The Land Use Database

The Query Module

The Land Use Database

7. The Query Module

Instructions on the use of the Query Module, covering how to define a query condition, how to select fields to include in the query output, and how to export data to different file formats.

7.1 Introduction to Querying

For analysis of collected land use information stored in The Land Use Database, the data must be retrieved and exported to other software programs, e.g. to spreadsheets or statistical packages. The general procedure to retrieve and export a subset of information from a database is called a **query**. In relational databases such as The Land Use Database, the design of a query is rather complicated. In *Sections 7.1.1 - 7.1.4* a general introduction to querying relational databases is given. In the table below, an overview is given of the steps required to carry out a query with reference to the introductory Sections and the Sections where instructions for the Query Module are given.

	Essential Query Steps	Introduction	Instructions
1.	Select an approval file	Section 7.1.2	Section 7.3.1
2.	Define rules and construct query condition	Section 7.1.1	Section 7.4
3.	Define output fields	Section 7.1.3	Section 7.5
4.	Execute the query	-	Section 7.7

7.1.1 What is a Query Condition

With the condition of a query, a section of the relational database can be selected. From this section, data can be retrieved for selected parameters (output fields).

A query condition consists of one or more **rules**. Three examples of rules are shown in the table:

		Rule	
		Criterion	
Rule no.	**Field name**	**Operator**	**Value**
1.	Administrative area	is equal to	Zimbabwe
2.	Plot size	is larger than	0.5 hectares
3.	Material input	is equal to	urea

Each rule consists of a **field name**, an **operator** and a **value**. The operator connects the name of the field with the required value for that field. The combination of an operator and a value is a **criterion**.

In conditions consisting of several rules, the rules are combined by **boolean connectors** (AND and OR), and can be grouped within parenthesis. With the above three rules four different query conditions can be constructed. After application of these conditions, information can be retrieved from different sections of the database.

rule-1 AND rule-2 AND rule-3

Only information can be retrieved from datasets on land uses in Zimbabwe, on plots larger than 0.5 hectares and where urea was applied.

rule-1 AND (rule-2 OR rule-3)

Information can be retrieved from datasets on land uses in Zimbabwe that take place on plots larger than 0.5 ha, as well as on land use in Zimbabwe in which urea is applied.

rule-1 OR (rule-2 AND rule-3)

Information can be retrieved from all datasets on land uses in Zimbabwe can be retrieved, as well as from datasets on land uses (not restricted to Zimbabwe) that take place on plots larger than 0.5 hectare and in which urea is applied.

rule-1 OR rule-2 OR rule-3

Information can be retrieved from all datasets on land uses in Zimbabwe, as well as from all datasets on land uses taking place at plots larger than 0.5 hectares and all datasets on land uses in which urea is applied.

The combination of rules within a query condition can be visualized by a so called parse tree. For the condition, **rule-1 AND (rule-2 OR rule-3)**, the parse tree is:
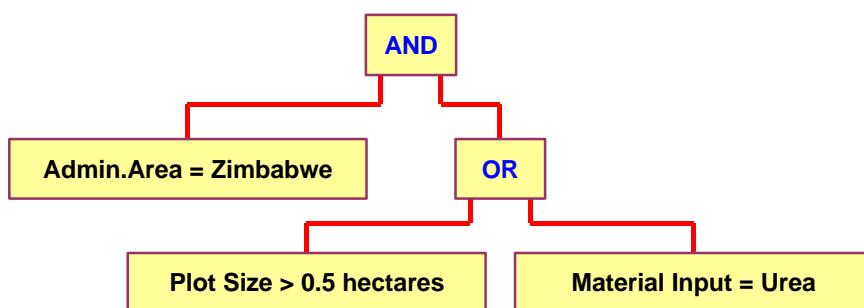
During query execution, individual rules are evaluated as 'true' or 'false' and subsequently the complete condition is assessed as true or false. For the evaluation of query conditions in relational databases the use of the so called 'approval file' is essential. The function of the approval file is explained in *Section 7.1.2*.

7.1.2   What is an Approval File

When a rule is evaluated as 'true' for data within a record, the whole record is 'approved'. This implies that all data in that record can be extracted. For example, when the rule 'material input = urea' was evaluated as true for a specific record, all information within that record may be retrieved as well, e.g. the urea quantity. You may also want to retrieve information from related data of the same dataset, which is stored in other records, e.g. information on the used implements.

The question is then of *which* implements information is required:
- Implements used for applying urea, or
- All implements used during the complete operation sequence.

In both cases, the rule of the query is identical: 'material input = urea', although the required query output is different. The problem is thus: 'How to determine which linked records may be used for data retrieval and which ones may not be used'.

The solution to this problem is the concept of the **approval file**. It functions as follows: when a rule is evaluated as 'true' for a record, not the record itself is approved, but the approval is shifted to a linked record in a another file. Records are linked when the files to which they belong are linked. This is the case when, in a schematic file structure as shown below, a file can be reached in one or more steps by going *only* left and up or *only* down and right. Thus, records in the **Operations** file are not linked to records in the **Infrastructure** file (this file cannot be reached by only going up and left), but are linked to those from the **Dataset Identifications** file (up and left), or the **Labour Inputs** file (down and below).

Dataset Identifications
└**Site Identifications**
  └**Land Use System Description**
    ├**Infrastructure**
    ├**Land Use Purpose and Quantities**
    ├**Operations**
    │ ├**Implements Used**
    │ ├**Material Inputs**
    │ ├**Obtained Products/Benefits**
    │ └**Labour Inputs**
    └**Observations**
      └**Implements Used**

The selection of an approval file determines from which section of the relational database information may be retrieved. This is shown in **Figure 14**.

A.   Approval file = Material Inputs.
Information can be retrieved from all records linked to the approved Material Input records, i.e. those containing urea as value for material input. No information can be retrieved from the file Implements Used.

B.   Approval file = Operations.
Information can be retrieved from all records that are linked to the approved Operations records. This implies that also information can be retrieved from Labour Input records. Also, information may be retrieved from Material Input records other than those in which urea is specified, which may be undesirable.

C.   Approval file = Land Use System Descriptions.
Information can be retrieved from all records linked with the approved Land Use System Description records. This implies that also information can be retrieved from records of the Infrastructure file. Also, information on operations in which *no* urea was used can be retrieved, which may be undesirable.

Depending on the type of information required, the approval file can be selected at different levels. When information is required on implements used, the approval file must be **Operations** or a higher file in the hierarchical structure.

A second function of the approval file is to 'converge' rules that contain field names belonging to related records in different files. For example, in addition to the rule 'material input = urea', there may be a rule stating that the 'administrative area = Zimbabwe'. Because these rules refer to related records in different files, one file (the approval file) must be selected in which records will be approved. In this example the Operations file or a higher file can be selected as the approval file, depending on what type of information is required.

C.A. de Bie
J.A. van Leeuwen
P.A. Zuidema
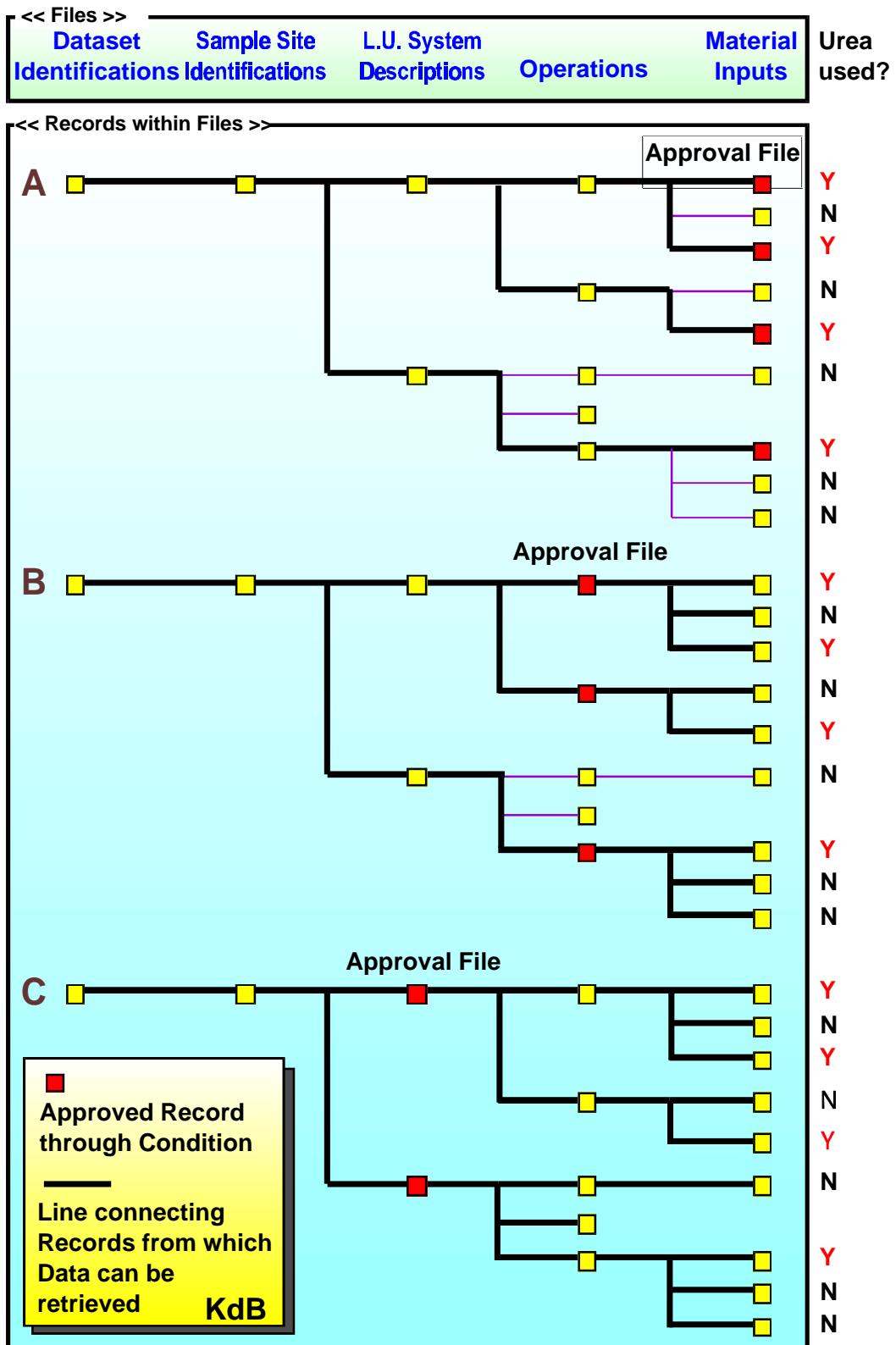
Figure 14. The effect of the selection of an approval file on the section of the relational database from which information can be retrieved.

7.1.3   What is Query Output

The contents of query output is determined by (1) the section of the relational database that has met the query condition; (2) within this section, the values of those parameters that were selected as output fields. Often, query output is presented as a flat file (table), since this format is required for data analysis. A flat file is less efficient to store data than a set of relational database files. This is shown in the next example.

In a relational database:

Dataset Identification	Sample Site Identification	Land Use SystemDescription
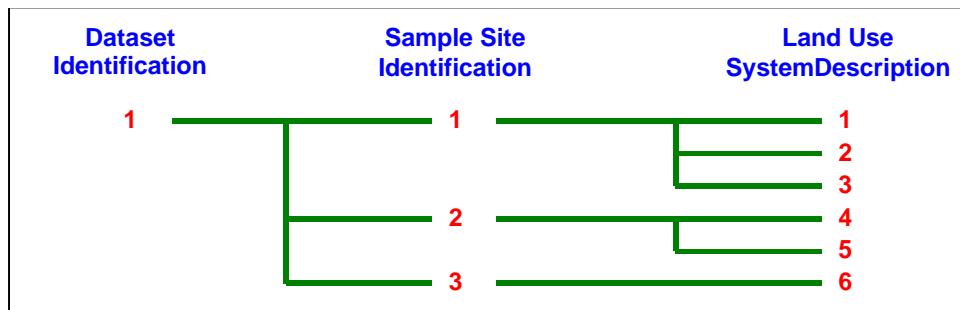
In a flat file:

Dataset Identifications	Site Identifications	Land Use System Descriptions
1	1	1
1	1	2
1	1	3
1	2	4
1	2	5
1	3	6

Due to the repetition of information in flat files (redundancy), query output files are often difficult to work with. It is therefore recommended to limit query output as much as possible to information retrieved from one file in a relational database.

