AN ADAPTATION OF "MIADS"

FOR AN I.B.M. 360/30

by

C.L. Kirby and W. Chow

FOREST RESEARCH LABORATORY

EDMONTON, ALBERTA

INFORMATION REPORT A-X-36

CANADIAN FORESTRY SERVICE

DEPARTMENT OF FISHERIES AND FORESTRY

AUGUST, 1970

TABLE OF CONTENTS

AN ADAPTATION OF "MIADS" FOR AN I.B.M. 360/30

by

C.L. Kirby[1] and W. Chow[2]

INTRODUCTION

An adaptation of a computer program called "MIADS" (map information and display system) by Amidon (1,2) is presented. Amidon's original programs were written in Fortran and Map languages. In order that MIADS might be used on an I.B.M. 360/30 disc operating system (DOS), our adaptations are written in Fortran IV. Some procedural changes have also been made: checks for invalid codes are now done manually instead of by computer, and methods of code filling, so that repetitious codes need not be coded on the input code sheets, have been modified. Our program for the I.B.M. 360/30 also contains numerous comment statements to assist users.

The "MIADS" system is contained in two computer programs (mapping and combinations). The mapping program is used to obtain, from code information on one map, area and product distribution for all codes or for selected codes in the form of maps and tables. The combinations program is used for selecting specified code combinations based on two maps pertaining to the same area (i.e., soils and forests), or for correcting and updating code information on one map. The card output

---

[1]Research Scientist, Canadian Forestry Service, Department of Fisheries and Forestry, Calgary, Alberta, Canada.

[2]Scientific Programmer, University of Calgary, Alberta, Canada

of the combinations program may be used to produce maps or to supply card input for the mapping program. The programs will be of great assistance to forest and land managers wishing to maintain current and accurate inventories. They may also be used as a decision-making guide where management decisions are simulated and outcome of the decisions are forecast.

The following notes on application and costs emphasize points frequently requiring clarification.

INPUT

The hand-coding of map information is an important and costly part of the system. It requires the most careful checking possible. Once the hand-coding and checking are complete, the information is placed on I.B.M. cards and verified.

Map information is first coded on translucent overlays (see Fig. 1). A two-character code system for MIADS is illustrated in Table 1. Up to 2200 two-character code combinations may be used at one time if computer storage permits. Each two-character cell on Figure 1 is 1/5" x 1/6" (1/30 of a square inch), corresponding to the tabulator or printer which produces 10 characters per inch horizontally and six lines per inch vertically. Maps produced from this system are of the same scale as the source map from which they were coded. The area covered by a 1/30-of-a-square-inch cell varies with scale of map as follows:

Scale of map	Representative fraction	Area covered by 1/30-square-inch cell (acres)
1" = 500'	1 : 6,000	0.19
1" = 1320'	1 : 15,840	1.33
1" = 2640'	1 : 31,680	5.33

ACCURACY AND PRECISION

The accuracy of computer mapping is controlled by the scale of the source map, the minimum size of area delineated on the source map, and the size of map for which area compilations are made. Two applications to determine the distribution of forest cover types on maps approximately 4 square feet in size (17, 280 coded cells) at a scale of 1 inch = 1320 feet, with a 5-acre typing limit, showed that the MIADS proportions were usually within 1 per cent of proportions based on measures taken with a planimeter.

Map features (such as roads) that are less than half a cell may not be accounted for unless the overlay (Fig. 1) is used as a dot grid, having a small dot placed in the center of each cell. Accurate estimates or road area may require measures of road length and width.

