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WORLD INVENTORY OF SOIL EMISSION POTENTIALS

PROFILE DATABASE USER'S MANUAL

(Version 1.0 for IBM-PC Compatible Microcomputers)

Batjes, N.H.

April 1993

ISRIC

INTERNATIONAL SOIL REFERENCE AND INFORMATION CENTRE

Related Reports and Publications:

World Inventory of Soil Emissions: Report of Working Group Discussions and Recommendations. Proceedings of an international workshop organized in the framework of the Netherlands National Research Programme on Global Air Pollution and Climate Change (24-27 August 1992). WISE Report No. 1, ISRIC, Wageningen, ii + 20 p.

World Inventory of Soil Emission Potentials. Proceedings of an International Workshop organized in the framework of the Netherlands National Research Programme on Global Air Pollution and Climate Change (24-27 August 1992). WISE Report No. 2, ISRIC, Wageningen, iv + 122 p. [ISBN 90-6672-049-2].

A Review of Soil Factors and Processes that Control Fluxes of Heat, Moisture and Greenhouse Gases. Technical Paper 23/WISE Report 3, ISRIC, Wageningen, viii + 201 p. [ISBN 90-6672-048-4].

World Inventory of Soil Emission Potentials: Guidelines for soil profile selection and protocol for completing the WISE data entry sheets. Working Paper and Preprint 93/02, International Soil Reference and Information Centre, Wageningen, ii + 32 p.

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Note: **Version 1.0 of the User's Manual should be used in combination with the "Guidelines for soil profile selection and protocol for completing the WISE data entry sheets".**
Suggestions from user's to improve release 1.0 of the WISE profile database are welcomed.

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SUMMARY

This User's Manual documents the first release of the soil profile data handling system which has been developed for a project on "World Inventory of Soil Emission Potentials" (WISE). It follows the methodological approach of the "Guidelines for soil profile selection and protocol for completing the WISE data entry sheets". The profile or "point data" will be linked to the "area data" of a 30 by 30 minutes raster-map derived from the "cleaned" 1:5 million scale Soil Map of the World of FAO/Unesco. Each grid cell will be characterized by its main soil units, the properties of which will be characterized using appropriate data held in the profile component of the WISE database.

The procedures of the WISE system are written in the dBASE language and can be operated on IBM-compatible microcomputers operating under MS-DOS version 4.0 or higher. The WISE system contains largely self-explanatory modules that permit storage and handling of a range of soil attributes - identified as being necessary for a variety of studies of global environmental change involving soils - using self-explanatory menus. Individual menus are available for entering and editing data and for making selections, the output of which can either be sent to the screen or to the printer. The modular structure of WISE makes it possible to add other procedures as the need arises, resulting in new releases of the software. Data in the individual datafiles can be off-loaded to ASCII-files to meet the data requirements of individual users. In view of the often specific nature of these "queries", these selections can best be formulated directly in the dBASE language.

1 Introduction

1.1 Background

This User's Manual documents the procedures for handling profile data in the global soil database which is being developed at ISRIC within the framework of WISE, a project on 'World Inventory of Soil Emissions Potentials' (Batjes and Bridges, 1992). The "point data" held in the profile component of the WISE database will be linked to a 30 by 30 minutes raster-version of the "cleaned" version of FAO's 1:5 million scale Soil Map of the World (see FAO, 1991). Each grid cell on the map will be characterized by its main soil units, the properties of which will be characterized using appropriate data held in the profile database (Figure 1). A suitable procedure for the 30 by 30 minutes rasterization of the digital map is being developed by FAO in collaboration with ISRIC (Van Engelen, 1992; Nachtergaele, 1992).

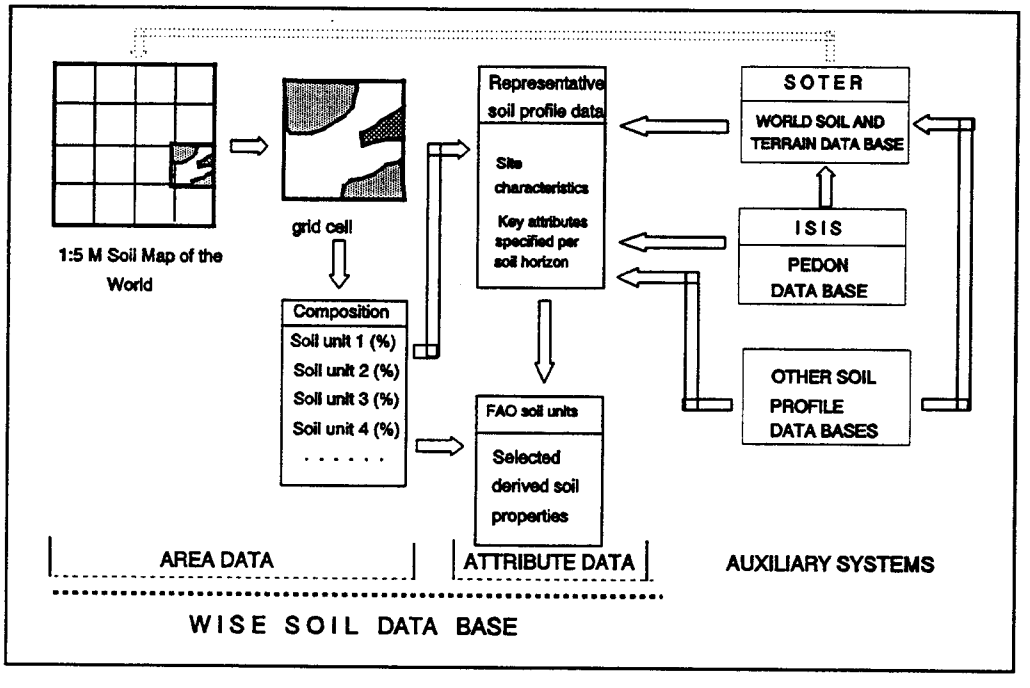


Figure 1. Schematic representation of the WISE database (Batjes, 1992)

WISE is a soil data handling system developed for IBM-compatible microcomputers. It includes procedures for inputting, editing, selecting and printing soil data. The procedures of WISE are written in dBASE III$^+$, a commonly used relational database management system. They are partly derived from ISIS, ISRIC's Soil (Pedon) Information System (Van Waveren and Bos, 1988a, 1988b), which also served as a basis for developing SDB, FAO's Soil Database System (FAO-ISRIC, 1989). Contrary to ISIS, which was primarily developed to handle the documentation of ISRIC's reference pedon collection, WISE aims to provide a basic set of soil data for global modelling. The data set selected for WISE is similar to the one which was independently proposed by IGBP-DIS/GCTE (Ingram, 1993). As a longer-term activity ISRIC is developing SOTER, a digital World Soils and Terrain Database, which also includes an update of the information on soil unit boundaries at a scale of 1:1 million (Van Engelen and Wen Ting-tiang, 1993).

1.2 Structure of report

In Section 2 an overview of the hardware and software requirements of the WISE system are given, and the installation procedure and type of files encountered are documented. How the various modules can be accessed from the main menu of WISE is discussed in Section 3. The function and operation of the main modules of the system, INPUT, EDIT, SELECTION and TOOLS, are discussed in Section 3.2 to 3.6. Conclusions concerning the implementation of the profile database are made in Section 4. The report contains 5 Appendices, which respectively present the list of datafiles (App. 1), the data file structure (App. 2), a data entry sheet (App. 3), a sample listing (App. 4), and general tips for using WISE (App. 5).

2 System overview

2.1 System requirements

2.1.1 Hardware

Version 1.0 of WISE was developed for systems with the following configuration:

- IBM PC-compatible computer, 286 (AT) or higher, with MS-DOS version 4.0 or higher
- one hard disk
- one high density floppy disk drive
- preferably at least 1 Mb of RAM, to ensure a reasonable performance with large databases
- a colour or monochrome monitor (EGA or VGA graphics)
- a line printer with 132 column capability (EPSON® compatible) or laser printer.

The system assumes the printer is connected to the first parallel port. In case of a laser printer, the printer manual should be consulted to see how it can be made to support the condensed pitch mode <Mode lpt1:132,8>. It is useful to install printer emulation software, such as PRINDIR®, which re-directs output sent to the first parallel port to an ASCII-file. This file can later be manipulated with a word processing system.