7.1.4   What Steps to Consider before further Data Analysis

Much of the information in relation databases is stored as nominal (categorial) data. For instance, the field 'Operation Name' contains values such as 'Tillage, Ploughing, Along contours', or 'Crop Maintenance, Spraying'. When this type of information is included in query output, it cannot directly be used for certain data analysis routines, but must first be normalised.

Example

A regression analysis is required to find out if the operation 'Weeding' has more impact on yields than the operation 'Spraying'. The values of the field 'Operation Name' are then not in the suitable format: they must be transformed to fields (parameters). The generated query output contains the following information:

Dataset	Operation Name	Yield
1	Weeding	500
1	Spraying	500
2	Weeding	450
3	Spraying	200
4	Weeding	550

Each parameter value for Operation Name must be normalised, i.e. it must be transformed into a parameter with values 0 and 1. Add a column (field) for each of the values:

Dataset	Operation Name	Weeding	Spraying	Yield
1	Weeding	1	0	500
1	Spraying	0	1	500
2	Weeding	1	0	450
3	Spraying	0	1	200
4	Weeding	1	0	550

Then, compress the number of records and remove the extra column (field) for Operation Name:

Dataset	Weeding	Spraying	Yield
1	1	1	500
2	1	0	450
3	0	1	200
4	1	0	550

Now, the data are structured in a suitable way for regression analysis. Note that many statistical packages have built-in options to perform sorting, classification, clustering and normalisation.

7.2   How to Start the Query Module

7.2.1   The 'First' Main Menu

After you selected **Query** from the Main Menu of The Land Use Database (*Section 4.1*), the 'first' Main Menu of the Query Module is displayed:
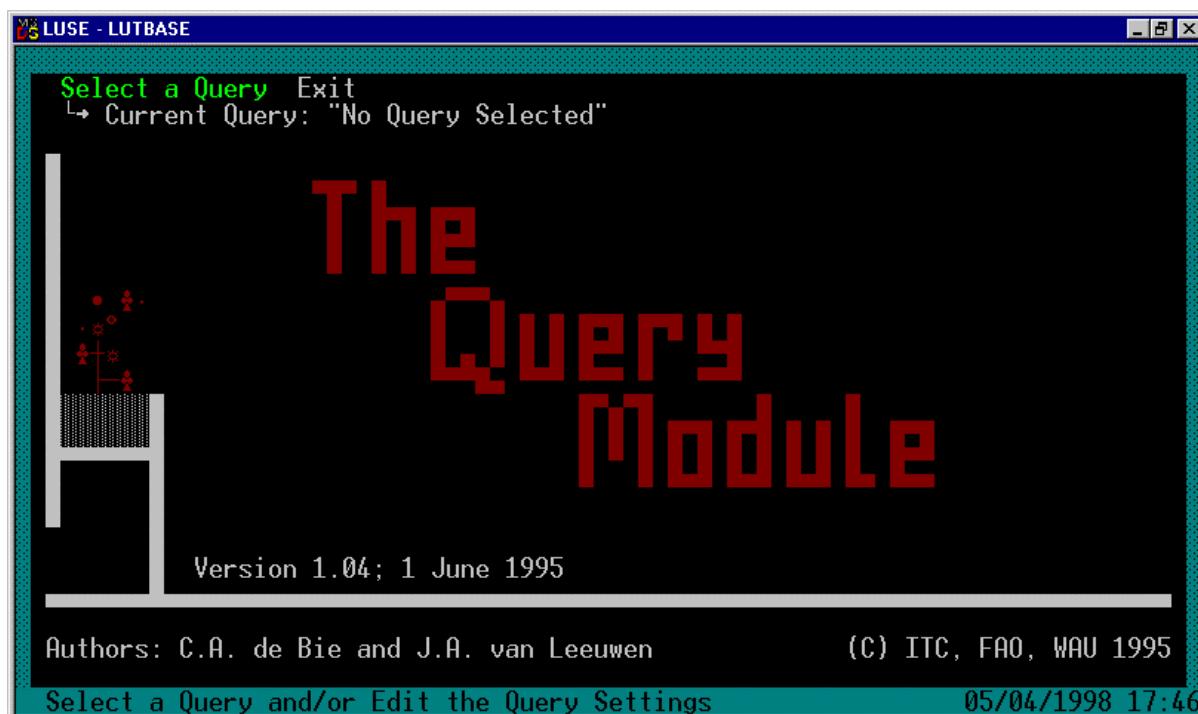
To select one of the two options from the 'first' main menu of the Query Module first highlight an option by using the arrow keys and then press **Enter** to select that option. The options are briefly explained below with reference to the Sections in which they are discussed:

Select a Query
　　With this option you can (*Section 7.2.2*):
- define a new query,
- select a stored query, and
- edit the setting of a stored query.

Exit or **Esc**
　　Exit the Query Module. You will return to the main menu of The Land Use Database.

7.2.2   Select a Query

Earlier defined queries are stored in The Land Use Database. After you selected the **Select a Query** option from the Query Main Menu, the **Queries** picklist appears which contains names of the stored queries. This picklist may either be empty or contain items:

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- The picklist is empty. No queries are currently stored. To **add** a query press **Ins** (**Section 7.3**).

```
┌«Queries»┐
│    «0»  │
└─────────┘
F1=Help Ins=Add
```

- The picklist contains one or more items:

```
┌«Queries»────────────────────────────────┐
│Coordinates of Single Cropping in Botswana│
│Spraying Biocides by Hand                 │
│Test Query                                │
│                                     «3»  │
└──────────────────────────────────────────┘
```

One or more queries are currently stored in The Land Use Database. Several options are available. Highlight an item from the picklist and choose one of the options:

- To **add** a new query press **Ins** (*Section 7.3*).
- To **select** a stored query in order to change condition, output fields and/or execute it press **Enter** (*Section 7.2.3*). Note that if items of the glossary have been grafted (*Section 5.2.12*), conditions of stored queries must be newly defined.
- To **edit the settings** of the highlighted query press **F10** (*Section 7.3*).
- To **print** information about a query press **F3**. Information on the settings, condition and output fields of the highlighted query is printed. This is **not** the query output, but information about aspects **of** the query (*Section 4.3.2*).
- To **copy** a query press **F5** (*Section 7.3*).
- To **delete** a query press **Delete** (*Section 4.3.3*).

7.2.3   The 'Second 'Main Menu

After you selected a query, the 'second' Main Menu of the Query Module is displayed, showing the name of the selected query and offering more options than the 'first' Main Menu:
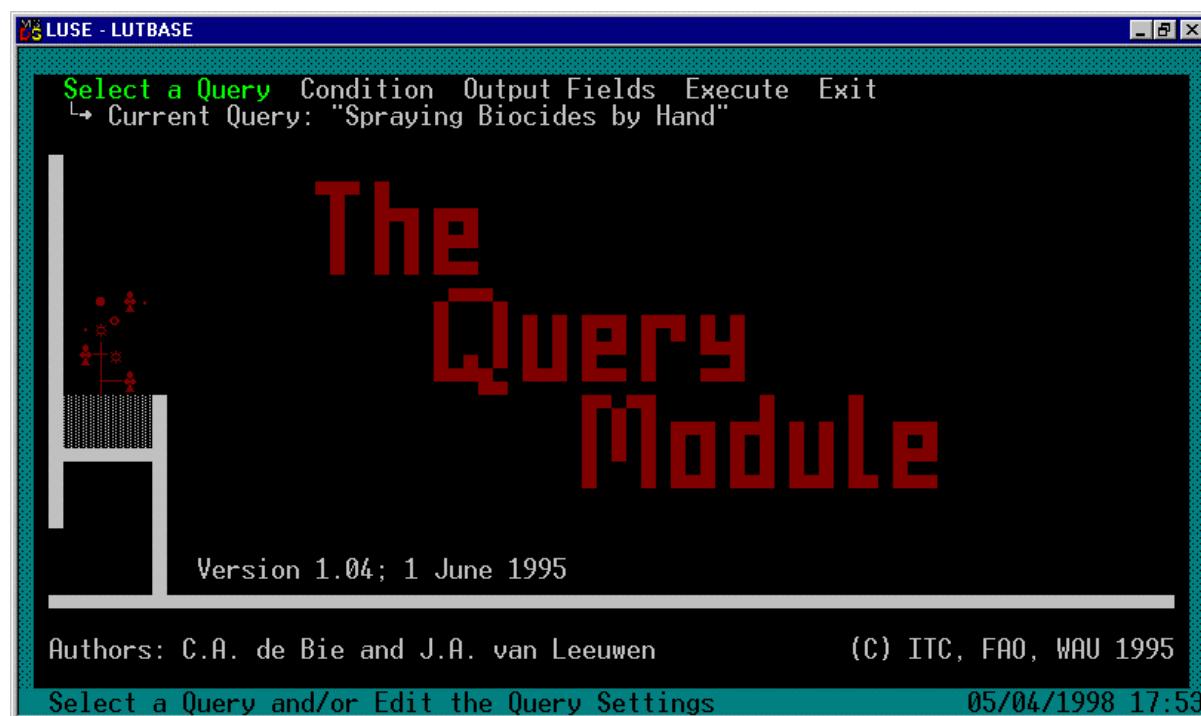
Choose one of the options from the 'second' Main Menu by selecting an option by using the arrow keys and then pressing **Enter**. The options are briefly explained below with reference to the Sections in which they are discussed:

Select a Query

With this option you can (*Section 7.2.2*):
- define a new query,
- select a stored query, and
- edit the setting of a stored query.

Condition

With this option you can (*Section 7.4*):
- define a new condition of the selected query, and
- edit the existing condition of the selected query.

Output Fields

With this option you can define from which fields (parameters) information must be included in the query output (*Section 7.5*). This option can not be chosen if the output format Land Use Database (multiple files) is selected in the query settings screen (*Section 7.3.3*).

Execute

With this option you can execute the selected query (*Section 7.7*).

Exit or Esc

Exit the Query Module. You will return to the main menu of The Land Use Database (*Section 4.1*)

7.3   Query Settings

If you wish to define a new query, or to copy or edit an existing one, the **Query Settings** screen will appear. In this screen, general information about a query is specified. Defining the query settings is a compulsory first step in preparing a query.

```
┌«Query Settings»──────────────────────────────────┐
│  Name                 :                           │
│  Approval File        : Dataset Identifications    │
│  Output Format        : Screen/Printer            │
│  Output File          : —                         │
│  Log File             : —                         │
│  Print Field Names?   : None                      │
│  Date Format          : dd/mm/yyyy                │
│  UTM Ellipsoid        : Airy 1849                 │
│  Query Type           : Without Formulas and Subqueries │
│  Used Items only?     : No                        │
└───────────────────────────────────────────────────┘
```

The fields of this edit screen are discussed below, or reference is given to the Section in which they are explained. Note that specification of one setting may influence other settings.

Description

The unique name of this query. Descriptive information on the query condition and output fields is stored here, e.g. **Biocides used for spraying**. To enter the query description type **a name**.

Approval File

The name of the file for which queried records are approved. This cannot be changed after a condition is defined. To invoke a picklist from which to select the approval file press **Enter** (*Section 7.3.1*).

Output Format

The (file) format in which query output is generated. To invoke a picklist from which to select the output format press **Enter** (*Section 7.3.2*).

Output File, or **Output Path**

The name of the output file to be generated or the path to which output files must be written. To enter the name of the output file or output path type **a name** (*Section 7.3.3*)

Log File

The name of the file to which information is written about the progress of query execution. To enter the name of the log file type **a name** (*Section 7.3.4*).

Print Field Names

A field name can be printed for each column of the query output. To invoke a picklist from which to select if and how field names are printed press **Enter** (*Section 7.3.5*).

Date Format

Dates in the query output may be written in three formats. To invoke a picklist press **Enter**. Select a date format, either **dd/mm/yyyy**, **mm/dd/yyyy**, or **yyyy/mm/dd** (*Section 6.2.2*).

UTM Ellipsoid

For conversion of locations from geographic coordinates to UTM coordinates and vice versa, conversion factors are used, derived from an ellipsoid (or spheroid). The default UTM Ellipsoid is selected in the settings screen in the Data Entry Module (*Section 6.2.2*). To invoke a picklist from which to select the ellipsoid/spheroid press **Enter** (*Section 6.2.2*).

Query Type

Complicated query conditions can be prepared if subqueries and formulas can be used. For explanations about the use of subqueries and formulas, see *Section 7.6*. To invoke a picklist from which to select if subqueries and formulas are allowed for the definition of a query condition and if formulas are allowed to define output fields press **Enter**.

