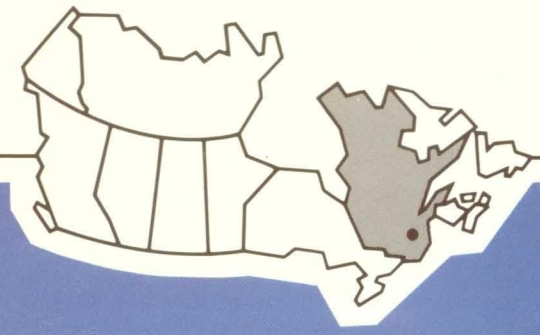
Forestry Canada Forêts Canada

PSP - Interactive computer program for monitoring research plantations (Version 1.0)

Claude Delisle



Information Report LAU-X-87E
Quebec Region

CENTRE DE FORESTERIE DES LAURENTIDES

Le Centre de foresterie des Laurentides (CFL) est un des six établissements régionaux de Forêts Canada (ForCan). Le Centre poursuit des travaux de recherche et de développement dans le but de promouvoir un aménagement et une utilisation plus rationnels des ressources forestières du Québec. En collaboration avec divers groupes et organismes québécois, les chercheurs du CFL visent à acquérir une meilleure compréhension du fonctionnement des écosystèmes forestiers en vue de contribuer à solutionner les problèmes majeurs en foresterie au Québec et à développer des méthodes acceptables pour l'amélioration et la sauvegarde de l'environnement forestier.

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LAURENTIAN FORESTRY CENTRE

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In the province of Quebec, ForCan's program consists of three major elements: forest resources research, forest protection research, and forest development. Most of the research is undertaken in response to the needs of forest management agencies, with the aim of improving the protection, growth, and quality of the region's forest resource. The results of this research are distributed to potential users through scientific and technical reports and other publications.

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Catalog No. Fo46-18/87E
ISSN 0835-1570
ISBN 0-662-17206-X
Printed in Canada

Limited additional copies of this publication are available at no charge from:

Forestry Canada, Quebec Region
Laurentian Forestry Centre
1055 du P.E.P.S.
Sainte-Foy, Quebec
G1V 4C7

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Aussi disponible en français sous le titre «PSP - Programme informatique interactif pour le suivi des plantations (Version 1.0)».

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ABSTRACT

This report describes the directives for using PSP, an interactive computer program that is very useful for creating and updating the data files of permanent sample plots in research plantations. Each plot may contain up to 186 seedlings, while the number of variables per seedling can reach 56. The program was developed to be used in conjunction with an IBM PC® or any other compatible system, but most particularly with the Microflex® PC-1000, a DAP hand-held computer which has a window display of 16 lines by 21 characters. A feature of this program is the permanent display of the sample plot, where each seedling is illustrated by a condition symbol. During data gathering, a cursor positions itself automatically over the seedling where the measurements are being taken. Data are recorded rapidly and the transfer to a computer permits immediate analysis by statistical packages such as SAS. This system replaces the pencil and paper method of data collection and eliminates most of the risk of error in the transfer of information.

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To obtain a copy of the PSP program, communicate directly with the author of this document.

RÉSUMÉ

Le présent rapport décrit le mode d'utilisation du programme PSP. Ce programme facilite la création et la mise à jour de fichiers informatiques relatifs à des parcelles-échantillons établies dans des plantations. Chaque parcelle-échantillon peut contenir jusqu'à 186 semis, et le nombre de variables correspondant à chacun des semis peut atteindre 56. Le programme a été développé pour fonctionner sur un IBM® PC ou un compatible IBM®, et plus particulièrement sur le Microflex® PC-1000 (ordinateur portatif de terrain de la compagnie DAP) qui possède un écran graphique de 16 lignes par 21 caractères. La grande particularité du programme PSP réside dans le fait qu'en plus d'être interactif, il affiche continuellement à l'écran de l'ordinateur le schéma de la parcelle dans lequel chacun des semis est représenté par un symbole correspondant à son état de santé. Lors de la collecte des données, un curseur se positionne sur le semis dont les mesures doivent être enregistrées. Les données sont recueillies rapidement, et les fichiers qui en résultent peuvent être traités directement par des logiciels statistiques comme SAS. Cette méthode permet donc de remplacer la méthode classique, crayon et papier, et d'éliminer ainsi la transcription sur support informatique qui présente des risques d'erreurs et allonge les délais d'obtention des résultats.

* * *

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Pour obtenir une copie du programme PSP, communiquer avec l'auteur de ce document.