Preferably, a colour monitor should be installed. However, in case of monochrome monitors an in-built check will set the configuration to the appropriate B&W-settings.

2.1.2 Software

Although the procedures or modules of WISE are written in dBASE®, the user does not need to have an understanding of this programming language to operate the WISE system. The modules of WISE are self-explanatory and can be accessed independently or in combination to meet the user's application requirements from a set of simple menus (Section 3). To make full use of data held in WISE, however, a working knowledge of DOS and dBASE commands is useful (see appropriate manuals).

Release 1.0 of the programs and database structures for WISE requires 240 Kb and comes on one diskette. It comprises 51 programs (*.prg), 12 index files (*.ndx), 7 format files (*.frm), 24 datafiles

(*.dbf), 18 of which are "code to description" conversion files, and one memofile (*.dbt). The programs cannot be operated without the dBASE III$^+$ or dBASE IV language, which must reside in a separate directory on the hard drive. A path to this directory must be specified in the autoexecution file which resides on the bootable hard disk, which is generally the C-drive. The computer uses path specifications to locate files within the DOS directory structure.

The path to the WISE system can be set by modifying the AUTOEXEC.BAT file, using a suitable line-editor or program-editor. Alternatively, a word processor may be used but in this case the autoexecution file must be saved as an ASCII-file. Typically, a path command would look like:

path: C:\, C:\DOS, ... **C:\dBASE, C:\WISE**

In the above example, DOS commands are printed in **bold.** Key-board operations are highlighted in the text using the format <statement>.

2.2 Directory structure

Before beginning to work with the WISE profile database, it is useful to have a basic understanding of how MS-DOS operated computer systems store and process data. This section provides a basic knowledge of the "data structure".

MS-DOS uses a hierarchy of directories to store and process data. It uses directories as a means of dividing files into related storage units (similar to drawers in a desk). Directories can be divided into various sub-levels of sub-directories. The highest level at which a file can be stored on a disk is the root-directory. Sub-directories can be created in the root-directory using DOS commands (see appropriate operation manual).

The programs and datafiles of WISE are stored in one directory, which is automatically created with the installation module. The advantage of this approach is that all WISE related operations are kept separate from operations of other software application systems, facilitating overall system maintenance.

2.3 Type of files

Under dBASE each type of file is given a specific extension. File names are up to 8 characters long, with an extension of 3 characters long. Each extension refers to a particular type of files (Table 1).

Table 1. System and database files

System files		Database files
name.PRG	program files	name.DBF data files
name.FRM	format files	name.DBT memo files
keyname.DBF	files for converting codes to descriptions	name.NDX index files

A differentiation can be made between so-called system files and database files. For a given release of WISE the contents of the system files are "fixed". The system files contain the dBASE commands necessary to carry out special operations with different types of data files. The contents of the data files will change as new data are appended to or off-loaded from the system. The structure and field-definitions for a particular database, however, are fixed. Each database consists of a number of records, which present information related to a certain "entity", for instance the site data of a particular soil profile. Each site variable or data field is described using a mnemonic field-name, for instance WISE_ID for the profile reference number and COUN for country.

Each field is characterized by its name, length, and the type of data it contains. These may be either of the C(haracter), N(umeric), L(ogical) or D(ate) type. In case of Numeric data, e.g. soil pH, the total number of positions and number of positions after the decimal point are indicated (e.g. 4.23 --> N 4 2). The structure of the various datafiles is presented in Appendix 2.

For ease of data entry and manipulation, many of the descriptive entries are coded, but in cases where the descriptions cannot be standardized, for instance for "remarks", whole text-strings are entered into the database (see Batjes, 1993).

To facilitate queries within the database, each datafile is indexed on one or more unique field-names. Within WISE, the index-files for a given datafile are activated when this file is opened. In this active state, the index-file is updated whenever changes are made to the associated data file. WISE searches the index files and not the data files proper, speeding up the searching process (see appropriate section in dBASE manual).

The index files for WISE can be deleted and recreated (re-indexed) using the TOOLS module (see Section 3.6). This action is essential when changes have been made to a database, for instance with the BROWSE or APPEND commands, without having activated the associated index files beforehand. This is necessary as index files are not automatically activated under dBASE.

2.4 Installation

Release 1.0 of the WISE system comes on one 3 1/2 inch double sided and high density floppy disk. No special preparation is required to install the software package on a suited PC. If the WISE system is already installed on your PC, please proceed to Section 3. Otherwise, for instance in cases where the copy on the hard disk has been inadvertently erased or damaged, proceed as described below.

(1) Reboot the system by pressing <Ctrl-Alt-Del>, which is necessary if you have just adapted your AUTOEXEC.BAT file to include a path to the dBASE and WISE directories.

(2) Put the "working copy" of the master diskette of the WISE system, which includes the programs and datafiles, into the A-drive, and "close" the diskette drive as appropriate. Define this disk as being the active one.

C> **cd A:**

Eventual typing errors can be corrected at this stage using the <del> or <backspace> keys. Pressing <enter> tells the system to execute a command.

(3) Type the following commands, followed by <enter>:

A> **dbase wissetup**

The PC will first access the dBASE command file using the path command defined earlier, and look for the program WISSETUP on the A-drive. This installation module creates the DOS directory structure required for WISE and copies the different type of files to the appropriate directory. This operation requires some time, as diskette drives are slow, so please be patient. Upon completion, the installation module sets the default drive to C.

(4) After program execution remove the diskette from the A-drive, place it in a jacket and store it in a safe and dust-free place.

Version 1.0 of WISE is now installed and can be accessed as described in Section 3.

3 Modules

3.1 Getting started

This is where the user starts once the WISE software has been installed.

(1) Switch on the computer by turning on the main power supply. There should be no floppy disks in either the A or B-drives at this time, so that the system automatically accesses the autoexecution file on the C-drive, which sets the configuration of the PC and path to the WISE and dBASE files.

(2) Depending on the general commands in your AUTOEXEC.BAT file, a number of messages may be echoed to the screen.

(3) In order to access the WISE system - at the level of DOS - type the following command behind the DOS prompt:
C> **dbase wis00000**

Upon pressing the <enter> key the computer first accesses dBASE and then the command file that initializes the system software, displaying the main menu on the screen. The user can now perform a number of operations from this menu. Each possible selection allows accessing of the appropriate module(s). Each module comprises a number of programs. The programs are incorporated into a hierarchical structure, each program calling a lower-level program as needed (Figure 2).

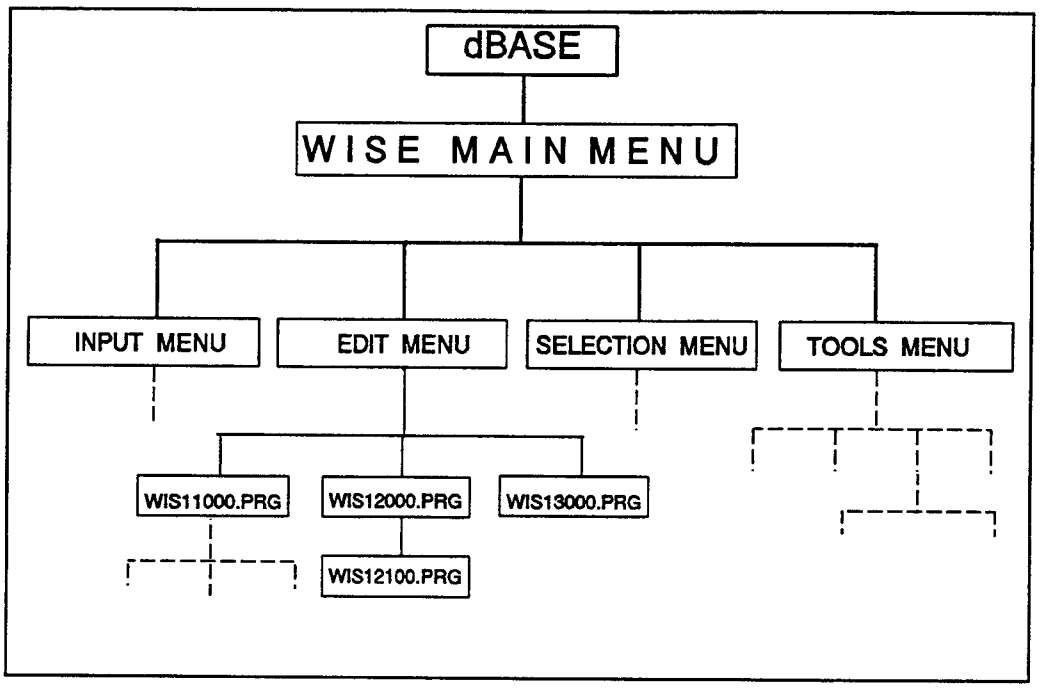


Figure 2. Schematic representation of the hierarchical menu structure

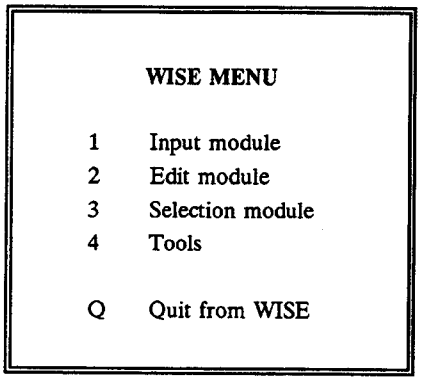
Each program is commonly called a procedure in dBASE. The procedures allow manipulation of the datafiles listed in Table 2, which also gives the names of the related index files and indexed fields. Format files, as listed in Appendix 1, are used to display selections of data held in a particular database file, either on the screen or as printed listings.