Used Items only?

It is possible to limit the number of displayed glossary items that can be selected as value when defining the query condition to only those items used for definition of stored land use information or *a-priori* land use classes. For example, if all stored land use information is applicable for the administrative area "Africa-Zimbabwe", only this item and used items at lower levels (e.g. districts in Zimbabwe) may be selected when defining a criteria for the field administrative area. *A-priori* land use classes selected in the Add/Edit a Land Use System Description screen (*Section 6.6.1*) are also considered as glossary items. To invoke a picklist from which to select **Yes** or **No** press **Enter**.

After defining or editing the required fields in the edit screen, save the contents of the Query Settings screen press **F10**. You will then return to the **Queries** picklist (*Section 7.2*).

7.3.1 Approval File

The approval file is one file of a relational database in which records are approved during query execution (see *Section 7.1.2* for background information). After you pressed **Enter** in the **Approval File** field of the Query settings screen, a picklist with possible approval files appears from which to select an item. The picklist may contain three or many items:

- The picklist contains three items:

```
┌«Approval File»────────────────┐
│Dataset Identifications        │
│└Site Identifications          │
│   └Land Use System Descriptions│
│                          «3»┘ │
└───────────────────────────────┘
```

Only three files are displayed because **Land Use Data** (Land Use Database Files) was selected as **Output Format** in the **Query Settings** screen (*Section 7.3*). In this case, only large datasets are exported, which secures data integrity.

- The picklist contains many items:

```
┌«Approval File»────────────────┐
│Dataset Identifications        │
│└Site Identifications          │
│  └Land Use System Descriptions│
│      ├Infrastructures         │
│      ├Land Use Purposes and Quantities│
│      ├Operations              │
│         ├Implements Used      │
│         ├Material Inputs      │
│         ├Products/Benefits Obtained│
│         └Labour Inputs        │
│      └Observations            │
│         └Implements Used      │
│A-Priori Land Use Classes      │
│├Species/Services//Products/Benefits│
│└Classifiers                   │
│                         «15»┘ │
└───────────────────────────────┘
```

Any listed file may be selected as approval file.

Selection of an approval file, implies that only files of the relational database that are directly linked with the approval file can be used for the definition of the condition and the output fields (*Section 7.1.2*).

An overview of all files that may be selected as approval file and their links with other files is shown below:

Dataset Identifications
└**Site Identifications**
　└**Land Use System Description** ──────── **Link to:** → **A-Priori Land Use Classes**
　　├**Infrastructure**　　　　　　　　　　　　　　　├**Purpose Classifiers**
　　├**Land Use Purpose and Quantities**　　　　└**Operation Sequence and Context**
　　├**Operations**　　　　　　　　　　　　　　　　　　**Classifiers**
　　　　├**Implements Used**
　　　　├**Material Inputs**
　　　　├**Obtained Products/Benefits** ──── **Link to:** → **A-Priori Land Use Classes**
　　　　└**Labour Inputs**　　　　　　　　　　　　　├**Purpose Classifiers**
　　├**Observations**　　　　　　　　　　　　　　　└**Operation Sequence and Context**
　　　　└**Implements Used**　　　　　　　　　　　　　**Classifiers**
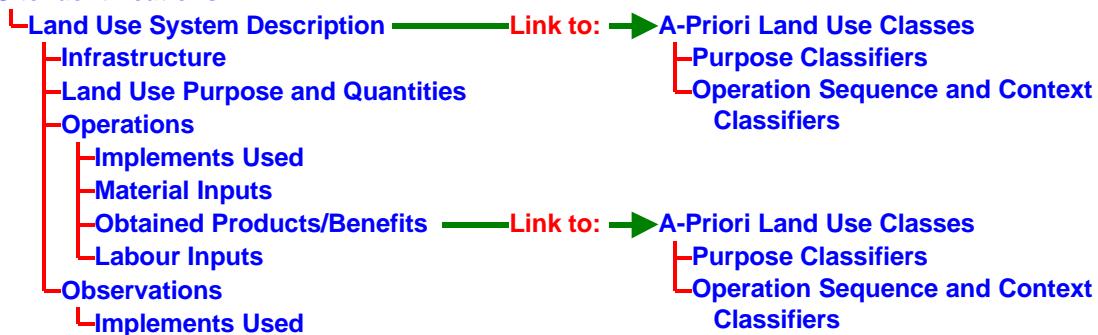
If **Operations** is selected as the approval file, only those files that are linked to this file may be used. This means: those files that can be reached by going *only* left and above or *only* down and right in the above scheme. In this case, these are:

Dataset Identifications
└**Site Identifications**
　└**Land Use System Description**
　　├**Infrastructure**
　　├**Land Use Purpose and Quantities**
　　├**Operations**
　　　　├**Implements Used**
　　　　├**Material Inputs**
　　　　├**Obtained Products/Benefits**
　　　　└**Labour Inputs**
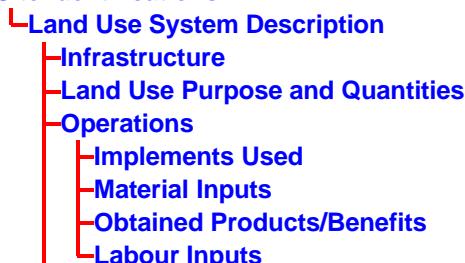
Files that are not linked with the approval file can be used in defining a query condition by using a subquery (*Section 7.6*). The files **A-Priori Land Use Classes**, **Purpose Classifiers** and **Op.Seq. and Context Classifiers** can always be used without a subquery: they are linked to the **Land Use Systems Descriptions** file and the **Obtained Products/Benefits** file.

The next figure shows the files that may be used for the definition of a condition and output fields for each possible selection of approval file.

Selected Approval File	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
A Dataset Identification	+	+	+	+	+	+	+	+	+	+	+	+	*	*	*
B └Site Identification	+	+	+	+	+	+	+	+	+	+	+	+	*	*	*
C └Land Use System Description	+	+	+	+	+	+	+	+	+	+	+	+	*	*	*
D ├Infrastructure	+	+	+	+	#	#	#	#	#	#	#	#	*	*	*
E ├Land Use Purpose and Quantities	+	+	+	#	+	#	#	#	#	#	#	#	*	*	*
F ├Operations	+	+	+	#	#	+	+	+	+	+	#	#	*	*	*
G ├Implements Used	+	+	+	#	#	+	+	#	#	#	#	#	*	*	*
H ├Material Inputs	+	+	+	#	#	+	#	+	#	#	#	#	*	*	*
I ├Obtained Products/Benefits	+	+	+	#	#	+	#	#	+	#	#	#	*	*	*
J └Labour Inputs	+	+	+	#	#	+	#	#	#	+	#	#	*	*	*
K └Observations	+	+	+	#	#	#	#	#	#	#	+	+	*	*	*
L └Implements Used	+	+	+	#	#	#	#	#	#	#	+	+	*	*	*
M A-Priori Land Use Classes	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+
N ├Purpose Classifiers	-	-	-	-	-	-	-	-	-	-	-	-	+	+	#
O └Op. Seq. and Context Classifiers	-	-	-	-	-	-	-	-	-	-	-	-	+	#	+

+　　Files that can be used directly.
#　　Files that can be used through a subquery (*Section 7.6*).
-　　Files that cannot be used.
*****　　The A-Priori Land Use Classes file and the two classifiers files can be used through the A-Priori Land Use Class fields in the Land Use System Descriptions and Products/Benefits obtained files. They can also be used through a subquery (*Section 7.6*).

7.3.2   Output Format

Query output can be written to different types of files or can be printed to the screen, or a printer. After you pressed **Enter** in the **Output Format** field of the query settings screen, a picklist appears:

```
┌«Output Format»────────────────────┐
│Screen/Printer                     │
│Land Use Data (Land Use Database Format)│
│Database - dBASE (One File)        │
│Text - SDF                         │
│Text - Comma Delimited             │
│Spreadsheet - 1-2-3 2.x            │
│Spreadsheet - 1-2-3 3.x            │
│Spreadsheet - Quattro              │
│Spreadsheet - Quattro Pro          │
│Spreadsheet - Symphony             │
│Spreadsheet - Excel 2.x            │
│Spreadsheet - Excel 3.x for Windows│
│Spreadsheet - Excel 4.x for Windows│
│                              «13» │
└───────────────────────────────────┘
```

Select one of the output formats from the picklist. If you wish to obtain the output in more than one format you must execute the query again several times, each time with a different output format setting.

Screen/Printer

> The query output is printed to the screen, a file or to a connected printer. If the output is sent to a printer and the width of the total output is larger than the **Report Width** specified in the Settings screen of the Data Entry Module (*Section 6.2*), the output is divided over several pages that can be pasted together. If this option is selected, the **Output file** field of the **Query Settings** screen is not applicable, and can therefore not be specified.

Land Use Data (Land Use Database Format)

> The query results can be written as database files in the original Land Use Database format (**.DBF** , **.DBT** and **.CDX** files). This is useful if you want to export a number of datasets belonging to one survey, e.g. to distribute it to a colleague who is only interested in a part of the collected dataset. The glossary files and settings files are an integral part with the data files. This means that, when moving the query output to another computer, all applicable files must ve copied. It is not possible to specify output fields when this output format is selected: all fields are automatically included in the output.

Database - dBASE (one File)

> The query results are written to one dBASE III or III PLUS compatible file (**.DBF**). Index files are not created. Information from free text windows (Comments) are stored in separate files (**.DBT**). Each field in the query output will automatically have an unique field name, so the **Add Field Names** option in the **Query Settings** screen cannot be specified.

Text - SDF

> The query output is written to an ASCII file in a so called "Structured Data Format". Output data is written in columns of a width that can be specified in **Output Fields**. No spaces, blanks, commas or other characters are written between the columns. Fields

that have a smaller width than specified, are filled with spaces. Field names that are wider than the specified column width, are continued on the next line.

Text - Comma Delimited
  The query output is written to an ASCII-file of reduced size. Fields within one column may have a variable width. Fields of different columns are separated with a comma. Text/number fields and free texts are placed between quotation marks (**"**), or start with a backslash (****) in case the field already contains a quotation mark. For character and memo fields, trailing spaces are stripped off.

Spreadsheet - 1-2-3 2.x
Spreadsheet - 1-2-3 3.x
Spreadsheet - Quattro
Spreadsheet - Quattro Pro
Spreadsheet - Symphony
Spreadsheet - Excel 2.x
Spreadsheet - Excel 3.x for Windows
Spreadsheet - Excel 4.x for Windows
  There are several options to write the query output to spreadsheets: versions of Lotus 1-2-3, Borland Quattro, Symphony and Excel. The column width for each field will be set to the width, as specified in **Output Fields** (*Section 7.5*). The spreadsheet output has the following characteristics:
- Numeric values are written in columns of the specified width **+ 1**.
- Dates are always written in the format **dd-mm-yy**.
- Free texts are truncated to the specified column width.
- Text/number fields are not truncated; a string of length 10 can be placed in a cell with a column width of 3.
- In text/number fields starting with a + or @ sign, these signs are preceded by a single quotation mark **'** , in order to prevent confusion with number or formula fields.

7.3.3   Output File or Output Path

The query output is written to a file or, if the output format is **Land Use Data (Land Use Database files)** to various files in a certain output path. Specification of the output file is not applicable if you selected **Screen/Printer** as output format.

Output File
  Enter the name of the output file, e.g. **C:\LUSE\RESULTS\TEST.DBF**. You do not need to enter the complete directory and file name:
- Without extension, e.g. **C:\LUSE\TEST**. The filename will be automatically stored with an extension specific for the selected output format:

Output Format	Extension of Output File
dBase (one File)	.DBF
Text - SDF (Structured Data Format)	.SDF
Text - Comma Delimited	.DEL
Spreadsheet - 1.2.3 2.x	.WK1
Spreadsheet - 1.2.3 3.x	.WK3
Spreadsheet – Quattro	.WKQ
Spreadsheet – Quattro Pro	.WQ1
Spreadsheet – Symphony	.WK1
Spreadsheet – Excel x.x	.XLS

If you enter a file name with an extension that does not belong to the output format, the program will not change it.

- Without directory, e.g. **TEST.DBF**. The file will automatically be written to the **C:\LUSE** directory.

Output Path

Enter the output path to which the various files in Land Use Database format must be written, e.g. **A:\QUERY**. The directory in which the files are stored must be empty, if not, you will be asked if existing files may be overwritten during the query execution. If you would like to write the files to the hard disk, the path must not be a subdirectory of the C:\LUSE directory.

