ROSELT Programme

User Guide for the ROSELT-SIEL_v1.4 tool

Regional Coordination: Montpellier LEIS cell

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1. GENERAL PRESENTATION

This document constitutes a practical user guide for the software tool ROSELT_LEIS_v1.4 distributed in the form of a software extension for ArcGIS™ (ArcView™ 8.3 distribution). The reader is briefly reminded in the introduction of the place of this tool in the ROSELT framework. The user is recommended to first read the ROSELT/OSS document on LEIS concepts (ROSELT/OSS, DS3, 2004). The practical use of this extension module in ArcGIS™ is then described, making reference at each stage to its relevance in the LEIS implementation. A glossary of technical words specific to the extension or to ArcGIS™ can be found in the appendix. These words are indicated in the text by an asterix (*).

1.1. OBJECTIVES

The Local Environment Information System implemented in the ROSELT/OSS observatories is centred on the spatial integration of the dynamic populations/environment interactions which is expressed in terms of usages and resources (ROSELT/OSS, DS3, 2004).

The goal of this tool is to implement a *model simulation** of *agricultural, pastoral and forestry space utilisation*, in relation to the needs of the local populations. This *modelling** allows the calculation of resource/usage balances and also to evaluate, follow and predict ecological changes in the ROSELT network observatories.

The modelling of the functioning of an observatory in terms of resources/usages is realised by structuring the observatory territory into Spatial Reference Units (SRU), and by the spatial distribution of resource extraction and available resources on these SRUs (ROSELT/OSS, DS3, 2004). In order to implement these two main tasks, a Minimum Dataset is first put together to provide a basis for the modelling (input data).

The tool allows four phases of fundamental processing:

- organise the input data (Minimum Dataset);
- create the SRUs (vector layer in the GIS*);
- calculate the SRU resource/usage balances and the resource degradation risk, and desertification risk indexes;
- carry out forecast analyses.

The first three phases are available as tool functions and constitute the exploratory mode for a given period. The forth phase concerns the forecast mode; it provides the realisation of forecast simulations.

A database called a 'modelling database' is produced in the form of a geodatabase. It contains the input data (table data and vector layers) as well as the different vector layers and tables generated by the extension module (see 8. ROSELT GeoDataBase).

1.2. THE EXTENSION MODULE

The GIS extension module visible in the menu bar is called LEIS/ROSELT. It was written in *Visual Basic for Applications*™ (VBA) integrated in to ArcGIS™ (ArcView™ 8.3 distribution) and uses a database in MS-Access™ format (see the Personal GeoDataBase in the ArcView™ manual) `SIEL-KitMini.mdb`, available in the distribution. This template database model is used to create a modelling data database; it takes in the input data and is completed when the extension is used, for example for the creation of a vector layer. This makes up what ArcGIS™ calls a GeoDataBase*.

A description of this database, from its data initialisation phase to the modelling phase, is made at a conceptual level, see section 8 of this document. A complementary document supplied with the distribution of the extension, in PDF format, describes the specification of the functionality, giving more detailed information about the algorithms.

As a VBA implementation, the extension is found in an ArcMap™* file (`.mxd`): `NOUVEL-OBSERVATOIRE.mxd`. To use the tool and thus start a *new model simulation* of an observatory, we click on the application (shortcut) LEIS that runs ArcMap™ and opens the `NOUVEL-OBSERVATOIRE.mxd` file. The tool then saves the file using the observatory codename at the chosen location (creating a folder containing the model simulation). To continue this modelling later, one may simply reopen this file.

A geodatabase created at the chosen location at this start-up stage, has the same name with the suffix `.mdb`, for MS-Access™ [1] databases. This geodatabase uses different models based on the same input dataset numbered from 1 to n. In effect, in exploratory mode, it is possible to construct several observatory model simulations according to different modelling parameters used in the extension, with the same input database.

In ArcMap™, a Data Frame* with the model simulation number and the observatory code is visible with each new model simulation.

The tool has a rapid evolution due to the ongoing improvements implemented to increase the tool's capabilities in terms of modelling and make it completely compatible with all possible situations in the ROSELT network observatories. Many versions of VBA code are envisaged for the same extension version number due to this rapid evolution. A simple procedure to update the code, either before starting a new LEIS or in an existing model simulation (.mxd file), is described in the following paragraph. After the description of the installation of the extension on a computer, the start-up phase is described in more detail, followed by the other user interfaces of the `ROSELT-SIEL_v1.4` tool.

2. EXTENSION INSTALLATION AND STARTUP

2.1. INSTALLATION ON A PERSONAL COMPUTER

The extension module is designed for a version of ArcGIS™ on a personal computer with the Windows 2000™ or XP™ operating systems.

For this tool's version of VBA, the compressed file `ROSELT-SIEL_v1.4.zip (WINZIP file)` must be decompressed in the installation folder: `C:\` for example.

Under the installation folder …\`ROSELT-SIEL_v1.4`, are the following folders (*cf.* Figure 1):

- `Bin`: this principally contains the file `NOUVEL-OBSERVATOIRE.mxd`, and a folder containing a copy of the VBA code for this version. A VBA code folder for a revision of this version may be placed in the same folder; the code update procedure for code in the `NOUVEL-OBSERVATOIRE.mxd` file is explained in the file `ReadMe.txt` (which also describes the other files present in this sub-folder);

[1] Careful, what happens in ArcMap, and the construction of the geodatabase are two seperate things: we can use the same geodatabase in different .mxd's and in the same .mxd we can use different geodatabases.

- `Documentation`: this contains the set of files that document the LEIS: Conception, Data Dictionary, Processing Specification, and the User Guide respectively issued by ROSELT/OSS DS3, 2004, internal document, and CT3, 2004.
- `Exemple`: this contains the model simulations for the NER_DT observatory (Dantiandou, Torodi and Tondikania in Nigeria);
- `DonnéeEntrée`: this contains the model for the minimal database to constitute a minimum entry Kit, `SIEL-KitMini.mdb`; the file `ReadMe_Data.txt` reiterates the different methods for initialising LEIS input data (see 2.2);
- `Nouveau-SIEL (New-LEIS)` is a shortcut to run ArcMap™ and open the `NOUVEL-OBSERVATOIRE.mxd` file contained in `Bin`; when installing or moving a shortcut, verify that the paths corresponding to these two parameters.

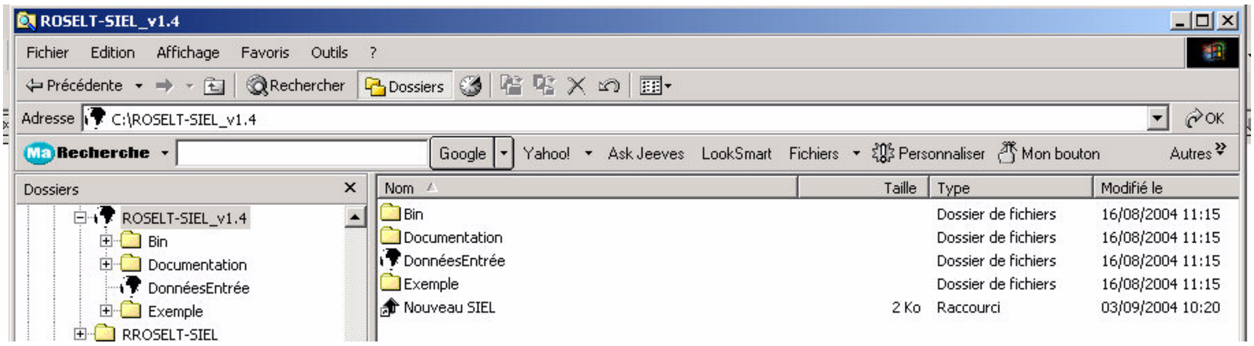


Figure 1 : Installation and start-up of a new LEIS.

2.2. EXTENSION STARTUP

The sequence of actions or events when a new model simulation is initialised follows:

1. you click on the `New-LEIS` shortcut;
2. ArcMap™ opens;
3. loading of the LEIS/ROSELT menu;
4. display of the **New Model simulation** dialog box menu;
5. you enter the information requested on the observatory being studied;
6. you click on OK;
7. display of the **options** dialog box;
8. you verify the information in the option box;
9. you close the dialog box.

This sequence is detailed below.

1 To start modelling an observatory functioning, in terms of resources/usages, open the `NOUVEL-OBSERVATOIRE.mxd` file, or use the `New-LEIS` shortcut that opens the file.

2 et 3 The LEIS/ROSELT menu is automatically[2] loaded in the ArcView™ menu bar, ArcView™ having just opened.

4 et 5 The **New Model simulation** dialog box opens; we must choose the observatory on which we are working, and the geographical coordinate system used in the observatory region: this means the constants coded by the ESRI to represent classic projection systems (see the ArcGIS™ manual). We must next choose the model simulation target folder that will contain the `.mxd*` file as well as the final model simulations database. The full path of the final database is automatically displayed as well as the name of the `FeatureDataset*`

[2] The `StartSIEL.INSTALL_MENU` macro reloads the LEIS/ROSELT menubar.

(virtual group of geographical layers in the geodatabase). The suffix of this `FeatureDataset` is the number of the model simulation on which we want to work. At the initialisation of the geodatabase, the suffix is "__1"; with the next opening of this dialog box for the same geodatabase it becomes "__2" automatically. The **–1** button allows us to go back to a previous model simulation and continue working on it.

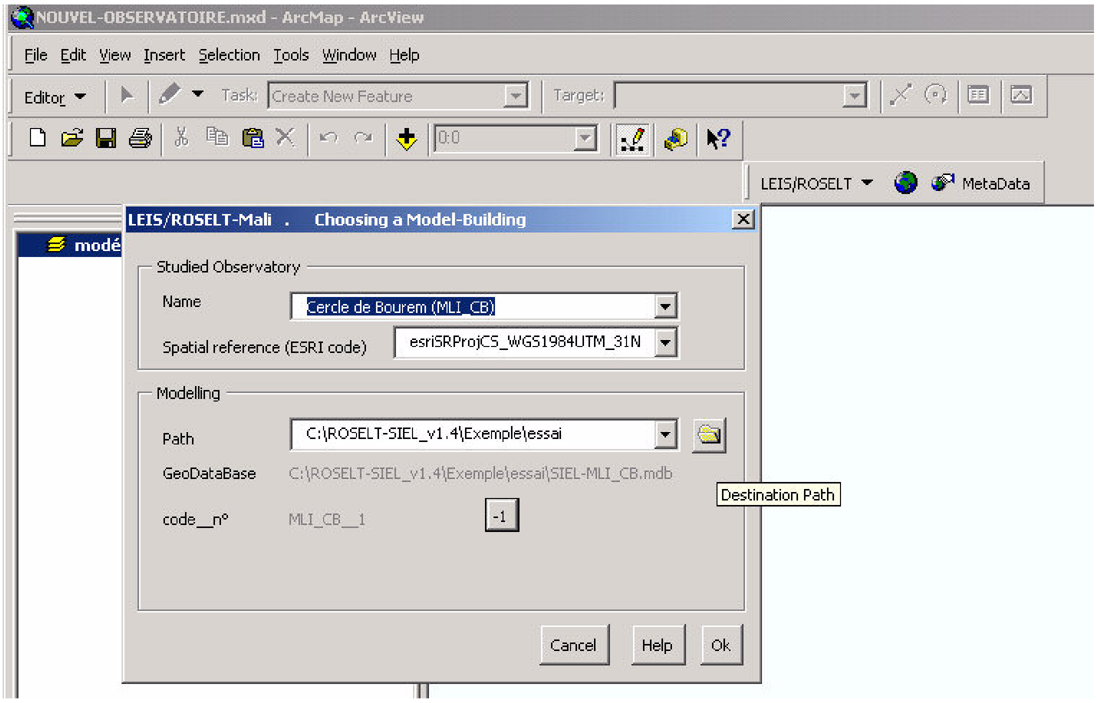


Figure 2 : New Model simulation dialog box

The modelling period given in the popup list is to be entered if this is not a new model simulation.

6. et 7 Validating the choices made, by clicking **Ok**, there will either be a direct update of the model simulation database, or it will be created if it does not exist at the specified[3] path, then updated:

- the creation of the database is made by copying the *template database** located in the `Bin` folder or by copying an existing database from the same template (an old template or a prior creation using the `SIEL-KitMini.mdb` database from the `DonnéesEntrée` folder); the input data modification dialog box then appears.
- a FeatureDataset (collection of vector layers in a geodatabase) with the name of the observatory and the suffix *__1* (first model simulation of this observatory) is created with given spatial reference. Each new model simulation based on the same input data can thus be stored in this geodatabase and identified in the *territoireObservatoire* table by model simulation number (the n in suffix __*n*).
- update refers to the possible creation of the FeatureDataset with the geographical characteristics of the given projection system.

8 et 9 To initialise the model simulations, the model simulation period must be chosen from those present in this database. The dialog box for choosing the period is displayed if this wasn't previously done (Figure 3):

[3] The complete path is created if it does not exist.

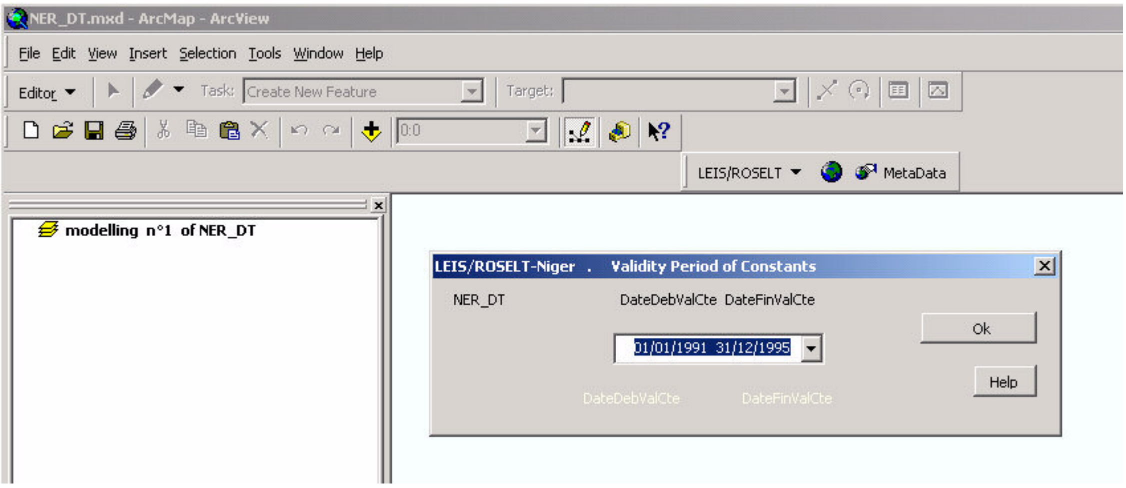


Figure 3 : New Model simulation dialog box (choice of period)

10 11 et 12 Once these steps are completed, the dialog box containing the options is displayed and thus provides the verification of the parameters input, and allows others to be set (see IV options).

The **LEIS/ROSELT> Model simulation n°…** menu (Figure 2) displays the **New Model simulation** dialog box either to create a new model simulation once ArcMap™ is running, or to go back to a previous model simulation of a LEIS/ROSELT geodatabase.

Apart from the LEIS/ROSELT menu that is used to set up and use an observatory LEIS, the ROSELT/OSS menu bar contains the “full extent” icon and a **Metadata** button. The latter is for the preparation of ROSELT metadata for the LEIS data in ArcCatalog™ and creates a link with the MDweb tools for complete management of the metadata.

3. OPTIONS

The Options dialog box is for verifying the model simulation parameters under development and to change them (Figure 4). To change the general modelling parameters, the **new model simulation** dialog box can be used.

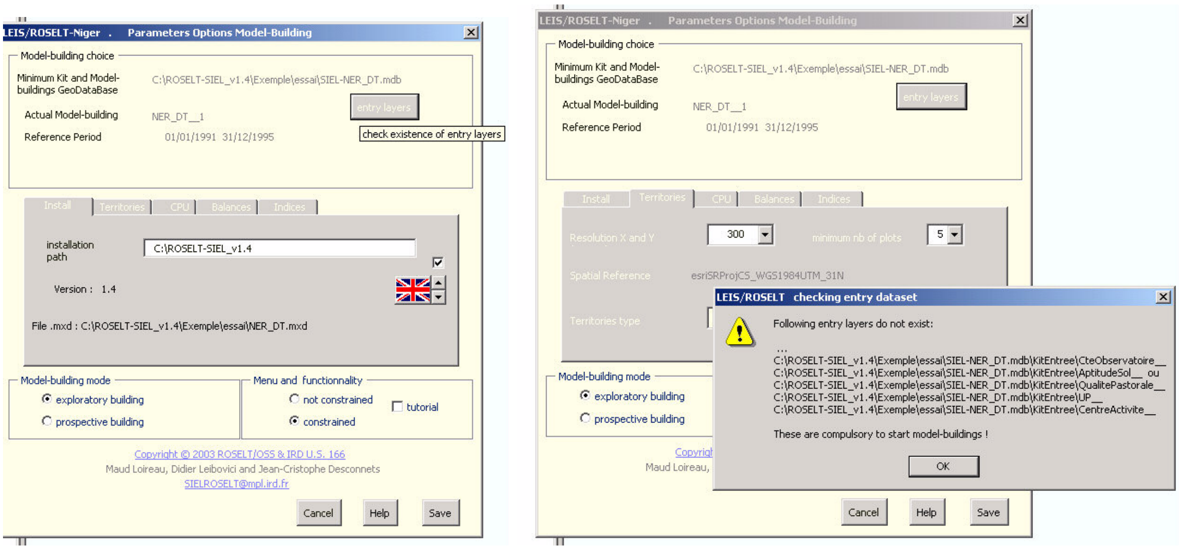


Figure 4 : Options dialog box

The model simulation in progress is visible on the screen. It is possible to verify which entry layers are not present in the modelling database, it is also possible on each tab, to see the parameters of the model simulations used.

The **construction in exploratory mode** allows for the set up of a model simulation for the calculation of balances on the given period. The **construction in forecast mode** provides a realisation of a model simulation with possible scenarios by varying certain temporal or spatial parameters.

The **tutorial** option, valid in each of the previous modes, allows the addition of a guide and automatic context-sensitive help while the extension is being used. By default, the **Menus and Utilisation** are in **restricted** mode: verification of input data from each dialog box and it is not possible to load layers that are not predetermined. The **Choice of Model simulation** provides a reminder of which model simulation is being worked on: geodatabase, model simulation number and observatory, and model simulation period. By clicking on the **entry layers** button, it is possible to verify the existence of entry layers, i.e. in the FeatureDataset `KitEntree`:

-`CteObservatoire__`	observatory contour
-`CentreActivite__`	layer of all activity centres
-`AptitudeSol__`	Soil Aptitude layer
-`QualPast__`	pastoral qualities layer
-`UP__`	Landscape Units layer

These layers, necessary for the use of the tool, are integrated into the geodatabase via the **Tools>Modify input data** menu, which is displayed by default at the beginning of a new modelling database.