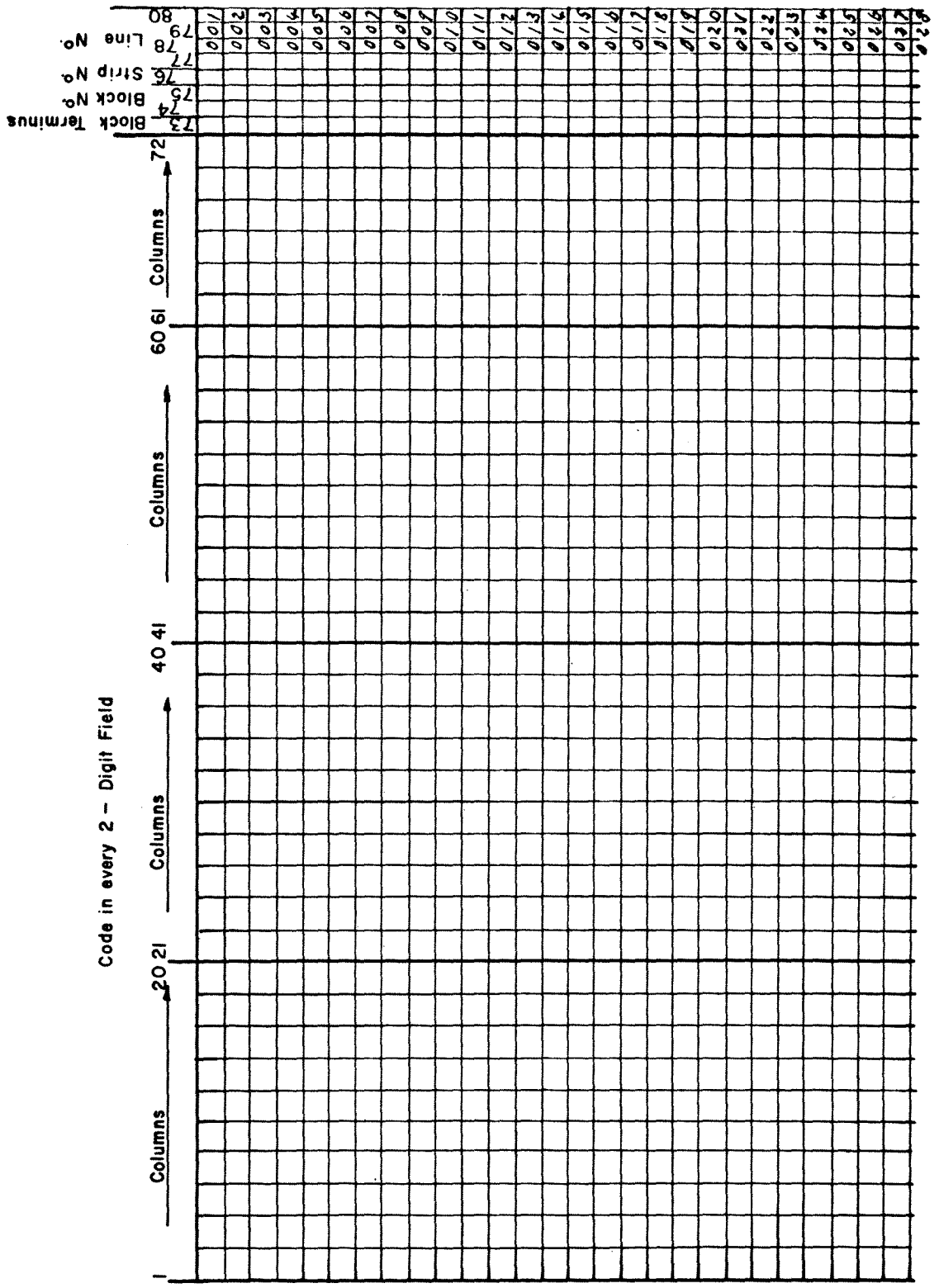

Figure 1. Example of coding sheet.

Table 1. Two-character codes for computer mapping[1].

HEIGHT CLASS, CROWN COVER, AND COVER TYPE

First letter in code	Height class[2] (feet)	Crown cover[2] (per cent)
A	1 (1 - 30')	A)(up to 30%)
B	1 (1 - 30')	B)(31 to 70%)
C	1 (1 - 30')	C)(71% +)
D	2x (31 - 45')	A)
E	2x (31 - 45')	B) "
F	2x (31 - 45')	C)
G	2y (46 - 60')	A)
H	2y (46 - 60')	B) "
I	2y (46 - 60')	C)
K	3 (61 - 80')	A)
L	3 (61 - 80')	B) "
M	3 (61 - 80')	C)
N	4 (81' +)	A)
O	4 (81' +)	B) "
P	4 (81' +)	C)

Second letter in code	Forest cover type
A	Aspen
B	Aspen and white spruce
C	White spruce and aspen
D	White spruce
E	Black spruce
N	Pine spruce aspen
O	Aspen and pine
P	Pine
Q	Pine aspen

Two character code	
MM	Meadow
RR	Rock outcrops
SS	Swamp
TS	Treed swamp
68	Year of cutting or burn

[1]For example: Code AA = 1 - 30 feet high, up to 30% crown cover aspen cover type.