INTRODUCTION

Forestry research often involves collecting large quantities of data on research plantations for detailed study of their development. Very often, data are still recorded on appropriate forms. A diagram of the sample plot is shown on the form to facilitate seedling location in the plot. This diagram is even more useful when the operator works with a relatively large number of seedlings spread out over a large surface area. Upon return from the field, the data are then transferred to computer files. This operation requires a great deal of time and mistakes during transcription are inevitable. There is also the problem of deciphering handwritten notes.

The development of portable micro computers over the past few years has made it possible to collect data directly on site (Cooney 1985), thereby eliminating the transcription phase. These devices must also be programmed for this purpose.

In 1986, the Laurentian Forest Centre (LFC) produced a data collection program[1] which displays a diagram of the sample plot on the screen while the data are being collected. This presentation was inspired by the encouraging results of two measurement years involving more than 60 000 seedlings.

IMPLEMENTATION

Implementation of the system involves the following steps:

1- pre-load the PC-1000 from an office computer (IBM PC®) using preliminary information;

2- carry out on-site data collection with portable computer;

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[1] The Laurentian Forestry Centre and the author assume no responsibility for the accuracy and reliability of the programs.

3- transfer data to office computer after collection;
4- edit, correct, and complete data using an office computer;
5- if necessary, transfer data to a more powerful computer to allow for application of statistical software.

HARDWARE USED

Office computer

The office computer is a 640 KB IBM PC® with a 30 MB hard disk and two floppy disk drives. The computer has an RS-232C serial port to communicate with the PC-1000 and the mainframe computer. It has a multifunction graphics card and uses a colour monitor which can display 80 characters per line by 25 lines.

Mainframe computer

The mainframe computer, a VAX® 8200, is used to analyze and store the data. It can only interface with the office computer.

Portable field computer (Figure 1)
(details collected from advertising pamphlet of DAP Technologies)

-Make: Microflex
-Model: PC-1000
-Size: 54 x 111 x 264 mm
-Weight: 1.1 kg
-Working environment:
-mechanical resistance (IEC standard 68-2-31)
-vibration (IEC standard 68-2-6)
-heat resistance (UL standard 94v6)
-magnetic field resistance (75 GAUSS)
-operating temperature (-20°C to +60°C, 95% humidity)
-Graphics screen: 16 line x 21 alphanumeric character window on a virtual screen of 25 lines by 80 characters

-Standard keyboard with 47 multi-function keys
-Communication through RS-232 serial port (300 to 19 200 BAUD)
-Memory: virtual disk with up to 1 536 KB
-Microprocessor: CMOS, 16 bit 80C88 operating at 4.9152 MHz
-Language: all languages supported by MS-DOS
-Application programs: all programs operating in an MS-DOS environment
-Price in 1987: $5 500 (1 536 KB virtual disk).

DESCRIPTION OF PROGRAM

The PSP program was written in ZBASIC® (Gariepy et al. 1986). It was designed for display within a 16 line, 21 character window, the size of the PC-1000 screen. However, lines 17 to 25, still available on the screen, are used during execution of PSP.

The program is interactive. This means that when a user runs it, he responds to a series of questions and provides certain parameters or yes/no answers. During execution, PSP performs very specific operations when the 6 pre-programmed keys are used. The 6 keys are the "$", the "@", the letter "C" and the F1, F5 and F7 function keys. The use of these keys will be shown in greater detail in an example, but a brief description of them follows.

- $: this character is used to modify the name of the file to be saved while PSP is running;
- @: the @ is used to interrupt, at any time, a sequence of questions PSP is asking the user;
- C: the letter C, placed at the end of a variable's entry code, tells PSP that this value is common to all the seedlings in the sample plot. The program then initializes these seedlings with the indicated value. This option saves time by not requiring the operator to enter this value for each seedling;

Figure 1. The Microflex PC-1000 used in sample plots. (Photo: Claude Moffet, ForCan)

- F1: this function equals the following sequence of five keystrokes: -99C followed by the **Enter** key;
- F5: this function displays a variable's codes on the screen during data collection. The VARIABLE.DAT file, which contains all the variables and their respective codes, must be on the working disk directory;
- F7: by simply pressing this key, the program lets the user end the session and return to DOS. It is important to note that unless previously saved, the data will be lost if the session is terminated.

PSP must function with at least eight variables. A list of variables and their respective codes is found in Appendix A. With the exception of variable 1 and variables 4 through 8, all variables can assume a different meaning from the one stated. Variables 4 through 8 are linked and inseparable. An explanation and some comments about the first eight variables follow:

- V1: represents the seedling number in the sample plot. The seedlings are numbered automatically by PSP and no changes can be made to this variable;
- V2: the date of measurement in Julian;
- V3: the species;
- V4: represents the seedling's condition. Six different conditions can be used and represented on the screen by a symbol. A living seedling is represented by a "v"; a dead seedling by an "o"; a nonplanted area by an "x"; a seedling which was not found by a "?"; a seedling lifted for evaluation by a "#"; and a replanting by an "r";
- V5, V6, V7 and V8: are used for writing in the cause of death for dead seedlings, or defects of live seedlings. The user can thereby record up to 4 defects per seedling.