Description of each tab:

- **Installation** tab: this shows the installation path along with the extension version, as well as the mxd file in use.
- **Territories** tab: this gives the parameters used for the construction of the exploitation territories: raster resolution (in meters) used for the delineation of the territories. The territory type makes reference to the choice of structuring activity and to a model simulation, **`centered`** or **`distributed`**, in relation with the activity centres.
- **CPU** tab: this gives the parameters used for the construction of Combined Practices Units: raster resolution[4] (transformation of Soil Aptitude polygons).
- The two last tabs, **Balances** and **Indexes** refer to the balance and indicators calculation parameters which, apart from the definition of land use useful for the calculation of agricultural vegetation resource extraction, are mainly for the forecast mode which is not available in this version.

4. SRU CONSTRUCTION INTERFACES

The NER_DT example observatory (Dantiandou, Torodi and Tondikandia in Nigeria, Exemple folder, `NER_DT.mxd file`) is used to describe the interfaces.

[4] More the resolution is increased (low value), the longer the calculations will be.

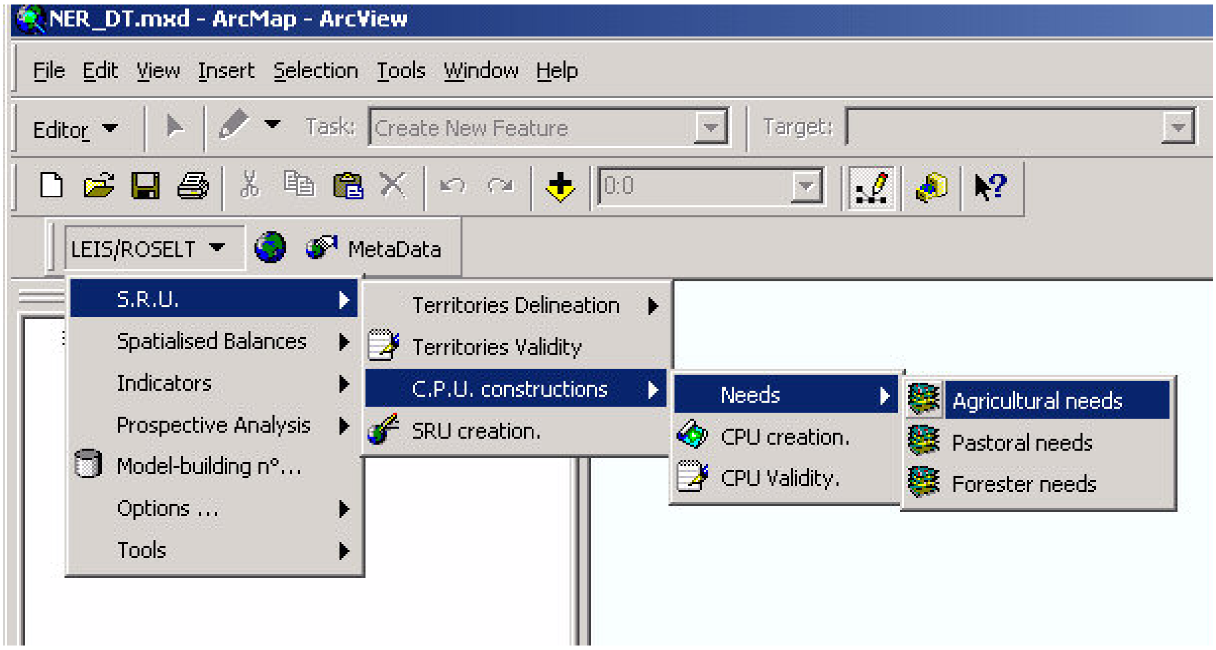


Figure 5 : general LEIS/ROSELT menu

4.1. REMINDER OF THE DIFFERENT SRU CONSTRUCTION STEPS

The SRUs are polygons, of which the whole set covers the observatory territory; they make use of the notion of localised *resources* in the landscape, and the notion of *usage* and application on a given space by a combination of exploitation practices (agricultural, pastoral, forestry) defined below by *combined practices*.

The *landscape* is defined by the layer of landscape units (LU), polygons whose characterisation is defined in the document ROSELT/OSS, DS3, 2004. The principles of construction of exploitation practices typology, called *combined practices*, are also described in the same document and in the methodological guide on the evaluation and monitoring of practices of exploitation of natural resources (ROSELT/OSS, CT2, 2004). The usage(s) structure the landscape by the exploitation of resources, through the spatially distributed combined practices (*combined practices units, CPU*). The CPUs are constructed at the interior of the exploitation territories, the first step of the modelling of the observatory territory by the LEIS (ROSELT/OSS, DS3, 2004).

The SRUs are obtained by crossing two types of geographical information: *Landscape Units* (LU) and *Combined Practices Units* (CPU).

The successive steps needed to achieve this structuring of the space in an observatory territory are:

- creation and input of the minimum kit;
- delineation of exploitation territories;
- validation of this delineation;
- calculations of needs (agricultural, pastoral, forestry);
- creation of the CPUs;

- creation of the SRUs by crossing CPUs and LUs.

Once this structuring into SRUs is modelled, it is possible to proceed to the calculation of resource/usage balances and to the calculation of indicators of resource degradation risks or desertification risks.

Before starting the modelling with delineation of territories, the input data must be prepared from the Minimum Kit of observatory data or be completed with the necessary layers. The Minimum Kit of data necessary for the construction of a LEIS constitutes part of the minimum kit of ROSELT observatory data. In effect, the latter also includes the minimum specific data for each thematic (formalised in the ROSELT/OSS methodological guides).

4.2. MINIMUM ENTRY KIT

At the start of a series of new *model simulations**, we are asked to load an existing Minimum Kit (a database existing from a previous model simulation, or an input database prepared before running the tool) or to create it. The dialog box that automatically displays for this purpose can also be found in the menu **LEIS/ROSELT>Tools>Modify input data** (Figure 6) and is used especially to integrate the vector layers necessary for this Minimum data Kit.

The input data and entry layers are located in the same *geodatabase** that contains the *model simulations*: the geodatabase with the codename of the observatory, e.g. `NER_DT.mdb` is stored in the modelling folder. It is possible to modify the database at the level of the attribute tables by opening the MS-Access™ file directly.

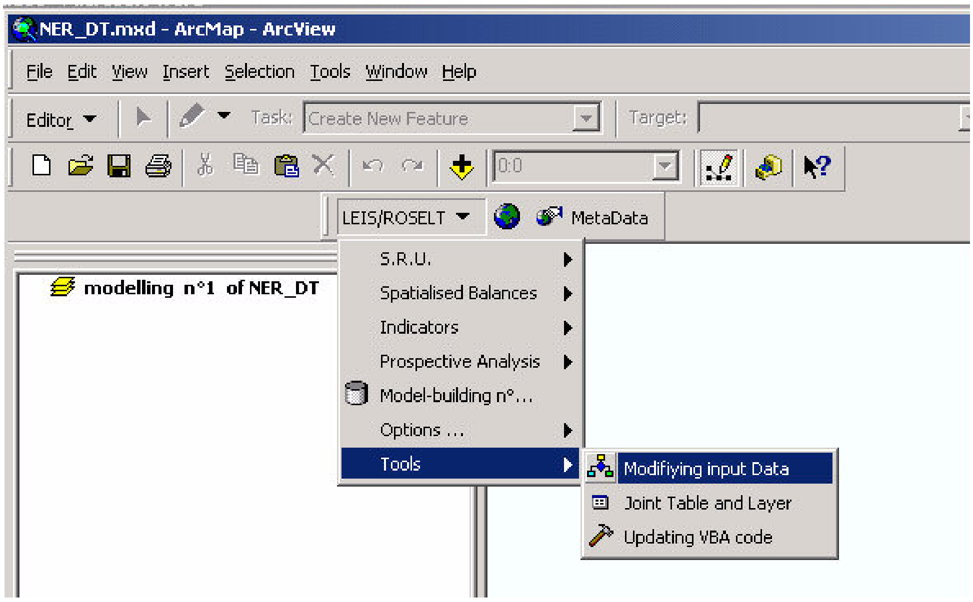


Figure 6 : LEIS/ROSELT>Tools menu

The sequence of operations or events are as follows:

1. you load the layers to be integrated into the minimum kit;
2. you create or modify it according to its existence in the database;
3. running of MS-Access™;
4. opening of the input form;
5. you click finish;
6. the joining dialog box opens (for each layer loaded in 2);

7. you click ok.

1 The full path of the current modelling database is displayed as a help bubble on the **modify** button.

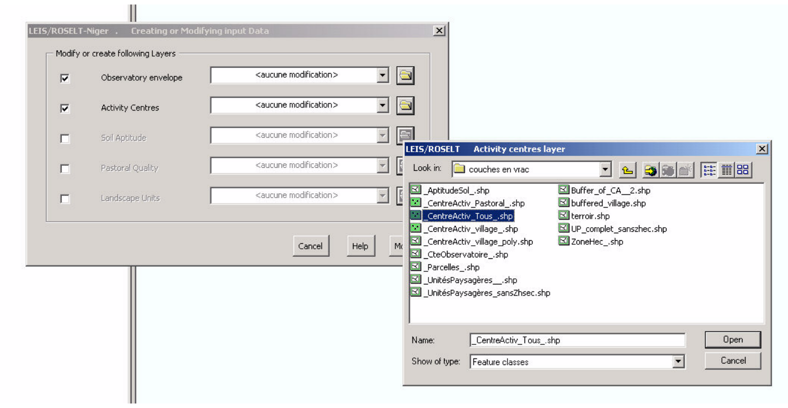


Figure 7 : Minimum Kit Creation or Modification dialog box

2 It is possible to load the *shapefiles** or *FeatureClass** of the layers essential to modelling. To avoid recreating an existing later, you deselect the corresponding tick box. These layers must contain the key fields existing in the tables associated to these layers, in order to allow joining (these fields can have different names but their types must correspond to fixed types in the data dictionary, *cf.* 8).

3, 4 and 5 create or modify open the MS-Access™ database and the minimum kit input form.

6 Once the data entry is **finished (see 4.2 INPUT OF THE MINIMUM KIT)**, for each layer selected, the dialog box to make a join of the shapefile with the table is displayed in order to create or recreate a *FeatureClass* in the geographic database SIEL-NER_DT.mdb in the FeatureDataset `KitEntree`). (*Cf.* 7.1 Joining Table Layers).

If no layer is selected, the purpose of this menu becomes the opening of the MS-Access™ database from Windows Explorer™.

4.3. INPUT OF THE MINIMUM KIT

The model simulation database used in the LEIS contains the input data (Minimum Kit) and the data that is automatically added by the tool. The input data are essential for the functioning of the tool. The methodologies to be implemented for the gathering or collection of this data is not the subject of this manual (*cf.* ROSELT/OSS, DS3, 2004 and methodological guides ROSELT/OSS CT2, CT8 2004). The data dictionary in section 8 can be consulted to get details on the tables, fields, relationships and constraints of the database `SIEL-NER_DT.mdb`. The glossary of technical terms in section 9 also contain conceptual terms specific to the entities being manipulated.

The tool allows three possibilities to initialise the input data:

- You copy the model simulation database (`SIEL-KitMini.mdb`) into a folder of your choice, then you open this database with MS-Access™. Next, from the general form, you enter the data; this database is located at the start-up of a model simulation to create the model simulations database.
- You reuse the input data from a previous set of model simulations; at the initialisation start-up; this database is located to create a model simulations database.
- At the start of a modelling, you create a completely new model simulations database (the empty model simulation database is copied).

In all three cases, the database has the codename of your observatory *e.g.* `SIEL-NER_DT.mdb` is created in the destination folder of the model simulation. In the last case, this database is empty.

On opening the database the main database input form is displayed. The same form opens for any database that comes from the extension, thus giving access to the minimum kit attribute[5] tables. It is also possible, for certain manipulations, to use the ArcMap™ editor or ArcCatalog™ which opens a table in attribute table mode with some useful functions (*cf.* ArcView™ manual).

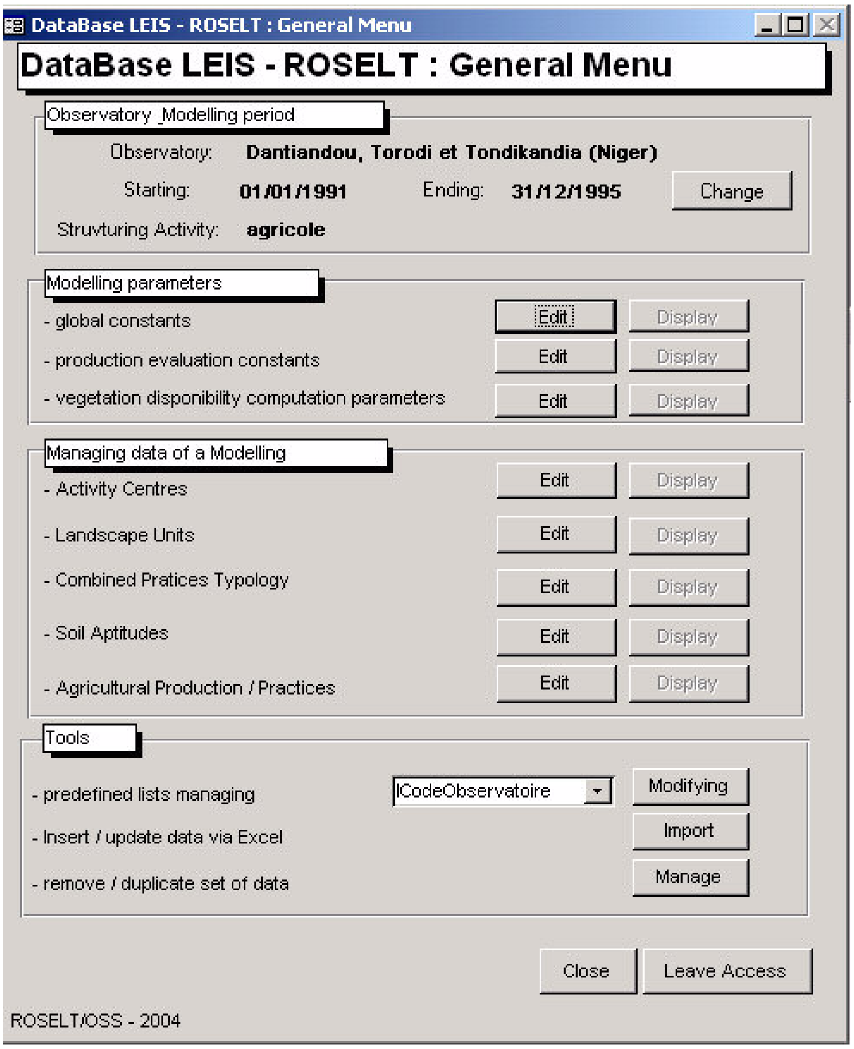


Figure 8 : Main Form for Minimum Kit Entry

[5] Beware! Do not modify the geographic tables!

According to the chosen structuring activity, different tables need to be filled.

The data model schema dictates the data entry order, from the top to the bottom (Figure 9). Generally, manual input does not present a problem, though a problem is more easily possible if the data is imported via an Excel™ sheet.

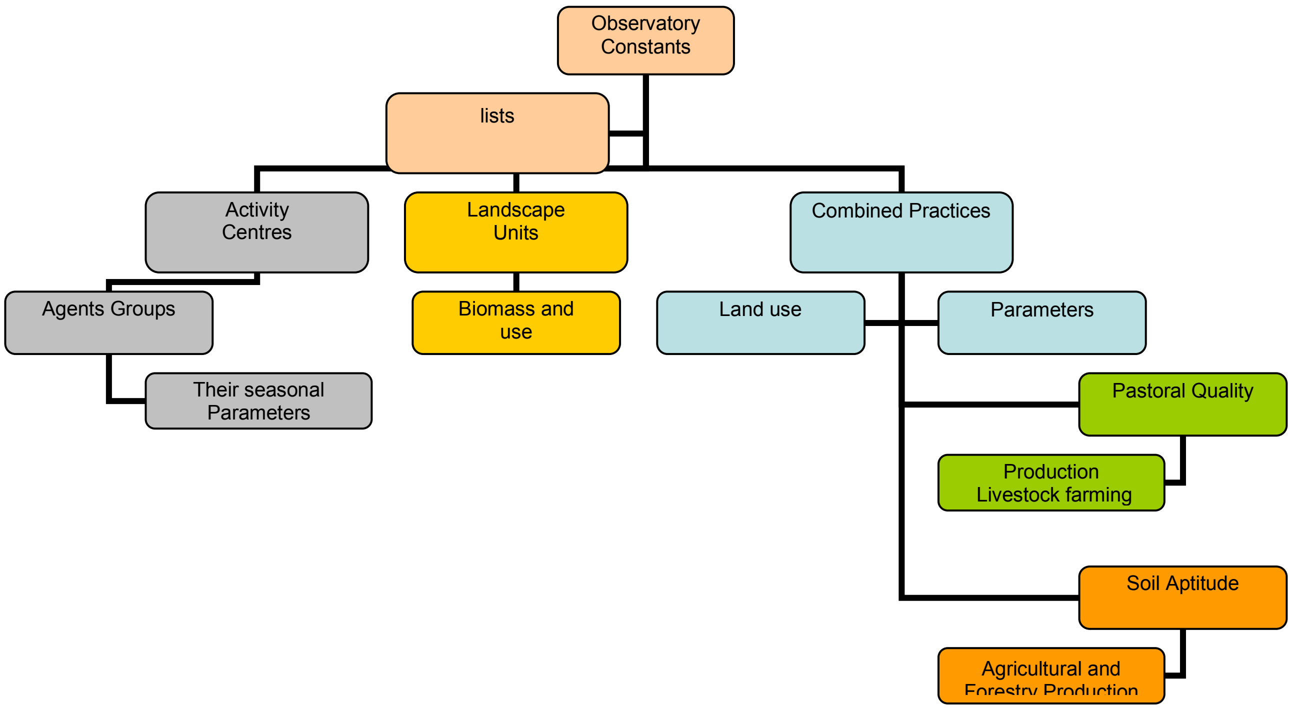


Figure 9 : Data entry order

The different schema colours make reference to the different conceptual aspects of the LEIS.

4.4. EXPLOITATION TERRITORIES

The delineation of exploitation territories is the first step of a modelling. On the basis of activity centres selected according to the structuring activity of the observatory, the exploitation territories can be modelled (agricultural territories, pastoral territories, forestry territories). In the ROSELT network, the territories named "agricultural" are all the agro-pastoral territories with a structuring agricultural activity. The territories named "pastoral" are the agro-pastoral or pastoral territories with a structuring pastoral activity.

The dialog box is displayed with the menu: **LEIS/ROSELT>SRU>Territory Delineation>Agricultural (or Pastoral or Forestry)**. In the current version (`ROSELT-SIEL_v1.4`), two general models, applicable for one of the three following structuring activities, are implemented: the **centered model** and the **distributed model**.

A **centered** model corresponds to the construction of **a territory** for an activity **centre**. The rules of this centered model are adapted to the agropastoral zones where the agricultural activity is structuring. They are equally adapted to the zones where the pastoral activity is structuring, in the case where the water points are localised at the same places as the encampments or farms. One or more possible values of activity centre type (ITypeCentDecis in TablisteCode) can be chosen and the activity operates around each of these focal points (*cf.* 4.4.4.1.). The **distributed** model allows for the construction of **a territory** using **several activity centres**, not necessarily of the same type (ITypeCentDecis).

