

An Automatic Data Processing System for the Documentation of Forest-Insect Survey Information¹

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ABSTRACT

An automatic data processing system (ADP) that will permit storage and rapid retrieval of forest-insect survey information is described. Although designed specifically for use within the 20 States of the Northeastern Area, consideration for nationwide use was given in its development.

The ADP system described is based on an open-ended numerical code in which IBM punch cards or magnetic tape are used for data storage. Two programs have been written in Fortran IV for retrieval of the stored information and for preparation of specific reports for field distribution.

Protection of forest resources from insect pests is an important function of forest resource management. However, to do this effectively requires an accurate and comprehensive knowledge of the presence, abundance, distribution, and fluctuations of forest insect populations. This knowledge is gained through field surveys from which biological and ecological data may be accumulated. These data, when analyzed, form the basis for future action by the resource manager.

Over the past 25 years Federal, State, and private agencies have been developing greater awareness of the need to protect our forest resources from forest insects. This awareness has evolved into a variety of survey systems designed to detect the presence of forest-insect problems and to determine their trend and probable impact upon the forest resources. Since 1954, forest-survey programs have been greatly expanded through Federal technical and financial assist-

ance to cooperating States. Today nearly all commercial forest areas are under some degree of surveillance aimed to detect forest-pest problems before they become epidemic.

This activity has greatly increased the quantity and quality of forest-insect survey information that is being gathered by the various State and Federal agencies concerned. The accumulation of this information has created, and still is creating, an increasing problem in storage and retrieval. The need has become more pressing for an efficient, easily operated, and flexible system for handling this information in a manner that would make it quickly available in a usable form. The large number of different organizations currently involved in collecting and using forest-insect survey information adds to the pressure.

In 1962, the author undertook to develop a procedure for meeting this problem. The automatic data processing (ADP) system used by the Forest Insect and Disease Survey, Forestry Branch, Canadian De-

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partment of Forestry and Rural Development, was used as a pattern in developing the system presented in this paper.

The system described here will permit the storage and retrieval of forest-insect survey information gathered annually by Federal and State forest-pest-control personnel throughout the 20 States within the Northwestern Area, State and Private Forestry. Consideration for nationwide use was given in the development of this ADP system.

DESCRIPTION.—The ADP system described is based on an open-ended numerical code in which IBM punch cards or magnetic tape are used for storing data.

The system involves a 1- to 11-digit code for each survey item recorded. For example, the insect-species code requires 11 digits. The location code, which is based upon State, county, and township, requires a 2-digit code for the State and a 3-digit code each for the county and township. The 3-digit tree-species code was adapted from the USDA Forest Service, Forest Survey Handbook.

Insect species was the most difficult item to code because of the large number of forest insects involved.

In preparing the insect-species codes, the following procedures were used:

1.—All insect orders were listed alphabetically, and each order was assigned a 2-digit code starting with 01 for Anoplura and ending with 27 for Zoraptera. Since we were interested only in forest-inhabiting insects, only those orders containing forest insect species were treated further. These orders were Coleoptera, Diptera, Homoptera, Hemiptera, Hymenoptera, and Lepidoptera. However, if species codes are needed for any of the other orders, the same procedures given below will be followed.

2.—All Nearctic families in each of the 6 orders just noted were then arranged alphabetically. For this purpose Borror and DeLong's (1960) book was used as a reference. The only exceptions were orders Diptera and Hymenoptera. For these the references used were those of Stone et al. 1965 for Diptera, and Muesebeck et al. 1951, Krombein 1958, and Krombein and Burks 1967 for Hymenoptera. Each family was then assigned a 3-digit code number, starting with 001.