Table 2. Interactive datafiles and associated index files and indexed fields

Type of data	Name of database file	Index files	Indexed field
- Site data	wisesite.dbf	sitecode.ndx	wise_id
		sitefao.ndx	FAO_74
		sitecoun.ndx	coun
	wiseanad.dbf	anadcode.ndx	wise_id
- Horizon data	wisehor.dbf	horid.ndx	wise_id
		horcode.ndx	wise_id+horiz
- Source data	wisesour.dbf	sourcode.ndx	source_id
- Laboratory data	wiselab.dbf	labcode.ndx	lab_id
- Laboratory method, codes	labatrib.dbf	atribcode.ndx	lab_id
- Lab. codes, descriptive	labmets.dbf	labmets.ndx	key

3.2 WISE menu

The main menu of WISE comprises 5 options. A particular option is accessed by typing the corresponding number or letter on the key-board. For instance, entering <1> at the level of the main menu brings the user to the INPUT menu, which in turn allows the user to select from a new range of options. At each level, it is possible to return to the preceding higher level and ultimately to the system or DOS level. For ease of convenience, a double-lined box at the head of every screen provides the user information on the module in use and type of data being processed.



Upon entering a data set with the INPUT module, it is crucial to control whether errors in data entry have been made. This checking is done with the EDIT menu, which is accessed from the WISE menu by entering <2>. In order to facilitate the control process, the data for a selected profile can be printed. Thereby they can be directly compared with the manuscript forms, which is often a safer way of checking data for inconsistencies than "simply" looking at the video screen.

Selections based on a number of specific criteria can be made with the SELECTION module. Release 1.0 only provides some basic options for selecting data sets; this number will be expanded as requirements of users are better defined. For experienced dBASE users, however, it may prove more efficient to directly access the relevant datafiles using their own programs with which they may off-load any information using a format that conforms to their wishes. To this avail, the datafile structure is presented in Appendix 2.

Option <4> of the WISE menu allows the user to access the TOOLS module, the applications of which are explained in Section 3.6.

Entering Q at the level of the WISE menu will return the user to the DOS prompt.

3.3 INPUT module

This module permits to enter data about the site and physico-chemical characteristics of geo-referenced profiles considered to be representative for a particular unit of the Soil Map of the World (see Figure 1). Additionally, it allows storage of the source from which the profile data were derived

and of the name/identifier of the laboratory where the corresponding analyses have been performed. The INPUT module also includes a procedure for specifying codes for the various analytical methods, and for entering descriptions of these methods into a "key" file.

The format of the INPUT menu is as follows:

WISE -- INPUT MENU

Site data	(Y/N)
Horizon data	(Y/N)
Reference to source of data	(Y/N)
Reference to laboratory name	(Y/N)
Coding of analytical methods	(Y/N)
Descr. of analytical methods	(Y/N)
Return to WISE menu	(W)

Contrary to the other menus of WISE, the INPUT menu allows simultaneous selections. A common procedure would be to enter the site and horizon data for each profile in one session, which requires typing <Y> for each of these selections. Generally, a number of profiles will have been derived from the same source (e.g. monograph or database) and analyzed with the same analytical procedures; this means this information does not have to be re-entered for every pit (Figure 3). Preferably, "reference" information should be stored when the first profile from a particular data set is entered.

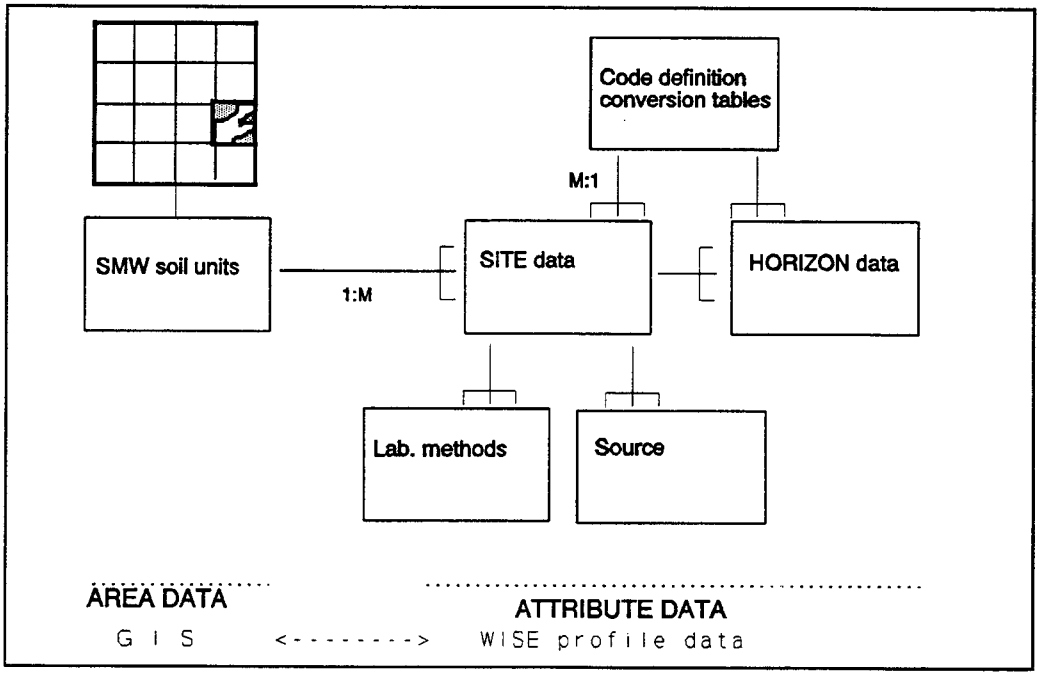


Figure 3. Schematic representation of the SITE and HORIZON data files, and related key-attribute files (M:1 stands for many to one relations, and 1:M for one to many relations)

Key-fields, such as the profile number and horizon number, are referenced by unique identifiers in WISE. It is on these identifiers that the indices have been placed. Each soil profile is given a unique number which consists of the country's two letter ISO-code, followed by three numerals. For example, the WISE_ID or profile code "JM003" would refer to the third soil pit available for Jamaica (JM). The "site" module includes a checking routine that precludes duplicate entry of a particular profile code. In cases where duplication is about to occur, the first (highest) free number for the country is calculated and automatically assigned to the profile. It is imperative that the user manually records this new profile number on the corresponding Data Entry Sheet to keep the referencing up to date.

Each horizon of a profile is automatically numbered in WISE starting from the surface to the bottom, the sequence in which they must be entered into the database. Horizons for any given profile are indexed on both WISE_ID and HORIZ_ID, i.e. the profile code and sequential horizon number.

Each soil laboratory - and its set of associated analytical procedures - is also identified by a unique code, called LAB_ID. It consists of the countries's ISO-code and two numerals, for instance UK01. The analytical procedures used at a particular laboratory are described by the methods-code. The format of this unique code is shown in Table 3. In the current, early stage of data collection it is not yet possible to fully fill-in Table 3. The coding system will be elaborated as the international data collection program proceeds.