In this version of the tool, the activity centres can only be points and the distributed model is still under development. The dialog box is identical for the delineation of exploitation territories whatever the structuring activity; only the title bar of the box changes and the label of the criteria is initialised according to the structuring activity type.

At the opening of the dialog box (Figure 10), there is a verification of the entry layers needed: observatory contour, and activity centre layer. A message shows the non-existent layers. In restricted mode, if the necessary layers do not exist, the OK button is disabled and it is not possible to load different layers other than those offered by default: all the activity centre layers and all the observatory contours from the geodatabase (or from input data or from previous model simulations).

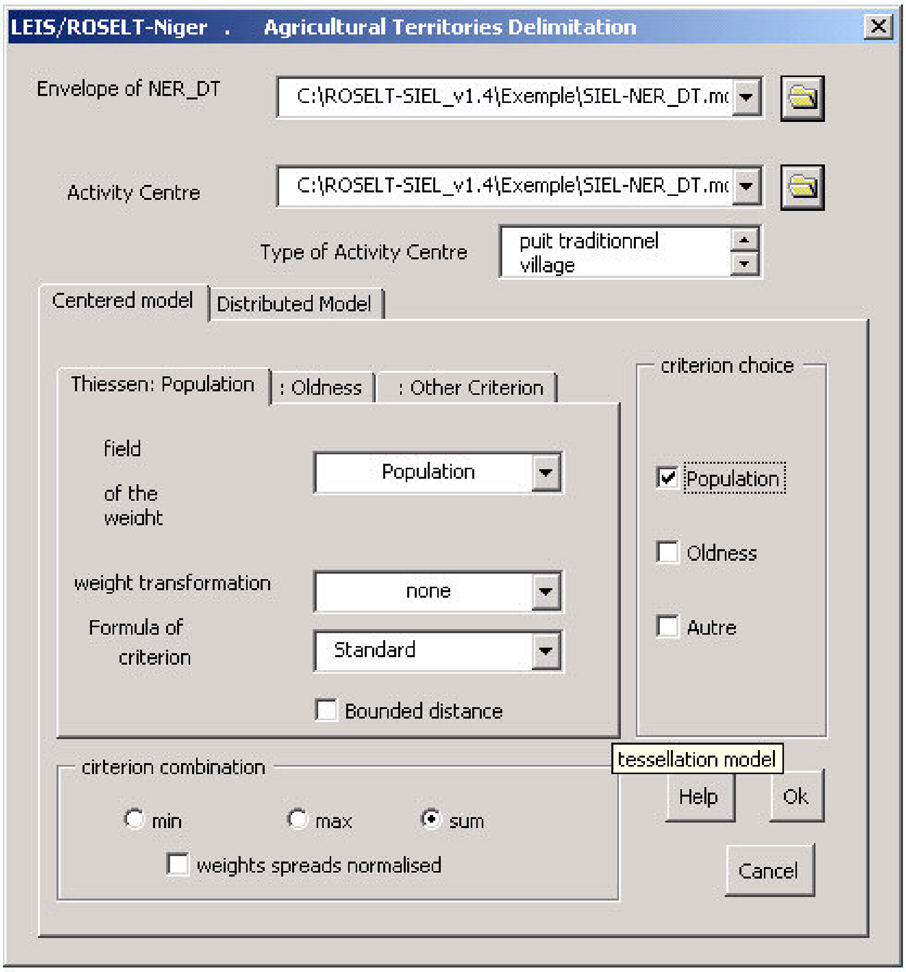


Figure 10 : Agricultural Territory modelling dialog box

Modelling assumes that potentially all the observatory space could be exploited and therefore makes a division creating a mosaic of the observatory.

This division is carried out in the observatory **contour** polygon previously obtained during the delineation of the observatory territory. It uses the type(s) of activity centres selected from the loaded layer.

4.4.1. DELINEATION OF THE EXPLOITATION TERRITORIES

Beside the choice of activity centres, the layer and types of activity centres (AC), and the delineation of the observatory depend on the model chosen.

4.4.1.1. Centered model

The Centred Model uses the principle of the Thiessen* algorithm to divide the space. This algorithm is improved by using a weighting: the weighted Thiessen algorithm.

This weighted Thiessen algorithm classifies all the points in space following a criterion which is a function of the weight and distance. The value of the criteria is calculated for each AC and the maximal value determines the classification of the point (i.e. its attachment to the AC in question). Classically, the **Standard** formula is $\sqrt{\text{weight}} / \text{distance}$.

The final criteria used for the algorithm can combine several criteria, each linked to a different weight: **Population** criteria, **Age** criteria, and **other** criteria. The choice of these relevant criteria is made according to local specifities. The combination of these criteria is either the sum, or the maximum, or the minimum of the selected criteria. When we use several criteria, it is recommended to **normalise** the weights, by selecting the corresponding interface tick box. This weight normalisation creates a linear transformation of the weight values in order to obtain, for each weight with the same range of values, that which has the greatest range of weights.

The **Population** criteria normally makes reference to the Population field (linked to the AC in the `ParamètreSaison` Table) but all other numeric fields (present in the layer) can be used; it takes account of the population that exploits the territory resources according to the structuring activity. In the same way, the **Age** criterion makes reference to the AC `AgeMin`; it takes account of the evolution history of the population in the zone. The **other**criterion is open and corresponds to a numeric layer field conserved at the time of the joining integration of this later into the geodatabase (for example: poverty index, access to basic services, organisation level, etc.; *cf.* sections 4.1 and 9). For each criterion, the weight given can also be chosen from several choices. Currently the **Standard**[6] formula and its transformations are taken as formulae, *e.g.* **Standard**^2 is the **Standard** formula of the square.

The adaptations of this model are proposed to take better account of local specifities, for example when the rural observatory territory includes an urban centre. It is thus possible to make a change to the formula by ticking **Bounded distance** which makes a dialog box appear for the parameters to enter.

[6] In the criteria formula the weight means the weight that has/has not undergone a transformation.

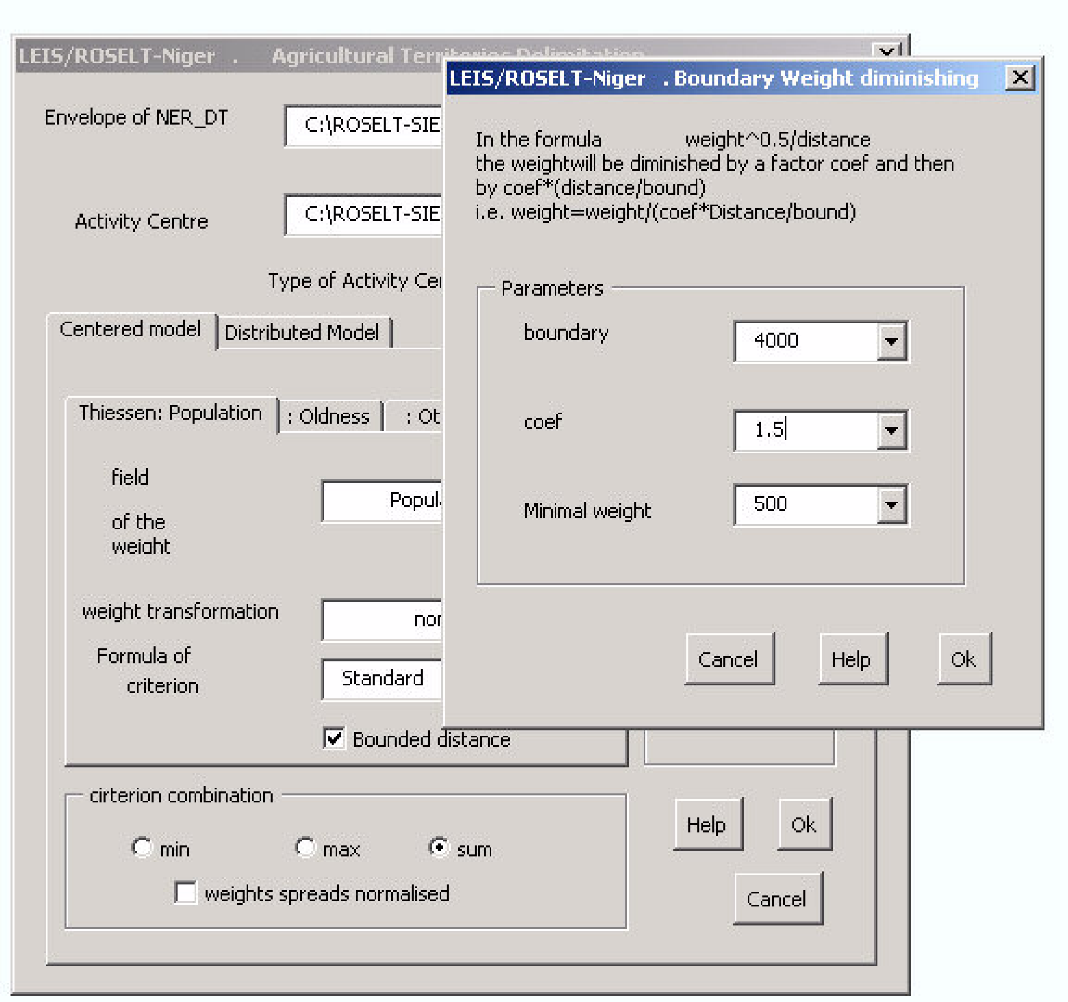


Figure 11 : Parameters for Bounded distance

This modification of the formula effectively allows us to limit for example the influence of the 'big' ACs.

In the formula used, as soon as the distance is greater than or equal to the **boundary** and the weight is greater than or equal to the **Minimum Weight**, the weight is progressively reduced. When the distance is equal to the **boundary**, the weight is divided by the **coef** value. Beyond this distance, it is divided by the value of $coef \times (\frac{\text{distance}}{boundary})$ i.e.

$$Weight = \frac{\text{Weight}}{\text{coef} \times (\frac{\text{distance}}{\text{boundary}})}.$$

By clicking **OK** a raster layer is created (in the folder given in the options); the pixel value is linked to the AC. Next, this layer is vectorised. The AC__1 et Agri__1 layers, respectively representing the agricultural territory polygons for model simulation n°1, are automatically loaded into ArcMap™ (Figure 12). These layers are stored in the SIEL-NER_DT.mdb database in the NER_DT__1 FeatureDataset.

For a good cartographic representation of this layer, the symbols for the ACs, with their names and for example the size of the points in relation to the population, can be added by using classic ArcMap™ functions. In the same way, the territories can be differentiated by arbitrary colours or linked to the validation of territories.

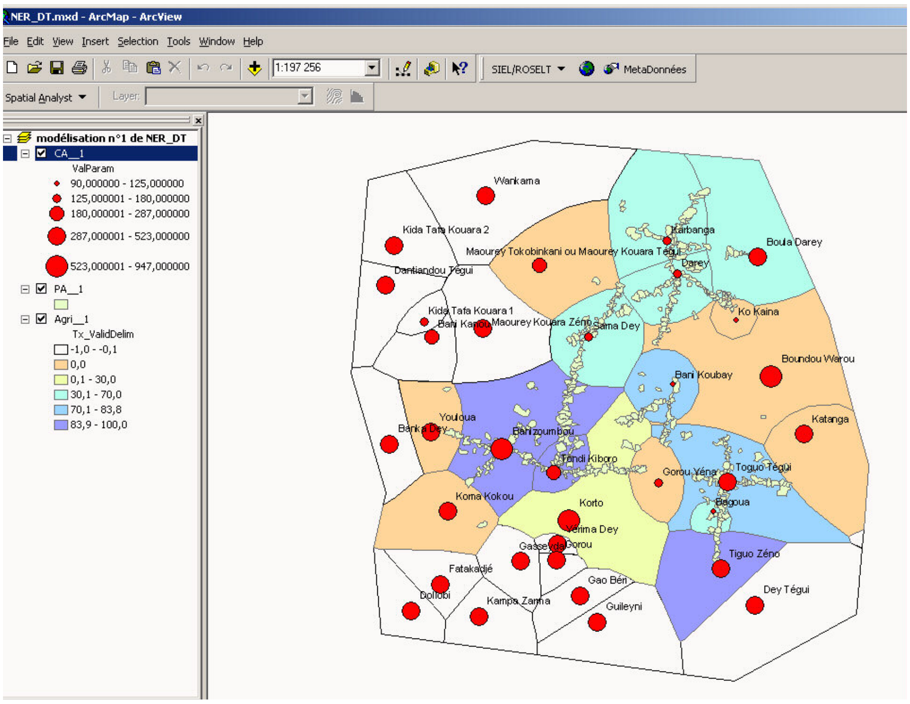


Figure 12 : Modelled territories example

If the constructed exploitation territories are Pastoral or Forestry territories, the layers created are named `Past__1` and `Fore__1` respectively.

The `TerritoireObservatoire` table is updated for the `P_Delim` field which contains the parameters used in the modelling of exploitation territories (Agricultural territories in Figure 12), and for the `TypeTerri` and `TypeModel` fields which contain `Agri__`, `Past__` or `Fore__` and `centered` or `distributed`.

Once a model simulation of the exploitation territories is finished, a validation of territories can be calculated via the **LEIS/ROSELT>SRU>Territory validity** menu.

4.4.1.2. Distributed Model

This model takes account of several activity centres to construct an exploitation territory. The division of the observatory space can always be done with 'competition' (weighted Thiessen) although no longer around a single activity centre, but groups of ACs or an envelope of AC groups. For this, it is necessary to make a hierarchy of the ACs, i.e. to identify the 'child' AC dependant on a 'parent' AC. This hierarchy process can be different according to the season. In this version of the tool, no distributed model algorithm has been implemented. The next version will allow the weighted Thiessen method of AC groups: a group will be defined as the ACs of the same hierarchy.

4.4.2. TERRITORY VALIDATION

This dialog box (Figure 13) is displayed using the menu: **LEIS/ROSELT>SRU>Territory Validity**. The territory polygons shown correspond to the layer referenced by the territory type and the model simulation number in progress: `Agri__1`, `Past__1`, `Fore__1`.

The type of validation offered in this version relates to the **Legitimate Plot rate** (or sampling sites) in the exploitation territory: a plot is legitimate if its attachment after surveying is the AC associated to the territory included in the plot. The construction validity of a territory is thus the relationship between the number of (spatially) included and legitimate plots, and the number of included plots. The parameters necessary for this calculation are:

- a polygon layer of sampled plots for which the attachment to an AC was obtained by survey and identified in the layer by a comparable field in the layer `Agri__1`, or `Past__1`, or `Fore__1`.
- A choice of fields in each of the layers to establish the legitimacy of the relationship: correspondence between the relationship by survey (field in the Plot layer) and spatial relationship (field in the exploitation territories layer).
- A choice of the type of spatial inclusion: either strict (100% of the plot is contained in the territory), or partial (30% inclusion), or minimal (a intersection exists).

It is possible to have a dual relationship for plots (or sampling sites) for which we have not been able to determine a unique attachable AC. We can simply give a field containing the second attachment and click on **or**.

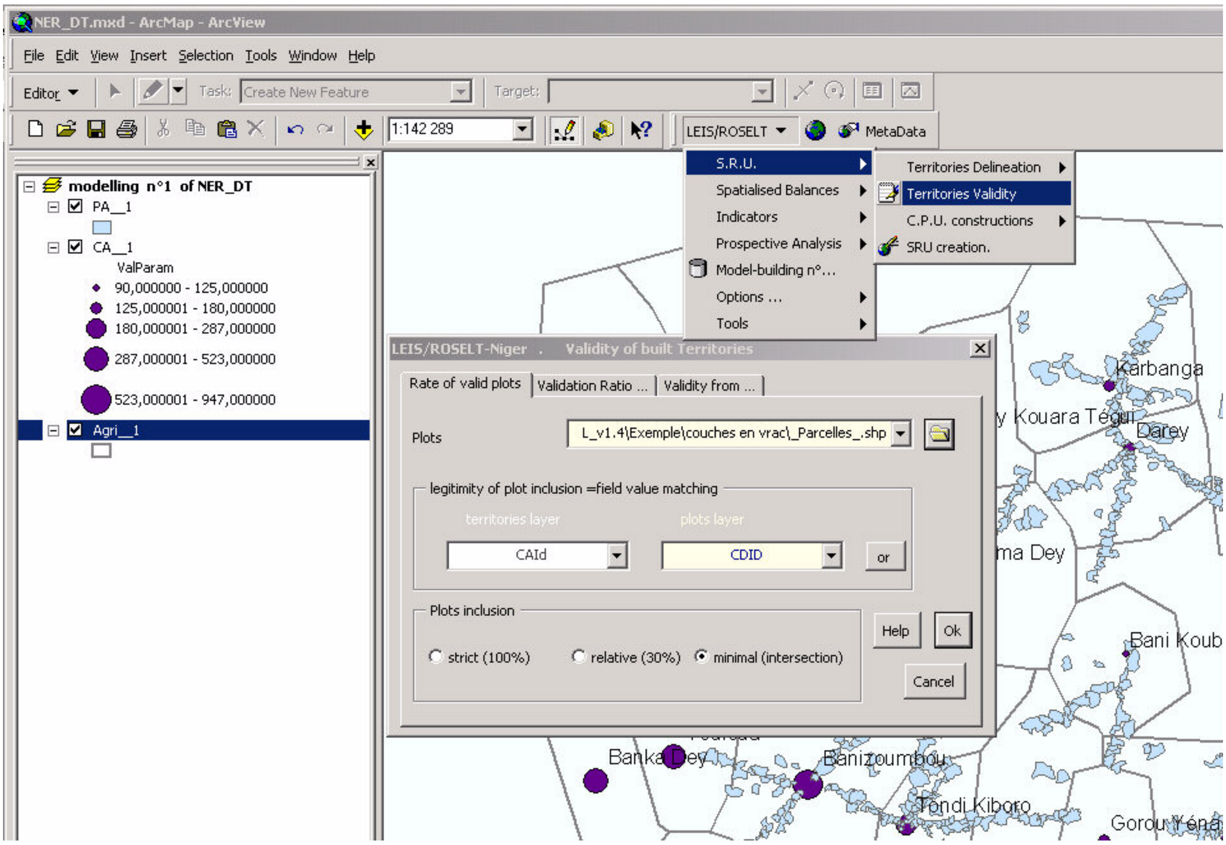


Figure 13 : Exploitation territories validation dialog box

By clicking on **ok**, two additional fields are added to the **Agri__1** layer, or `Past__1`, or `Fore__1`: Tx_ValidDelim and Nb_PolyUtil which are respectively the validity percentage and the number of plots included. The TerritoireObservatoire table fields, Tx_ValidDelim and Nb_PolyTest are also updated. They contain respectively the average rate for the territories containing at least 5 (**Options** parameter) sampled plots, and the number of territories verifying this criteria. This validity rate can be used to define a colour gradient differentiating the territories. It is possible to validate the exploitation territories with other plot layers (or sampling sites) at any moment.

The plot layer (or sampling sites) imported in the SIEL-NER_DT.mdb database with the name **PA__1** is loaded into ArcMap™ automatically.