7.3.4   Log File

When required, a log file may be created during query execution. This file will contain general information about the query (settings, condition and output fields) and about approved records and created output during query execution. A log file may be useful to check whether the query was executed properly. The log file will only be created if a file name is entered.

Enter a file name in the **Log file** field, e.g. **C:\LUSE\DATA\TEST.LOG**. You do not need to enter the complete directory and file name:

- Without directory, e.g. **TEST.LOG**. The log file will automatically be written to the **C:\LUSE** directory.
- Without extension, e.g. **C:\LUSE\TEST**. The file will be automatically stored with a **.LOG** extension.

Note that existing log files will be overwritten. An example of the contents of a log file is printed below for a query to obtain information about land use systems in which shelled grain is produced, and which are located in plots larger than 5 hectare. The codes at the bottom of the file are internal codes used to identify glossary items and a-priori land use classes.

```
* Logfile of Query
Date: 03/03/1995   Time: 15:35:03

Settings:
--------
Approval Alias: SEQUENCE

Edit Query Settings
-------------------
Name                :     Grains in Large Plots
Approval File       :     Land Use Systems Descriptions
Output Format       :     Spreadsheet - 1-2-3 3.x
Output Path         :     C:\BOTSWANA\GRAINS.WK1
Log File            :     C:\BOTSWANA\GRAINS.LOG
Headers in Output   :     Descriptive with Line
Date Format         :     dd/mm/yyyy
UTM Ellipsoid       :     Geodetic Reference System (GRS) 1980
Query Type          :     No Formulas and Subqueries
Used Items only?    :     Yes

Query Condition
---------------
Product/Benefit is equal to Plant Produce, Flowers/Fruits/Seeds, Grain (Cereals), Shelled
 and
Minimum Plot Size is larger than 5.0 Hectare (ha) (10000.0000000000) (>> Plot Size Unit)

Output Fields
-------------
Column              :     Dataset Number
```

```
                              QUESTION->Quest_Nr
Display Format        :       As entered
Column Width          :       4

Column                :       Administrative Area
                              QUESTION->Ctry_ID
Display Format        :       Description: last Level
Column Width          :       30

Query Condition
---------------
   Alias              :       CAQUAN
   Criterion          :       Product/Benefit is equal to Plant Produce, Flowers/Fruits/Seeds, Grain (Cereals),
                              Shelled
   Condition          :       LEFT( CAQUAN->SOUTP_ID, 4) == '     2 '
AND
   Alias              :       SEQUENCE
   Criterion          :       Minimum Plot Size is larger than 5.0 Hectare (ha) (10000.0000000000) (>> Plot Size
                              Unit)
   Condition          :       Conv2Unit(SEQUENCE->Size,SEQUENCE->Size_Unit, ConvValue, '   ') > 5.0

EVALCONDIT Evaluating LEFT( CAQUAN->SOUTP_ID, 4) == '     2 '
Results (in LBQ00005):
       1           2           5           9          10          12          13
      16          19          21          22          27          36          53
      54          63          69          70          71          72          73
      80          83          84          86          87         106         107
     113         116         118         120         121         129         132
     133         134         135         137         141         142         143
     147         148         149         151         152         154         159
     161         163         164         165         166         167         168
     170         172         173         174         175         176         177
     178         179         180         183         185         189         190
     191         192         193         196         197         199         205
     206         207         211         213         214         215         216
     218         219         220         221         222         223         225
     234         235         237
(Count: 94)
------------------------------------------------------------------
Conv. Factor for Hectare (ha) is 10000.0000000000

EVALAND ANDing Conv2Unit(SEQUENCE->Size,SEQUENCE->Size_Unit, ConvValue, '   ') > 5.0
with LBQ00005
(90 Deleted)
Results (in LBQ00005):
     113         154         225         237
(Count: 4)
------------------------------------------------------------------

Making Output
-------------
Files in use:
SEQUENCE        1.1.1
QUESTION        1

Column  1     :       Dataset Number
 Real         :       QUESTION->Quest_Nr
 Picture      :       1 => As entered
 Glossary:

Column  2     :       Administrative Area
 Real         :       QUESTION->Ctry_ID
 Picture      :       9 => Description: last Level
 Glossary     :       AA

SEQUENCE     113                        46   1   1
QUESTION     113                        46
SEQUENCE     154               U        77   1   1
QUESTION     154               U        77
SEQUENCE     225                  68   1   1
QUESTION     225                  68
SEQUENCE     237                  80   1   1
QUESTION     237                  80

* EOF Logfile
```

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7.3.5 Print Field Names

After pressing **Enter** in the **Print Field Names** field of the **Query Settings** screen, a picklist is displayed from which to select whether field names must be printed, and if so, how they must be printed.

```
┌«Print Field Names?»─┐
│None                 │
│Descriptive          │
│Descriptive with Line│
│Unique               │
│                «4»──┘
```

None
> No field names are printed as headers for the columns of the query output. The first line in the query output will be the first data line.

Descriptive
> A complete descriptive field name is printed as header of each column in the query output.

Descriptive with Line
> As previous, but in addition to a header, also a dashed line is printed between the headers and the output data.

Unique
> A unique field computer-generated name of maximal 8 characters (letters, digits, underscores) is printed as a header for each column in the query output.

7.4 Condition

The query condition consists of a number of rules that must be combined with boolean connectors and which may be grouped through parentheses. Basic information on defining a query condition is provided in *Section 7.1.1*.

Note that defining a query condition is not compulsory. If no condition is defined, information can be retrieved from all records stored in The Land Use Database.

After you selected **Condition** from the second Query Main Menu, the **Query Condition** picklist appears, in which you can add new rules, or edit existing ones. This picklist may either be empty, or contain one to several items:

- The picklist is empty:

```
┌«Query Condition»┐
│            «0»──┘
```

  No rules are currently defined for this query condition. There are two options:
  - To **add** a new rule press **Ins**. Continue with the selection of a file (*Section 7.4.1*).
  - To **cancel** the definition of the querty condition press **Esc**. You will return to the second Main Menu of the Query Module (*Section 7.2.3*).

- The picklist contains one item:

```
┌«Query Condition»─────────────────────────────────────────┐
│Maximum Number of Used Implements is not between 67.0 and 56.0│
│                                                        «1»│
└──────────────────────────────────────────────────────────┘
```

The condition currently consists of one rule. There are several options:
- To **add** a new rule press **Ins**. Continue with the selection of a file (*Section 7.4.1*).
- To **edit** the highlighted rule press **Enter**. Continue with the selection of a file.
- To **copy** a rule press **F5**. The copied rule will appear below the original rule.
- To **save** the query condition and **exit** the picklist press **Esc**. After the program has checked the validity of the condition, you will return to the second Main Menu of the Query Module (*Section 7.2.3*). When you already have defined the output fields, the query can now be executed (*Section 7.7*).

- The picklist contains more than one item:

```
┌«Query Condition»────────────────────────────────────────┐
│(                                                         │
│■ Average Parcel Size is larger than 25.0 Are (100m²) (100.0000000000)(├─ Par│
│  or                                                      │
│Implement is equal to Mechanically Powered, Tractors      │
│) and                                                     │
│Administrative Area is equal to Africa, Botswana          │
│                                                       «6»│
└──────────────────────────────────────────────────────────┘
```

The condition may consists of several rules, boolean connectors and parentheses. There are several options in this picklist. Choose an option:
- To **add** a rule press **Ins**. Continue with the selection of a file (*Section 7.4.1*).
- To **add** the boolean connector **and** press **Alt-A**.
- To **add** the boolean connector statement **or** press **Alt-O**.
- To **add** an opening parenthesis "**(**" before the highlighted rule press **(**. The parenthesis is placed as a separate item above the rule, or together with a boolean statement, e.g **and (**.
- To **add** a closing parenthesis "**)**" after the highlighted rule press **)**. The parenthesis is placed as a separate item below the rule, or together with a boolean statement, e.g **) and**.
- To **edit** the highlighted rule press **Enter**. Continue with the selection of a file.
- To **change** the highlighted boolean connector **and** into **or** press **Alt-A**; and to change **or** into **and** press **Alt-O**.
- To **move** the highlighted rule press **Alt-M** (*Section 7.4.7*).
- To **copy** the highlighted rule press **F5**. The new rule will be last in the row and will be linked to the previous by the boolean connector **and**.
- To **delete** the highlighted rule press **Del**. The highlighted rule will be deleted without confirmation.
- To **delete** the highlighted boolean connector, parenthesis or both press **Del**. If the highlighted item contains both a parenthesis and a boolean connector, a picklist is displayed from which to select what must be deleted: the parenthesis, the boolean connector or both.
- To **save** the query condition and **exit** the picklist press **Esc**. After the program has checked the validity of the condition, you will return to the second Main Menu of the Query Module (*Section 7.2.3*). When you already have defined the output fields, the query can now be executed (*Section 7.7*).

7.4.1   Select a File

To define a rule for a query condition, the first step is to select a file which includes the field that must meet a certain criterion. After you pressed **Ins** or **Enter** in the **Query Condition** picklist, the **Select a File** picklist appears containing several files.

Which files and how many files are shown in the picklist depends on the selected approval file. A table showing which files may be used for different selections of approval files is included in *Section 7.3.1*.

In case you selected the option **Allow Formulas and Subqueries** as **Query Type** in the query settings, the **Select a File** picklist also contains the item **<Formula>**.

An example of a **Select a File** picklist after selection of **Dataset Identifications** as approval file and **Allow Formulas and Subqueries** as query type, is shown below. Two more examples are shown after following the instructions.

```
┌«Select a File»─────────────────────┐
│Dataset Identifications             │
│└Site Identifications               │
│   └Land Use System Descriptions    │
│      ├Infrastructures              │
│      ├Land Use Purposes and Quantities│
│      ├Operations                   │
│      │  ├Implements Used           │
│      │  ├Material Inputs           │
│      │  ├Products/Benefits Obtained│
│      │  └Labour Inputs             │
│      └Observations                 │
│         └Implements Used           │
│<Formula>                           │
│                              «13»  │
└────────────────────────────────────┘
```

In this case, there are three options:

- To **select** the highlighted file press **Enter**. Continue with the selection of a field (*Section 7.4.2*).
- To **define a formula** as a condition highlight **<Formula>** and press **Enter**. This option is only available when **Allow Formulas and Subqueries** is selected as **Query Type** in the query settings (*Section 7.6.3*).
- To **cancel** the selection of a file press **Esc**. You will return to the **Query Condition** picklist (*Section 7.4*)

Two more examples of the possible **Select a File** picklists are shown below.

- If the approval file is **Labour Inputs**, the **Select a File** picklist will be:

```
┌«Select a File»──────────────────────┐
│Dataset Identifications              │
│└Site Identifications                │
│   └Land Use System Descriptions     │
│      ├Operations                    │
│      │  └Labour Inputs              │
│<Formula>                            │
│                               «6»   │
└─────────────────────────────────────┘
```

- If the approval file is **Land Use Classes** the **Select a File** picklist will be:

```
┌«Select a File»─────────────────────┐
│A-Priori Land Use Classes            │
│ ├─Species/Services//Products/Benefits│
│ └─Classifiers                        │
│<Formula>                             │
│                                 «4»─┘
```

7.4.2   Select a Field

The second step to define a rule is the selection of a field that must meet a certain criterion. After you selected a file from the **Select a File** picklist, by pressing **Enter**, the **Select a Field** picklist appears. It contains fields of the selected file. An example of the fields of the land use system description file is shown below. A complete list of fields that may be used is included in Appendix 3.
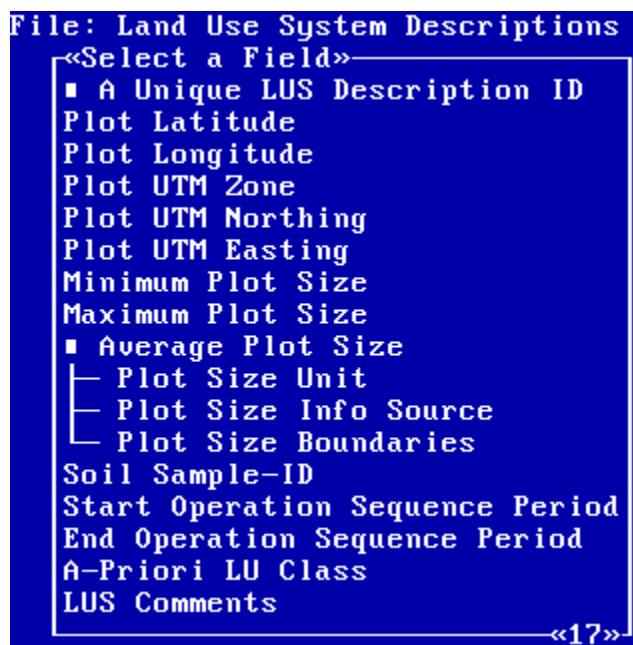
```
File: Land Use System Descriptions
  ┌«Select a Field»──────────────┐
  │ ■ A Unique LUS Description ID  │
  │Plot Latitude                  │
  │Plot Longitude                 │
  │Plot UTM Zone                  │
  │Plot UTM Northing              │
  │Plot UTM Easting               │
  │Minimum Plot Size              │
  │Maximum Plot Size              │
  │ ■ Average Plot Size           │
  │  ├─ Plot Size Unit            │
  │  ├─ Plot Size Info Source     │
  │  └─ Plot Size Boundaries      │
  │Soil Sample-ID                 │
  │Start Operation Sequence Period│
  │End Operation Sequence Period  │
  │A-Priori LU Class              │
  │LUS Comments                   │
  │                         «17»─┘
```

Fields that do not appear in the edit screens during the data entry procedures, but which can be selected to define a rule are marked with a   :
- **A   Unique .... ID** is the identifier number for a record within the selected file of the database. These fields can be used if you want to define a sub-query (*Section 7.6.1*).
- **Average ....** is the average value of minimum and maximum fields, e.g. **Average Holding Size**.