Table 3. Format for coding analytical methods

Organic carbon:
OC01: Method of Walkley/Black
OC02: Loss on ignition (%)
OC03: Method of Allison
OC04: Method of Kurmies
OC05: Method of furnace combustion (e.g. LECO)
OC0y: Method of .....
Total Nitrogen:
ON01: Wet digestion according to Kjeldahl method
ON0z: Method of .....
$CaCO_3$ content:
CA01: Method of Scheibler
CA02: Method of Wesemael
CA03: Method of Piper
CA0x: Method of .....
etc., for other methods

As was mentioned earlier, the INPUT screens prompt the user for specific types of inputs. It is imperative that all data are coded and entered exactly according to the format described in the "Guidelines for soil profile selection and protocol for completing the WISE data entry sheets" (Batjes, 1993). Input screens will only accept the data types (e.g. numerical; character) specified in the program, each with their own pre-defined field type and length. Numerical entries are automatically right-justified. Character fields for descriptive data are left-justified, and a character should always

occupy the leftmost position. For character strings it is crucial to distinguish between the letter O and the number 0; all searches are carried out based on exact matches in WISE!

In case of attributes defined as being numerical, the dBASE software cannot differentiate between "" (space) and 0 (zero). This creates a potential risk of contaminating the integrity of the database. In WISE this problem has been circumvented by defining all attributes as being "missing values" when the data entry starts. On the input screen, this is shown by a "-" in case of character data and a "-1" in case of numerical data. The actual data can be entered directly over this information, provided the key-board is in the <insert> mode.

The cursor may be moved from one screen-field to the other using the →, ←, ↑ and ↓ keys. When the last entry is entered, or <PgDn> is used to go to the end of the current input screen, the system prompts:

"= = > Save or modify the above data (S/M)"

Entering <S> closes the current input screen, while pressing <M> allows the user to modify the displayed data using the appropriate arrow keys. At this stage, the data are not yet saved! This first happens upon entering <Y> at the following prompt:

"= = > Write data to disk (Y/N) or exit (E)"

Alternatively, when <N> is entered, the input screen is cleared and none of the data are stored in a disk file. The system proceeds to the next module irrespective of whether <Y> or <N> was entered. Pressing <E>, however, allows the user to exit (return) to the main menu of the WISE system.

3.4 EDIT module

This module permits the updating of information held in WISE, using a set of fully interactive and self-explanatory menus. The general procedure is that the unique identifier of a particular data set is entered into the system, for instance CA001 for the first profile from Canada, after which the system displays the associated information on the screen. In case non-existing codes or combinations of codes have been entered, the user will be prompted to re-enter a correct entry. Alternatively, the module can then be "exited" by typing <E> which will return the user to the first higher-level procedure.

The current data stored in a datafile are displayed on the screen, using screen displays identical to those of the INPUT module, facilitating the editing process. Data are edited by overwriting the displayed information, while the keyboard is in the <insert> mode. The arrow-keys or page down <Pg Dn> may again be used to move over the screen without changing the contents of the data fields. Note that at this stage all missing values must be entered either as <-1> for numerical values or <-> for character strings. Once the data for a whole screen have been edited, the user will again be prompted to indicate whether the information should be saved or modified. In the affirmative, the user must indicate whether the modified data should be written to disk or not. This may seem a somewhat cumbersome process, but it precludes that "unwanted" modifications are introduced into the WISE data system. Contamination is one of the greatest threats that can damage the integrity and thereby applicability of a data handling system!

The selections possible with the EDIT menu are:

WISE -- EDIT MENU

1	Site data
2	Horizon data
3	Source of data
4	Laboratory name
5	Laboratory methods [coding]
6	Laboratory methods [descriptive]
7	Additional remarks
8	Print data for one profile
W	Return to WISE menu

3.5 SELECTION module

This module permits the user to extract specific data sets from the WISE database. Version 1.0 of WISE only contains a limited number of possible selections. This number may be expanded as the database development activity proceeds and the user requirements are further defined. Alternatively, it may prove more practical that for model-specific applications, the queries are made directly using dBASE commands. A discussion of the appropriate commands is beyond the scope of this User's Manual (see appropriate manuals).

Possible selections in release 1.0 of WISE are:

WISE -- SELECTION MENU

1	FAO/Unesco (1974) classification
2	Location (country or coordinates)
3	Country and FAO-Unesco (1974) classification
4	Source of profile (lit. reference)
5	Source and type of analytical data
6	Listing of analytical methods
7	Viewing/listing of ID-fields in database
8	Viewing/listing of one profile
W	Return to WISE menu

3.6 TOOLS module

TOOLS allows the user to carry out a number of common manipulations of files from a menu:

WISE -- TOOLS menu

1	Re-index datafiles
2	Convert *.DBF <--> *.TXT format
3	Make backup of datafiles
4	Delete contents of databases
5	Delete site, horizon and remarks for 1 profile
W	Return to WISE menu

Upon confirmation, <1> re-indexes the user-interactive datafiles of the WISE system; this is a recommended option when dBASE has been exited in an unorthodox way, e.g. by using <Ctrl-Alt-Del>. Option <2> permits off-loading of data held in the "code-text" conversion files (*.DBF) into an ASCII file (*.TXT). This text file can be edited easily with a word processor; the file must be saved as ASCII or DOS text. The updated file can thereafter be re-transferred to a dBASE database file.

Backups of the datafiles can be made with option <3>, which is self explanatory. After insertion of a diskette in the A-drive - the contents of which will be erased! - all data files are copied to the diskette (for tips see Appendix 5).

Option <4>, which is access-limited by a password, permits to delete the contents from the interactive datafiles of WISE, preserving the database structure. This option is useful when a new system is being installed.

Option <5> is also access limited. It allows deletion of the site, horizon and remarks of one particular profile at a time. Alike for option <4>, the deletions are of an irreversible nature!

4 Conclusion

With the completion of the methodology, protocol, data handling system and User's Manual for the soil profile component of the WISE database, the actual filling-in of the database can start. A number of suitable profiles have already been identified from searches of survey monographs and international conference proceedings held in ISRIC's library. Additionally, an international data collection programme, based on the "guidelines and protocol", has been initiated to obtain sets of regionally representative profiles for the soil units shown on the Soil Map of the World from national soil survey organizations. An additional activity will be the transcribing and off-loading of information held in auxiliary, digital profile databases into the WISE system. The possibility of transferring different soil data sets between various databases, including ISIS, FAO-SDB, the SCS-database of Lincoln and WISE, will be a topic of discussion during an IGBP-DIS meeting which ISRIC will host (26-27 April 1993). ISRIC, in its capacity of international reference and information centre on the soils of the world

would seem well placed to coordinate the activities related to the development of a global soil database for studies of environmental change, using its experience gained in developing ISIS, SOTER and WISE.

References

Batjes, N.H., 1992. The WISE database: general considerations on a possible structure and attribute data. In: N.H. Batjes and E.M. Bridges, *A review of soil factors and processes that control fluxes of heat, moisture and greenhouse gases,* p. 149-158. Technical Paper 23 / WISE Report 3, ISRIC, Wageningen.

Batjes, N.H., 1993. *World Inventory of Soil Emission Potentials: guidelines for soil profile selection and protocol for completing the WISE data entry sheets*. Working Paper and Preprint 93/02 - WISE Report 4, International Soil Reference and Information Centre, Wageningen.

Batjes, N.H. and E.M. Bridges (eds), 1992. *World inventory of soil emission potentials*. Proceedings of an international workshop organized in the framework of the Netherlands National Programme on Global Air Pollution and Climate Change. WISE Report 2, ISRIC, Wageningen.

FAO, 1991. *The digitized Soil Map of the World. Notes: Volume - Africa.* World Soil Resources Report 67/1 (Release 1.0), FAO, Rome.

FAO-ISRIC, 1990. *FAO-ISRIC Soil Database (SDB)*. World Soil Resources Report 64, FAO, Rome.

FAO-Unesco, 1974. *Soil Map of the World*. Volume I: Legend. Unesco, Paris.

FAO-Unesco, 1988. *FAO-Unesco Soil Map of the World: Revised Legend*. World Soil Resources Report 60, FAO, Rome [Reprinted as Technical Paper 20, ISRIC, Wageningen, 1989].

Ingram, J.S.I. (ed.), 1993. *Report of the IGBP-DIS/GCTE Global Soils Database Workshop* , Silsoe (8-9 October 1992).

Nachtergaele, F., 1992. *Testing of 30' x 30' grid database for the Soil Map of the World*. Internal Working Document, FAO-AGLS, Rome.