Variable 9 is used for height measurements and has a special display feature. All the different seedlings with -99 values (see the section on file format) under this variable will flash on and off and be covered by a semi-transparent rectangle. This

option is only available on computers with graphic cards. The flashing option is not available on the PC-1000, but it can display the semi-transparent rectangle.

The other variables in the VARIABLE.DAT file can be redefined as needed; however, the print format (see Appendix B.) may no longer be adequate for printing these new variables.

Sample plot size

PSP is designed to display sample plots on the screen in a square or rectangular form, with a maximum of 11 rows and 19 columns (individuals per row). However, the number of individuals in the plot must not exceed 186. Although a linear plot can still be sampled, the graphic representation will not be accurate if the plot has more than 11 individuals. A practical way of overcoming this obstacle is to represent the linear plot in rectangular form by fixing the number of seedlings per column at 5 or 10, for example. In this way, each column can represent the plot's subdivisions.

Numbering of seedlings in sample plots

Numbering always starts at the lower right hand corner of the plot, whether the reference stake is on the left or the right. The numbering follows an ascending order from 1 to x, x being the total number of seedlings in the plot. This numbering is always done from bottom to top and from right to left. The program will follow this order while recording the data.

Figure 2 shows the numbering order of seedlings in a plot. The numbers in the right and in the upper part of the diagram represent row and column numbering. To save space, only the last digit of the number is displayed when columns 10 to 19 are used.

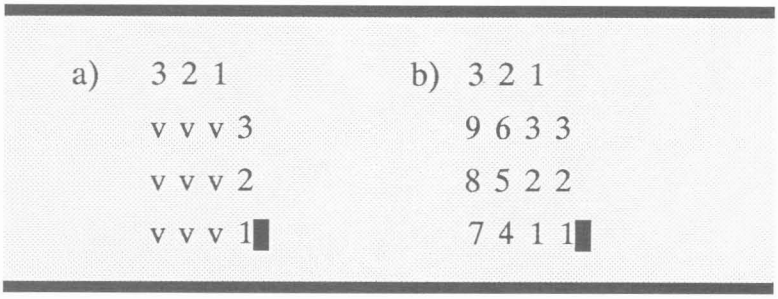

Figure 2. a) Diagram of a plot with 9 living seedlings (v). The ▮ represents the reference stake.
b) Numbering order of seedlings in the plot.

File format

PSP creates files which are represented in a matrix or two-dimensional table; the columns represent the measurements of different variables and the lines represent the observations. The data are numeric values only, and saved in a free format, meaning no specific format is used to save or read a file. Positive values are separated by two white spaces. Negative values are separated by a single space. The number of lines in the file corresponds to the number of observations or seedlings in the plot. The number of columns is equal to the number of variables plus one; PSP creates a zero column to store information related to the plot. This information is stored in the first four lines and corresponds respectively to the position of the reference stake, the number of rows and columns in the sample plot, and the number of variables in the file. PSP always reads these four lines of information before reading the entire file.

When creating a file, PSP initializes all elements of the matrix at -99. This value was reserved for representing missing data.

File size

The maximum size of a PSP file is 56 variables and 186 lines. The minimum size is 8 variables and 4 lines. The zero column or zero variable is excluded when the number of variables is specified.

Printing files

The PSP program uses a format for printing data. Printers that accept EPSON codes print in compressed mode. If the word ERROR appears in the listing instead of data, it means that the string has too many characters and exceeds the limits of the print format. If this situation occurs, it could be an indication of erroneous data.

On-screen file editing

The PSP program allows for files to be edited on-screen while creating or updating files. Unfortunately, with an editing width of only 21 characters, data consultation becomes more difficult as the number of variables increases for this purpose. It is more practical to use text editors which are already on the market. Most text editors can read and modify PSP files with fewer than 133 characters per line. When the number of characters exceeds 132, corrections can still be made on the IBM PC® with editors such as EDLIN[2] or SideKick[3], and on the VAX® with the TPU[4] editor. PSP will be able to read the files resulting from these corrections without any difficulty.

With the aid of examples, the following sections give a detailed description of using PSP with its various functions and programmed keys. Also described are two information files which the program can access to facilitate the operator's work: the first file (VARIABLE.DAT) contains the variable codes and the second file (INIT.VAR) contains the variable numbers which the user wishes to update. Since the PSP program distinguishes between creating and updating files, we will deal with them in separate chapters.