3.—The genera and species in each family were treated in the same manner. The genera in those families that have forest-inhabiting species were also arranged alphabetically by families; and each genus was assigned a 3-digit code, starting with 001. Finally, the species were then arranged and coded in the same

FOREST INSECT SPECIES CODE

03 000 000 000	COLEOPTERA		
	<u>REFERENCE:</u>	ARNETT, JR. R.H., 1960 THE BEETLES OF THE U.S. CATHOLIC UNIV. OF AMERICA PRESS, WASHINGTON, D.C.	5 6
03 020 000 000	CERAMBYCIDAE		717
	<u>REFERENCE:</u>	DILLON, L.S. & DILLON, E.S., 1961. A MANURL OF COMMON BEETLES OF EASTERN N.A. ROW, PETERSON & CO., ELMSFORD, N.Y.	719 720
		LINSLEY, E.G., 1961. THE CERAMBYCIDAE OF N.A., PART I, UNIV. CALIFORNIA PRESS.	722
		1962. PART II	725
		1962. PART III	727
03 020 005 000	AEGOSCHEMA		730
03 020 005 001	MODESTA GYLLENHAL		732
03 020 011 000	AMNISCUS		735
	<u>REFERENCE:</u>	DILLON, L.S., 1956. (REV. ACANTHOCININI) ANN. ENT. SOC. AMER., 49: 134-167; 207-235; 332-355.	737 738
03 020 011 001	MACULUS (SAY)		740
03 020 011 002	SEXGUTTATUS (SAY)		741
03 020 023 000	ASEMUN		744
03 020 023 001	ATRUM ESCHS.	*PINE-STUMP BORER*	746
03 020 024 000	ASTYLEIOPUS		749
03 020 024 001	VARIEGATUS (HALDEMAN)		751
03 020 035 000	CALLIDIUM		754
03 020 035 001	ANTENNATUM NENN.	*BLACK-HORNED PINE BORER*	756
03 020 035 002	SCHOTTI SCHFFR.		757
03 020 035 003	VIOLACEUM (LINN.)		758

FIG. 1.—A sample of the Coleoptera code showing how the species are coded.

NAME OF INSECT *	STATE *	COUNTY *	HOST SPECIES *	DATE *	INSECT STAGE *	DAMAGE DEGREE *	ACRES
MULSANTINA	MAINE	ANDROSCOGGIN	BALSAM FIR.	4/6/65	UNKNOWN	UNKNOWN	0
				5/6/65	UNKNOWN	NONE-LGT	0
				7/6/65	UNKNOWN	NONE-LGT	0
		SOMERSET	BALSAM FIR	1/6/65	UNKNOWN	NONE	0
		YORK	EASTERN WHITE PINE	27/5/65	UNKNOWN	UNKNOWN	0
HYLOBIUS	PALES (HBST.)		PALES WEEVIL				
	PENNSYLVANIA	BRADFORD	EASTERN WHITE PINE	30/10/65	UNKNOWN	MODERATE	3
		CLARION	FIR	15/10/67	ADULT	MOD-HVY	10
		INDIANA	EASTERN WHITE PINE	30/10/65	UNKNOWN	MODERATE	3
		MONTGOMERY	EASTERN WHITE PINE	30/10/65	UNKNOWN	MODERATE	1
	WEST VIRGINIA	GRANT	PITCH PINE	5/8/63	ADULT	NONE	0
				15/8/63	ADULT	NONE	0
			EASTERN WHITE PINE	15/8/63	ADULT	LIGHT	0
				19/8/63	ADULT	NONE	0
		GREENBRIER	EASTERN WHITE PINE	12/9/63	ADULT	SEVERE	3
				2/5/67	ADULT	NONE-LGT	0
		HARDY	EASTERN WHITE PINE	19/8/63	ADULT	LIGHT	15
HYLOBIUS	RADICIS BUCH.		PINE ROOT COLLAR WEEVIL				
	PENNSYLVANIA	DAUPHIN	SCOTCH PINE	1/6/67	LARVAE	MOD-HVY	1
ODONTOPUS	CALCERATUS (SAY)						
	PENNSYLVANIA	ALLECHENY	YELLOW-POPLAR	1/7/67	ADULT	LIGHT	1000
		BUTLER	YELLOW-POPLAR	1/7/67	ADULT	LIGHT	100
		PAYETTE	YELLOW-POPLAR	1/7/67	ADULT	LIGHT	1000

Fig. 2.—An ADP report printout prepared from stored survey information.

manner as the genera. Fig. 1 is an excerpt from a section of the Coleoptera code showing how species are coded.