Van Engelen, V.W.P., 1992. *Rasterization of the FAO-Unesco Soil Map of the World: various options tested*. Internal Working Document, ISRIC, Wageningen.

Van Engelen, V.W.P. and Wen Ting-tiang, 1993. *Global and National Soils and Terrain Digital Databases (SOTER): Procedures manual*. A joint publication of FAO, ISRIC, ISSS and UNEP. ISRIC, Wageningen (In preparation).

Van Waveren, E.J. and A.B. Bos, 1988a. *Guidelines for the description and coding of soil data (Revised edition)*. Technical Paper 14, ISRIC, Wageningen.

Van Waveren, E.J. and A.B. Bos, 1988b. *ISRIC Soil Information System - User Manual and Technical Manual*. Technical Paper 15, ISRIC, Wageningen.

Glossary

The glossary was compiled from the following sources:

[1] ORNL, 1990. *Glossary: Carbon dioxide and climate*. Environmental Sciences Division Publication No. 3532, The Carbon Dioxide Information Analysis Centre, Oak Ridge National Laboratory.

[2] SSSA, 1979. *Glossary of soil science terms*. Soil Science Society of America, Madison, Wisconsin.

[3] Burrough, P.A., 1986. *Principles of Geographical Information Systems for land resources assessment*. Monographs on Soil and Land Resources Survey No. 12, Clarendon Press, Oxford. p. 177-183.

[4] Reinhardt, R.D., 1992. *Geographic Information Systems (GIS) - A global perspective*. Global Environmental Change Report, Cutter Information Corporation, Arlington.

Attribute: Non-graphic information associated with a point, line, or area element in a GIS [3].

Classification, soil: The systematic arrangement of soils into groups or categories on the basis of their characteristics. Broad groupings are made on the basis of general characteristics and subdivisions on the basis of more detailed differences in specific properties [2].

Climate change: The long-term fluctuations in temperature, precipitation, wind, and all other aspects of the Earth's climate. External processes, such as the Earth's orbital parameters (eccentricity, precession, and inclination), lithosphere motions, and volcanic activity, are factors of climate. Internal variations of the climate system also produce fluctuations of sufficient magnitude and variability through the feedback processes interrelating the components of the climate system [1].

Data base: A collection of interrelated information, usually stored on some form of mass-storage system such as magnetic tape or disk. A GIS data base includes data about the position and the attributes of geographical features that have been coded as points, lines, areas, pixels or grid cells [3].

Data base management system (DBMS): A set of computer programs for organizing the information in a data base. Typically, a DBMS contains routines for data input, verification, storage, retrieval, and combination [3].

Data set: A collection of logically related items arranged in a prescribed manner [4].

Greenhouse effect: A popular term used to describe the roles of water vapour, carbon dioxide, and other trace gases in keeping the Earth's surface warmer than it would be otherwise. The 'radiatively-active' gases are relatively transparent to incoming shortwave radiation, but are relatively opaque to outgoing long-wave radiation. The latter radiation, which would otherwise escape to space, is trapped by these gases within the lower levels of the atmosphere. The subsequent reradiation of some of the energy back to the surface maintains surface temperatures higher that they would be if the gases were absent. There is concern that increasing concentrations of greenhouse gases, including carbon dioxide, methane and manmade chlorofluorocarbons, may enhance the greenhouse effect and cause global warming [1].

Grid: A cellular-based data structure composed of pixels or cells of equal size arranged in columns and rows [4].

Grid map: A map in which the information is carried in the form of grid cells.

Hierarchical data base structure: A method of arranging computer files or other information so that the units of data storage are connected in a hierarchically defined pathway. From above to below, relations are one-to-many [3].

Map scale: An expression of a unit of measure on a map and the equivalent measure on the Earth's surface, often expressed as a representative fraction of distance [4]. For instance, 1:5,000,000, or one unit (e.g. cm) on the map equals 5,000,000 units on the Earth's surface.

Modelling: An investigative technique that uses a mathematical or physical representation of a system or theory that counts for all or some of its known properties. Models are often used to test the effects of changes in system components on the overall performance of the system [1].

Profile, soil: A vertical section of the soil through all its horizons and extending into the parent material [2].

Relational data base: A method of structuring data in the form of sets of records or 'tuples' so that relations between different entities can be used for data access and information [3].

Soil: (i) The unconsolidated mineral material on the immediate surface of the earth that serves as a natural medium for the growth of land plants. (ii) The unconsolidated mineral matter on the surface of the earth that has been subjected to and influenced by genetic and environmental factors of: parent material, climate (including moisture and temperature effects), macro- and microorganisms, and topography, all acting over a period of time and producing a product - soil - that differs from the material from which it is derived in many physical, chemical, biological and morphological properties, and characteristics [2].

Spatial data: Information concerning location, shape and relationships among geographic features, usually stored as coordinates within a topological function [4].

Appendices

App. 1 Overview of program files

Program files	Function	Calls/uses[1]
WISSETUP.PRG	Installation procedure	DOS; dBASE
WIS00000.PRG	WISE starter module	wis0001.prg; wis10000.prg; wis20000.prg; wis30000.prg; wis40000.prg
WIS00001.PRG	Procedure file	wis0002.prg
WIS00002.PRG	Procedure file	
WIS00003.PRG	Procedure file	
WIS10000.PRG	INPUT module	wis11000.prg; wis12000.prg; wis13000.prg; wis14000.prg; wis15000.prg; wis16000.prg
WIS11000.PRG	Input site data	wis11000.prg; wisesite.dbf; skelet.dbf (temp.)
WIS11100.PRG	Flag missing values	-
WIS12000.PRG	Input horizon data	wis12100.prg; wisehor.dbf; skelet.dbf (temp.); wisesite.dbf
WIS12100.PRG	Flag missing values	-
WIS13000.PRG	Source input screen	wisesour.dbf; skelet.dbf (temp.)
WIS14000.PRG	Lab. references	wiselab.dbf; skelet.dbf (temp.)
WIS14100.PRG	Lab. method codes	labatrib.dbf; skelet.dbf (temp.)
WIS15000.PRG	Remarks input screen	wiseanad.dbf; skelet.dbf (temp.)
WIS16000.PRG	Code+descr. lab meth.	labmets.dbf; skelet.dbf (temp.)
WIS20000.PRG	TOOLS module	wis21000.prg; wis22000.prg; wis23000.prg; wis24000.prg
WIS21000.PRG	Re-index databases	wisesite.dbf –> wise_id (sitecode.ndx) –> fao_74 (sitefao.ndx) –> coun (sitecoun.ndx) wisehor.dbf –> wise_id (horid.ndx) –> wise_id+horiz (horcode.ndx) wiseanad.dbf –> wise_id (anadcode.ndx) wisesour.dbf –> source_id (sourcode.ndx) wiselab.dbf –> lab_id (labcode.ndx) labatrib.dbf –> lab_id (atribcode.ndx) labmets.dbf –> key (labmets.ndx)
WIS22000.PRG	*.dbf <–> *.txt	wis22100.prg; wis22200.prg; wis00001.prg
WIS22100.PRG	*.dbf –> *.txt	wis00003.prg
WIS22200.PRG	*.txt –> *.dbf	wis00003.prg
WIS23000.PRG	Backup *.db?; *.txt; *.ndx to the A-drive (runs via DOS)	
WIS24000.PRG	Delete contents of *.dbf (Note: password protected)	
WIS25000.PRG	Deletes a profile	wisesite.dbf; wisehor.dbf; wiseanad.dbf
WIS30000.PRG	SELECTION module	wis30000.prg to wis38000.prg
WIS31000.PRG	FAO/Unesco (1974)	wisesite.dbf; keyfao.dbf; wisesise.frm
WIS32000.PRG	Country or coordinates	wis32100.prg; wis32200.prg

[1] Extension: frm= format files; ndx= index file; prg= program file; mem= memory variables.