---

[2] EDLIN is an editor provided with IBM's DOS.

[3] SideKick is a software package by Borland International Inc.

[4] TPU is an editor produced by Digital Corporation.

Creating files with PSP

The following examples shows how PSP operates when the user is sampling a plot for the first time. For the purpose of the example, our plot will have 9 seedlings in 3 rows and 3 columns. A total of 9 variables will be recorded.

First, PSP asks the user if an existing file is to be used.

PSP > DOES REGIONAL DATA ALREADY EXIST, (Y)ES OR (N)O ?
USER > N

When the N key is pressed, PSP asks the user a series of questions to assist the user in identifying the file in which data will be stored. All characters used by DOS for naming files may be used.
Two characters must be used to identify the region.

PSP > ENTER THE REGION EX: GM: GRAND-MERE?
USER > GM

Three characters must be used for the sample plot number.

PSP > ENTER THE S.P. NUMBER EX: 001?
USER > 001

Three characters must be used to identify the main species of the sample plot.

PSP > ENTER THE S.P. SPECIES EX: BLS: BLACK SPRUCE?
USER > BLS

The year of measurement must be represented by two characters.

```
PSP > ENTER THE YEAR OF MEASUREMENT  EX:  88?
USER > 87
```

If all characters were entered correctly in the answers, the file will be named GM001BLS.87M. The dot separating the prefix and the suffix is added automatically, and the letter M is added by the program to tell the user this file has been created by PSP. If even a single character was omitted in the previous answers, PSP will begin the last series of questions again. Otherwise, the series of questions will continue, determining the size of the sample plot and specifying the number of variables in the data file.

```
PSP > NUMBER OF ROWS, MAXIMUM 11?
USER > 3
PSP > NUMBER OF COLUMNS, MAXIMUM 19?
USER > 3
PSP > NUMBER OF VARIABLES TO BE SAVED, MINIMUM = 8
MAXIMUM = 56?
USER > 9
```

When sample plots are established, they are usually delimited by stakes at all four corners. One of the stakes is always reserved for the plot number and then may serve as a reference point during sampling. With the PSP program, the position of the stake can be recorded and then displayed on the screen.

```
PSP > POSITION OF STAKE          RIGHT = 1   LEFT = 2?
USER > 1
```

The screen now appears as follows:

```
        321                    - line representing column numbering;
            3
            2
          - 1                  - the  shows the reference stake position;
      1                        - the number on this line shows the seedling number
                                 where the cursor is positioned;
GM001BLS.87M (9)               - file name in which the (9) variables will be saved;
ENTER CODE FOR
VARIABLE #2:                   - line for entering results;

V5  V6  V7  V8  V9
-99 -99 -99 -99 -99            - information line showing the codes for variables 5
                                 through 9.
```

At this point, the user may change the file name, the size of the plot and the number of variables, by pressing the "$" sign. If no change is necessary, the user can continue entering results by answering the following questions.

```
PSP > ENTER CODE FOR VARIABLE #2:
USER > 175C
PSP > ENTER CODE FOR VARIABLE #3:
USER > 4C
PSP > ENTER CODE FOR VARIABLE #4:
USER > 1C
```

By using the letter C at the end of a numeric value, all the seedlings from the cursor position to the end of the plot will be initialized with the same value. However, using any other letter will cause the line of data to be completely erased. This is the only way of making corrections to the first character of an answer, since the first character cannot be erased with the correction key (BACK SPACE).

PSP > ENTER CODE FOR VARIABLE #5:
USER > 2
PSP > ENTER CODE FOR VARIABLE #6:
USER > 7
PSP > ENTER CODE FOR VARIABLE #7:
USER > **ENTER** KEY
PSP > ENTER CODE FOR VARIABLE #9:
USER > 54

When used alone, the **ENTER** key is programmed to enter the code -99 for the variable concerned. Nevertheless, it functions somewhat differently for variables 5 through 8. Answering the question about variable 5 with the **ENTER** key causes the value -99 to be assigned to variables 5 through 8 for the corresponding seedlings. If this key is used for variable 6, variables 6 through 8 will be assigned code -99, and so on up to variable 8. If the F1 key is used to answer the question about variable 5 instead of the code 2, variables 5 through 8 will be coded as -99 for all seedlings.

After the questions concerning seedling number 1 are answered, the cursor advances to seedling number 2 and the symbol v (living) appears in position 1. The series of questions continues in this manner up to seedling number 9. During this procedure, the codes for the variable in question may be displayed on the screen (**F5** key). The codes can then be erased with the **ENTER** key. The user can also move the cursor within the sample plot, using the arrow keys, and make any necessary corrections to the seedling at the cursor position. After entering the data for all the seedlings, PSP offers a choice of printing the results or displaying them on the screen.