4.5. CPU

Before being able to determine the Combined Practices Units, the *needs*[7]* must be calculated. These provide a basis to determine the extent of exploited zones within each potential exploitation territory around the AC(s) (*cf.* ROSELT/OSS, DS3, 2004).

4.5.1. NEEDS

The needs of agricultural, pastoral or forestry products can be calculated. The type of need, is chosen according to the choice of structuring activity on the observatory.

A general calculation method was implemented in the tool:

$$Need = \mathrm{Need}_{consu} + \mathrm{Need}_{Stock} + \mathrm{Need}_{commerce}$$

This formula expresses the need of the exploitation's structuring activity, in the form of the sum of different needs of exploitation products according to their use by the agent groups attached to the AC: consumption, stock, commerce.

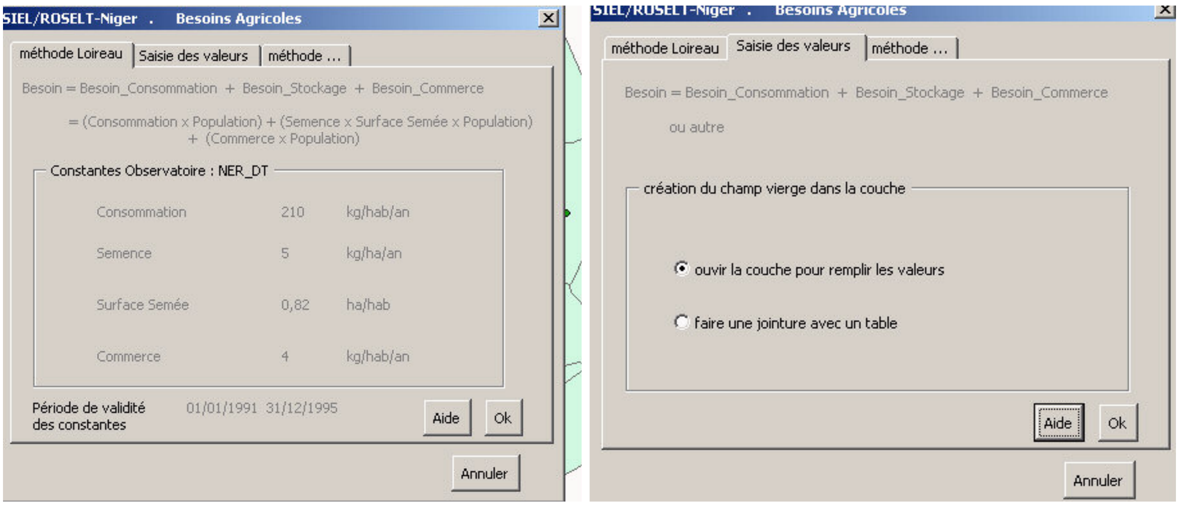


Figure 14 : agricultural needs calculation dialog box

Using the **LEIS/ROSELT>SRU>CPU construction>Needs>Agricultural needs** menu, the dialog box is displayed. The Loireau method (on the right of Figure 14) uses constants (*cf.* 9) valid throughout the observatory and takes account of the human population; the agricultural need follows the formula:

$$\begin{aligned} Need &= Need_{consu} + Need_{seed} + Need_{commerce} \\ &= (\mathrm{CteConsuCult} \times \mathrm{Population}) + (\mathrm{CteSeed} \times \mathrm{CteSurfSeed} \times \mathrm{Population})\ \text{CteSurfSeed} \\ &\quad + (\mathrm{CteCommerceAgri} \times \mathrm{Population}) \end{aligned}$$

Another implemented method consisted of entering the values, either directly in the table (of the exploitation territories layer) or by joining with another table containing an identifier of the exploitation territory, like for example the identifier of the AC in the case of the centered model.

By clicking on **ok** a new field is added in the territory layer table `Agri__1 : Besoin_Agri`.

[7] Need : products of exploitation necessary for life for groups of individuals on the exploitation territory.

For the other structuring activities, the general formula was implemented as well as the input of values. Each particular need is the product of a constant (consumption, stock, commerce) valid throughout the observatory, multiplied by the (human) population (of agent groups) of the exploitation territory.

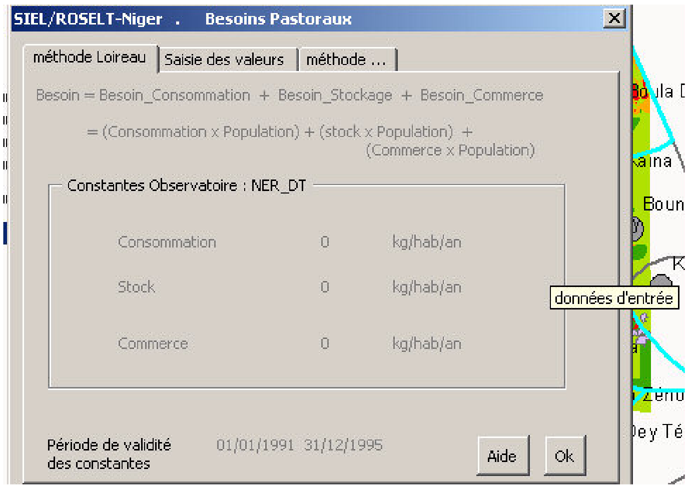


Figure 15 : pastoral needs calculation dialog box

The constants used are expressed, by way of example, in *kg* (per habitant per year). Any other unit may be used so long as it identical to the unit used to define the production obtained via the types of exploitation practices and the quality of the usable resource. Experience has shown that moving to an equivalent monetary system for example can facilitate the establishment of constants and productions (*cf.* section 9).

4.5.2. MAXIMUM INTEREST

The creation of Combined Practice Units (CPU) is a process of several steps, described below, automated in a single dialog box (Figure 16). The spatial distribution of combined practices uses the concept of maximum interest, i.e. that a class of combined practices is potentially[8] applied to the places where the interest value is at a maximum compared to other classes of combined practices (ROSELT/OSS, DS3, 2004):

1) **Calculation of a maximum interest raster image**:

The value of each pixel is the number of the combined practices class (from the set of combined practices applicable on the exploitation territory[9]) giving a maximum interest; the interest is defined by the relationship:

$$\mathrm{Pr}\,oduction(px) \big/ Effort(px)$$

This relationship is calculated on the point (or pixel) *px* of the image, where the effort (effort of the agents) is a function of the combined practices class at the point and geographic position of the AC(s) in relation to the point *px* (ROSELT/OSS, DS3, 2004).

The **Loireau** method implemented in the tool for the calculation of effort is:

$$Effort = \left[(1+pe)^{1/cd}\right]^{d\ /td}$$

[8] It will effectively be spatially distributed, or not, by the calculation processes of the CPU envelopes.
[9] Either all the combined practices, or a subset determined by the present strategic groups (see the definition of activity centre agent groups).

with:
pe = degree of artificialisation of each combined practices class, with a value between 0 and 1.
cd = coefficient of distance (with a value between 1 and 10); this gives an order of appearance of the types of combined practices as we get further away from the activity centre. The higher it is, the further away the combined practices are applied from the activity centre. It is relevant in the case of an encircling organisation of practices around the activity centres. In the opposite case, its value is reduced to 1. It is a distance penalising coefficient linked to the combined practices class chosen for the point px.
td = threshold distance linked to the AC; this is parametric data when a threshold is identified from the activity centre, over which the distance becomes a highly constricting factor for applying all combined practices classes. It is a distance penalising coefficient specific to the AC (independent of the combined practices).
and *d* = the distance from the point *px* to the AC.

The **Ba** method implemented in the tool for the calculation of effort is a variant of the Loireau method. It consists of forcing an almost zero effort for a given practice beyond a buffer distance depending on the AC (`dTampon` to add to the AC layer). The chosen practice is thus spatially distributed in a buffer zone around the ACs.

2) **Calculation of an associated production raster image**:
A raster image of production associated with the maximum interest is produced simultaneously at the first step. By default, a resolution of 300m is chosen, but it is possible to change this parameter in the **options**. This step assumes that the table linked to the combined practices classes has been filled in; in particular the exploitation products according to combined practice class and the usable resource (soil quality or pastoral quality) (*cf.* ROSELT/OSS, DS3, 2004, *cf.* section ?).

3) **Calculation of CPU envelopes**:
The effective zone of exploitation, or CPU envelope, which provides a balance of production and need, is delineated. It corresponds to the homothetic polygon of the exploitation territory for which the cumulated production achieves the need. If the need is not achieved, the envelope is equal to the territory and the territory is declared deficient.

In version 1.3 of the tool, it is possible to re-adjust the envelopes of the exploitation territories in surplus according to a redistribution of production in the deficient territories. The implemented algorithm increases the CPU envelopes in the exploitation territories in surplus until the global deficit of the observatory (sum of the deficits of the deficient exploitation territories) is satisfied or reduced.

Other redistribution algorithms will be offered in a future version of the tool in order to better take into account the different strategies in the ROSELT observatories.

4) **CPU obtainment**

The CPUs are this obtained by intersection of the CPU envelopes and the maximum interest layers.

Using the **LEIS/ROSELT>SRU>CPU construction>CPU creation** menu, the dialog box in Figure 16 is displayed. The CPU modelling parameters are defined here in order to execute the sequence of steps that follow:

1. you choose the effort calculation method;

2. you choose the reference period of the Combined Practices[10]: `DateDebValPrat` and `DateFinValPrat` from the PratiqueCombinee table; these dates are normally the same as those used for the validity of the observatory constants but can be useful for a finer temporal granularity.
3. you click on Ok.

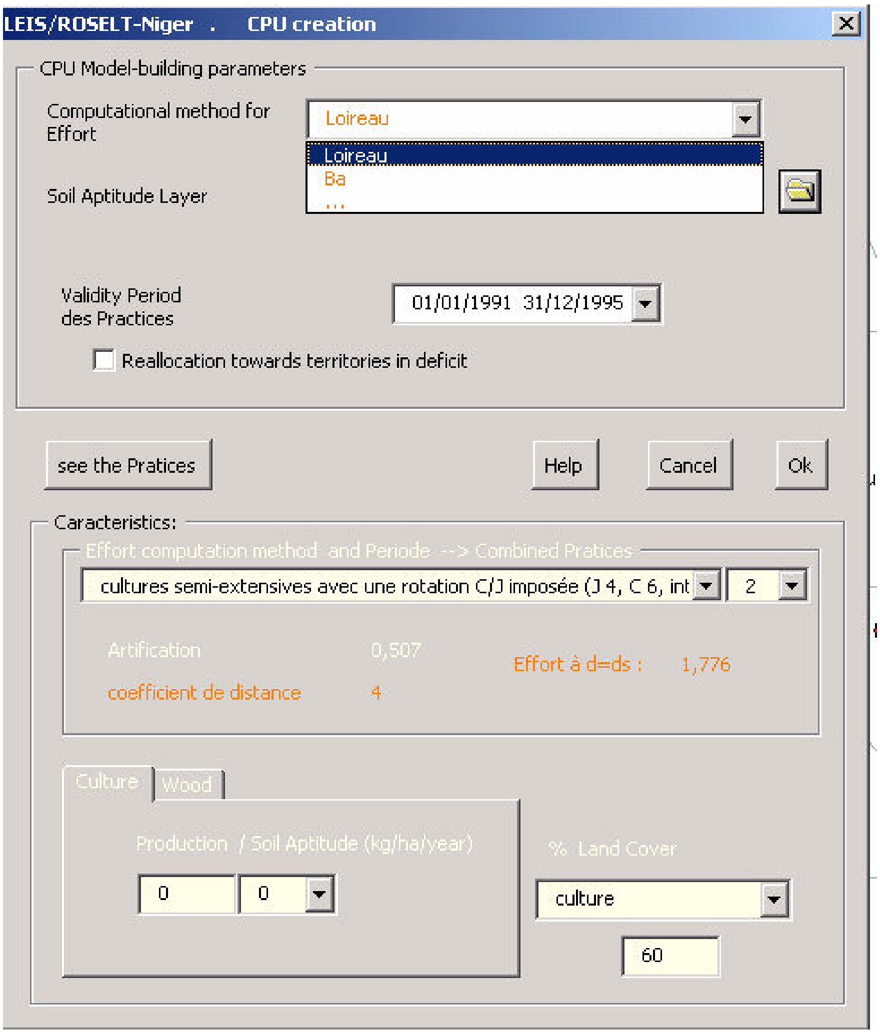


Figure 16 : CPU creation dialog box

It is possible at this level to see the parameters (**show practices** button which becomes **hide practices** to hide this section) of the combined practices classes (from the `SIEL-NER_DT.mdb` database, i.e. identical to the minimum kit at the beginning).

Clicking on **ok**, a reasonably long calculation starts (at least 10 mins for the VBA version) with the creation of the maximum interest combined practices raster (pixel value= `IdPratComb`), of the raster associated with productions, of the CPU envelope polygon layer `EnvUPC__1`, and finally the `UPC__1` layer. The `EnvUPC__1` layer contains, in particular, the `exedentUPC` field which gives the value of the production surplus (negative if deficient) after a possible redistribution of the surplus.

An update of the `TerritoireObservatoire` table fills the `P_ProdUPC` field with the parameters used to create the CPU layer as well as the `DeficitUPC, Nb_DeficitUPC,`

[10] Only the practices for the same constants validity dates as the observatory are available.

`ExedentUPC` and `Nb_ExedentUPC` fields. The values of the deficiencies and surpluses are the values after the redistribution of the surplus whereas the number of deficient territories or territories in surplus are the numbers before redistribution.

The `UPC__1` layer is automatically loaded and the CPUs are identified by the `l'IdPratComb`.

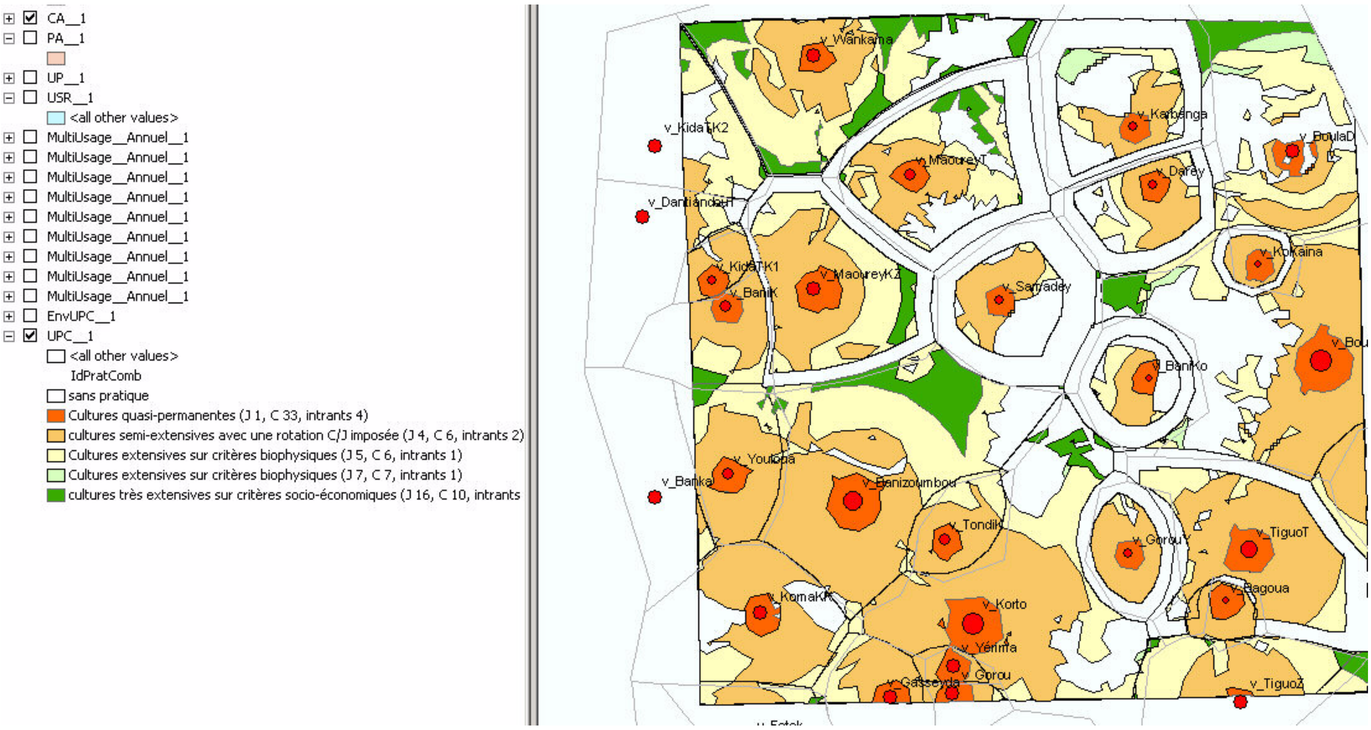


Figure 17 : example of CPU

4.5.3. VALIDATION OF THE CPU

Using the **LEIS/ROSELT>SRU>CPU construction>CPU validity** menu, it is possible to validate the CPUs. As for the exploitation territories, the **legitimate Plot rate (or sampling site)** method was implemented (ROSELT/OSS, DS3, 2004). For this method, each CPU receives a Validation Rate value and the number of sampled plots (spatially included in the CPU).

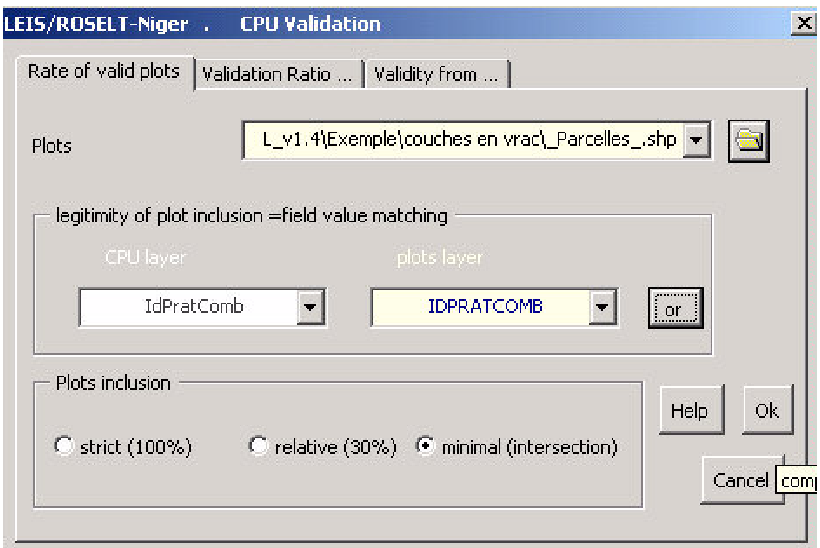


Figure 18 : CPU validation dialog box

The principle of the calculation is the same as for the validation of the exploitation territories, in being concerned only with the combined practices classes that are surveyed and modelled.

4.6. SRU

The SRUs are obtained simply by intersection of the LUs and CPUs. To show the dialog box, we use the menu: **LEIS/ROSELT>SRU>SRU construction** (Figure 19).