WIS32100.PRG	Country ISO-code	wisesite.dbf; keycoun.dbf; wisesise.frm
WIS32200.PRG	Lat-lon coord.	wisesite.dbf; wisesise.frm
WIS33000.PRG	Country + FAO clas.	wisesite.dbf; keycoun.dbf; keyfao.dbf; wisesise.frm
WIS34000.PRG	Source of profiles	wisesour.dbf
WIS35000.PRG	Source of analyses	wiselab.dbf; wiseatrib.frm
WIS36000.PRG	Analytical methods	labatrib.dbf; labmets.dbf;
WIS37000.PRG	List key-fields	wisesite.dbf; wiselist.frm
WIS48000.PRG	Print profile	
WIS40000.PRG	EDIT module	wis4100.prg to wis48000.prg
WIS41000.PRG	Edit site data	wisesite.dbf
WIS42000.PRG	Edit horizon data	wisehor.dbf; wisesite.dbf; tempstore.mem (temp.)
WIS43000.PRG	Edit source data	wiseour.dbf; tempstore.mem (temp.)
WIS44000.PRG	Edit lab. name	wiselab.dbf; tempstore.mem (temp.)
WIS45000.PRG	Edit lab. method codes	labatrib.dbf; tempstore.mem (temp.)
WIS46000.PRG	Edit lab. descriptions	labmets.dbf; tempstore.mem (temp.)
WIS47000.PRG	Edit remarks for pit	wiseanad.dbf; tempstore.mem (temp.)
WIS48000.PRG	Print profile	wis48100.prg; wis48110.prg; wisesite.dbf
WIS48100.PRG	Print site data	wisesite.dbf; keystatu.dbf; keyfao.dbf; keyph74.dbf; keyph90.dbf; keycoun.dbf;keylandf.dbf; keyposit.dbf; keydrain.dbf; keyparen.dbf; keykoppe.dbf; keylus.dbf; keycrops.dbf; keyveget.dbf
WIS48110.PRG	Data handling	
WIS48200.PRG	Print horizon data	wis48210.prg; wisesite.dbf; wisehor.dbf; wisesour.dbf; wiselab.dbf; wiseanad.dbf
WIS48210.PRG	Data handling	labatrib.dbf; labmets.dbf

App. 2 Datafiles and structures

A) Profile data files

wisesite.dbf

Field Name	Type	Width	Dec	Description
WISE_ID	Character	5		Unique profile reference number
LAB_ID	Character	4		Unique laboratory reference number
SOURCE_ID	Character	8		Unique reference number for source of profile data
HORNUM	Numeric	1		Number of horizons described for pit (control variable)
FAO_74	Character	2		FAO/Unesco (1974), classification as code
PHA_74	Character	2		As above, but code for (main) phase
TOP_74	Character	1		As above, but code for topsoil textural class
FAO_90	Character	3		FAO/Unesco (1990), classification as code
PHA_90	Character	2		As above, but code for (main) phase
USCL	Character	50		US Soil Taxonomy classification, descriptive
USYR	Character	2		Year (version of Soil Taxonomy, e.g. 75)
LOCAL	Character	50		Local classification, descriptive
DESCR	Character	1		Profile description status, code
DATE	Character	5		Date profile was first described
COUN	Character	2		ISO code for country of origin
LOCAT	Character	50		Location of profile, descriptive
LATIT	Character	1		Latitude of profile (N/S)
LATDEG	Character	2		degrees
LATMIN	Character	2		minutes
LATSEC	Character	2		seconds
LONGI	Character	1		Longitude of profile (E/W)
LONDEG	Character	3		degrees
LONMIN	Character	2		minutes
LONSEC	Character	2		seconds
ALTIT	Numeric	4		Elevation (m)
LFORM	Character	2		Landform, code
POSIT	Character	2		Position, code
ASPECT	Character	3		Aspect, code
SLOPE	Character	3		Slope at profile site (%)
DRAIN	Character	2		Drainage condition, code
GRWHI	Numeric	4		Average, highest groundwater level (cm)
GRWLO	Numeric	4		Average, lowest groundwater level (cm)
SOLDEP	Numeric	4		Average, soil depth to a physically limiting layer (cm)
PARMAT	Character	3		Parent material, code
PARREM	Character	50		Remarks on parent material, descriptive
KOPPEN	Character	3		Köppen climate classification, code
LANDUS	Character	3		Land use, code
CROPS	Character	2		Crops, code
VEGCOD	Character	2		Vegetation, code
VEGREM	Character	100		Remarks on either land use or vegetation, descriptive
REMARKS	Memo	10		Memo field (disabled in version 1.0)

wisehor.dbf

Field Name	Type	Width	Dec	Description
WISE_ID	Character	5		Unique soil profile number
HORIZ	Character	1		Unique horizon number (in combination with WISE_ID)
DESIG	Character	8		Horizon designation, coded acc. to local system
TOPDEP	Numeric	3		Upper depth of horizon (cm)
BOTDEP	Numeric	3		Lower depth of horizon (cm)
DCOLOR	Character	8		Dry matrix Munsell code
MCOLOR	Character	8		Moist matrix Munsell code
MOTTLE	Character	1		Mottling, code
ROOTS	Character	2		Roots abundance/size, code
ORGC	Numeric	5	2	Organic carbon (%, acc. to method specified in labmets.dbf)
TOTN	Numeric	5	2	Total Nitrogen (%)
PTOT	Numeric	5	2	Total phosphorus (mg P_2O_5 kg^{-1})
CACO3	Numeric	4	1	Calcium carbonate content (%)
GYPSUM	Numeric	4	1	Gypsum content (%)
PHH2O	Numeric	4	1	pH measured in water
PHKCL	Numeric	4	1	pH measured in KCl solution
PHCACL2	Numeric	4	1	pH measured in CaCl2 solution
ECE	Numeric	5	2	Electrical conductivity (dS m^{-1} or mmho cm^{-1})
EXCA	Numeric	5	1	Exchangeable calcium (cmol(+) kg^{-1})
EXMG	Numeric	5	1	Exchangeable magnesium
EXNA	Numeric	5	1	Exchangeable sodium
EXK	Numeric	5	1	Exchangeable potassium
EXACID	Numeric	5	1	Exchangeable acidity
EXALUM	Numeric	5	1	Exchangeable aluminum
CECSOIL	Numeric	5	1	Cation exch. capacity (cmol(+) kg^{-1}; pH7 in 1*M* NH_4OAc)
ECEC	Numeric	5	1	Effective CEC (cmol(+) kg^{-1}; field conditions of pH)
BSAT	Numeric	3		Base saturation, expressed as % of CEC
SAND	Numeric	4	1	Sand content (w/w%; for specified esd)
SILT	Numeric	4	1	Silt content
CLAY	Numeric	4	1	Clay content
GRAVEL	Numeric	3		Gravel content (v/v %)
STRUCT	Character	2		Soil structure, code
BULKDENS	Numeric	4	2	Bulk density (g cm^{-3})
PF	Character	1		Soil moisture content (control variable)
PF00	Numeric	4	1	Soil moisture content (%v/v) at pF 0
PF10	Numeric	4	1	As above, but at pF1.0
PF15	Numeric	4	1	As above, but at pF1.5
PF17	Numeric	4	1	As above, but at pF1.7
PF20	Numeric	4	1	As above, but at pF2.0
PF23	Numeric	4	1	As above, but at pF2.3
PF25	Numeric	4	1	As above, but at pF2.5
PF27	Numeric	4	1	As above, but at pF2.7
PF34	Numeric	4	1	As above, but at pF3.4
PF37	Numeric	4	1	As above, but at pF3.7
PF42	Numeric	4	1	As above, but at pF4.2
AWC	Numeric	4		Available water capacity
HC	Character	1		Hydraulic conductivity (control variable)
CONDSAT	Numeric	4	1	Saturated
CONDUNSAT	Numeric	4	1	Unsaturated

wiseanad.dbf

Field Name	Type	Width	Dec	Description
WISE_ID	Character	5		Unique profile number
ADD	Character	254		Remarks, descriptive

wisesour.dbf

Field Name	Type	Width	Dec	Description
SOURCE_ID	Character	8		Unique reference number for source of profile data
AUTHOR	Character	70		Author name and initials
AUTYR	Numeric	2		year of publication
REFTIT	Character	100		Title of monograph/database, descriptive
REFPUB	Character	100		Series/publisher/year, descriptive

wiselab.dbf

Field Name	Type	Width	Dec	Description
LAB_ID	Character	4		Unique laboratory code
LABNAM	Character	150		Reference to laboratory, descriptive

labatrib.dbf

Field Name	Type	Width	Dec	Description
LAB_ID	Character	4		Unique laboratory code
ORGC	Character	2		Number-code of analytical method
TOTN	Character	2		As above, but for total nitrogen
PTOT	Character	2		As above, but for total phosphorus
CACO3	Character	2		As above, but for calcium carbonate content
GYPSUM	Character	2		As above, but for gypsum content
PHH2O	Character	2		As above, but for pH-water
PHKCL	Character	2		As above, but for pH-KCl
PHCACL2	Character	2		As above, but for pH-CaCl2
ELECON	Character	2		As above, but for electrical conductivity
EXBAS	Character	2		As above, but for exchangeable Ca, Mg, K and Na
EXACID	Character	2		As above, but for exchangeable acidity
CECSOIL	Character	2		As above, but for CEC
ECEC	Character	2		As above, but for ECEC
BSAT	Character	2		As above, but for base saturation
TEXTURE	Character	2		As above, but for texture (definition of esd-sizes + method)
BULKDENS	Character	2		As above, but for bulk density
MOISTCON	Character	2		As above, but for moisture content (pF measurements)
HYDROCON	Character	2		As above, but for hydraulic conductivity