The message (1ST TIME) means that if the user answers NO, he will have a second chance to print the data. Data can be printed for either a specific seedling, several, or all seedlings.

```
PSP > PRINT (1ST TIME):  (Y)ES OR (N)O ?
USER > Y
PSP > PRESS  (S)CREEN  (P)RINTER
USER > P
```

```
PSP > FROM  SEEDLING NO?
USER > 1
PSP > TO SEEDLING NO?
USER > 9
```

Figure 3 shows an example of printed data.

FILE NAME: GM001BLS.87M
SIZE OF SAMPLE PLOT 3 x 3
DATE = 09/15/88
VARIABLE NO

1	2	3	4	5	6	7	8	9
1	175	4	1	2	7	-99	-99	54
2	175	4	1	-99	-99	-99	-99	-99
3	175	4	1	-99	-99	-99	-99	52
4	175	4	1	11	-99	-99	-99	-99
5	175	4	1	-99	-99	-99	-99	38
6	175	4	1	3	4	12	-99	-99
7	175	4	1	3	-99	-99	-99	27
8	175	4	1	-99	-99	-99	-99	-99
9	175	4	1	8	-99	-99	-99	-99

Figure 3. Sample printout of data from the printer. The code -99 represents missing data.

The user can add the plot diagram to the file listing by pressing CTL 5 when using the PC-1000, or SHIFT PrtSc on the IBM PC.

Using the option for displaying the data on the screen, the user can quickly verify the results and make the necessary corrections.

To make corrections, the user has two options. He may either use the INITVAR.COM program with the INIT.VAR file, used previously to define the variables to be corrected, or he may enter the variables directly as in the example above.

The option of correcting with pre-defined variables is very useful in updating sample plots, because the user avoids repeating the variables to be updated for each plot. If the user specifies variable 4 to be corrected, variables 5 through 8 are initialized automatically to be corrected as well. During correction, however, the letter C cannot be used with variables 4 through 8 to indicate data that is common to all seedlings.

```
PSP > CORRECTION OF VARIABLES: (Y)ES OR (N)O?
USER > Y
PSP > CORRECTION OF DEFINED VAR. (Y)ES OR (N)O?
USER > N
PSP > NUMBER OF VARIABLES TO CORRECT?
USER > 2
PSP > VARIABLE NUMBER TO BE CORRECTED?
USER > 2
PSP > VARIABLE NUMBER TO BE CORRECTED?
USER > 4
```

At any time, data correction can be interrupted by using the @ symbol. PSP then

repeats the series of questions.

```
PSP > PRINT (1ST TIME):  (Y)ES  OR (N)O?
USER > N
PSP > CORRECTION OF VARIABLES:  (Y)ES  OR (N)O?
USER > N
PSP > PRINT (NO=SAVE):  (Y)ES  OR (N)O?
USER > N
```

By answering NO to the last question, the data will be saved in the file named GM001BLS.87M. Once the data transfer is complete, PSP allows the user to continue the session and print or correct the file.

Figure 4 shows the data as found in the GM001BLS.87M file. Since the data are saved without a format, the columns are not aligned.

```
 1  1  175  4  1  2  7 -99 -99  54
 3  2  175  4  1 -99 -99 -99 -99 -99
 3  3  175  4  1 -99 -99 -99 -99  52
 9  4  175  4  1  11 -99 -99 -99 -99
 0  5  175  4  1 -99 -99 -99 -99  38
 0  6  175  4  1  3  4  12 -99 -99
 0  7  175  4  1  3 -99 -99 -99  27
 0  8  175  4  1 -99 -99 -99 -99 -99
 0  9  175  4  1  8 -99 -99 -99 -99
```

Figure 4. The GM001BLS.87M file, which is stored on the disk.

In addition to creating new files, existing files can be updated using PSP.

Updating files with PSP

The following example shows how PSP is used to update the GM001BLS.87M file created in the previous example. The update will consist of modifying 2 variables - day of measurement and height of seedlings - and recording a new variable, root collar diameter (RCD), for seedlings previously measured for height.

Before beginning the update, the INITVAR.COM program will be used to specify that 3 variables are to be modified, namely, variables 2, 9 and 12, which correspond respectively to the date of measurement, height and RCD of the seedlings. Using INITVAR.COM is helpful when the user has several files to update. It will save him from re-specifying the variables to be modified for each of the files.

To update the file, the user must specify the full name of the file he wants to modify.