Choose one of the following options:
- To **select** the highlighted field press **Enter**. Continue with the selection of an operator (*Section 7.4.3*).
- To **cancel** the selection of a field press **Esc**. You will return to the **Select a File** picklist (*Section 7.4.1*)

7.4.3 Select an Operator

The third step to define a rule is the selection of an operator that connects the field with the value that it must have (*Section 7.1.1* for general information on operators).

After you selected a field from the **Select a Field** picklist, by pressing **Enter**, two types of picklists may appear:

- A picklist with two items appears. The operator was automatically selected as **is equal to** (*Section 7.4.5*).

- The **Select an Operator** picklist appears. The provided operators are related to the type of field you selected. An example picklist for the field **A Unique Dataset ID** is displayed below, followed by instructions. For a list of all available operators and explanations, see *Section 7.4.4*.

```
File: Dataset Identifications
└─Field: ■ A Unique Dataset ID
  ┌─«Select an Operator»───────────┐
  │ is equal to                    │
  │ is not equal to                │
  │ is smaller than                │
  │ is smaller than or equal to    │
  │ is larger than                 │
  │ is larger than or equal to     │
  │ is between                     │
  │ is not between                 │
  │ is unspecified                 │
  │ is specified                   │
  │ having                         │
  │ not having                     │
  │                         «12»─┘
```
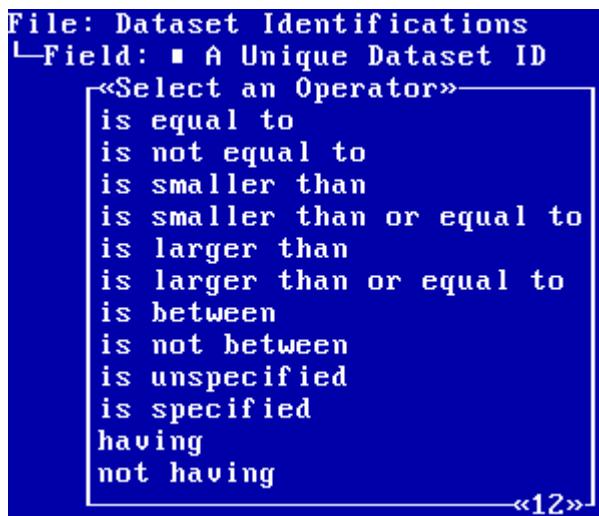
There are two options:
- To **select** the highlighted operator press **Enter**. Depending on your selection, there are three possibilities:
  - The **Query Condition** screen appears. The selected operator does not require specification of a value, e.g. **is not empty**. The new rule is added to the **Query Condition** picklist (*Section 7.4*).
  - A picklist appears from which to select a value (*Section 7.4.5*).
  - An edit screen appears in which to enter the value (*Section 7.4.6*).
- To **cancel** selection of an operator press **Esc**. You will return to the **Select a File** picklist (*Section 7.4.1*).

7.4.4 List of Operators

An alphabetical list of all available operators with explanations given below. The set of operators that may be selected depends on the type of field, as is shown in the cross table following the list of operators. The field type for all fields is included in Appendix 3.

contains
   The field must contain a certain string of letters and/or numbers.

does not contain

The field must not contain a certain string of letters and/or numbers.

ends with

The information in the field must end with a certain string of letters and/or numbers.

having

The information of the selected field must be linked with records containing a field that meets a criterion. This operator is applicable in two cases.

- If the field **A-Priori LU Class** was selected. It is then possible to link this field with fields from the **A-Priori LU Classes**, **Purpose Classifiers** and **Op.Seq. and Context Classifiers** files.
- If a **A Unique ... ID** field was selected and **Allow Formulas and Subqueries** was selected as **Query Type**, a subquery can be executed. For information and instructions on subqueries see *Section 7.6.1*.

is between

The value of the field must be within the range of two numerical values.

is empty

The field must not contain any information.

is equal to

The value of the field must be equal to a certain value or string of numbers and/or letters.

is larger than

The value of the field must be larger than a certain numerical value. In case the field contains dates, this operator means "is after".

is larger than or equal to

The value of the field must be larger than or equal to a certain numerical value. In case the field contains dates, this operator means "is after, including the specified date".

is not between

The value of the field must not be within the range of two numerical values.

is not empty

The field must contain information.

is not equal to

The value of the field must not be equal to a certain value or string of numbers an/or letters.

is smaller than

The value of the field must be smaller than a certain numerical value. In case the field contains dates, this operator means "is before".

is smaller than or equal to

The value of the field must be smaller than or equal to a certain numerical value. In case the field contains dates, this operator means "is before, including the specified date".

is specified

The field must contain information.

is unspecified

The field must not contain information.

not having

The information of the selected field must not be linked to records containing a field that meets a certain criterion. See under **having** for more information.

starts with

The information in the field must start with a certain string of letters and/or numbers.

The following table shows the operators that can be used in the definition of a rule, depending on the type of field selected. The types of fields of all fields can be found in Appendix 3.

	Type of Field							
	>> fields			- fields				
Operators	**g**	**a**	**f**	**n**	**c**	**m**	**d**	**l**
contains	-	-	-	-	*	*	-	-
does not contain	-	-	-	-	*	*	-	-
ends with	-	-	-	-	*	-	-	-
having	-	*	-	-	-	-	-	-
is between	-	-	-	*	*	-	*	*
is empty	-	-	-	-	-	*	-	-
is equal to	*	*	*	*	*	-	*	*
is larger than	-	-	-	*	*	-	*	*
is larger than or equal to	-	-	-	*	*	-	*	*
is not between	-	-	-	*	*	-	*	*
is not empty	-	-	-	*	-	*	-	-
is not equal to	*	*	-	*	*	-	*	*
is smaller than	-	-	-	*	*	-	*	*
is smaller than or equal to	-	-	-	*	*	-	*	*
is specified	*	*	-	*	*	-	*	*
is unspecified	*	*	-	*	*	-	*	*
not having	-	*	-	-	-	-	-	-
starts with	-	-	-	-	*	-	-	-

| * | = | operator can be selected |
| - | = | operator cannot be selected |

>> fields = fields in which picklist items are entered; e.g. from:
    g = glossary
    a = a-priori land use classes
    f = fixed picklists

- fields = fields in which text or numbers are entered; i.e.:
    n = numbers only
    c = characters
    m = free texts
    d = dates
    l = latitudes and longitudes

7.4.5   Specify the Value in a Picklist

The fourth step to define a rule is to specify the value that the selected field must have. After selecting the operator, the value may either be specified by selecting an item from a picklist or entering it into an edit screen (*Section 7.4.6*). This step is only necessary if specification of a value is compulsory for the selected operator. Two types of picklists may be invoked:

- A fixed picklist without title, for example:

```
File: Land Use System Descriptions
└Field: Plot Size Boundaries
     is equal to

     ┌──────────────────────────────────┐
     │ Based on actual Plot Boundaries  │
     │ Based on Enumerator-defined Boundaries │
     └────────────────────────────«2»──┘
```

The picklist contains two fixed items from which to select one. The contents of the picklist depends on the field that you selected. There are four fields in The Land Use Database in which fixed picklists are used: **Dataset Type**, **Plot Aggregation**, **- Plot Size Boundaries** and **Periodicity**.

To **select** the highlighted item press **Enter**. After selection, you will return to the **Query Condition** picklist. The newly defined rule is added to the picklist (**Section 7.4**).

- A picklist with glossary items, for example:

```
File: Land Use System Descriptions
└Field: Plot Size Info Source
     is equal to
  ┌«Info Sources»────────────────────────────┐
  │  5 Collected in the Plot              0 »│
  │ 10 Collected from Documents           0  │
  │ 15 Inferred Information               0  │
  │ 20 Aggregated Information             0  │
  └──────────────────────────────────────«4»┘
```

The picklist corresponds to the first level of a glossary tree. The contents of the picklist depends on the field that you selected. The required field value can be selected from this picklist.

There are several options in this picklist. Choose one of the following options:
- To **select** the highlighted item, i.e. field value press **Enter**. If there is a next level for this item, you will go to this level, in which you can again select an item or choose **Unspecified** by pressing **F6**. After selection, you will return to the **Query Condition** picklist. The newly defined rule is added to the picklist (*Section 7.4*).
- To **cancel** the specification of a value press **Esc**. You will return to the **Select an Operator** picklist (*Section 7.4.3*).
- To **search** for an item in the applicable glossary tree press **F4** (*Section 4.3.4*).
- To **print** information on items of this glossary tree press **F3** (*Section 4.3.4*).

7.4.6   Specify the Value in an Edit Screen

As stated in the previous Section, the fourth step to define a rule is to specify the value that the selected field must have. After selecting the operator, the value may either be specified by selecting an item from a picklist (*Section 7.4.5*) or entering it into an edit screen. This step is only necessary if specification of a value is compulsory for the selected operator.

An edit screen is invoked, for example:

```
File: Land Use System Descriptions
└─Field: ■ Average Plot Size
     is equal to


   ■ Average Plot Size :      0.0
```

The edit screen contains one field in which to enter the required value of the field that you selected. There are two options:

- To **enter** the value type **numbers** and/or **letters** and press **Enter** or **F10**. After this, three screens may be displayed:
  - The **Query Condition** picklist appears. The newly defined rule is added to the picklist, see *Section 7.4*.
  - Another edit screen appears in which to enter a second value, in case you selected the operator is **between** or is **not between**. After entering the second value, the **Query Condition** picklist appears.
  - The **Data Units** picklist appears from which to select the data unit of the required value. This is only applicable for fields that are connected with a data unit. After selection of a data unit, the **Query Condition** picklist appears.
- To **cancel** the specification of a value press **Esc**. You will return to the **Select an Operator** picklist (*Section 7.4.3*).

7.4.7   Move a Rule

Rules can be moved in the **Query Condition** picklist when required. After you pressed **Alt-M** for the highlighted rule that you want to move, a copy of the condition is displayed on top of the original picklist:

```
┌«Query Condition»────────────────────────────────────────────────────┐
┌«Move Query Condition»─────────────────────────────────────────────
 (
 ■ Average Parcel Size is larger than 25.0 Are (100m²) (100.0000000000)(├─ Par
  or
 Implement is equal to Mechanically Powered, Tractors
 ) and
 Administrative Area is equal to Africa, Botswana
 <Last Item>
                                                                   «7»
```

There are three options:
- To **move** the rule to the lowest position in the picklist then highlight **Last Item** and press **Enter**.
- To **move** the rule to another position highlight the item **below** the new position of the rule and press **Enter**.
- To **cancel** the move press **Esc**.

In both cases you will return to the **Query Condition** picklist (*Section 7.4*).

7.5   Output Fields

The selection of fields that are included in the query output is called 'output fields'. This option is not available if you selected **Land Use Data (Land Use Database Format)** as output format in the **Query Settings** screen (*Section 7.3*).

It is recommended to extract information from one file of The Land Use Database at the time if you wish to extract large amounts of information (*Section 7.1.3* and Appendix 6). Thus, execute the query several times with different specifications for the output fields.