B) Key-Description conversion files

labmets.dbf

Field Name	Type	Width	Dec	Description
KEY	Character	4		Unique identifier code (such as "OC"+"01")
LABMETHOD	Character	150		Description of laboratory method

keyfao.dbf

Field Name	Type	Width	Dec	Description
KEYFAO90	Character	3		Code in FAO/Unesco (1990) Revised Legend
FAOUNIT90	Character	20		Code in FAO/Unesco (1974) Legend
KEYFAO74	Character	2		FAO/Unesco (1990) classification, descriptive
FAOUNIT74	Character	20		FAO/Unesco (1974) classification, descriptive

keyph74.dbf

Field Name	Type	Width	Dec	Description
KEY	Character	2		Code for FAO/Unesco (1974) phase
PHA_74	Character	15		As above, but descriptive

keyph90.dbf

Field Name	Type	Width	Dec	Description
KEY	Character	2		Code for FAO/Unesco (1990) phase
PHA_90	Character	15		As above, but descriptive

keytext.dbf

Field Name	Type	Width	Dec	Description
KEY	Character	1		FAO topsoil texture class, code
TOP_74	Character	15		As above, but descriptive

keystatu.dbf

Field Name	Type	Width	Dec	Description
KEY	Character	1		Profile description status, code
DESCR	Character	25		As above, but descriptive

keymottl.dbf

Field Name	Type	Width	Dec	Description
KEY	Character	1		Soil mottling, code
MOTTLE	Character	20		As above, but descriptive

keyroots.dbf

Field Name	Type	Width	Dec	Description
KEY	Character	2		Roots abundance and size, code
ROOTS	Character	40		As above, but descriptive

keystruc.dbf

Field Name	Type	Width	Dec	Description
KEY	Character	2		Soil structure, code
STRUCT	Character	30		As above, but descriptive

keycoun.dbf

Field Name	Type	Width	Dec	Description
ISO	Character	2		Country ISO code
COUNTRY	Character	20		Country name, descriptive

keylandf.dbf

Field Name	Type	Width	Dec	Description
KEY	Character	2		Landform, code
LFORM	Character	35		As above, but descriptive

keyposit.dbf

Field Name	Type	Width	Dec	Description
KEY	Character	2		Site position, code
POSITI	Character	25		As above, but descriptive

keydrain.dbf

Field Name	Type	Width	Dec	Description
KEY	Character	2		Soil drainage class, code
DRAIN	Character	40		As above., but descriptive

keyparen.dbf

Field Name	Type	Width	Dec	Description
KEY	Character	3		Parent material, code
PARMAT	Character	50		As above, but descriptive

keylus.dbf

Field Name	Type	Width	Dec	Description
KEY	Character	3		Land use, code
LANDUS	Character	45		As above, but descriptive

keycrops.dbf

Field Name	Type	Width	Dec	Description
KEY	Character	2		Arable crops, code
CROPS	Character	25		As above, but descriptive

keyveget.dbf

Field Name	Type	Width	Dec	Description
KEY	Character	2		Vegetation classification, code
VEGCOD	Character	30		As above, but descriptive

App. 3 WISE soil data entry sheet (version 1.0)

WISE_ID: |___|___|___|___|___|

WISE Soil Profile Data Entry Sheet - A

FAO-Unesco soil unit (1974): |___|___| Remarks:_____
Phase (1974): |___|___| Remarks:_____
Topsoil texture class: |___|
FAO-Unesco soil unit (1988): |___|___|__| Remarks:_____
Phase (1988): |___|___| Remarks:_____
USDA subgroup: *Descriptive* _____
edition (year): |___|___|
Local soil classification: *Descriptive* _____

SOURCE_ID: |___|___|___|___|___|___|___|
LAB_ID: |___|___|___|___|

Soil prof. description status: |___| Remarks:_____
Date (MM|YY): |___|___|___|___|

Country: |___|___| Remarks:_____
Location: *Descriptive* _____
Coordinates of soil profile:
LAT.: |___| N or S |___|___| degrees |___|___| minutes |___|___| seconds
LON.: |___| E or W |___|___|___| degrees |___|___| minutes |___|___| seconds
Altitude: |___|___|___|___| m
Landform: |___|___| Remarks:_____
Landscape position: |___|___| Remarks:_____
Aspect: |___|___|___|
Slope gradient (%): |___|___|___|
Drainage class: |___|___| Remarks:_____
Groundwater depth (mean high): |___|___|___| cm
Groundwater depth (mean low): |___|___|___| cm
Soil depth to rock: |___|___|___| cm (estimate when necessary)
Parent material/lithology: |___|___|___| Remarks:_____
Remarks on p.m./lithology: *Descriptive* _____
Köppen climate classification: |___|___|___| Remarks:_____
Name of climate station: *Descriptive* _____
Current land use (LU): |___|___|___| Remarks:_____
Main crop (for arable uses): |___|___| Remarks:_____
Vegetation (VE): |___|___| Remarks:_____
Remarks on LU or VE: *Descriptive* _____

No. of horizons for this profile: |___|

WISE_ID: |___|___|___|___|___|

WISE Soil Profile Data Entry Sheet - B

Horizon		top (cm)	bottom (cm)	Org. C (%)	Tot. N (%)	Tot. P (mg P_2O_5 kg^{-1})	pH			EC (dS m^{-1})	$CaCO_3$ (W%)	$CaSO_4$ (W%)	Exch. base cations (cmol(+) kg^{-1})				Exch. $Al^{3+}+H^+$ (cmol(+) kg^{-1})		CEC (cmol(+) kg^{-1})	ECEC (cmol(+) kg^{-1})	BS (%)
No.	Design.						H_2O	KCl	$CaCl_2$				Ca^{2+}	Mg^{2+}	K^+	Na^+	Acid.	Al^{3+}			
1																					
2																					
3																					
4																					
5																					
6																					

Hor	Matrix colour		Mottling	roots	Struct. type	Particle size distribution			Stone and gravel content (%v/v tot. soil)	Bulk dens. (g cm^{-3})	volume per cent water (% v/v) held at: (indicate pF for Field Capacity and Permanent Wilting Point)						AWC (% v/v)	Hydr. cond. (cm hr^{-1})	
	Dry	Moist				sand size	silt size	clay size			pF=	pF=	pF=	pF=	pF=	pF=		Sat.	Unsat.
1																			
2																			
3																			
4																			
5																			
6																			

-A reference to the source is attached as photocopy No.____ (SOURCE_ID= _____)

-A reference to laboratory methods is attached as photocopy No.:____ (LAB_ID= _____)

-A climatic data sheet is attached as photocopy No.: _____ (CLIM_ID= _____)

Name of climate station: _____

LAT.: |___|___| degrees |___|___| minutes, |___| N or S

LON.: |___|___|___| degrees |___|___| minutes, |___| E or W.

*The Data Entry Sheets must be used in conjunction with: *World Inventory of Soil Emission Potentials: Guidelines for soil profile selection and protocol for completing the WISE data entry sheets* (WPP 93/02, ISRIC, Wageningen) which specifies the compulsory data format. *Missing* numerical values must be entered as '-1.'