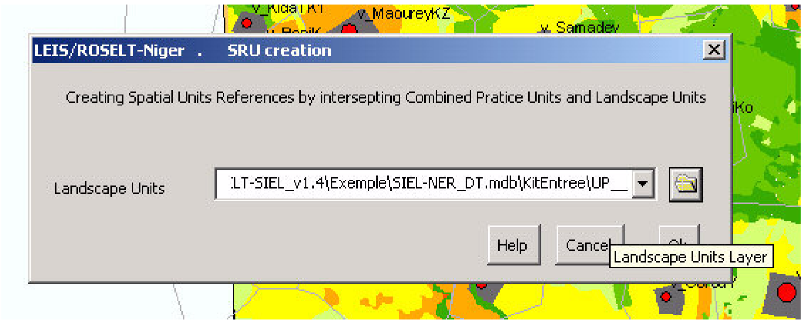


Figure 19 : SRU creation dialog box

After the calculation of the intersection, the `USR__1` layer is automatically loaded and the SRUs are identified by the `codeUP` and `l'IdPratComb` (Figure 20).

Once the Spatial units are established, the different resource extractions, available resources and balances calculations are brought into effect. The models of spatial distribution of resource extractions and available resources are thus applied (ROSELT/OSS, DS3, 2004).

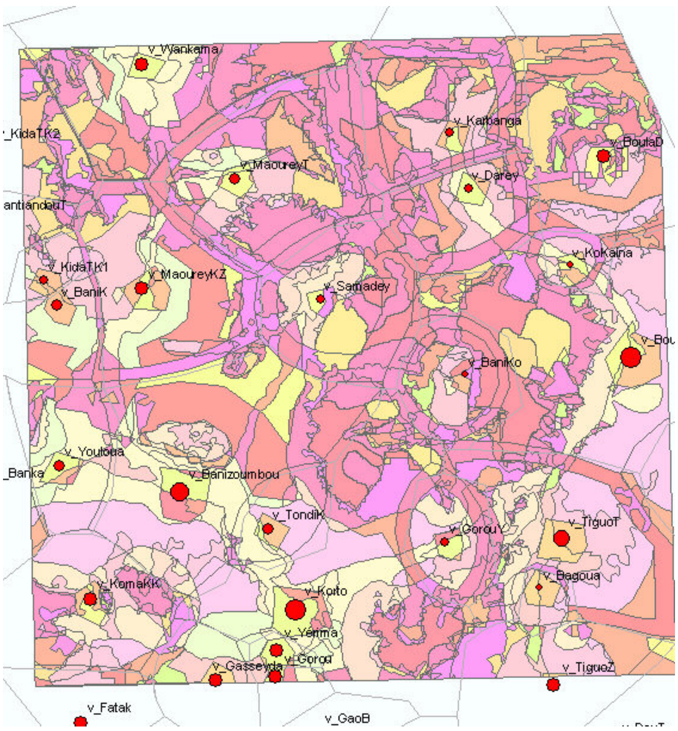


Figure 20 : example SRU

It is important to note that the space was structured by a particular exploitation activity (a particular usage), the other activities (other usages) and their impact on the environment are taken into account at the level of resource extractions/available resources which are applied in this structuring of the space into SRUs.

5. BALANCES AND INDICATORS

5.1. RESOURCE/USAGE BALANCES

To create spatial balances, we can use the **LEIS/ROSELT>Spatial Balances>Resource extraction>Available resources** menu (Figure 21):

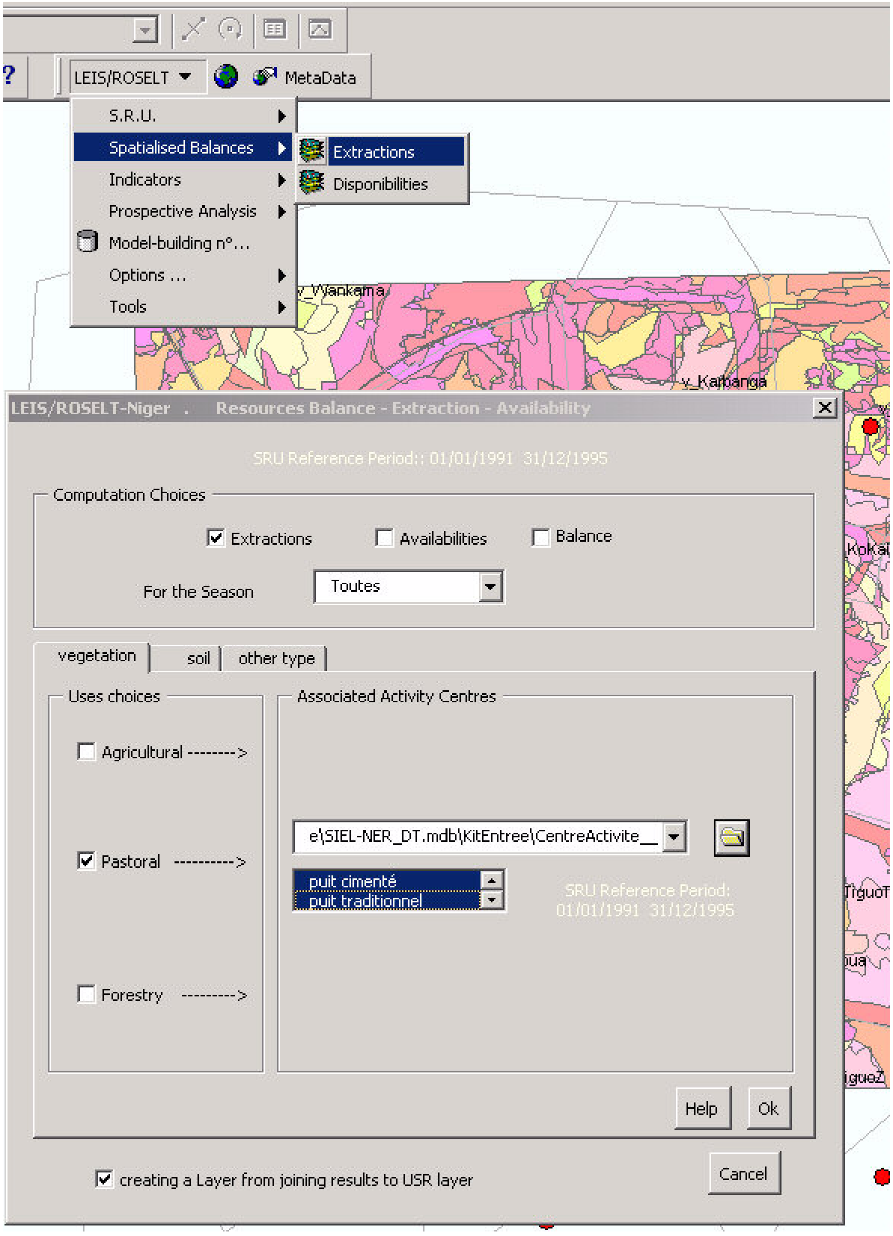


Figure 21 : LEIS/ROSELT>Spatial Balances menu and dialog box

The reference period of the `USR__1` (or the current number) corresponds to the validity period of the combined practices classes used for the creation of the CPUs.

The dialog box permits the calculation of the **resource extractions**, the **available resources**, and finally the **balances** (by subtraction) of different types of resources: **vegetation**, **soil**, etc.

In this version only, the balances of vegetal resources have been implemented. They cover three usages; for each SRU, they are established in the following manner:

- **Agricultural**: the resource extraction of natural vegetal resources due to an agricultural activity is considered as the equivalent of the total phytomass (in dry matter, DM) of the areas with a certain type of land use (defined in the SRU in relation to its characteristics inherited from the CPU) which are cleared annually for the instigation or reinstigation of crops (for example the oldest fallow in the case of a rotation of crops/fallow). We can define these land uses in the Balances tab in the Options menu.
- **Pastoral**: the extraction of natural vegetal resources due to a pastoral activity is the equivalent of the foraging consumption (in DM) of livestock: it is calculated by making the product of the `population`[11] of the chosen AC (water points for example; these ACs can be other types of AC than those chosen for the construction of the CPUs) with the foraging consumption constant (`CteConsoFour`); this value is applied to a zone of circular resource extraction defined by the pastoral access radius (`RayonAccPast`). The density of resource extractions is this calculated and applied to the intersection area between the SRU and the resource extraction zone; which gives the resource extraction in the SRU.
- **Forestry** (energy): the extraction of natural vegetal resources due to the activity of wood extraction is calculated in the same way as for the pastoral resource extraction with the `CteConsoBois` and `RayonAccBois`, but with the possibility of applying different resource extraction densities according to whether the area is under the influence of crops or not. The density differential is expressed by a coefficient of preference; this coefficient `CtePrefBoisZhec` is an observatory constant.

The calculation of the available vegetal resources for each usage corresponds to the weighted sum of the equivalents of phytomass in dry material of the different strata of vegetation. The weights depend on the usage type and land use type; they are percentages and are part of the input data in the `PctDispoBiomasse` table. Thus, the generic calculation is:

$$
\begin{aligned}
&\mathrm{Re}source\_availability(usage, land\_use)_{sru} = PctMStotal(usage, land\_use) \times MStotal_{sru}(land\_use) + \\
&PctMSherba(usage, land\_use) \times MSherba_{sru}(land\_use) + \\
&PctMSlignFeuiB(usage, land\_use) \times MSlignFeuiB_{sru}(land\_use) + \\
&PctMSlignFeuiH(usage, land\_use) \times MSlignFeuiH_{sru}(land\_use) + \\
&PctMSlignTige\_4(usage, land\_use) \times MSlignTige\_4_{sru}(land\_use) + \\
&PctMSlignTige4\_(usage, land\_use) \times MSlignTige4\_{}_{sru}(land\_use)
\end{aligned}
$$

The *sru* indice signifies the dependence on the SRU characteristics (landscape unit and combined practices class).

For example, in the Dantiandou observatory (Nigeria), the calculations of available vegetal resources with respect to the Pastoral usage of fallow land use for a year is half of the herbaceous biomass, the total biomass of low wood and half the biomass for the high wood:

[11] Animal population in Tropical Livestock Unit (TLU) or General Livestock Unit (GLU) or all other unit also chosen for the constant of foraging consumption.

$$\mathrm{Re}\,source\_availability(Pastoral, fallow1)_{sru} = 0 \times MStotal_{sru}(fallow1) + 50 \times MSherba_{sru}(fallow1) + 100 \times MSlignFeuiB_{sru}(fallow1) + 50 \times MSlignFeuiH_{sru}(fallow1) + 0 \times MSlignTige\_4_{sru}(fallow1) + 0 \times MSlignTige4\_{}_{sru}(fallow1)$$

$MSherba_{sru}(fallow1)$ is the equivalent in dry material of the woody biomass for the fallow land use for a year defined by the land unit of the SRU, multiplied by the percentage of land use defined by the combined practices class that characterised the SRU.

These balances are calculated annually, though of course the resource extractions can be calculated per season (generally the case for pastoral activity) and accumulated to evaluate the annual resource extraction.

In the dialog box the following choices must be made:

1. you choose between resource extraction and/or available resources and/or balances;
2. you choose the season;
3. you choose the usages for these balances;
4. for each usage, you load the appropriate AC layer and you select the types of activity centres linked to this usage;
5. you click on **ok** to run the longest calculation of the different stages of the modelling[12];
6. a balance table is created and automatically joined with the `USR__n` layer for the chosen season; we obtain a layer with the generic name `MultiUsage__<saison>__n`.

The stereotypical table for the balance type and model simulation number has the name `BilanVeg__1` where Veg indicates vegetation (the 1 is the model simulation number). The possible values of resource extractions or available resources (and also difference and quotient balances) are updated for the validity period of the constants given for this model simulation. For agricultural usage, we have the variables `dPreleAgri` and `dDispoAgri`, for the density of resource extraction and of available resources respectively, and `dDmPAgri` and `DmPAgri` for balance differences in density and in quantity.

Figure 22 gives as an example the calculation of agricultural resource extractions for a year.

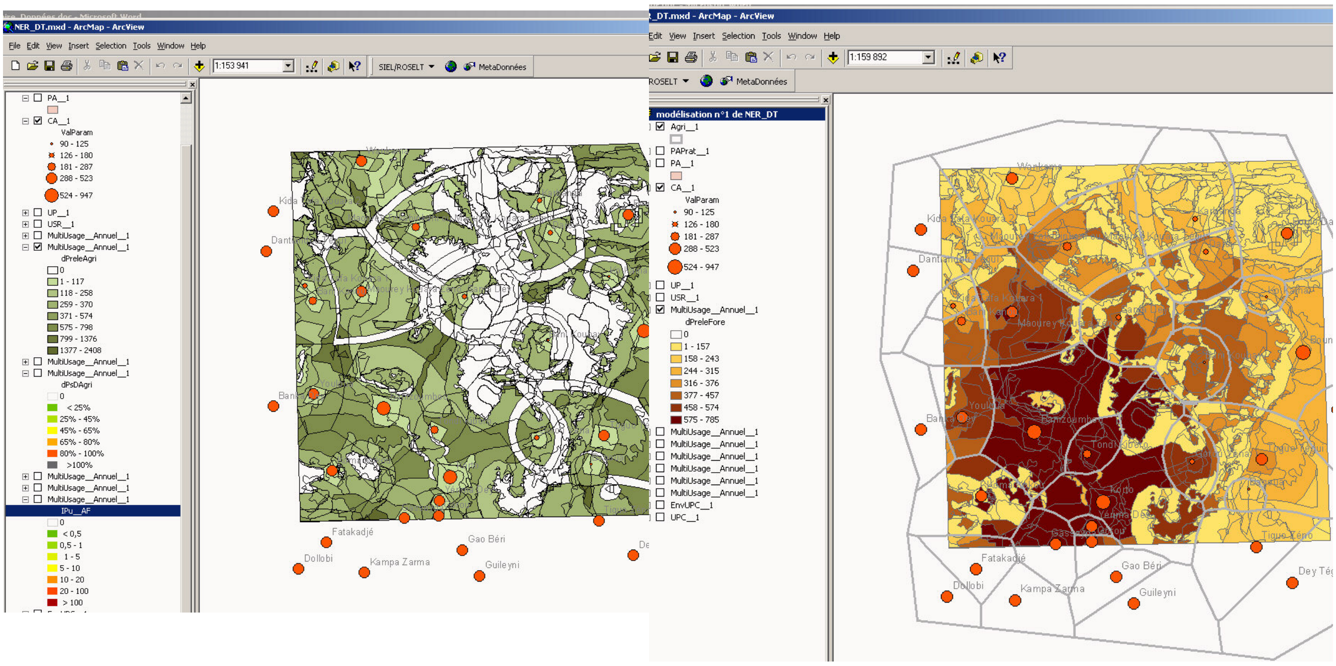


Figure 22 : agricultural and forestry resource extractions example

[12] This calculation can take up to several hours.

5.2. INDICATORS

From the calculations of resource extractions, available resources and balances, it is possible to calculate indicators according to predefined formulae. The indicator menu (Figure 23 and Figure 24) is for this type of calculation applied to the SRUs.

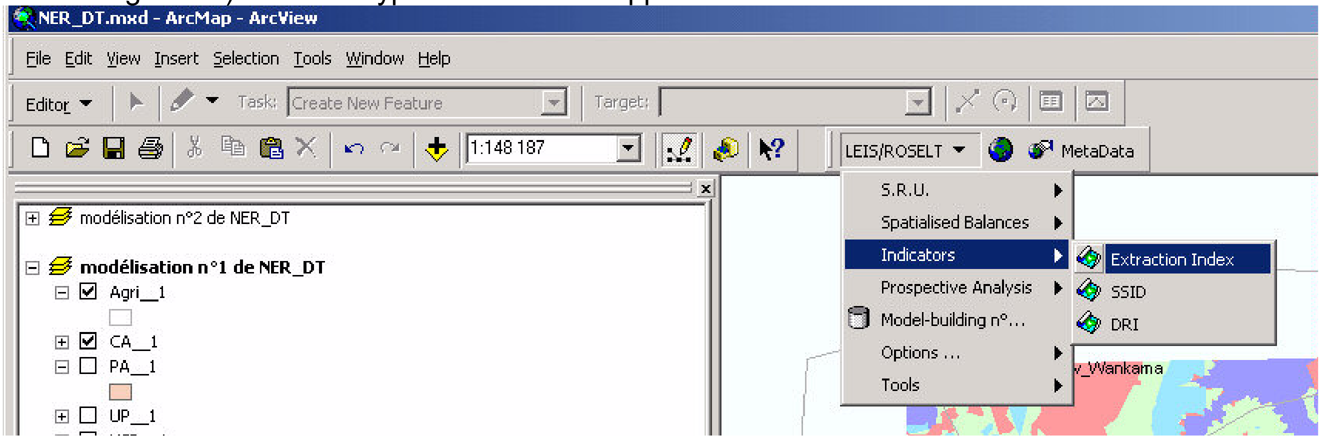


Figure 23 : LEIS/ROSELT>Desertification indicators menu

A few predefined formulae are given in this version of the tool, but other simple combinations of SRU attributes can be made simply using the classic functions of ArcMap™, by using a layer editor and the creation of a new field: for the chosen season, a `MultiUsage__<saison>__n` layer is edited.

The Absolute Resource Extraction index (absolute EI – from the French *l'indice de Prélèvement Absolue, IP absolu*) for a usage, is the relationship between the resource extractions (P) and the available resources (D) for the current SRU (ROSELT/OSS, DS3, 2004):

$$EI_i = (P_i / D_i)$$

The Relative Resource Extraction index (relative EI – from the French *l'indice de Prélèvement Relatif*, *IP relatif*) is a formula comparing the resource extractions (P) and available resources (D) for the current SRU and the averages of the observatory (EIg) or the SRUs of the same type (EIu) (ROSELT/OSS, DS3, 2004):

$$EIg_i = (P_i / D_i)/(P_g / D_g) \text{ and } EIu_i = (P_i / D_i)/(P_u / D_g)$$

i for the current SRU
u for all SRUs of the same type as i (average)
g for all the SRUs (average).

To calculate the AREI, the `BilanVeg__n` table must chosen, as well as a season and finally the usages to consider.