If the file does not exist or the name is entered incorrectly, PSP will display the following message: "File Not Found Error in File #01 (C)ont. or (S)top?". The user must end the session by pressing the letter S, and repeat the procedure.

```
PSP > DOES REGIONAL DATA ALREADY EXIST (Y)ES  OR (N)O?
USER > Y
PSP > ENTER THE NAME OF THE FILE      EX:  GM001BLS.87M?
USER > GM001BLS.87M
```

If the file does exist, PSP will read the information in the zero variable, then display the file name on the screen with its number of variables. The user must now specifiy the number of variables for the file in order to make the necessary changes.

The user chose to save 12 variables so he could record the RCD in variable 12.

```
PSP > GM001BLS.87M    (9)
PSP > NO OF VARIABLES TO SAVE, MIN=8  MAX=56?
USER > 12
```

At this stage, PSP reads the entire file from the memory and displays the following message on the screen: "Data Transfer PLEASE WAIT!" Transfer time is a function of the size of the file being read and the power of the computer being used. Transfer time can vary from a few seconds to more than one minute. Reading of files is generally slower than saving.

After reading the 9 variables from the disk, PSP initializes the new variables, 10 through 12, at -99. If the user had specified 8 variables to be saved instead of 12, the new files would only have had 8 variables and variable 9 would not have been saved. Consequently, it is very important to verify the number of variables which appears in parentheses in the plot diagram displayed on the screen. This indicates the number of variables to be saved.

The user must now enter 2 characters to indicate the year of measurement. The year entered will be the extension in the name of the new file.

```
PSP > ENTER THE YEAR OF MEASUREMENT      EX:  87?
USER > 88
```

The year suggested by PSP in this example is the year of the last file read.

This is how the screen appears at this stage.

```
                321          - diagram of a plot in which all seedlings are living (v);
                vvv3
                vvv2
                vvv1
GM001BLS.88M    (12)         - name of file in which the (12) variables will be saved at
                               the end of the update.
PRINT (1ST TIME)
 :(Y)ES  OR (N)O?
```

If a mistake is made in entering the year of measurement, press the "$" key and enter the new year of measurement. However, it is impossible to correct the number of variables to be saved; to do so, you must exit PSP by pressing the **F7** key and repeat the process.

In our example, the user chose to use the variables defined at the outset with the INITVAR.COM program.

```
PSP > CORRECTION OF DEFINED VAR.  (Y)ES  OR (N)O?
USER > Y
```

PSP will read the variables to be corrected from the INIT.VAR file and begin the series of questions concerning variables 2, 9 and 12. The user will notice that seedlings with previous height measurements will flash on and off and be covered by a semi-transparent cursor. This option, only available in updating variable 9, facilitates on-site location of seedlings with previous height growth measurements.

Entering variables is done the same way as in file creation. The user enters the letter C at the first question to indicate that all seedlings will be measured the same day. PSP then asks the user to enter the code for variable 9, but since the first two seedlings are not to be measured, not having been measured previously, to enter the code for variables 9 and 12 the operator must move the cursor to seedling number

3, using the arrow keys. Moving the cursor onto one of the seedlings covered with a semi-transparent cursor erases this cursor, but does not mean a new measurement has been recorded. When the data entry for seedling number 7 is completed, the operator exits the series of questions using the @ symbol. The data file can now be printed and saved.

When data is collected on site, files in the PC-1000's memory can be saved on a diskette by using a portable, battery-powered disk drive.

DETAILS CONCERNING DATA COLLECTION PROGRAM UTILITIES

Using the INITVAR.COM program

As mentioned earlier, the user specifies the variables to be updated with the INITVAR.COM program. The variables are saved in the INIT.VAR file which PSP will use.

The user simply specifies the number of variables to be corrected, then enters the variable numbers one by one. When variable 4 is specified, the program also initializes variables 5 through 8 to be corrected.

Using the PSPRINT.COM program

This program allows the user to "batch" print up to 150 PSP data files. The user must first create a FICHIER.DAT file, which will contain the files to be printed. The following DOS command creates this file: A>DIR *.88M>FICHIER.DAT

In this example, the FICHIER.DAT file will contain all the files with the .88M extension.

Secondly, PSPRINT.COM must be used to print all the files in FICHIER.DAT.

CONCLUSION

The PSP program was developed to respond to the needs of the greatest possible number of users collecting sample plot data. However, situations may occur where PSP does not fulfill all requirements. If this should occur, the user may communicate with the author to find a solution to the problem.

The author is now developing a new version of PSP which will allow the user to define the printing format for his files. As well, a program (**PREPARE.COM**) that allows the user to keep only those variables that are to be up-dated, has been created. This program will prove to be very useful when the user must update a large number of files on a daily basis or when the memory of the PC-1000 is limited.