SOURCE_ID: |___|___|___|___|___|___|___|___|___|

Source (Authors + initials): *Descriptive*
year: |___|___|
title: *Descriptive*

series/publisher/year: *Descriptive*

LAB_ID: |___|___|___|___|
Laboratory name: *Descriptive*

Coding system for analytical methods:

Organic Carbon:	OC|___|
Total Nitrogen	TN|___|
Total Phosphorus	TP|___|
pH-water	PH|___|
pH-KCl	PK|___|
pH-$CaCl_2$	PC|___|
Electrical conductivity	EL|___|
Free CaCO3	CA|___|
Gypsum	GY|___|
Exch. Ca, Mg, K, and Na:	EX|___|
Exch. acidity and Aluminum:	EA|___|
CEC soil	CS|___|
ECEC soil	CE|___|
Base saturation:	BS|___|
Particle size distribution:	TE|___|
Bulk density	BD|___|
Moisture content	MC|___|
Hydraulic conductivity	HC|___|

App. 4 Example of WISE listing

WISE SOIL PROFILE DATA SHEET

WISE_ID: CA001 WISE/ISRIC - 05/04/93

Source_ID: PRO11 Lab_ID: CA01
Description status: 2 - routine description
Described on (MM/YY): 06/78

SOIL CLASSIFICATION:
FAO_Unesco Legend (1974): Luvic Chernozem Phase: -- Topsoil text.: M
FAO_Unesco Legend (1990): Luvic Chernozem Phase: --
USDA Soil Taxonomy (1975): Typic Argialboll
Local Classification System: Eluviated Black Chernozemic

SITE DATA:
Location: New Edmonton, Alberta (Canada) (Coord.: N 53 25 - ; W 113 33 -)
Altitude: 686 (m.a.s.l.)
Landform: plain
Position: crest Slope: 1% Aspect: E
Drainage class: moderately well to well drained
Groundwater: -1 to -1 (cm)
Eff. soil depth: -1 (cm)
Parent material: lacustrine (glacio-lacustrine, fine-textured overlying till)
Koeppen climate: Dbf (Humid cont., coldest mt < -3 C, warmest mt < 22 C and no dry season)
Land use (LU): annual field cropping (Main crop: --)
Vegetation (VE): --
Remarks on LU/VE: Research station, grains, horticulture, oilseed, farmland, exp. plots

PROFILE DATA:

Horiz.	Depth	Org. C	Tot. N	P tot	CACO	GYPS	pH H2O	pH KCl	pH CaCl2	ECe	Exch. bases and acidity Ca	Mg	K	Na	Ac	Al	CEC	ECEC	BS
Desig.	(cm)	(%)	(%)		(%)	(%)											(meq/100g)		(%)
Ap	0- 30	5.20	0.50	-1.00	0.00	-1.00	6.8	-1.0	6.4	-1.00	35.70	4.90	0.50	0.10	-1.00	-1.00	40.0	-1.0	100
Ac	30- 37	0.90	0.10	-1.00	0.00	-1.00	6.6	-1.0	6.2	-1.00	10.70	3.10	0.30	0.10	-1.00	-1.00	16.1	-1.0	88
Bt1	37- 87	0.30	0.04	-1.00	0.00	-1.00	6.5	-1.0	6.3	-1.00	11.20	4.20	0.50	-1.00	-1.00	-1.00	16.8	-1.0	-1
Bt2	87-113	0.30	0.04	-1.00	0.50	-1.00	7.2	-1.0	7.0	-1.00	18.20	6.60	0.70	0.10	-1.00	-1.00	21.8	-1.0	100
Ccag	113-130	-1.00	-1.00	-1.00	4.10	-1.00	7.6	-1.0	7.5	0.40	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.0	-1.0	-1

* Abbrev.: CACO= calcium carbonate; GYPS= gypsum; BS= base saturation; -1= missing values.
[P tot. expressed in mg P_2O_5 kg^{-1}; ECe expressed in dS m^{-1}]

Horiz.	Colour Dry	Colour Moist	M	R	Sand (%)	Silt (%)	Clay (%)	GR (%)	ST	Bd	pF00	pF10	pF15	pF17	pF20	pF23	pF25	pF27	pF34	pF37	pF42	AWC	HCs	HCu
Ap	-	10YR3/1	N	MF	22.0	53.0	25.0	0	SB	1.20	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1	-1.0	-1.0
Ac	-	10YR5/3	N	MF	28.0	51.0	21.0	0	PL	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	21.0	-1.0	-1.0	-1.0	8.2	13	-1.0	-1.0
Bt1	-	10YR4/3	N	MF	44.0	30.0	26.0	10	PR	1.80	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1	-1.0	-1.0
Bt2	-	10YR4/2	N	FF	27.0	38.0	35.0	10	PR	1.70	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	26.0	-1.0	-1.0	-1.0	15.0	11	-1.0	-1.0
Ccag	-	10YR5/4	F	O	23.0	49.0	28.0	5	MA	1.60	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1	-1.0	-1.0

* Abbrev.: m= mottles; r= roots; ST= structure; Bd= bulk density; kg m^{-3}); HC= hydraulic conductivity (mm hr^{-1}), saturated (s) resp. unsaturated (Hu); -1= missing values.

(Continued overleaf...)

REMARKS:

(Cont. for CA001)

a) Source:

Crown, P.H. and Greenlee, G.M., 1978. A soils and land use tour in the Edmonton Region Alberta. Tours E1, E2 and E3. 11th Congress of ISSS, p. 21-25.

b) Laboratory:

Canada Soil Survey Committee, 1976. Soil sampling and methods of analyses (Ed. by J.A. McKeague). Soil Research Istitute, Ottawa, 212 pp.

c) Additional comments:

None.

d) Summary of laboratory methods:

Organic Carbon (OC04):	Method of furnace combustion (e.g. LECO)
Total Nitrogen (TN01):	Method of Kjeldahl
Total P (TP--):	--
pH-H2O (PH02):	pH 1:2.5 soil/water
pH-KCl (PK--):	--
pH-CaCl2 (PC02):	pH in 1:2.5 soil/1M CaCl2 solution
Electr. conductivity (EL--):	--
CaCO3 content (CA04):	Calcimeter method
Gypsum content (GY--):	--
Exch. Ca, Mg, Na and K (EX01):	Various methods (no apparent differences in results)
Exch. acidity and aluminum (EA--):	--
Base saturation (BS01):	Sum of bases as percentage of CEC
CEC soil (CS01):	CEC in 1M NH4Ac buffered at pH 7
Effective CEC (CE01):	Sum of cations
Particle size analysis (TE01):	Pipette method, with appropriate dispersion treatment
Bulkdensity (BD02):	Clod samples
Soil moisture content (MC01):	sand/silt baths and porous plates
Hydraulic conductivity (HC--):	--

App. 5 General tips

1. Data entry plays a key role in any form of data analysis. Analyses which are based on incorrect data (i.e. sampling errors, description errors, analytical errors, errors in classification, coding errors, data entry errors) will produce erroneous results. Correct data entry therefore is critical for meaningful applications of the WISE system.

2. WISE does not include a full-scale validation procedure. Therefore, it is imperative that all entered data are checked for their accuracy directly upon their entry into the system. The best way of doing this is first to generate a listing with option <8> of the EDIT module. This listing is then compared with the manual data entry form, so that eventual differences/errors may be identified and marked. The listing will also reveal whether descriptive texts for all allowed codes have been defined in the relevant key-files.

3. It is recommended that for a particular profile at least the site and horizon data are entered in one session. This will reduce the risk of getting incompletely entered profiles in WISE. Entry of the full descriptions for the source name, laboratory name/reference and types of analytical methods used in this laboratory may be done at any suitable moment. This is so because the same codes may apply to different sets of profiles. It should be appreciated however, that a complete listing of a profile can only be generated once all the associated data have been entered.

4. Computer files can easily be lost or damaged, for instance after a power-failure or if the system "hangs-up", so that it is imperative to regularly make duplicate copies of these files. This process is known as making back-ups. Backups of WISE related datafiles residing on the hard disk should be made to a diskette each time new data have been added to the system. Keeping a double set of backups up to date is considered a good practice. The respective sets can be used on alternating days, ensuring that a fairly up to date set is always available in case the system crashes. In the worst case scenario, only the data sets for one whole day would have to be re-entered and re-checked for eventual data entry errors. Backups of the datafiles can be made with option <3> of the TOOLS menu.

4. Manipulation of data in WISE should always be done from copies of the original databases; the original version should never be tampered with in any way!

5. Regularly delete obsolete data files from the disk so that new free space is created on the hard disk. This may be done for individual profiles using option <5> of the TOOLS menu.