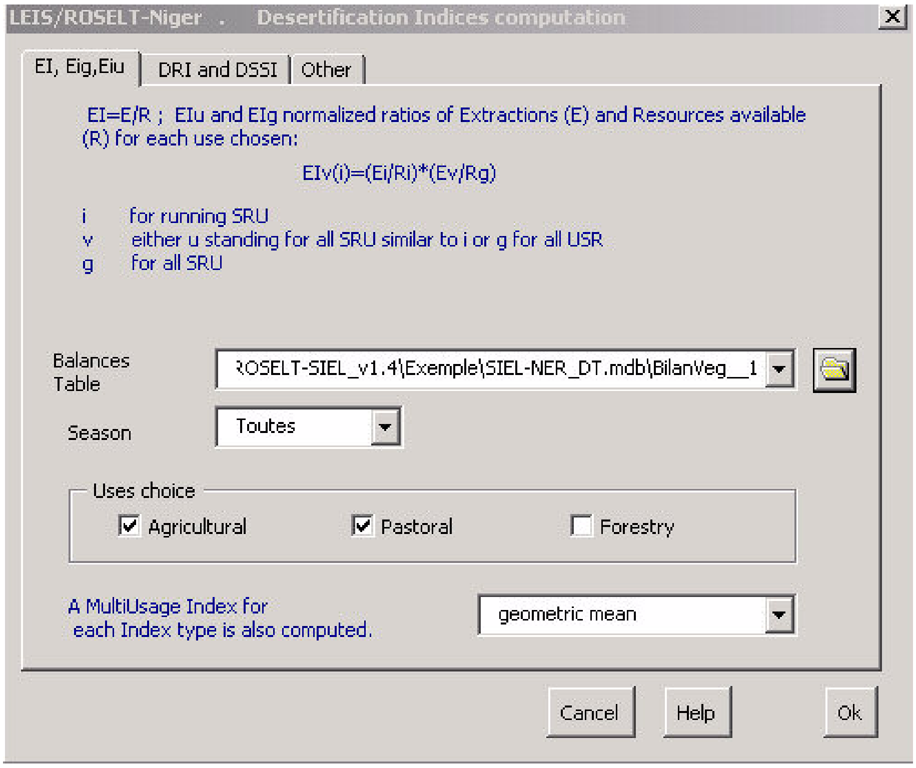


Figure 24 : indicators calculation dialog box

For several usages, each index can be calculated and a multi-usage 'summary' of indexes is calculated: product, arithmetic average, geometric average.[13]

It is therefore possible to produce balance maps or desertification risk index maps using the functionality of `ArcMap™` to create the maps. These maps, as well as the data used to produce them, are usefully referenced in the observatory metadata database.

Systems of symbol types, for balances and indexes, have been stored in the `.lyr` files in the `Bin` installation folder. To use a classification, its legend and the colour palette, we can import the following symbols.

[13] The summary calculation does not take account of zero values.

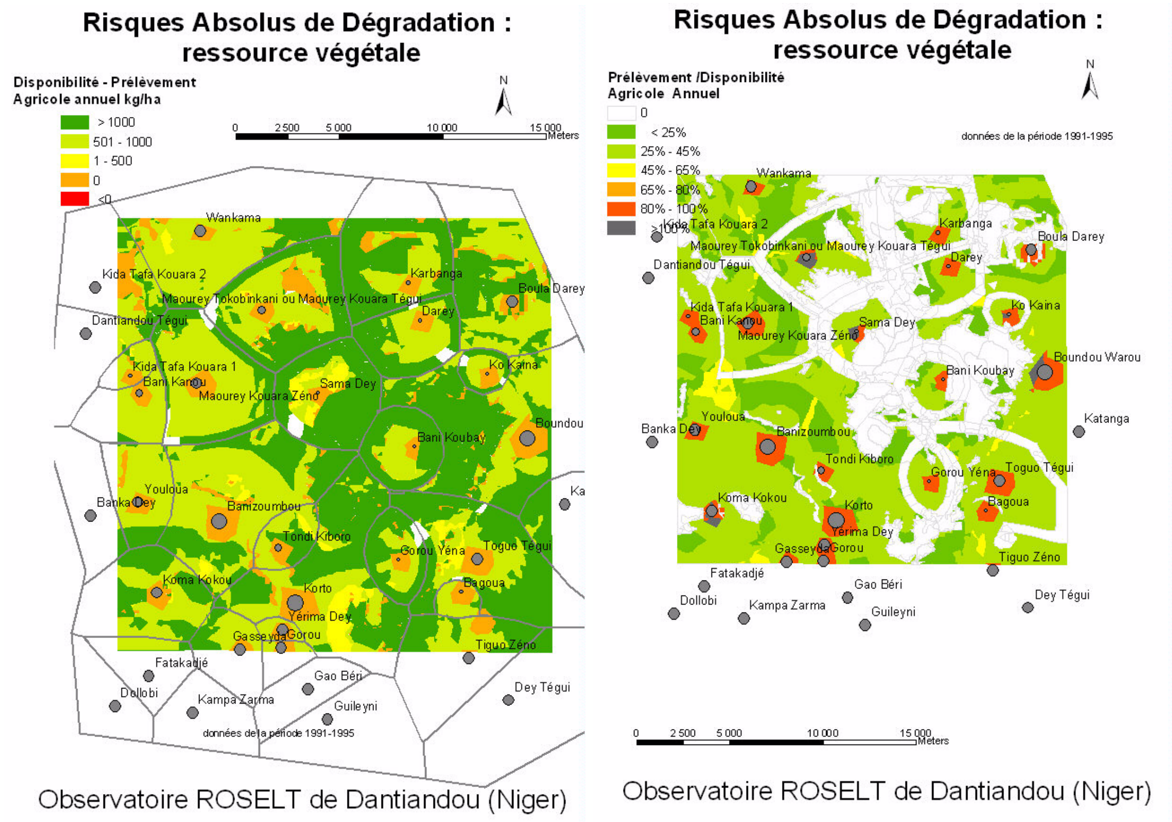


Figure 25 : Agricultural balance map of vegetal resource degradation in Dantiandou (Nigeria)

Figure 25 presents the vegetation balance in relation to the agricultural activity; the AREI on the left clearly shows the important resource extractions (greater than 80% of the available resources) in the zones close to the villages and even a over-extraction around Maouey TokobinKani.

Figure 26 : zoom of the agricultural EI on the zone of over-extraction

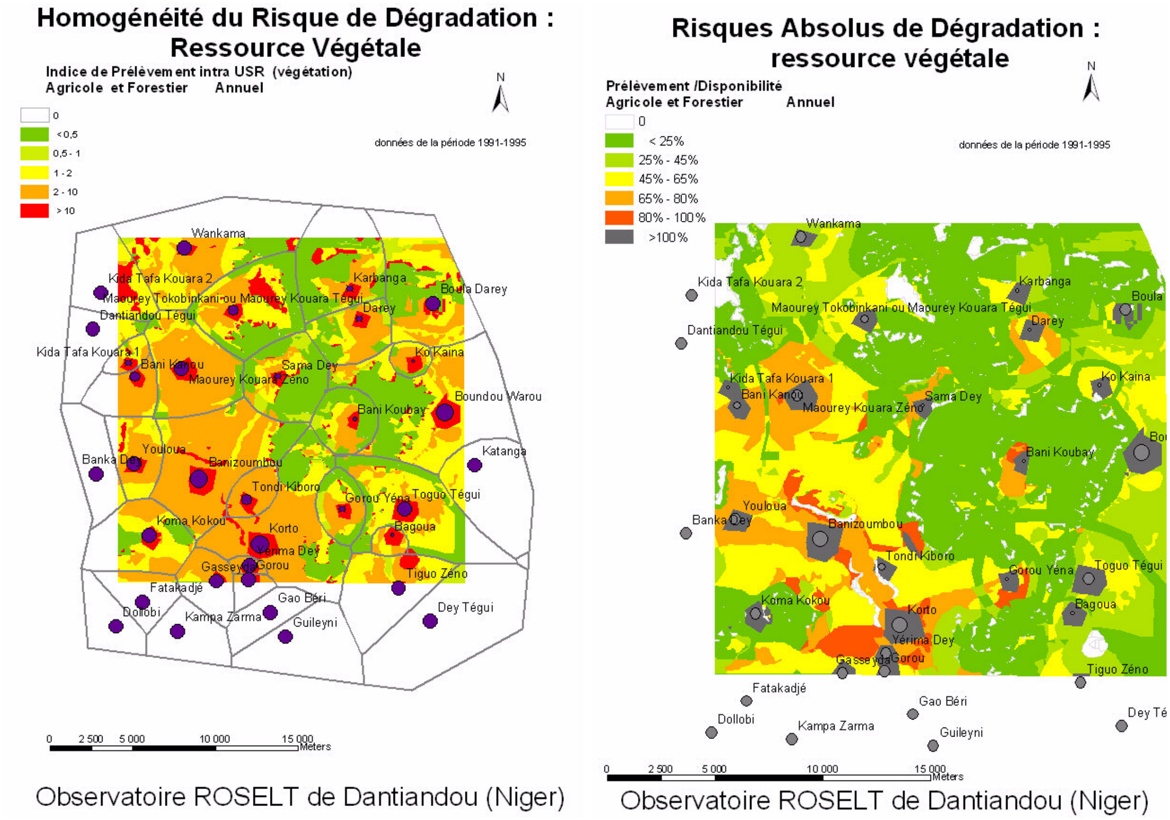


Figure 27 : Homogeneity map of (Agricultural and Forestry) Desertification risk and of Absolute Desertification Risk at Dantiandou (Nigeria)

For the desertification risk homogeneity map, the red zones indicate the zones of over-extraction in relation to the SRU 'average' of the same type as the indicated SRU.

6. FORECAST ANALYSIS

This module is under development and will be completely operational in version 1.4 of the tool. It has two additional tabs to understand and/or preview the evolution of resource degradation due to a combination of anthropic and climatic factors acting on the given environment (the observatory).

The first tab concerns the development of a forecast scenario from a choice of parameters linked to the different aspects of the LEIS, usages, resources, and/or different global models (climatic, socio-demographic, previsions and strategies of the agents) acting on the LEIS parameters. On the basis of a forecast scenario which is first defined by a time horizon and a time step, the calculation of predictions of resource/usage balances already made for the exploratory period will be made at each defined time step in the scenario.

The second tab is for the statistical analysis of a temporal sequence of balance maps or indicators in order to either describe the observed evolution or to predict a future evolution.

The calculation of forecast resource/usage balances on one or many time steps implies two approaches. The first consists of considering that the parameters defined in the scenario have not effectively changed between two time steps. This means to evaluate a balance at T_{0+3}, does not depend on the 'result' obtained at T_{0+2} neither at T_{0+1}, T_0 being the modelling reference date for the structuring of the observatory (the last year of the reference period for the construction of the SRUs).

A finer approach should consider that the 'result' of the prediction at T_{0+1} influences the prediction at T_{0+2}, but that implies the development of models allowing the definition of the influence of a prediction 'result' on the other sensitive LEIS parameters. This second more complex approach is envisaged in the future but a significant conceptual and methodological process will need to precede an evolution of the tool in this direction.

6.1. FORECAST SCENARIO

To create a scenario for the evolution of certain LEIS parameters and calculate the forecast resource/usage balances, use the menu **LEIS/ROSELT>Forecast analysis>Forecast scenario**.

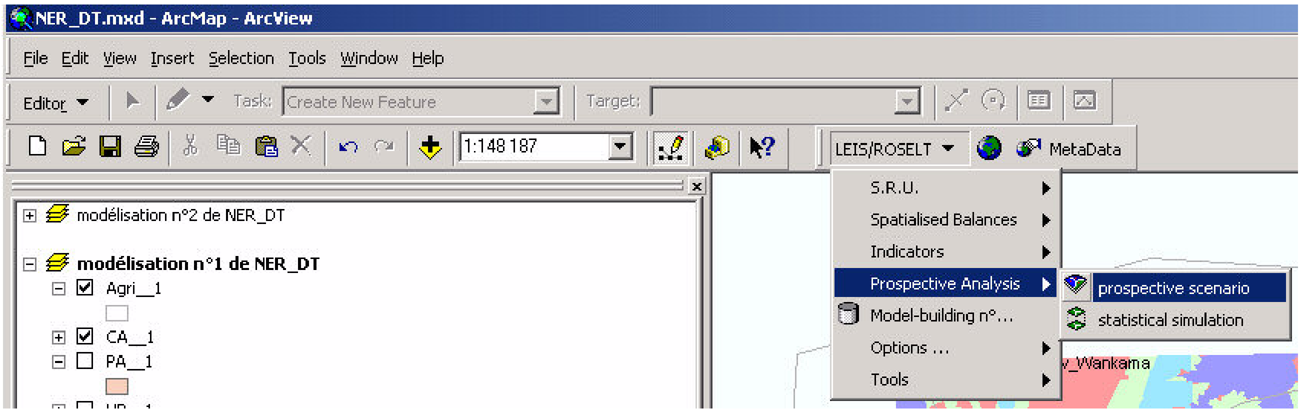


Figure 28 : LEIS/ROSELT>Forecast analysis>Forecast scenario menu

The dialog box shows the temporal reference of the current model simulation and gives a time horizon of forecast calculations. To reach this *time horizon*, several *time steps* are proposed: at each time step, a resource/usage balance calculation will be made[14]. A `MultiUsagePros__1` layer, i.e. associated with the vegetation balance for model simulation n°1 will be created, identical from a structural point of view to that of the balances (`MultiUsage__<saison>__1`) with, also, the season taking the values already calculated in exploratory construction mode and a field identifying the scenario (*cf.* section 9).

The scenario is presented according to the numeric and/or cartographic parameters from three general LEIS aspects: Usages aspect, Resources aspect, and a Global aspect for which the parameters directly influence the first two aspects (there may be an accumulation of evolution scenarios).

[14] Note that all the modelling choices are taken as is; only the parameters which undergo an evolution are updated to make the new calculations.

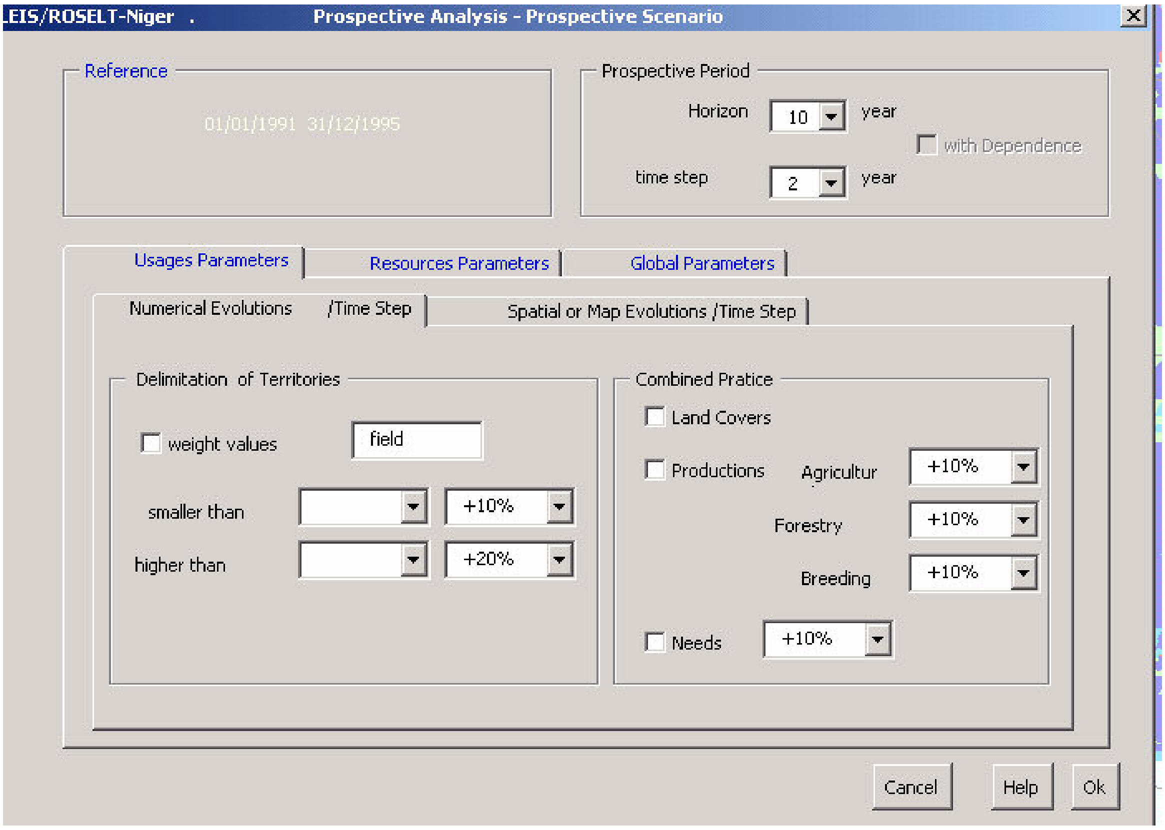


Figure 29 : Forecast scenario dialog box

For each numerical parameter ticked, a percentage increase (or decrease) at each new time step must be specified. For cartographic evolutions, a sequence of maps of desired data (e.g. successive Soil Aptitude layers), must be supplied in a single layer: a field identifies the number of the time step 1, 2, 3 (see `SIEL_Dictionnaire_Données.pdf`).

The global scenario, called subjective (previsions and strategies of the agents), defines a succession of subjective qualifications of the type “Good year”, “Average year”, “Bad year” allowing the recalculation of productions at each time step (see the `PctBonMoyMau` table in which the LEIS data are thus qualified at input).

The global socio-demographic scenario will for the time being only affect the (animal and human) population parameter and the consumption constants.

The implementation of global climatic scenarios will require for example a model giving an increase or decrease of biomass (and by land use) given the knowledge of predicted rain levels, for a given period (and for each time step).

Once the `MultiUsagePros__1` layer is created, it is reusable by the Indicators menu to calculate, at the desired time step, a forecast map of vegetal resource degradation risk in this case. The dialog box adapts to the fact that we have the forecast balances: appearance of the field scenario n°, time step n°. It is also reusable for the recalculation of balances by changing the usage, season, and activity centre: the population, biomasses and observatory constants are used, for the time steps considered.

6.2. STATISTICAL SIMULATION

This functionality is envisaged for version 2.0 of the tool onwards, due in 2005. The statistical spatio-temporal model will be implemented in order to describe an evolution of several maps illustrating the risk of desertification associated with an observatory. This description will then allow, on one hand, the development of scenarios based on a model (see the previous section), and on the other hand, the development of forecast simulations based on statistical properties.

7. TOOLS

Besides the modification of the minimum dataset, the **tools** menu provides a **Joining Table and Layer** function. This joining allows in particular the addition of a geographical layer to the minimum kit.

7.1. JOINNG TABLE AND LAYER

A joining *n to 1* indicates that a join is made between several geographical objects from a layer and a line from the table. This joining establishes the correspondence between the fields of the vector layer and the fields of the table. Adding attributary information to a layer of geographical objects the matching up is from one row on the table side; we do not add geographical objects onto the layer.

At the time of the joining (Figure 30), there is an automatic deletion of all the layer fields other than the *foreign key** fields and the fields linked to the geometric aspect of the layer. At the same time, using the dialog box, it is possible to keep certain layer fields. Beware, to make a join, there must be a correspondence between the field values, but also the type(s) of the field(s) (text, integer, real, etc.).