Although, at present, the **IBM PC®** does not allow for the merging of previously collected variables with those of the **PREPARE.COM** program, this can be accomplished on a VAX® 8200 using **FORTRAN**.

The author welcomes all comments and suggestions concerning PSP and its utilities.

Appendix A. List of variables[5] and codes contained in the VARIABLE.DAT file

0 - POSITION OF REFERENCE STAKE ON SITE: 1:(1)RIGHT; (2)LEFT 2:NB OF ROWS 3:NB OF COLUMNS 4:NB OF VARIABLES IN THE FILE

1 - SEEDLING NUMBER

2 - DATE OF MEASUREMENT: JULIAN (365 DAYS)

3 - SPECIES: (1)JP; (2)SP; (3)WS; (4)BS; (5)RA; (6)RO; (7)RP; (8) ; (9) ; (10) ; (11)NS

4 - CONDITION OF SEEDLING: (1)LIVE; (2)DEAD; (3)NOT PLANTED; (4)NOT FOUND; (5)UPROOTED; (6)REPLANTED

5 - CAUSES: (1)FROST HEAVING; (2)FROST; (3)LEADER BROWSED: (4)LATERALS BROWSED; (5)DRY; (6)DROWNED; (7)GIRDLED; (8)INSECT DEFOLIATION; (9)BADLY PLANTED; (10)MECHANICAL DAMAGE; (11)FORKED LEADER; (12)VEG. COMP.

6 - CAUSES: (13)CHEM. SPRAYING; (14) SPIRAL ROOTS; (15)ROOT COLLAR WEEVIL; (16)LATE SPRING FROST; (17)ARMILLARIA ROOT ROT; (18)WHITE PINE WEEVIL; (19)JACK PINE NODULE MAKER; (20)STUMP SPROUTING; (21)WINTER DESSICATION; (22)DEFICIENT ROOT SYSTEM

7 - CAUSES;

8 - CAUSES;

9 - HEIGHT: CM

10- DEGREE OF COMPETITION: (1)NONE; (2)GRASS+; (3)GRASS++; (4)GRASS+++; (5)SHRUBS+; (6)SHRUBS++; (7)SHRUBS+++; (8)TREES+; (9)TREES++; (10)TREES+++; (11)POLYTRICHUM; (12)SPHAGNUM

11- MICRO-SITE: (1)FURROW BOTTOM; (2)FLANK; (3)TOP; (4)BOTTOM WITH SURFACE WATER IN SPRING; (5)ROCKY OUTCROP; (6)FLAT

12- RCD: (MM) EX: 2.2 MM

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[5] The maximum number of characters per variable which PSP can read is 255.

13- DBH: (MM) EX: 2 MM

14- SITE PREPARATION: (1)NONE; (2)BRÄKE; (3)FINNED BARRELS AND CHAINS; (4)DISCING; (5)BULLDOZER

15- TYPE OF PLANTING TOOL: (1)POTTIPUTKI; (2)FOREST PICKAXE; (3)SHOVEL; (4)DIBBLE

16- GIRDLING: (1)NONE; (2)SLIGHT 1/3 OF CIRCUMFERENCE; (3)MODERATE 2/3; (4)SEVERE 3/3

17- POSITION OF DAMAGE ON SEEDLINGS BEGINNING AT ROOT COLLAR: SEEDLINGS DIVIDED INTO 4 PARTS. (1); (2); (3); (4); (5)DAMAGE ENTIRE LENGTH

18- FREE

19- FREE

20- RCD AT PLANTING (MM) EX: 2.2MM

21- SLOPE: (1)0-5%; (2)6-15%; (3)16-30%; (4)31-50%; (5)51-75%; (6)76%+

22- DRAINAGE CLASS: (1)RAPID; (2)GOOD; (3)AVERAGE; (4)POOR; (5)VERY POOR; (6)OTHER

23- FREE

24- SITE EXPOSURE: (1)FLAT; (2)NORTH SLOPE; (3)SOUTH; (4)EAST; (5)WEST; (6)OTHER

25- ECOLOGICAL ZONE:

26- AGE AT PLANTING: WEEKS

27- HEIGHT AT PLANTING: CM

28- DAY OF YEAR OF PLANTING: JULIAN (365)

29- YEAR OF PLANTING: EX: 1987

30- SPACE BETWEEN ROWS OF SEEDLINGS: 2.2M

31- SPACE BETWEEN COLUMNS OF SEEDLINGS: 2.2M

32- PLANTATION MAINTENANCE: (1)NONE; (2)MANUAL WEEDING; (3)MECHANICAL; (4)CHEMICAL; (5)OTHER

33- PROTECTORS: (1)PURE THIRAM ENTIRE TREE; (2)PURE THIRAM TREE BASE (15 CM); (3)CAREFREE TREE WRAP

34- NAMES OF PLANTERS: (1) ; (2) ; (3) ; (4) ;