After you selected **Output Fields** from the second Main Menu of the Query Module, the **Output Fields** picklist appears. There are two possibilities:

- The picklist is empty:

```
┌«Output Fields (Parameters)──────┐┌Display Format─────┐┌Width┐┌Sort Order─┐┌SPr»┐
 Enumerator's Name                  As entered           20    0-9,A-Z,a-z     5
 Operation Name                     Item Code            30    z-a,Z-A,9-0    10
 Plot Latitude                      Negative values in ()║11;5
 Plot Longitude                     Negative values in ()║12;5
 A-Priori LU Class                  Item Names of all Lev║100
                                                                          «5»
```

No output fields were earlier defined and stored for the current query. There are two options:
  - To **add** a new output field press **Ins**. Continue with the selection of a file (*Section 7.5.1*).
  - To **cancel** definition of output fields press **Esc**. You will return to the second Main Menu of the Query Module (*Section 7.2.3*).

- The picklist contains one or more items:

```
┌«Output Fields (Parameters)──────┐┌Display Format─────┐┌Width┐┌Sort Order─┐┌SPr»┐
 Enumerator's Name                  As entered           20    0-9,A-Z,a-z     5
 Operation Name                     Item Code            30    z-a,Z-A,9-0    10
 Plot Latitude                      Negative values in ()║11;5
 Plot Longitude                     Negative values in ()║12;5
 A-Priori LU Class                  Item Names of all Lev║100
                                                                          «5»
```

One or more output fields were defined for the current query. Each output field is displayed in one row, containing information about the selected field (parameter), e.g. **Enumerator's Name**, the format in which the information will be displayed in the output, e.g. **As entered**, the width of the column in which the information will be written, e.g. **20**, the order of the records within an output column, e.g. **0-9,A-Z,a-z,** and the priority for sorting the output fields, e.g. **5**.

The items in the **Output Fields** picklist are displayed in the order of the sorting priority (SPr): the output fields with the lowest sorting priority number appears first. The output fields for which no sorting priority was defined are displayed below.

Several options are available. Choose one of the following options:

- To **add** a new output field press **Ins**. Continue with the selection of a file (*Section 7.5.1*).
- To **edit** the highlighted output field press **F10** or **Enter**. Continue with the selection of a file (*Section 7.5.1*).
- To **move** the highlighted output field press **Alt-M**. This is only possible for output fields for which no **Sorting Order** is specified (*Section 7.5.9*).
- To **copy** the highlighted output field press **F5**. The new output field will be the highlighted one after copying, and will have the same display format, width, etc., as the original one.
- To **delete** the highlighted output field press **Del**.
- To **save** the output fields and **exit** the picklist press **Esc**. You will return to the 'second' Main Menu of the Query Module (*Section 7.2.3*). When you have defined a query condition, the query can now be executed (*Section 7.7*).

7.5.1   Select a File

The first step to define an output field is the selection of a file containing the field from which information in required. After pressing **Ins**, **Enter** or **F10** in the **Output Fields** screen, the **Select a File** picklist appears containing a number of files.

Which files and how many files are shown in the picklist depends on the selected approval file. A table showing which files may be used for all possible selections of approval files is included in *Section 7.3.1*.

If you selected the option **Allow Formulas and Subqueries** as **Query Type** in the query settings, the picklist may also contain the item **<Formula>**.

An example of a **Select a File** picklist after selection of **Dataset Identifications** as approval file and **Allow Formulas and Subqueries** as query type, is shown below. For other examples, see *Section 7.4.1*.
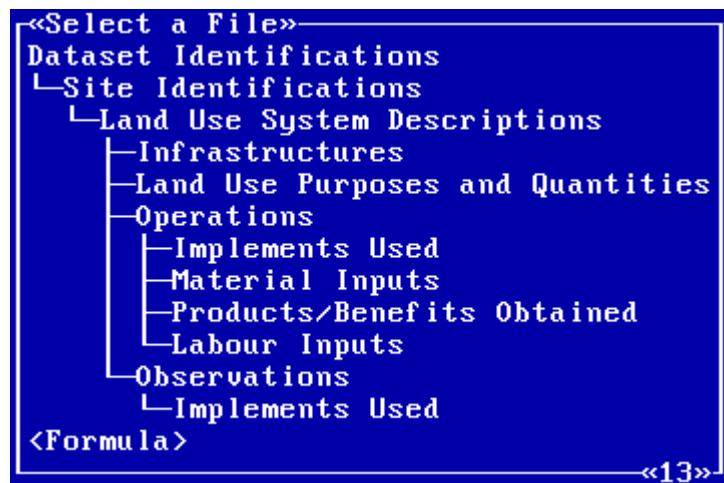
```
«Select a File»
Dataset Identifications
└─Site Identifications
    └─Land Use System Descriptions
        ├─Infrastructures
        ├─Land Use Purposes and Quantities
        ├─Operations
        │   ├─Implements Used
        │   ├─Material Inputs
        │   ├─Products/Benefits Obtained
        │   └─Labour Inputs
        └─Observations
            └─Implements Used
<Formula>
                                    «13»
```

In this case, there are three options:
- To **select** the highlighted file press **Enter**. Continue with the selection of a field (*Section 7.5.2*).

- To **define a formula** as output field highlight **<Formula>** and press **Enter**. This option is only available when **Allow Formulas and Subqueries** is selected as **Query Type** in the query settings (*Section 7.6.3*).
- To **cancel** the selection of a file press **Esc**. You will return to the **Output Fields** picklist (*Section 7.5*).

7.5.2   Select a Field

The second step in the definition of an output field is the selection of a field from which information is included in the query output. After you selected a file from the **Select a File** picklist, by pressing **Enter**, the **Select a Field** picklist appears, containing fields of the selected file. An example of the fields belonging to the **Material Inputs** file is shown below. For a complete list of all fields that may be selected, see Appendix 3.
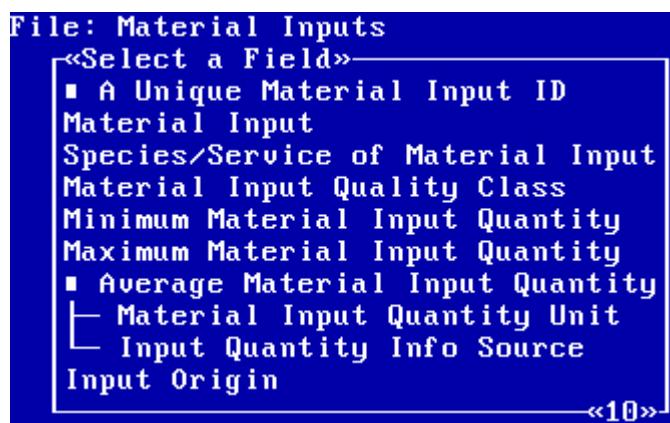
```
File: Material Inputs
 ┌«Select a Field»─────────────
 │ ■ A Unique Material Input ID
 │Material Input
 │Species/Service of Material Input
 │Material Input Quality Class
 │Minimum Material Input Quantity
 │Maximum Material Input Quantity
 │ ■ Average Material Input Quantity
 │ ├─ Material Input Quantity Unit
 │ └─ Input Quantity Info Source
 │Input Origin
 │                          «10»
 └────────────────────────────
```

Fields that do not appear in the edit screens during the data entry procedures, but which can be selected to define a output fiels are marked with a   :
- **A   Unique .... ID**   is the identifier number for a record within the selected file of the database.
- **Average ....** is the average value of minimum and maximum fields, e.g. **Average Holding Size**.

Apart from this, some fields are linked to others by a "⌐" sign. If you select such a field, you are advised to select the linked fields as well. The related fields contain information which is essential to the selected field, e.g. **Average Parcel Size** (=159) must be accompanied by the **Parcel Size Unit** (= ha) in order to make sense: 159 ha.

Choose one of the following options:
- To **select** the highlighted field press **Enter**. Depending on your selection, there are now two possibilities:
  - The **Select a Display Format** picklist appears (*Section 7.5.3*).
  - The **Select a Display Format** picklist is skipped: an edit screen appears in which to enter the column width (*Section 7.5.6*).
- To **cancel** the selection of a field press **Esc**. You will return to the Select a File picklist (*Section 7.5.1*).

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7.5.3   Select a Display Format

The third step in defining an output field is to determine the format in which the information of an output field is displayed in the query output. After selecting a field, the **Select a Display Format** picklist is displayed.

The provided display formats relate to the type of field you selected. An example picklist for the field **Material Input** is displayed below, followed by instructions. For an alphabetical list and explanations of all possible display formats see *Section 7.5.4*.

```
File: Material Inputs
└─Field: Minimum Material Input Quantity
  ┌─«Select a Display Format»────────────────┐
  │ As entered                               │
  │ Left justified                           │
  │ Negative values in ()                    │
  │ Negative values in () and left justified │
  │ Convert to Standard Unit                 │
  │                                    «5»   │
  └──────────────────────────────────────────┘
```

There are two options:
- To **select** the highlighted display format press **Enter**. Depending on the selected display format, there are two possibilities:
  - When you selected **Convert to Standard Unit**, the **Data Units** picklist will be displayed (*Section 7.5.5*).
  - When you selected any other display format, continue to define the column width (*Section 7.5.6*).
- To **cancel** the selection of a display format press **Esc**. You will return to the **Select a File** picklist (*Section 7.5.1*)

7.5.4   List of Display Formats

An alphabetical list of all available display formats and explanations is given below. The set of display formats that may be selected depends on the type of field, as is shown in the cross table following the list of display formates. The field type for all fields is included in Appendix 3.

As entered
> The field information will be printed as it was entered or stored in the program. Numeric values will be printed without any data conversion, texts will be printed without edition.

Convert to Standard Unit
> Numeric field information is converted to a standard unit (*Section 7.5.5*).

Coordinate, Negative for Western or Southern Hemisphere
> Latitudes and longitudes are printed in decimal format with negative values for locations in the Southern and Western Hemisphere, e.g. **-18.3998** for **18.3998** degrees West.

Date Format of Output File
> Dates are printed in the date format used by the specified output format, e.g. as **@DATE(..)** in spreadsheets, and special date fields in dBase. This has the advantage that the exported dates can be used for calculations in other software, e.g. to calculate

the numbers of days between two dates. This option can only be used if a spreadsheet or dBase format is selected as output format in the **Query Settings** screen (**Section 7.3**). If the day, month or year is missing in the stored date, the output field will be empty.

Day of Date

Only the day of the date is printed, e.g. the day of the date 15 February 1995 is printed as **15**. If no day is specified, the field will be empty. Relative dates will be printed as a zero or left blank.

Degrees, Minutes, Seconds (^{o}'")

Latitudes and longitudes are displayed in the hexadecimal system with an abbreviation for the hemisphere **(W = Western Longitude; E = Eastern Longitude; N = Northern Latitude; S = Southern Latitude)**.

First letters uppercase, others lowercase

The text of the selected option is printed in lowercase letters but each new word starts with a capital letter, e.g. **Parcel-1**. New words are considered to start following a **Space**, **a hard return** and .-/,&(+\.

Item Code

The code belonging to the glossary item, or to the *a-priori* land use class is printed in the output field. The code will contain sets of 3-digit numbers.

Item Code of Fixed Picklist

The output field will contain the series number that identifies an item in a fixed picklist. The Land Use Database contains four such fixed picklist (the item codes are displayed left of the item name):

Field Name	Item Names
Dataset Type	1. Hypothetical
	2. Actual
Plot Aggregation	1. Each LUS Description is valid for one Plot
	2. Each LUS Description is Generalised for several Aggregated Plots
- Plot Size Boundaries	1. Based on actual Plot Boundaries
	2. Based on Enumerator-defined Boundaries
Perdiodicity	1. Yes
	2. No

Item Names of all Levels

The names of all glossary items that were selected for the specification of a value, are printed in the output fields, e.g. **Africa, Zimbabwe, Midlands** for an administrative area. Similarly, the names of all *a-priori* land use classes that were selected at all levels, are included.

Item Name of Last Specified Level

Only the name of the glossary item that was selected at the lowest level for the specification of a value, is printed in the output fields, e.g. only **Midlands** for an administrative area in Zimbabwe, Africa. Similarly, the name of the *a-priori* land use class that was selected at the lowest level, is included.

Left justified

Field information will be printed with the first digit at the left side of the column.

Lowercase

The text in the output field is printed in lowercase letters, e.g. **parcel-1**.

Month of Date

Only the month of the date is printed, e.g. the month of the date 15 February 1995 is printed as **02**. If no month is specified, the field will be empty. Relative dates will be printed as a zero or left blank.