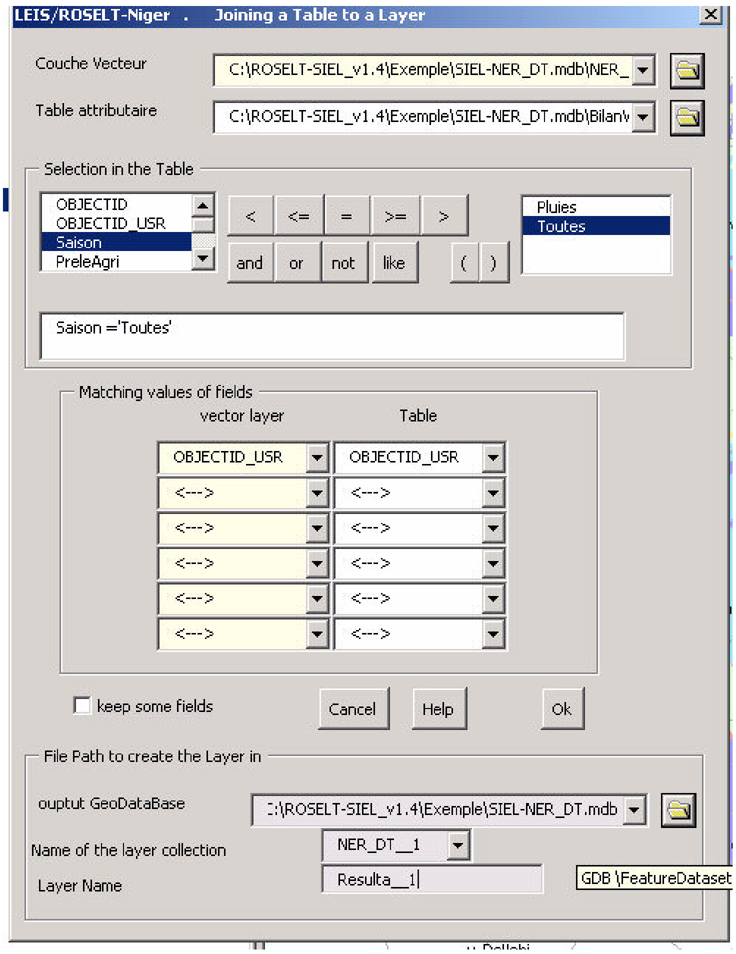


Figure 30 : Table and Layer Joining dialog box

The fields in white are the fields from the **table** constituting the foreign key (side 1) of the **FeatureClass*** under the names given in yellow (side n).

We have the prior possibility to extract by **selection in the table**, a sub-table in order to obtain the *1* of the table side for the joining elements chosen (subset of the *primary key**). The default choices of layer join destination are modifiable: the database, the FeatureDataset* and the layer name.

7.2. CODE UPDATE

The VBA version of the extension code is stored in a sub-folder of the distribution `Bin` folder. Updates to the code can be copied into this sub-folder and the **code update** folder is used to reload the code into the .mxd files already used. As indicated in the `ReadMe.txt` file in the Bin folder, it is also possible to recreate a `NOUVEL-OBSERVATOIRE.mxd` model simulation file.

8. LEIS/ROSELT GEODATABASE

For ArcView™ ESRI made available personnal geodatabases as MS-ACCESS™ databases. They contain attribute data as well as geographic information. Inside the tool the LEIS database will be always named : SIEL-<Observatory code>.mdb. ArcCatalog™ is the application to browse geodatabases and manage metadata. An extension module has been developed for ROSELT metadata ; once its menu loaded into ArcCatalog™ it is possible to manage metadata according to ROSELT uses with the ISO19115 norm. XML files can be produce to be imported from MDweb (ROSELT/OSS TC12, 2004.
After an overview of the Minimm Kit of data and the database containing the modelling, a thorough description of of the Data Dictionnary is given at section 8.3.

8.1. KIT MINIMUM BROWSING

Figure 31 shows the SIEL database with the entry dataset and the modelling layers. The Kit Minimum concerns attribute tables and some layers; these layers are gathered in the FeatureDataset called KitEntrée.

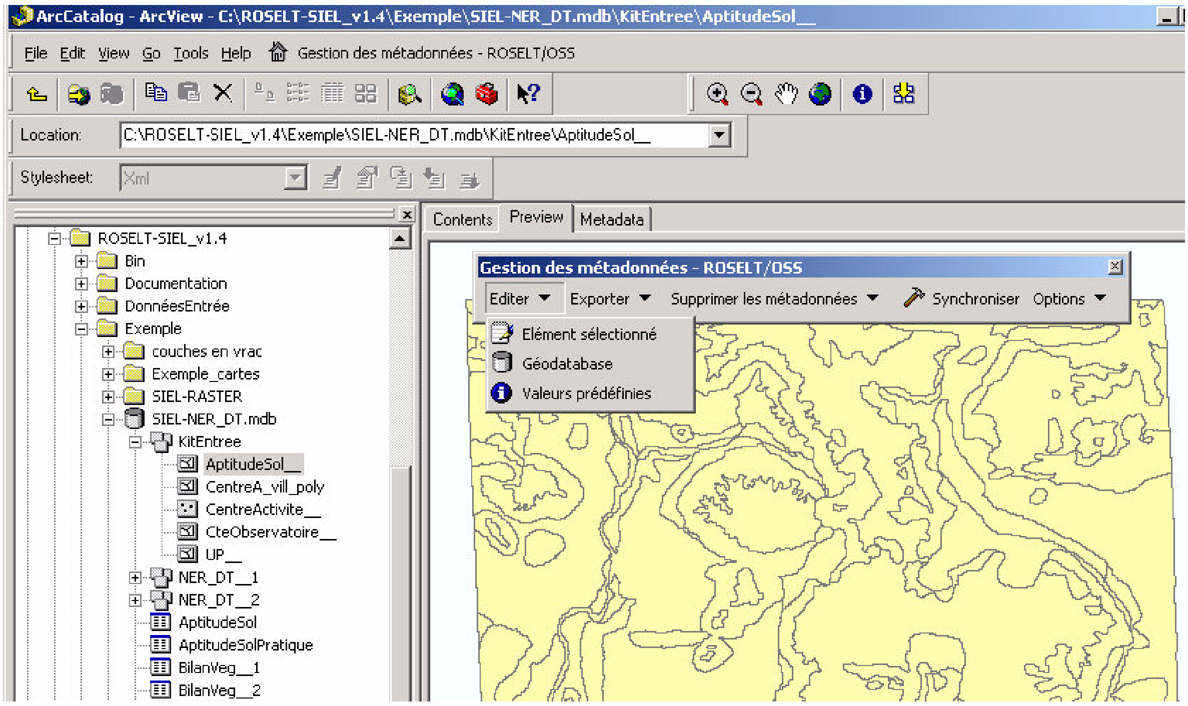


Figure 31 : LEIS GeoDataBase and minimum kit

Preparing, importing, exporting, visualising and destroying are the main functionalities. Another important functionnality is towards medata automatic and manual editing for exporting to MdWeb. From Arcatalog ArcToolbox can be run to perform some GIS operations such as projecting a layer onto a given spatial reference.

8.2. MODELLING STORAGE

The GeoDatabase will grow modelling step after modelling step and for each different modelling. Every table or layer generated by the tool is always named with __<number> as suffix indicating the modelling number.

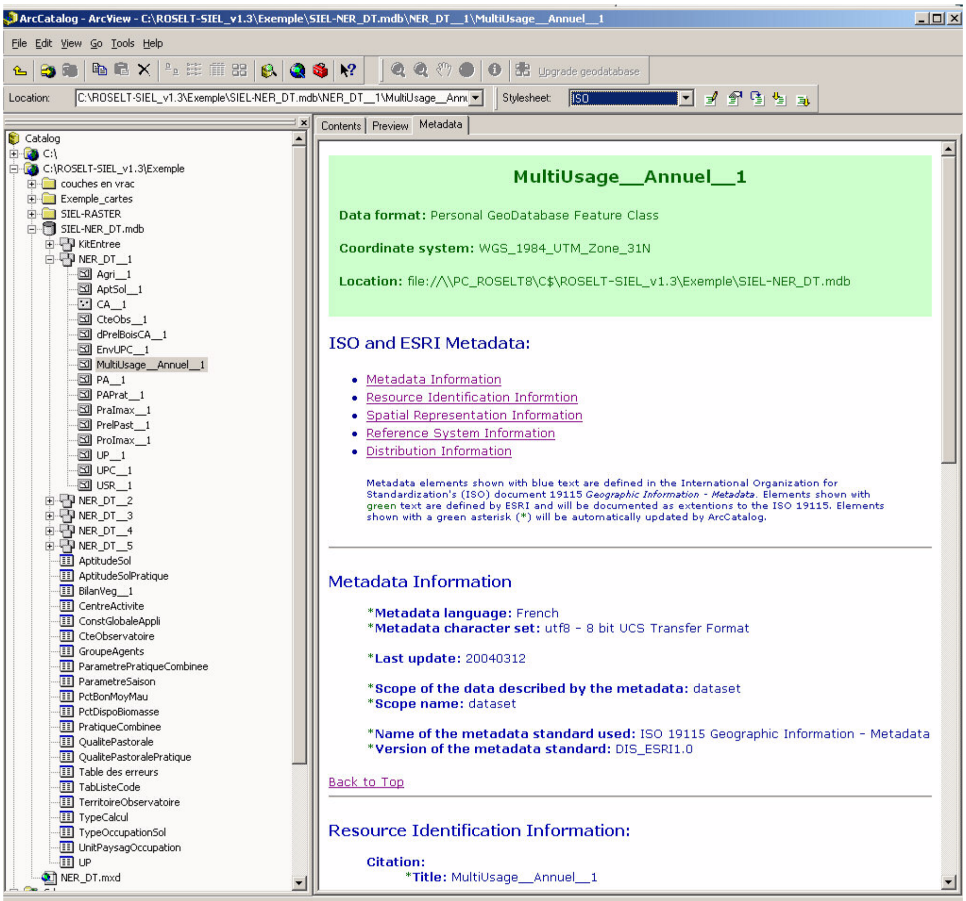


Figure 32 : LEIS GeoDataBase and modelling

For example the FeatureDataset `NER_DT__1` is a collection of layers generated under the modelling `1` while aiming at modelling the SRU layer `USR__1` and containing the Indicator or balances layer as well.

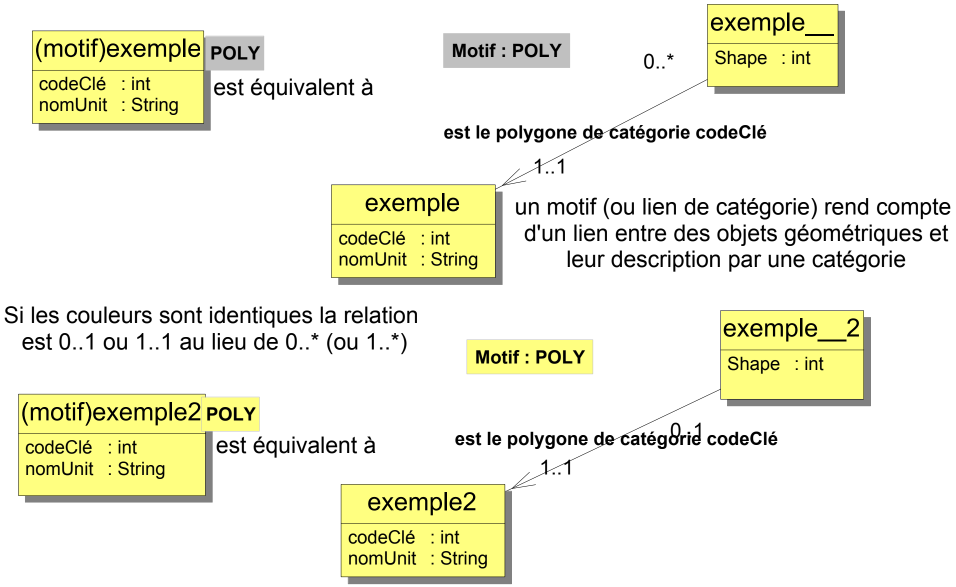
8.3. DATA DICTIONARY

This section is standalone and could be read independently. It explains the LEIS Object model and its RDBMS counterpart. The necessary datasets to be used by the tool `SIEL-ROSELT_v1.4` called the Minimum Kit is fully described and this section establishes the reference of it.

8.3.1. ENTRY DATASET SPECIFICATIONS

8.3.1.1. DATA OBJECT MODEL (UML formalism)

Figure 33 : geometric pattern



For a better understanding of the data structure one should refer to the document describing the LEIS concepts (ROSELT/OSS, DS3, 2004). A glossary at the end of this section makes a quick remind with the later mentionned document.

The model explained applies for `ROSELT-SIEL_v1.4` version of the tool and could evolve for future versions.

Opposite figure explains that geometric objects described by catégories are expressed by a relation between their category (thematic description) and their purely geometry part. When a category can be linked to more than one geometric object the label has a different colour than the class.

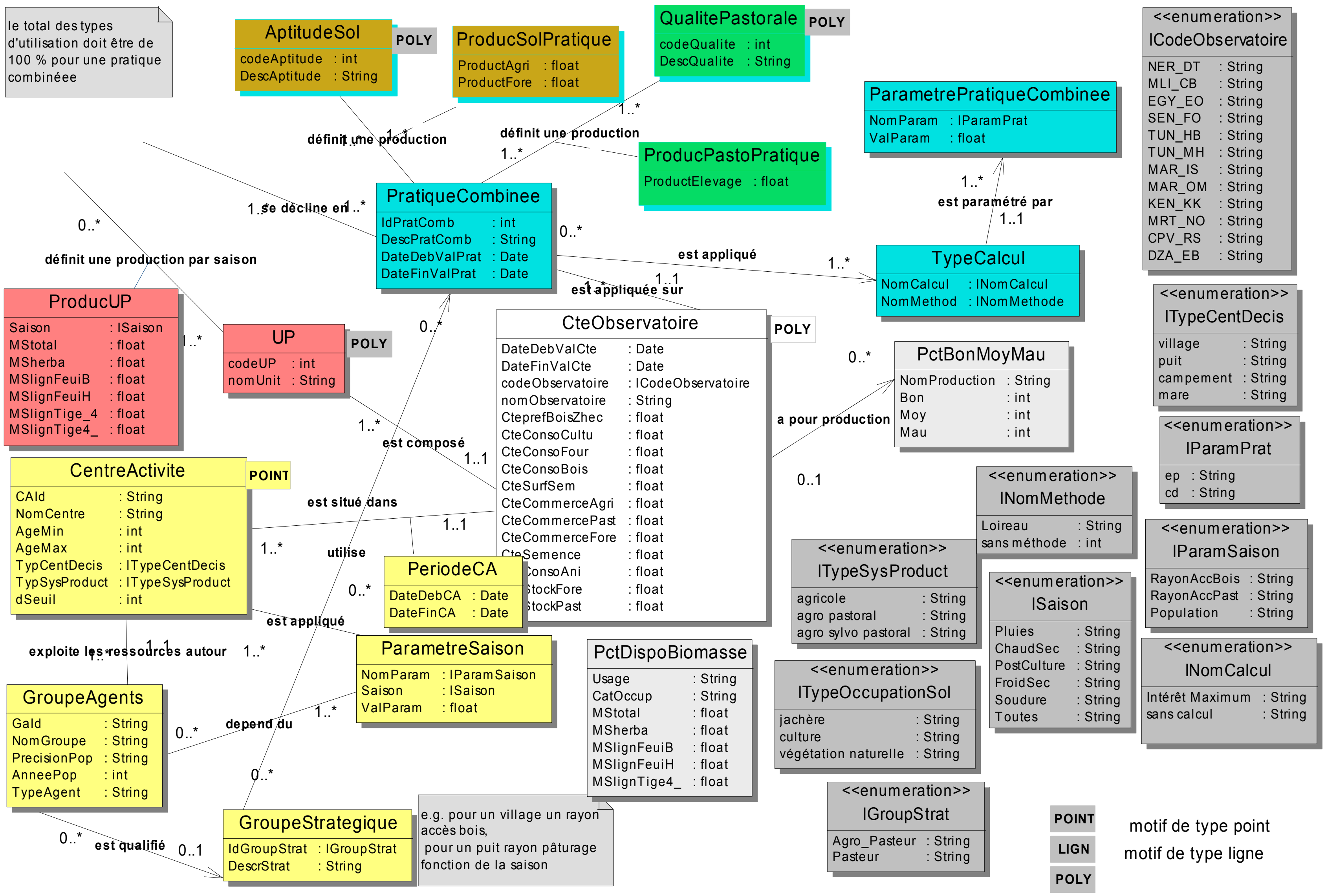


Figure 34 : Modèle conceptuel des données d'entrée du SIEL

The Observatory is registered for a given period by the class `CteObservatoire` where some constants applicable in all the observatory for this period are defined. `PctBonMoyMau` informs if productions given for that period correpond to a good, average, or bad period ; one gives the value 100 for the one considered and rates the others according to the order: **bad < average < good**. *For example if the agricultura production given is an average one, `Moy` takes the value 100, and say `Bon` will have 150, `Mau` 66, saying that if I had had a period of god crops I would have been 1,5 times higher, and if it had been a bad period crops would have been lower by a third. Another set of global parameters to establish availabilities amounts according to use and land use catégories when multiplying these percentage parameters by the actual biomass production are also necessary (`PctDispoBiomasse`). Enumeration parameters mustbe checked to be in agreement with local specificties such as the name of the seasons, land use names, activity centres type names respectively in `lSaison`, `lTypeOccupationSol`, `lTypeCentDecis`, but some lists must not be modified (`lCodeObservatoire`, `lNomMethode`[15]), see 8.3.1.3.3.*

In term of uses the observatory is linked to its activity centres (`CentreActivite`) from where the Agents (`GroupeAgents`) are exploiting the area around (resource extractions according to some parameters `ParametreSaison`). Exploitation strategies are described by the typology of Combined Pratices (`PratiqueCombinee`) which have different operational caracteristics (`TypeCalcul`, `ParametrePratiqueCombinee`, `TypeOccupationSol`) and productions (`ProducPastoPratique`, `ProducSolPratique`) depending on local land conditions (`Aptitudesol` et `QualitePastorale`). The agent groups may have different strategies by belonging to different strategic groups having specific combined practices.

The observatory is also linked to its landscape (`UP`) from which vegetation resources are measured according to land uses and season (`ProducUP`).

8.3.1.2. PHYSICAL MODEL OF ALPHANUMERIC DATA

From the above conceptual UML mode a physical model compatible with MS-Access 2000 used by ArcGIS™ 8.3 for local RDBMS has been implemented for the LEIS geodatabase. Specifications given here relies on this solution .
This database template is given in the tool distribution under the name `SIEL-KitMini.mdb` and can be used outside the ARGIS extension to be filled.

[15] Its modification implies new code in the extension.