The ADP system described in this paper is only a part of an ADP reporting package that is under development. Current plans are to expand this system to include information on biological evaluations and suppression programs. Some of the information stored will include that related to the insecticide formulation used, the rate of application, the method of treatment, treatment cost per acre, results of the suppression program, and the cost-benefit ratio.

OPERATION.—A special instruction manual² was prepared for use by field personnel in coding field data. In addition, a special field form (Forest Service Form NE-5200-1) was developed for recording both the regular field data and the ADP codes for those data.

In operation, the Northeastern Area's ADP system requires 3 steps for completion: (1) collecting and recording field data, (2) coding and storing these data, and (3) retrieving and printing the desired information.

The cooperator may record field data in 1 of 2 ways. One way would be to use the form currently used by the agency, after which the data can be transcribed, coded, and recorded on a specially designed ADP summary sheet. The other way would be to use the specially designed field form (NE-5200-1). The proper ADP codes for the data recorded are later inserted in the space provided on the form,

or they may also be recorded on the ADP summary sheet. Data-storage cards can be prepared from either the special field form or from the summary sheet.

IBM punch cards are used for storage. When the volume of survey information has accumulated to the point where the punch cards become unmanageable, the data will be transferred to magnetic tapes. Two programs have been written in Fortran IV for summarizing survey information and preparing reports for field distribution (Fig. 2).

DISCUSSION.—The volume of forest-insect survey information that may eventually be processed by this system can be illustrated by the following example. In 1967, the Maine Forest Service received more than 4000 survey reports from their field personnel. Each of these reports covered, on an average, 4 insect species. This would provide ca. 16,000 individual insect species records annually. Within 5 years, at least 10 additional States may be accumulating a similar number of reports annually. Some of these states already have accumulated insect-survey data for several years. Maine, for example, has more than 20 years of field data that can readily be assimilated into the Northeastern Area's ADP system.

When the total system is in full operation, it will be possible to store and retrieve all essential information obtained from the time a forest insect is detected in the field to final evaluation of a suppression project. The system would also provide a storage and retrieval source for an annual census-data file of forest-insect conditions. This information would then be readily available for forest experiment stations, uni-

² J. L. Bean, 1967. An automatic data processing system for use in forest insect surveys. USDA Forest Serv. Northeast Area State and Private Forestry, Upper Darby, Pa. 33 p.

versities, and State pest control agencies as well as for Federal pest control specialists. In addition, outputs from this system will be available and usable to personnel from outside the United States to integrate with comparable survey information. These outside sources could also provide a valuable input to this system.

REFERENCES CITED

- Borror, D. V., and D. M. DeLong.** 1960. An Introduction to the Study of Insects. Holt, Rinehard, & Winston Press, New York. 1030 p.
- Krombein, K. V.** 1958. Hymenoptera of America north of Mexico, synoptic catalogue. USDA Monog. 2, 1st Suppl. 305 p.
- Krombein, K. V., and B. D. Burks.** 1967. Hymenoptera of America north of Mexico, synoptic catalogue. Ibid. 2nd Suppl. 584 p.
- Muesebeck, C. F. W., K. V. Krombein, and H. K. Townes.** 1951. Hymenoptera of America north of Mexico, synoptic catalogue. Ibid. 1420 p.
- Stone, A., C. W. Sabrosky, W. W. Wirth, R. H. Foote, and J. R. Coulson.** 1965. A catalog of the Diptera of America north of Mexico. USDA Agricultural Handbook 276. 1696 p.
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