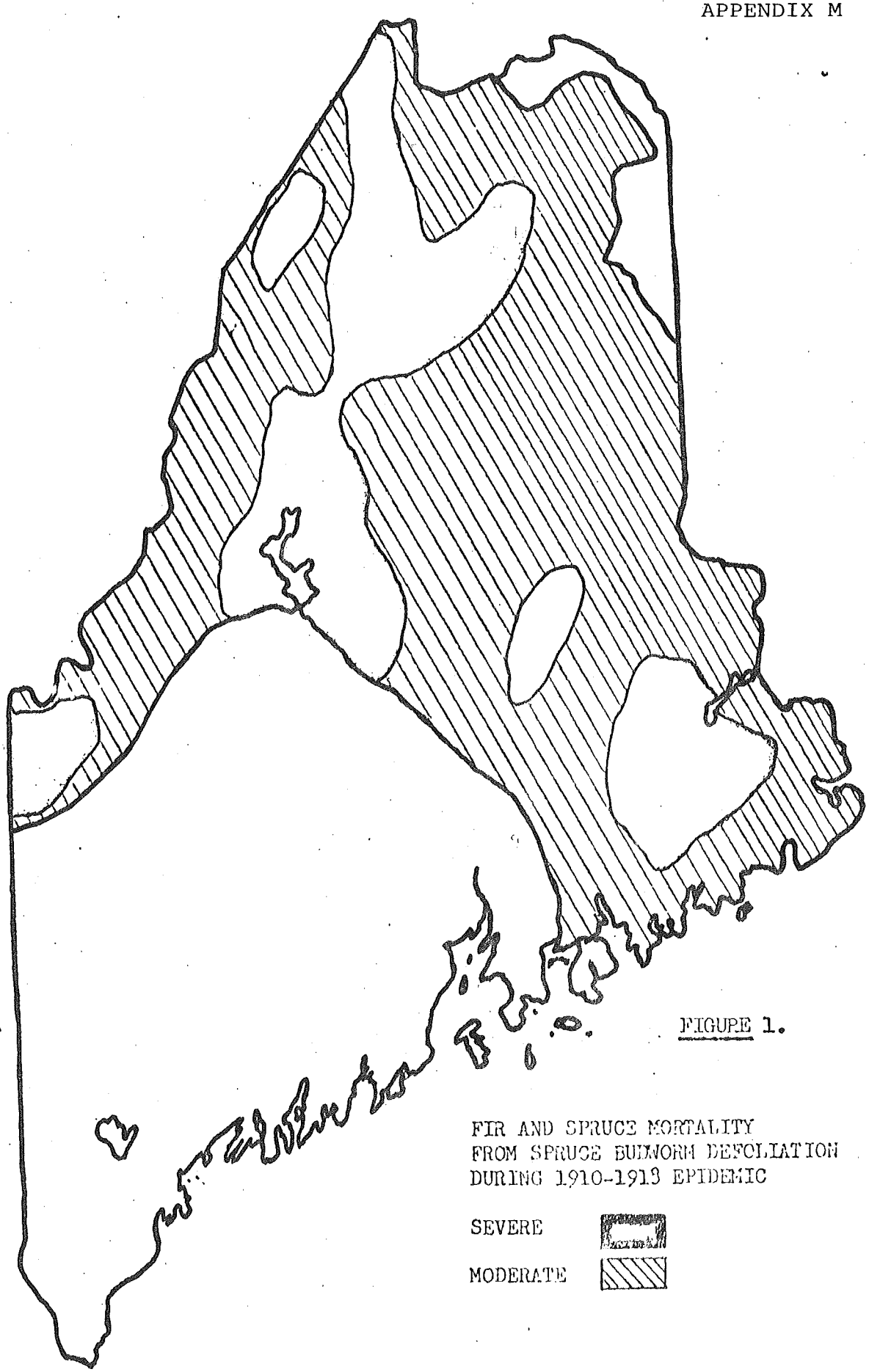


FIGURE 1.

FIR AND SPRUCE MORTALITY
FROM SPRUCE BUDWORM DEFOLIATION
DURING 1910-1919 EPIDEMIC

SEVERE

MODERATE

§ 501-A. Organization of Bureau of Forestry; research

The director shall be the executive head of the Bureau of Forestry, commonly known as the Maine Forest Service and hereinafter in chapters 201 to 215 referred to as the "bureau." For purposes of administration the director shall organize the bureau as he shall deem necessary to provide:

1. **Forest management.** Advice and assistance in forest management to small woodland owners;

2. **Wood products.** Advice and assistance in the field of utilization and marketing of wood products;

3. **Reforestation.** Production of forest tree seedlings for reforestation purposes;

4. **Insects and diseases.** Protection against insects, diseases and other pests of forest, shade and ornamental trees;

5. **Fires.** Protection against forest fires;

6. **Educational information.** Informational and educational materials for public dissemination;

7. Repealed. 1973, c. 460, § 2.

8. Repealed. 1973, c. 28, § 2.

9. **Geological survey.** Mapping inventory and interpretation of geological information.

The bureau is authorized to carry on research in the fields of forestry, insects and diseases and at least annually shall review its research and coordinate proposed projects with the school of forestry of the University of Maine.

1965, c. 226, § 3; 1971, c. 91 (P. & S.L.), § D3, eff. July 1, 1971; 1973, c. 28, § 2; 1973, c. 460, §§ 2, 18; 1973, c. 625, § 61.

§ 1007. Emergencies

Responsibility for control of insect and disease outbreaks shall, in all but emergencies, rest with the owners of the property whether private or public.

Emergencies shall be so considered when in the opinion of the director the infestation or infection is likely to kill or seriously injure trees in large numbers, or so localized that immediate control will prevent a large possible outbreak, or of recent foreign origin or apt to create a public health nuisance.

In emergencies the State Entomologist and his agents, under the supervision of the director, may enter into agreement with municipal officials to pay up to ½ the cost of control, if state funds are available for this purpose. Whenever the State does contribute funds for this purpose, it shall have the authority to determine the control methods to be used. The State may make similar agreements with groups of private owners, if the project is approved by municipal officials.

In emergency control programs spraying and dusting, by ground equipment or aircraft, eradication or other control measures may be done directly by the State or may be done on a contract basis with responsible private companies or individuals with the State assuming partial or all costs in either case.

R.S.1954, c. 36, § 25. 1965, c. 226, § 26; 1973, c. 460, § 18.

STATE OF MAINE
HOUSE OF REPRESENTATIVES
106TH LEGISLATURE
SPECIAL SESSION

JOINT ORDER

WHEREAS, many forested areas of northern Maine are endangered by an insect infestation known as the spruce budworm; and

WHEREAS, the State of Maine shares the cost of spraying programs in an effort to bring this infestation under control; and

WHEREAS, appropriations for this control program have increasingly mounted to meet expanded infestations; and

WHEREAS, the course of the infestation indicates that substantial funds will be needed in the future to deal with the spruce budworm problem; now, therefore, be it

ORDERED, the Senate concurring, that the Legislative Council be authorized and directed to fully review the spruce budworm control problem including, but not limited to, determining the overall direction of the State concerning this problem, the costs involved on behalf of the State with a view toward ascertaining with all possible certainty what progress has been made to date in bringing the infestation of spruce budworm under control and to what extent the Legislature can reasonably anticipate costs of protection and state participation in the future; and be it further

ORDERED, that the council report the results of their findings and recommendations, including any needed legislation, at the next regular session of the Legislature.

HP1944

NAME: Neil Rolde

TOWN: York

Reproduced and distributed under the direction of the Clerk of the House.
1/4/74