[2]Alberta Forest Service tree height and crown cover classes.

The mapping and combinations computer programs produce tables and maps of area and product distribution for all codes or for selected codes from one map or for selected code combinations from two or more maps. Computer output for selected codes from one map is shown in Table 2 which gives area and product distribution; in Figure 2 the location of the selected codes is indicated.

TABLE 2.

EXAMPLE OF COMPUTER MAPPING TABULAR OUTPUT FROM THE MIADS ADAPTION TO THE I.B.M. 360/30.

```
// JOB S8027375 T015 P020 8204 CHUN                    22.22.00
 JOB NUMBER    1 OF    1 JOBS

                        PEACE RIVER MAPPING PROJECT....BILL CHUN DEPT. OF FORESTRY, CALGARY.

NUMBER OF DATA CARDS =   499

NUMBER OF OUTPUT CODES =    16

NUMBER OF CODES DELETED =    38

NUMBER OF BLOCKS =     1

BOTH CARD AND TABLE OUTPUT

CODES TO BE DELETED ARE
  BA  BB  BC  CA  CD  EC  ED  EE  FB  FC  FD  FE  GA  GB  GC  GD  GU  HA  HB  HC  HD  HE  HN  HQ  IA  IB  IC  ID  IE  IO  IP  IQ
  TS  MM  WW  SS  IN  MB
OUTPUT CODES WITH THE INTEGER WHICH REPRESENTS THEM IN THE TABLES ARE
  1. 99  2.     3. KC  4. KD  5. LA  6. LB  7. LC  8. LD  9. MA 10. MC 11. MD 12. ND 13. OC 14. OD 15. PC 16. PD
 RECIPROCAL OF REPRESENTATIVE FRACTION USED FOR COMPUTING BLOCK AREA =    15840.  FOR BLOCK    1  EVERY CELL CODED
 RATES PER ACRE USED
  KC.  0.400E 04  KD.  0.600E 04  LA.  0.0          LB.  0.400E 04  LC.  0.800E 04  LD.  0.120E 05  MA.  0.0          MC.  0.120E 05
 MD.  0.150E 05  ND.  0.100E 05  OC.  0.120E 05  OD.  0.180E 05  PC.  0.150E 05  PD.  0.200E 05

 NO T BL IDENT          BLOCK   1 CODE FREQUENCIES
                              1             2             3             4             5             6
  1 2  1   122                0.            0.            6.           49.           15.            8.
                              7             8             9            10            11            12
  2 2  1   122               47.           211.            0.           76.          166.           15.
                             13            14            15            16
  3 2  1   122              139.          673.          223.          491.
 BLOCK   1 FREQUENCY TOTAL =      12806.

 BLOCK   1 FREQUENCY TOTAL =  0.12806000E 05


 NO T BL IDENT          BLOCK   1 CODE PROPORTIONS
                              1             2             3             4             5             6
  1 2  1   122          0.0           0.0           0.0004685     0.0038263     0.0011713     0.0000247
                              7             8             9            10            11            12
  2 2  1   122          0.0036702     0.0164766     0.0           0.0059347     0.0129627     0.0011713
                             13            14            15            16
  3 2  1   122          0.0108543     0.0525535     0.0174137     0.0383414


 NO T BL IDENT          BLOCK   1 CODE ACREAGES
                              1             2             3             4             5             6
  1 2  1   122                0.            0.            8.           65.           20.           11.
                              7             8             9            10            11            12
  2 2  1   122               63.           281.            0.          101.          221.           20.
                             13            14            15            16
  3 2  1   122              185.          897.          297.          655.
 BLOCK   1 ACREAGE =      17075.

 BLOCK   1 ACREAGE =  0.17074660E 05

ONE CELL(1/30TH SQUARE INCH) =  0.1333332IE 01 ACRES
```