Negative values in ()

Negative numeric values are placed between parenthesis, the minus sign is not printed, which may be required for better readability. For latitude and longitude values, the values between brackets denote locations in the Southern or Western hemisphere. For example:

Normal Number	Negative values in ()
-1.00	(1.00)
-300.30	(300.30)

Negative values in () and left justified

Negative numeric values are placed between parenthesis, the minus sign is not printed, and the first digit of the number is placed at the left side of the column, which may be required for better readability. For latitude and longitude values, the values between brackets denote locations in the Southern or Western hemisphere. For example:

Normal Number	Negative values in () and left justified
3.50	3.50
-1.00	(1.00)
-300.30	(300.30)

Relative Date

Relative dates are printed as numbers. Absolute dates are printed as zeros or left blank.

Text Format

Dates in the output fields are printed as a text in the format that was selected in the **Query Settings** screen (*Section 7.3*). Since the dates are written as text, they cannot be used in calculations in the output files. Relative dates are not printed in the output. For example, **31/12/94**, **/12/94**, **/ /94**, **/12/** .

Uppercase

The text in the output field is printed in capital letters, e.g. **PARCEL-1**.

Year of Date

Only the year of the date is printed, e.g. the date 15 February 1995 is printed as **1995**. If no year is specified, the field will be empty. Relative dates will be printed as a zero or left blank.

The following cross table shows the display formats that can be used for the specification of the output fields depending on the type of field selected. The types of fields of all fields can be found in Appendix 3.

Display Formats	>> fields			- fields				
	G	A	F	N	C	M	D	L
As Entered	-	-	-	*	*	*	-	-
Convert to Standard Unit	-	-	-	*	-	-	-	-
Coordinate, Negative for Western ...	-	-	-	-	-	-	-	*
Date Format of Output File	-	-	-	-	-	-	*	-
Day of Date	-	-	-	-	-	-	*	-
Degrees, Minutes, Seconds (o'")	-	-	-	-	-	-	-	*
First letters uppercase, others ...	-	-	*	-	*	*	-	-
Item Code	*	*	*	-	-	-	-	-
Item Code of Fixed Picklist	*	*	-	-	-	-	-	-
Item Names of all Levels	*	*	-	-	-	-	-	-
Item Name of Last Specified Level	-	-	-	-	-	-	-	-
Left Justified	-	-	-	*	-	-	-	*
Lowercase	-	-	-	-	*	*	-	-
Month of Date	-	-	-	-	-	-	*	-
Negative Values in ()	-	-	-	*	-	-	-	*
Negative Values in () and left just...	-	-	-	*	-	-	-	*
Relative Date	-	-	-	-	-	-	*	-
Text Format	-	-	-	-	-	-	*	-
Uppercase	-	-	-	-	*	*	-	-
Year of Date	-	-	-	-	*	*	*	-

* = display format can be selected
- = display format cannot be selected

>> fields = fields in which picklist items are entered; e.g. from:
g = glossary
a = a-priori land use classes
f = fixed picklists

- fields = fields in which text or numbers are entered; i.e.:
n = numbers only
c = characters
m = free texts
d = dates
l = latitudes and longitudes

7.5.5 Convert to Standard Unit

Numeric values for one field may be entered in different data units. They must then be converted to a standard unit to allow comparison of the values. The **Convert to Standard Unit** option offers the possibility to convert data. For example, if part of the information on plot size is stored in acres, and another part in square meters, you may want to obtain all plot sizes in hectares. After selecting this display format, the following picklist is displayed:

```
File: Land Use System Descriptions
└Field: ■ Average Plot Size
  └Display Format: Convert to Standard Unit
┌«Data Units»─────────────────────────────────────
  5 No Dimension    (Just Numbers)                »
  6 Percentages          (%)                      »
 10 Lengths       (Linear Measures)               »
 15 Areas         (Square Measures)               »
 20 Volumes       (Cubic Measures)                »
 25 Masses            (Weights)                    »
 30 Time             (Duration)                    »
 35 Rates;Yield     (Weight/Area)                  »
 40 Rates;Yield     (Volume/Area)                  »
 45 Rates;Flow      (Volume/Time)                  »
 50 Rates;Density   (Weight/Volume)               »
 55 Rates;Growth    (Length/Time)                 »
 65 Currency                                       »
                                               «13»
```

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Data conversion can only be conducted for the same data type, i.e. areas cannot be converted into time values or rates. Therefore, from this picklist, you must select the data unit that was stored for the numeric field you selected. For example, if you want to convert plot sizes to a standard unit, you must select **Areas** from the above picklist.

There are two options:
- To **select** a data unit press **Enter**. A picklist with data units is shown from which to select a data unit. After selection of a data unit, continue to specify the column width of the output fields (*Section 7.5.6*).
- To **cancel** selection of a data unit press **Esc**. You will return to the **Display Format** picklist (*Section 7.5.3*).

7.5.6   Column Width & Number of Decimals

The fourth step to define an output field is to determine the width of the output column for the selected field, and, for numeric fields, to determine the number of decimals required. After selecting a display format, a small edit screen appears in which to enter column width and number of decimals, when applicable:

```
File: Dataset Identifications
└Field: Dataset Number
  └Display Format: As entered


  Column Width        :    4
  Number of Decimals  :    0
```

Column Width
> The width of the column in the query output for the selected field. A suggested default value is already shown. Type a **number** to specify a width that differs from the default and press **Enter**.

Number of Decimals
> This option is only shown for some numeric fields. It denotes the number of decimals that is printed for the field values. A default value is already shown. Note that if decimals are printed in the output, the decimal point occupies one character space, e.g. if the column width is entered as 8 and the number of decimals as 2, there will be 5 remaining character spaces for the numbers left of the decimal point. Type a **number** to specify a number that differs from the default and press **Enter**.

After entering the column width and, if applicable, the number of decimals, save and exit the edit screen by pressing **F10**. Continue with the selection of the sort order (*Section 7.5.7*).

7.5.7   Sort Order

The fifth step to define an output field is to specify the order in which the records are sorted within the current column of the query output. After defining the column width and number of decimals for a column, a picklist is displayed from which to select the sort order of records with a column:

None

Records are not sorted. The records will be printed in the order in which they are processed during query execution.

0-9, A-Z, a-z

Records are sorted in ascending order. First the records are sorted according to numbers, then to capital letters, and finally to lowercase letters.

z-a, Z-A, 9-0

Records are sorted in descending order. First the records are sorted according to lowercase letters, then to capital letters, and finally to numbers.

0-9, Aa-Zz

Records are sorted in ascending order. First the records are sorted according to numbers, then according to letters.

Zz-Aa, 9-0

Records are sorted in descending order. First the records are sorted according to letters, then according to numbers.

Select a sorting option from his picklist and press **Enter**. There are two possibilities:
- If you selected **None** you will return to the **Output Fields** picklist in which the newly defined or edited output field is shown (*Section 7.5*).
- If you selected another item, continue with the selection of the sort priority (*Section 7.5.8*).

7.5.8   Sort Priority

The sixth and last step to define an output field is to determine the priority in which columns are sorted, i.e. which column will be sorted first, which second, etc. This is important if the records of more than one output column are sorted. After selecting an option for sorting of records from the **Record Sort Order** picklist, an edit screen appears in which you can determine the priority to sort this column:

Column Sort Priority

The priority number for sorting the current column: the output column with the lowest sort priority number will be sorted first. The default sort number is **9999** (the lowest priority). Enter **a number** and press **Enter** or **F10**. You will return to the **Output Fields** picklist (**Section 7.5**). In this picklist you can change the order of not-sorted columns (*Section 7.5.9*).

7.5.9   Move Output Field

Output fields can be moved in the **Output Fields** picklist in order to change their position in the query output. After you pressed **Alt-M** for the highlighted output field that you want to move, a copy of the original **Output Fields** screen is displayed on top:

```
┌«Output Fields (Parameters)────║Display Format────────║Width║Sort Order─║SPr»┐
┌«Move Output Field»────────────────────────────────────────────────────────
 Enumerator's Name               ║As entered             ║ 20 ║0-9,A-Z,a-z║  5
 Operation Name                  ║Item Code              ║ 30 ║z-a,Z-A,9-0║ 10
 Plot Latitude                   ║Negative values in ()  ║11;5║           ║
 Plot Longitude                  ║Negative values in ()  ║12;5║           ║
 Plot Longitude                  ║Negative values in ()  ║12;5║           ║
 <Last Item>                                                            «6»
```

There are three options:
- To **move** the output field to the lowest position in the picklist highlight **<Last Item>** and press **Enter**.
- To **move** the output field to another position highlight the item **below** the new position of the field and press **Enter**.
- To **cancel** the move press **Esc**.

In both cases you will return to the **Output Fields** picklist (*Section 7.5*).

7.6   Subqueries and Formulas

The Land Use Database offers the possibility to execute subqueries, i.e. a query that is embedded in another query. Subqueries are used when the approval file of a query needs to be temporary shifted to another file, in order to define the complete query condition. This is the case when you would like to define a criterion for a field belonging to a file that is not directly linked with the selected approval file. Through a subquery, the approval file can be temporary shifted to a file that is directly linked to the file containing the field for which you wish to define a criterion.

Subqueries can only be defined if **Allow Formulas and Subqueries** was selected as query type in the **Query Settings** screen (*Section 7.2.3*). Further instructions and an example are provided in *Section 7.6.1 and 7.6.2*.

The Land Use Database also offers the possibility to use formulas for the definition of a query condition and output fields. This may be required if the standard procedures (*Sections 7.4 and 7.5*) are not sufficient to define the condition or output fields. Formulas are especially useful when calculations have to be made.

Formulas can only be defined if **Allow Formulas and Subqueries** was selected as query type in the **Query Settings** screen (*Section 7.2.3*). Further instructions and examples are provided in *Section 7.1.3 and 7.1.4*.

7.6.1   Subquery

A subquery is defined within a query condition. The steps to define a subquery are explained below. An example of a subquery is provided in *Section 7.6.2*.

Start with entering the **Query Condition** picklist and pressing **Insert** or **Enter** in order to add or edit an existing rule.

The Select a File picklist is displayed:

```
┌«Select a File»─────────────────────────┐
│Dataset Identifications                  │
│ └─Site Identifications                  │
│    └─Land Use System Descriptions       │
│       ├─Infrastructures                 │
│       ├─Land Use Purposes and Quantities│
│       ├─Operations                      │
│       │  ├─Implements Used              │
│       │  ├─Material Inputs              │
│       │  ├─Products/Benefits Obtained   │
│       │  └─Labour Inputs                │
│       └─Observations                    │
│          └─Implements Used              │
│<Formula>                                │
│                                   «13»  │
└─────────────────────────────────────────┘
```

Highlight the file that must be the temporary approval file for the subquery (note that this is not the file for which the rule is specified) and press **Enter**. The **Select a Field** picklist is displayed. The following example shows all fields of the **Land Use System Descriptions** file:

```
File: Land Use System Descriptions
  ┌«Select a Field»──────────────┐
  │ ■ A Unique LUS Description ID │
  │Plot Latitude                 │
  │Plot Longitude                │
  │Plot UTM Zone                 │
  │Plot UTM Northing             │
  │Plot UTM Easting              │
  │Minimum Plot Size             │
  │Maximum Plot Size             │
  │ ■ Average Plot Size          │
  │ ├─ Plot Size Unit            │
  │ ├─ Plot Size Info Source     │
  │ └─ Plot Size Boundaries      │
  │Soil Sample-ID                │
  │Start Operation Sequence Period│
  │End Operation Sequence Period │
  │A-Priori LU Class             │
  │LUS Comments                  │
  │                         «17» │
  └──────────────────────────────┘
```

Subqueries can only be constructed for the   **A   Unique .... ID** fields (the unique reference to a record of the selected file) or for the field **A-Priori Land Use Class**.