35- FREE

36- FREE

37- FREE

38- FREE

39- FREE

40- FREE

41- FREE

42- FREE

43- FREE

44- BLOCK NUMBER (ANOVA)

45- MUNICIPALITY CODE

46- LOT NUMBER

47- NURSERY: (1)CPPFQ; (2)PAMPEV; (3)GRANDES-PILES; (4)ST-MODESTE; (5)STE-LUCE; (6)BECHEDOR; (7)DUCHESNAY; (8)METIS

48- SEED PROVENANCE: (1)BS ROBERVAL MER LOT 71-138; (2)JP GM ET LD 81-83 OUTAOUAIS PETAWAWA LOT 71033

49- TYPE OF CONTAINER: (1)QC TUBE; (2)QC TUBE WITHOUT PAPER; (3)STYRO 8; (4)STYRO 4; (5)STYRO 2A; (6)CAN-AM2; (7)PAPERPOT 508; (8)BARE ROOT; (9)STYRO 20; (10)IPL 45-110; (11)IPL 67-50

50- TYPE OF PEAT; STATE OF DECOMPOSITION AND TEXTURE

51- SITE LOCALIZATION: LATITUDE NORTH EX: 5225 FOR 52° 25'

52- SITE LOCALIZATION: LONGITUDE WEST EX: 6750 FOR 67° 50'

53- ALTITUDE IN METRES

54- AREA OF PLANTATION (ha): EX 2.1 ha

55- TOPOGRAPHY: (1)HIDDEN VALLEY; (2)OPEN VALLEY; (3)FROST POCKET; (4)SLOPING; (5)OTHER

56- ORIGIN: (1)CLEAR CUT; (2)FIRE; (3)WINDFALL; (4)AGRICULTURE; (5)PLANTATION; (6)FALLOW; (7)SAND OR GRAVEL PIT; (8)OTHER

Appendix B. Print format for variables

Variable 1 " ### ";
Variable 2 " ##### ";
Variable 3 " ### ";
Variable 4 " ### ";
Variable 5 " ### ";
Variable 6 " ### ";
Variable 7 " ### ";
Variable 8 " ### ";
Variable 9 " ### ";
Variable 10 " ### ";
Variable 11 " ### ";
Variable 12 " ###.# ";
Variable 13 " ### ";
Variable 14 " ### ";
Variable 15 " ### ";
Variable 16 " ### ";
Variable 17 " ### ";
Variable 18 " ### ";
Variable 19 " ### ";
Variable 20 " ###.# ";
Variable 21 " ### ";
Variable 22 " ### ";
Variable 23 " ###.# ";
Variable 24 " ### ";
Variable 25 " ### ";
Variable 26 " ### ";
Variable 27 " ### ";
Variable 28 " ### ";

Variable 29 " ##### ";
Variable 30 " ###.# ";
Variable 31 " ###.# ";
Variable 32 " ### ";
Variable 33 " #### ";
Variable 34 " #### ";
Variable 35 " ### ";
Variable 36 " ### ";
Variable 37 " ### ";
Variable 38 " ### ";
Variable 39 " ### ";
Variable 40 " ### ";
Variable 41 " ### ";
Variable 42 " ### ";
Variable 43 " ### ";
Variable 44 " ### ";
Variable 45 " ### ";
Variable 46 " ### ";
Variable 47 " ### ";
Variable 48 " ### ";
Variable 49 " ### ";
Variable 50 " ### ";
Variable 51 " #### ";
Variable 52 " #### ";
Variable 53 " #### ";
Variable 54 " ####.# ";
Variable 55 " ### ";
Variable 56 " ### ";

The # represents a character

REFERENCES

Borland International, Inc. 1985, Sidekick, [user manual]. Scotts Valley, Ca. 2nd ed. 122p.

Cooney, T.M. 1985. Portable data collectors, and how they're becoming useful. J. For. January 1985: 18-23.

Gariepy, A.; Overton, D.; Terry, S. 1986. ZBasic a powerful interactive BASIC compiler, 3rd ed. Zedcor Inc., Arizona. 622 p.

IBM. (International Business Machines Corporation) 1987. Manuel de référence. Collection: Systèmes d'exploitation (DOS). Version 3.30, April ed., Montreal (Qc). Multiple pagination. Translated from English.

SAS Institute Inc. 1986. User's Guide: Basics. Cary, N.C. Version 5 Edition. 1 292 p.

Canada