Table 2 (continued)

BLOCK 1 CUMULATIVE CODE PROPORTIONS AND ACREAGES

PROPORTION	ACREAGE	PROPORTION	ACREAGE	PROPORTION	ACREAGE	PROPORTION	ACREAGE	PROPORTION	ACREAGE
1		2		3		4		5	
0.0	0.	0.0	0.	0.0004685	8.	0.0042949	73.	0.0054662	93.
6		7		8		9		10	
0.0060909	104.	0.0097610	167.	0.0262377	448.	0.0262377	448.	0.0321724	549.
11		12		13		14		15	
0.0451351	771.	0.0463064	791.	0.0571607	976.	0.1097142	1873.	0.1271278	2171.
16									
0.1654692	2825.								

BLOCK 1 PRODUCT PROPORTIONS

NO T BL IDENT											
		1		2		3		4		5	6
1 2 1 122		0.0		0.0		0.0007110		0.0087093		0.0	0.0009480
		7		8		9		10		11	12
2 2 1 122		0.0111384		0.0750067		0.0		0.0270166		0.0737625	0.0044435
		13		14		15		16			
3 2 1 122		0.0494120		0.3586592		0.0990906		0.2909029			

BLOCK 1 CODE PRODUCTS

NO T BL IDENT											
		1		2		3		4		5	6
1 2 1 122		0.		0.		32000.		392000.		0.	42667.
		7		8		9		10		11	12
2 2 1 122		501333.		3375996.		0.		1215998.		3319998.	200000.
		13		14		15		16			
3 2 1 122		2223998.		16151989.		4459995.		13093325.			

BLOCK 1 PRODUCT = 45009264.

BLOCK 1 PRODUCT = 0.45009264E 08

BLOCK 1 CUMULATIVE PRODUCT PROPORTIONS AND PRODUCTS

PROPORTION	PRODUCT	PROPORTION	PRODUCT	PROPORTION	PRODUCT	PROPORTION	PRODUCT	PROPORTION	PRODUCT
1		2		3		4		5	
0.0	0.	0.0	0.	0.0007110	32000.	0.0094203	424000.	0.0094203	424000.
6		7		8		9		10	
0.0103682	466666.	0.0215067	967999.	0.0965133	4343995.	0.0965133	4343995.	0.1235299	5559993.
11		12		13		14		15	
0.1972924	8879991.	0.2017359	9079990.	0.2511479	11303988.	0.6100070	27455968.	0.7090976	31915958.
16									
1.0000000	45009264.								