Highlight on of the metioned items and press **Enter**. The **Select an Operator** picklist is displayed, e.g.:

```
File: Land Use System Descriptions
└─Field: ■ A Unique LUS Description ID
  ┌«Select an Operator»──────────────
  │is equal to
  │is not equal to
  │is smaller than
  │is smaller than or equal to
  │is larger than
  │is larger than or equal to
  │is between
  │is not between
  │is unspecified
  │is specified
  │having
  │not having
  │                              «12»
```
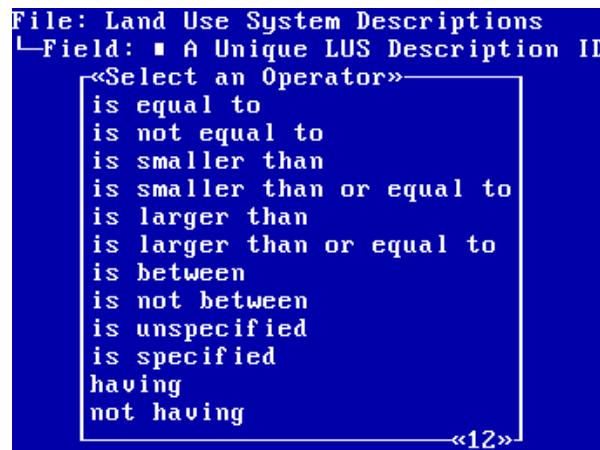
Highlight **having** or **not having** and press **Enter**. These operators connect the unique reference number field (or the **A-Priori Land Use Class** field) of the temporary approval file with fields in files linked to this approval file. A subquery can only be defined if either **having** or **not having** is selected as operator.

After this, a new **Query Condition** screen is displayed in which the sub-query condition can be defined as described in *Section 7.4*. If required, also another subquery can be defined within this subquery.

7.6.2   Example of a Subquery

In order to further explain the use of subqueries, an example of a query condition with a subquery is presented here.

You would like to obtain information on operations in which mineral fertilizers are applied, belonging to a land use system of which the land use purpose is to produce vegetative plant parts. The operations must also be carried out on plots that are located in the Midlands of Zimbabwe. In summary, the condition consists of the following three rules:

rule-1:	**Material Input**	is equal to	**Mineral Fertilzer**
rule-2:	**Product/Benefit**	is equal to	**Vegetative Plant Produce**
rule-3:	**Administrative Area**	is equal to	**Zimbabwe**

Dataset Identifications
└**Site Identifications**
  └**Land Use System Description**
    ├**Infrastructure**
    ├**Land Use Purpose and Quantities**
    ├**Operations**
    │ ├**Implements Used**
    │ ├**Material Inputs**
    │ ├**Obtained Products/Benefits**
    │ └**Labour Inputs**
    ├**Observations**
    │ └**Implements Used**

In the list on the left, the underlined files contain fields for which criteria are defined. The purpose of this query is to obtain information on *operations*, therefore the **Operations** file must be selected as approval file. However, the **Land Use Purposes and Quantities** file that contains the plant produce, is not directly linked with the approval file. This file can therefore not be selected when defining the query condition.

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The solution for this problem is to perform a subquery in which a number of records of the **Land Use System Descriptions** file are approved in case their product/benefit, as specified in the **Land Use Purposes and Quantities** file, is equal to a vegetative plant produce.

In the subquery the **Land Use System Descriptions** file will be temorary approval file. A number of records of the **Land Use System Descriptions** file will be approved in the subquery. These records are linked with records of the **Land Use Purposes and Quantities** file in which the product/benefit is a vegetative plant produce. The records approved in the subquery will subsequently be approved or rejected in the approval file of the complete query, i.e. the **Operations** file.

To define the condition for the subquery in the above example, carry out the following steps. Start from the **Query Condition** picklist.
- Press **Insert** or **Enter** to invoke **the Select a File** picklist
- Select **Land Use System Descriptions** from the **Select a File** picklist
- Select   **A Unique LUS Description ID** from the **Select a Field** picklist
- Select **having** from the **Select an Operator** picklist
- Press **Insert** in the **Query Condition** picklist
- Select **Land Use Purpose and Quantities** from the **Select a File** picklist
- Select **Product/Benefit** from the **Select a Field** picklist
- Select **is equal to** from the **Select an Operator** picklist
- Select **Plant Produce** from the **Products/Benefits** picklist
- Select **Vegetative Parts** from the **Plant Produce** picklist
- Press **F6** in the **Vegetative Parts** picklist
- Press **Esc** in the **Query Condition** picklist in which the subquery condition is shown

After this, the **Query Condition** picklist of the complete query condition is displayed, containing the subquery condition.

7.6.3   Formula

A formula can be entered when defining a query condition or the query output fields. It is especially useful for mathematical calculations. Two examples of formulas are provided in *Section 7.6.4*.

The formula is created with the following 5 elements:
1.   Codes of fields
2.   Codes of items from the glossary
3.   Codes of a-priori land use classes
4.   Operators and mathematical functions (expressions of the Clipper language)
5.   Numbers

There are two rules in using formulas:
1.   A formula must at least contain one field code.
2.   If a formula is used in the definition of a query condition, it may not contain fields from different files.

After selecting **<Formula>** from the **Select a File** picklist, that is displayed when defining a query condition as well as when determining query output fields, the formula window is displayed:

```
┌«<Formula>»──────────────────────────────────────────────────┐
│                                                              │
│                                                              │
│                                                              │
│                                                              │
│                                                              │
└──────────────────────────────────────────────────────────────┘
 F1=Help F10=Save Alt-F=Field Alt-G=Glossary Item Alt-L=Land Use Class
```

The formula window is a special type of free text window (*Section 4.2.5*) in which you can enter codes and functions. Codes can be typed into the formula window manually, but can also be entered automatically by selecting items from picklists. All elements in a formula must be separated from each other by one space.

To create a formula, use the following options:
- To **enter a code** manually type the code. This is only possible if you know the code. If not, use one of the following three options.
  - To **enter a field code** automatically press **Alt-F**. The **Select a File** picklist appears from which to select the file to which the required field belongs. Subsequently, you can select a field from the **Select a Field** picklist. The code of the selected field is displayed in the formula window, e.g. **QUESTION->Ctry_ID** for the field **Administrative Area** of the **Dataset Identifications** file.
  - To **enter a glossary item** code automatically press **Alt-G**. The **Select Glossary Tree** picklist appears from which to select a glossary tree. Subsequently, an item can be selected from picklists with glossary items, in most cases at different levels. Only glossary items that are used, can be selected. After selection, the code of the item is entered in the formula window, e.g. **Codify ("005020")** for the item **Botswana** of the **Administrative Area** glossary tree.
  - To enter an a-priori land use class code automatically press **Alt-L**. The **Land Use Classification Systems** picklist appears from which to select a classification system to which the required land use class belongs. Subsequently, an a-priori land use class can be selected from picklists with land use classes. Only a-priori land use classes that are used, can be selected. After selection, the code of the a-priori land use classe is entered in the formula window, e.g. **Codify("005001")** for the a-priori land use class **Single Cropping of Cereals** of the **FAO-Field Test** classification system.
  - To **enter an operator or function** type the **operator** or **function**. A list of all possible operators and (mathematical) functions that can be used in formulas is included in Appendix 8.
  - To **enter a number** type **a number**.

After creating the formula, either save the formula, or exit without saving:
- To **exit and save** press **F10**.
- To **exit without saving** press **Esc**.

You will return to the **Query Condition** picklist, in case you were defining a query condition, or you will go to the **Display Format** picklist if you were defining output fields.

7.6.4   Examples of Formulas

In order to explain the use of formulas, two examples are presented below, one for the definition of a query condition and one for determining the output fields.

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Example 1   You would like to select those land use system descriptions for which the quantities of harvested products are reliable, i.e. the maximum quantity is less than twice the minimum quantity. Using the standard procedure to define a condition, as describe in *Section 7.4*, this rule cannot be formulated. So, you need to use a formula.

To make a formula for this example rule, carry out the following steps. The approval file must be Land Use System Descriptions. Start from the **Query Condition** picklist (*Section 7.4*):

- Press **Insert** or **Enter** to invoke the **Select a File** picklist
- Select **<Formula>** from the **Select a File** picklist
- Press **Alt-F** in the **Formula** window
- Select **Land Use Purposes and Quantities** from the **Select a File** picklist
- Select **Maximum Product/Benefit Quantity** from the **Select a Field** picklist
- Type **< 2 *** in the formula window (with one space left and right of it)
- Press **Alt-F** in the **Formula** window
- Select **Land Use Purposes and Quantities** from the **Select a File** picklist
- Select **Minimum Product/Benefit Quantity** from the **Select a Field** picklist

The formula should now look like:

```
┌«<Formula>»────────────────────────────────────────────────────
│CAQUAN->QuantityX <2 * CAQUAN->Quantity
│
│
│
│
F1=Help F10=Save Alt-F=Field Alt-G=Glossary Item Alt-L=Land Use Class
```

- Press **F10** to save the contents of the **Formula** window. The formula is shown as one rule in the **Query Condition** picklist.

Example 2   You would like to obtain information about the quantity of material inputs per area unit (as used). This can not be carried out when following the standard procedures for defining output fields, as described in *Section 7.5*. So, a formula is used.

To make a formula for this example output field, carry out the following steps. Start from the **Output Fields** picklist (*Section 7.5*):

- Press **Insert** or **Enter** to invoke the **Select a File** picklist
- Select **<Formula>** from the **Select a File** picklist
- Press **Alt-F** in the **Formula** window
- Select **Material Inputs** from the **Select a File** picklist
- Select **Average Material Input Quantity** from the **Select a Field** picklist
- Type **/** in the formula window (with one space left and right of it)
- Press **Alt-F** in the **Formula** window
- Select **Land Use System Descriptions** from the **Select a File** picklist
- Select **Average Plot Size** from the **Select a Field** picklist

The formula should now look like:

```
┌«<Formula>»────────────────────────────────────────────────────
│AVGU( INPUT->Quantity, INPUT->QuantityX) / AVGU( SEQUENCE->Size,
│SEQUENCE->SizeX)
│
│
F1=Help F10=Save Alt-F=Field Alt-G=Glossary Item Alt-L=Land Use Class
```

- Press **F10** to save the contents of the **Formula** window

After saving the formula, the display format, column width, etc. has to be selected for this output field.

7.7   Execute

After you selected Execute from the 'second' Main Menu of the Query Module, the query execution starts immediately. Two picklists may appear before this:

- A picklist from which to select an output device (*Section 4.3.2*):

```
┌«Select Output Device for Coordinates of Single Cropping in Botswana »┐
│Screen                                                                │
│New File                                                              │
│Append to File                                                        │
│Printer 1                                                             │
│Printer 2                                                             │
│Printer 3                                                             │
│                                                                 «6»│
└──────────────────────────────────────────────────────────────────────┘
```
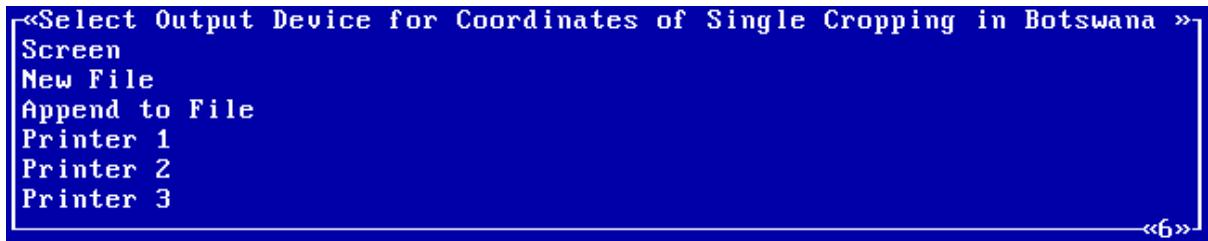
After specifying an output device, the query execution will start.

- A picklist to allow replacing of existing files:

```
┌────────────────────────────┐
│Path C:\TMP\ is not         │
│empty                       │
│Replace present Files?      │
├────────────────────────────┤
│Yes                         │
│No                          │
│                      «2»│
└────────────────────────────┘
```

The directory that you specified as **Output Path** for output files in Land Use Database format is not empty. Select one of the options:

Yes
    Only files with the same names as the newly created files will be overwritten.
    The query execution will continue.
No
    No files are overwritten. The query execution is aborted. You will return to the 'second' Main Menu of the Query Module.

During query execution, the information bar and a small screen will display messages about the progress of the query procedure. The query procedure has the following order.

First, the defined condition is strucured in a parse tree (see *Section 7.1.1* for an example). The following message appears:

Building Parse Tree ...

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Secondly, the records of the selected files are evaluated for the rules, one rule at a time. The message belonging to this is:

.. Records Evaluated for ..

Thirdly, a list with all output fields, one for each selected output field, is made, indicated by the message:

Creating Column List ...

Finally, the required information of the approved files is written to a specified output file or other output device.

.. Records written to ...

If you entered a file name for **Log File** in the query settings (*Section 7.3*), the steps of the query execution procedure are written to a log file. An example of the contents of a log file is shown in *Section 7.3.4*.