END OF JOB NUMBER 1 OF 1 JOBS
CONTROL CARD COUNT = 499 COMPUTER CARD COUNT = 499

IDENTIFICATION NUMBER OF LAST (NO. 499) CARD PROCESSED WAS 122

EOJ S8027375 22.31.02

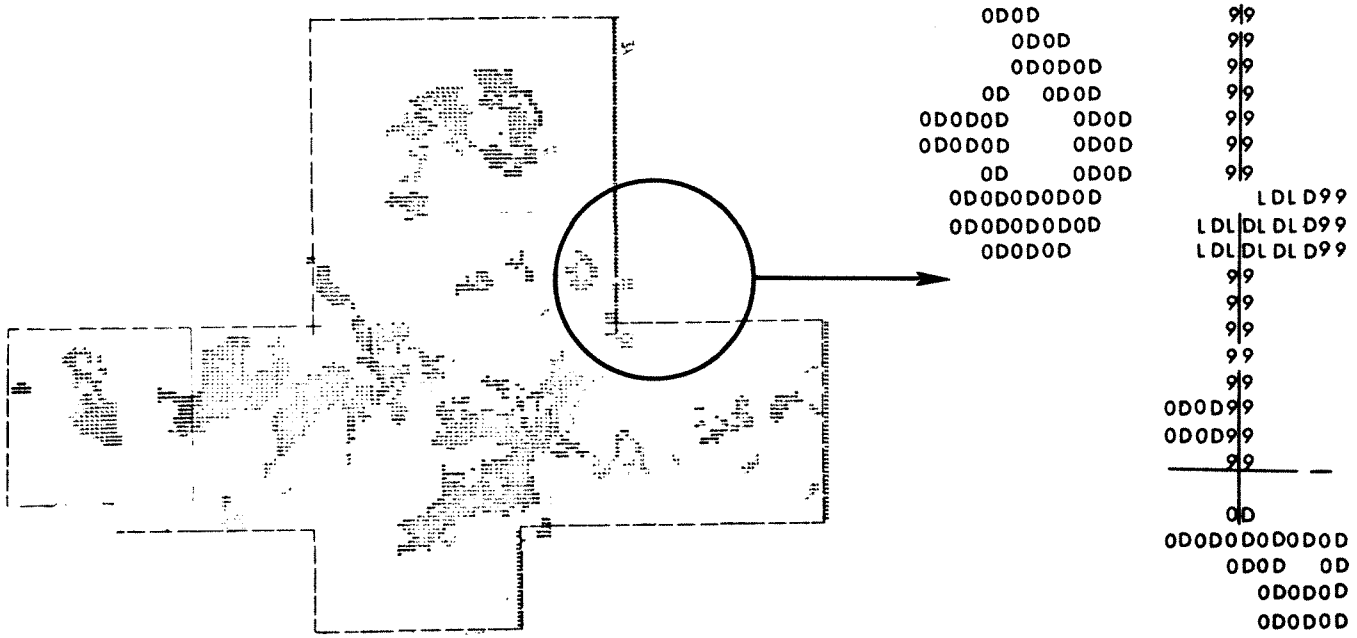

Figure 2. A reduced Computer Map showing code selection of merchantable cover types.

COSTS

The following costs are approximate for processing a map at a scale of 1" = 2640', 4 square feet representing an area of 92,160 acres. This map would be contained on 480 I.B.M. cards, or approximately 40 feet of magnetic tape at 800 bits per inch (B.P.I.). Cost involved are as follows:

1. Hand coding and verifying map information on code sheets

   $\frac{576 \text{ sq. inches of map}}{\text{coding at 20 sq. inches per hour}}$ x $3.00 per hour = $ 86.40

2. Key punching and verifying

   480 cards 12.00 hours at $4.00 per hour = 48.00

3. Compiling map information on I.B.M. 360/30

   acreages and volumes by strata

   480 cards in approximately 5 minutes at

   $2.00 per minute = 10.00

4. Producing one map on I.B.M. 360/30 showing

   location of specified codes

   480 cards in approximately 3 minutes at

   $2.00 per minute = 6.00

5. Planning charge (costs may vary widely)

   5 hours at $10.00 per hour = 50.00

   $200.40

Cost per acre = $\frac{\$200.40 \times 100}{92{,}160 \text{ acres}}$ = .22¢

Computer processing cost will vary with number of codes used in the computer program. Large computers with operating system "OS" for

the I.B.M. 360 are very efficient for running this program, and the program is being revised for "OS". However, costs for computer time on an I.B.M. 360/30 disk oriented system ("DOS") were reasonable. With this system, investment in computer mapping of a forest management situation with a scale of 2" = 1 mile would be approximately $\frac{1}{4}$ of a cent per acre. If mapping were at a scale of 4" = 1 mile the cost would be approximately one cent per acre.

While the initial investment in computer mapping is considerable when millions of acres are involved, the savings in mapping and drafting costs are great, and the possibilities of correcting and updating previous information with a minumum of effort justify "MIADS" as a forest management tool.

A listing of the computer programs for an I.B.M. 360/30 disc oriented system will be sent out on request by writing to:

Director, Department of Fisheries & Forestry,

Canadian Forestry Service, Alberta Region

5320 - 122 Street

Edmonton 70, Alberta

REFERENCES

1. Amidon, E.L. 1964. A computer-oriented system for assembling and displaying land management information. U.S. Dep. Agr., Forest Serv., Pacific S.W. Forest Range Exp. Sta., Res. Pap. PSW 17.

2. Amidon, E.L. 1966. An alphanumeric map information and display system for a large computer. U.S. Dep. Agr., Forest Serv., Pacific S.W. Forest Range Exp. Sta., Res. Pap. PSW 38.