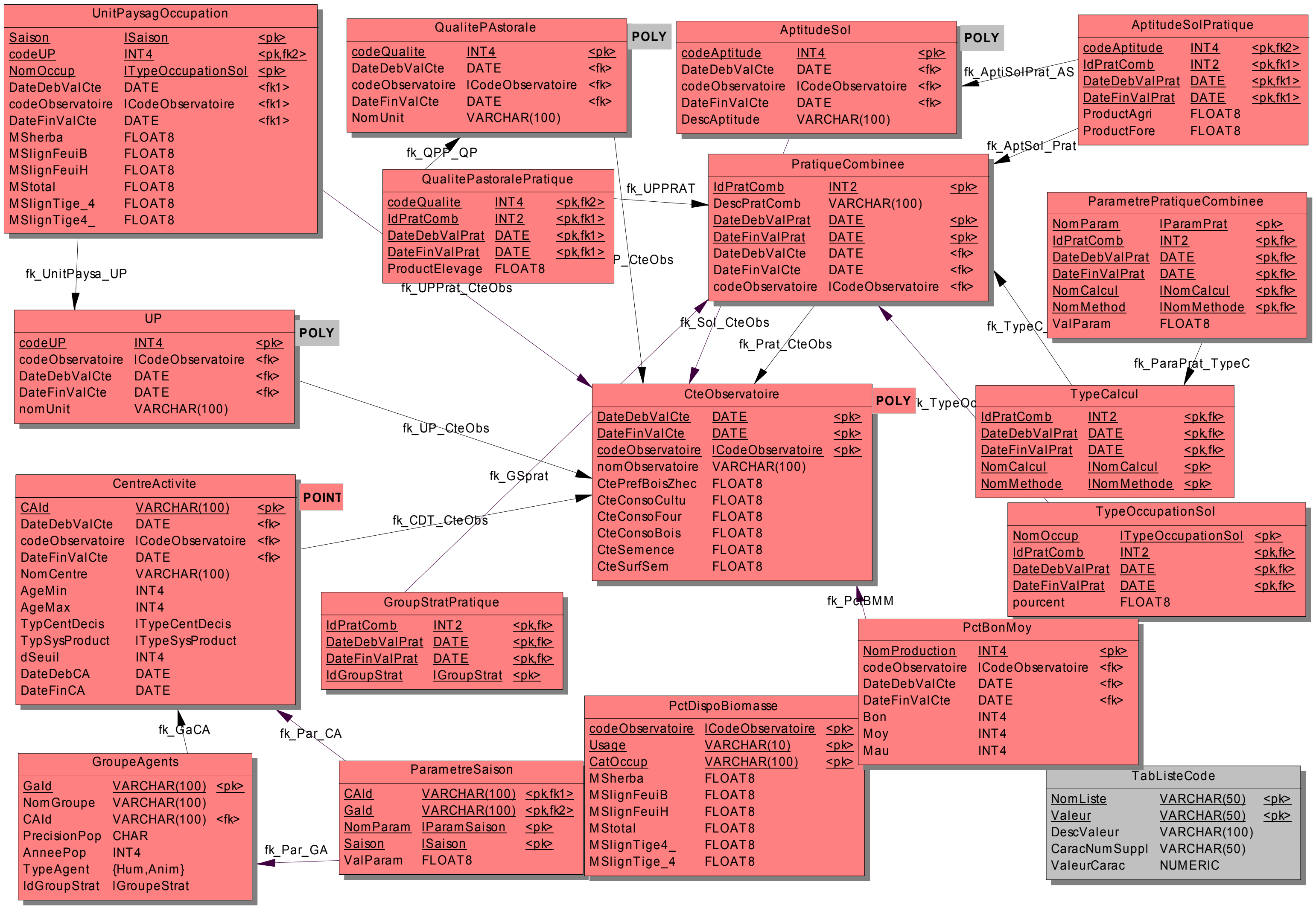


Figure 35 : Physical model of SIEL-KitMini.mdb

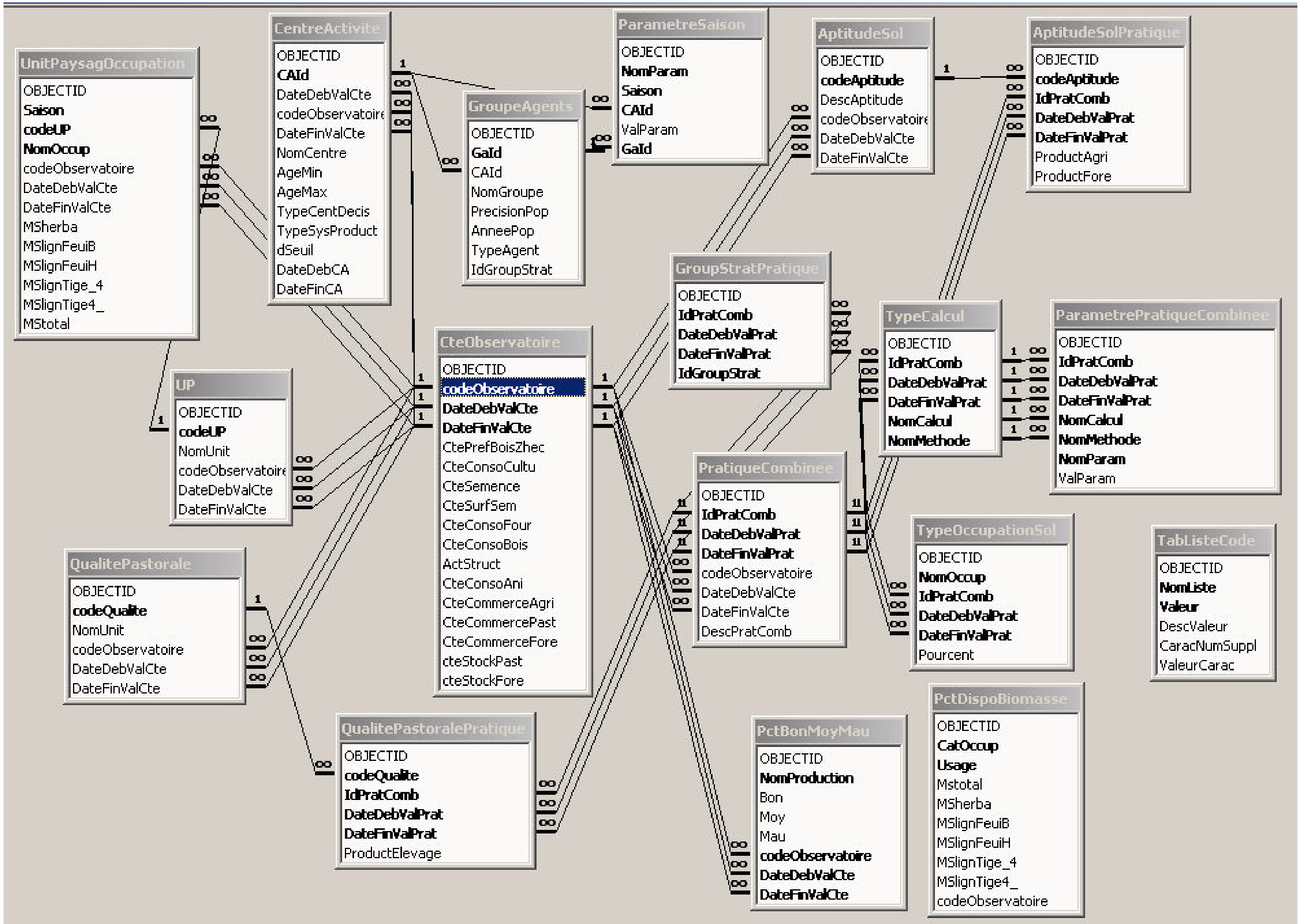


Figure 36 : SIEL-KitMini.mdb as seen in MS-Access

8.3.1.3. LEIS Data Dicionary

8.3.1.3.1. list of Tables

Name	Commentary	Type
AptitudeSol	Soil Aptitude ategories expressing potentiality for agricultural activity.	Pattern POLY
AptitudeSolPratique	Productions of a given Combined Practice for a given soil aptitude	Attribute Table
CentreActivite	Description of Activity Centres	Pattern POINT
CteObservatoire	The global Observatory territory	Pattern POLY
GroupeAgents	Caracteristics of an Agent Group	Attribute Table
GroupStratPratique	Links betwwen Strategic Groups and Combined Pratices	Attribute Table
ParametrePratiqueCombinee	Name and value of parameters of a Combined Pratice used for some computation (such as maximum Interest)	Attribute Table
ParametreSaison	Seasonal Parameters linked to an Agent Group or directly to an Activity	Attribute Table
PctBonMoyMau	Subjective rating of activity productions	Attribute Table
PctDispoBiomasse	Coefficient used for biomass availabilities	Attribute Table
PratiqueCombinee	Dexription of Combined Pratices	Attribute Table
QualitePatorale	Pastoral Quality expressing potentiality for pastoral activity	Pattern POLY
QualitePatoralePratique	Productions of a given Combined Pratice for a given pastoral quality	Attribute Table
TabListeCode	Enumerations	Attribute Table
TypeCalcul	Computation names linking the combined pratices and its parameters	Attribute Table
TypeOccupationSol	Land uses attached to a Combined Pratice	Attribute Table

UnitPaysagOccupation	Biomass measures associating landscape categories and land uses	Attribute Table
UP	Landscape categories	Pattern POLY

8.3.1.3.2. Fields

The fields in each table are seen on the model therefore here are listed only different fields names (the table given is only the main one). Primary keys and foreign keys are also seen on the model. Some units are given as example but can be changed with coherence: production in kg and in need constants kg/hab or production in income equivalent and need constant in income equivalent per habitant.

Name	Table	Commentary	Type	domain
codeAptitude	AptitudeSol	Code of the Soil	integer	
DescAptitude	AptitudeSol	Description of the soil aptitude	Text (100)	
ProductAgri	AptitudeSolPratique	Agricultural productionin kg/ha	Real	
ProductFore	AptitudeSolPratique	Forestry Production in kg/ha	Real	
AgeMin	CentreActivite	Minimum oldness of the Activity centre	integer	
AgeMax	CentreActivite	Maximum oldness of the activity centre	integer	
CAId	CentreActivite	Identifier of an Activity Centre	Text (100)	
DateDebCA	CentreActivite	Beginning validity Date	Date	
DateFinCA	CentreActivite	Ending Validity Date	Date	
dSeuil	CentreActivite	threshold distance penalysing the activity effort	integer	
NomCentre	CentreActivite	Name of the activity centre	Text (100)	
TypCentDecis	CentreActivite	Category of the activity centre (village, well, encampement …)	lTypeCentDecis	
TypSysProduct	CentreActivite	Production system type	lTypeSysProduct	
codeObservatoire	CteObservatoire, ,	Observatory code	lCodeObservatoire	
CteStockPast	CteObservatoire	Constant Need in Storage constant from pastoral production (ex Kg/hab/an)	Real	

CteStockFore	CteObservatoire	Need in Storage constant from forestry (wood enery) (Kg/hab/an)	Real	
CteCommerceAgri	CteObservatoire	Constant Need for trading from agricultural production (Kg/hab/an)	Real	
CteCommercePast	CteObservatoire	Constant Need for trading from pastoral activity (breeding)(Kg/hab/an)	Real	
CteCommerceFore	CteObservatoire	Constant Constant Need for trading from forestry activity (Kg/hab/an)	Real	
CteConsoAni	CteObservatoire	Constant Need for comsumption from pastoral activity (kg/hab/year)	Real	
CteConsoBois	CteObservatoire	Constant Need for consumption from forestry activity (kg dry matter/Day/hab)	Real	
CteConsoCultu	CteObservatoire	Need for consumption from agricultural (kg/hab/an)	Real	
CteConsoFour	CteObservatoire	Constant need for fodder consumption (kg of dry matter/Say/Tropical Bovin Unit)	Real	
CtePrefBoisZhec	CteObservatoire	Coefficient of preference for wood extraction on outside crops zones	Real	
CteSemence	CteObservatoire	Seed quantity constant (kg /ha year)	Real	
CteSurfSem	CteObservatoire	Seeded area constant (ha/hab)	Real	
DateDebValCte	CteObservatoire	Beginning validity date of constants	date	
DateFinValCte	CteObservatoire	Ending validity date of constants	date	
nomObservatoire	CteObservatoire	Name of the observatory	Text (100)	
AnneePop	GroupeAgents	Year of censing or estimation of population	integer	
GaId	GroupeAgents	Identifier of an Agent Group	Text (100)	
NomGroup	GroupeAgents	Nae of an an Agent Group	Text (100)	
PrecisionPop	GroupeAgents	Precision of the population	caractère	E=estimated

				R=censed (I= unkowed)
TypeAgent	GroupeAgents	Agent Type Hum=Humans Anim=Animals	Text (10)	Hum ; Anim
IdGroupStrat	GroupeStratPratique	Name of the strategic associated to the Combined Practice	IGroupStrat	
NomMethod	ParametrePratiqueCombinee	Name of the method	INomMethode	
NomParam	ParametrePratiqueCombinee	Name of the parameter	IParamPrat	
ValParam	ParametrePratiqueCombinee	Value of the parameter	Real	
NomParam	ParametreSaison	Name of the seasonal parameter	IParamSaison	
Saison	ParametreSaison	Season name	ISaison	
ValParam	ParametreSaison	Value of parameter	Real	
DateDebValPrat	PratiqueCombinee	Beginning validity date	date	
DateFinValPrat	PratiqueCombinee	Ending validity date	date	
DescPratComb	PratiqueCombinee	Description de la pratique combinée	Text (100)	
DescPratComb	PratiqueCombinee	Description de la pratique combinée	Text (100)	
NomProduction	PctBonMoyMau	Filed name of production ProductAgri ;ProductFore, ProductElevage	Text (100)	
Bon	PctBonMoyMau	Percent (0-100) coefficient for productions	integer	0 - 100
Moy	PctBonMoyMau	Percent (0-100) coefficient for productions	integer	
Mau	PctBonMoyMau	Percent (0-100) coefficient for productions	integer	
CatOccup	PctDispoBiomasse	Land use	INomOccupation	
Usage	PctDispoBiomasse	Name of use	Text	Agricole, Forestier, Pastoral

MStotal	PctDispoBiomasse	Percent (0-100) coefficient for linear combination in resource availability	integer	
MSherba	PctDispoBiomasse	Percent (0-100) coefficient for linear combination in resource availability	integer	
MSlignFeuiB	PctDispoBiomasse	Percent (0-100) coefficient for linear combination in resource availability	integer	
MSlignFeuiH	PctDispoBiomasse	Percent (0-100) coefficient for linear combination in resource availability	integer	
MSlignTige4_	PctDispoBiomasse	Percent (0-100) coefficient for linear combination in resource availability	integer	
MSlignTige_4	PctDispoBiomasse	Percent (0-100) coefficient for linear combination in resource availability	integer	
codeQualite	QualitePastorale	Pastoral Quality code	integer	
NomUnit	QualitePastorale	Pastoral Quality description	text(100)	
codeQualite	QualitePastoralePratique	Pastoral Quality code	integer	
ProductElevage	QualitePastoralePratique	Production from pastoral activity in (for example) kg/ha	Real	
NomListe	TabListeCode	Name of a list	Text	
Valeur	TabListeCode	Value of a list	Text	
DescValeur	TabListeCode	Value description	Text	
CaracNumSuppl	TabListeCode	Name of an associated variable	Real	
ValeurCarac	TabListeCode	Value of the variable CaracNumSuppl	Real	
NomCalcul	TypeCalcul	Name of the computattion	lNomCalcul	
NomMethode	TypeCalcul	Name of the method associated to the computation	lNomMethode	
NomOccup	TypeOccupationSol	Land use name	lTypeOccupationSol	
pourcent	TypeOccupationSol	Pourcent	Real	0-100
codeUP	UP	Landscape unit code	integer	
nomUnit	UP	Landscape category description	text(100)	
MStotal	UnitPaysagPratique	Total Dry matter production (dry	Real	

		matter kg /ha)		
MSherba	UnitPaysagPratique	Herbaceous production(dry matter kg /ha)	Real	
MSlignFeuiB	UnitPaysagPratique	Ligneaous low leaves biomass production (kg dry matter/ha)	Real	
MSlignFeuiH	UnitPaysagPratique	Ligneaous high leaves biomass production (kg dry matter/ha)	Real	
MSlignTige_4	UnitPaysagPratique	Ligneaous steam <4cm biomass production (kg dry matter/ha)	Real	
MSlignTige4_	UnitPaysagPratique	Ligneaous steam ≥4cm biomass production (kg dry matter/ha)	Real	

8.3.1.3.3. Predefined lists of values

These values are stored in the table `TabListeCode` of `SIELKitMini.mdb` and were the values used for the exemple of the observatory NER_DT. Most of the values are not to be changed for another observatory as mentioned in the description and by the boldface of the elements.

- **List lCodeObservatoire**

Only the observatories of the considered country can be kept and new observatories for this country can be set. NER_DT and TUN_MH must be kept in the list as they are the examples shown in the tool presentation.

NomListe	Valeur	DescValeur
lCodeObservatoire	EGY_EO	ElOmayed (Egypte)
lCodeObservatoire	DZA_EB	El Biod(Algérie)
lCodeObservatoire	KEN_KK	Kibwesi Kiboko (Kenya)
lCodeObservatoire	MAR_IS	Issougui (Maroc)
lCodeObservatoire	MAR_OM	Oued Mird (Maroc)
lCodeObservatoire	MLI_CB	Cercle de Bourem (Mali)
lCodeObservatoire	MRT_NO	Nouackchott (Mauritanie)
lCodeObservatoire	**NER_DT**	**Dantiandou, Torodi et Tondikandia (Niger)**
lCodeObservatoire	SEN_FO	Ferlo (Sénégal)
lCodeObservatoire	TUN_HB	Haddej Bou hedma (Tunisie)
lCodeObservatoire	**TUN_MH**	**Menzel Habib (Tunisie)**

- **List lParamPratique (do not change)**

New parameters can be added (implying an extension of the tool).

NomListe	Valeur	DescValeur
lParamPratique	**Cd**	Distance coefficient
lParamPratique	**ep**	Artifitialisation of a combined practice (0-1)
lParamPratique	**sans calcul**	sans calcul used to specify a parameter without computation formally associated

- **List lNomCalcul (do not change)**

New computation names can be added.

NomListe	Valeur	DescValeur
lNomCalcul	**Intérêt Maximum**	Computation of the Maximum interest of a combined pratice at a given location Interest=Production/effort

- **List lNomMethode (do not change)**

New method names can be added (implying an extension of the tool).

NomListe	Valeur	DescValeur
lNomMethode	**Loireau**	Maud Loireau (thèse 1998)
lNomMethode	**Ba**	Magatte Ba (atelier février 2004)
lNomMethode	**sans**	sans methode

- **List lTypCentDecis**

NomListe	Valeur	DescValeur
lTypeCentDecis	campement	campement
lTypeCentDecis	forage	forage
lTypeCentDecis	mare	mare
lTypeCentDecis	puit cimenté	puit cimenté
lTypeCentDecis	puit traditionnel	puit traditionnel
lTypeCentDecis	village	village

- **Liste ISaison**

The `NbJours` value is compulsary and an annuel « season » is required.

NomListe	Valeur	DescValeur	CaracNumSuppl	ValeurCarac
ISaison	ChaudSec	Chaud et Sec	**NbJours**	70
ISaison	FroidSec	Froid et Sec	**NbJours**	71
ISaison	Pluies	Pluies	**NbJours**	72
ISaison	PostCulture	PostCulture	**NbJours**	73
ISaison	Soudure	Soudure	**NbJours**	74
ISaison	Toutes	Toutes les Saisons	**NbJours**	365

- **List IparamSaison (do not change)**

New parameters can be added.

NomListe	Valeur	DescValeur
IParamSaison	**Population**	Population humaine ou animale liée au Groupe d'agents
IParamSaison	**RayonAccBois**	Rayon Accés bois
IParamSaison	**RayonAccPasto**	Rayon Accés Patoral

- **Liste ITypSysProduct**

NomListe	Valeur	DescValeur
ITypeSysProduct	agricole	agricole
ITypeSysProduct	agro pastoral	agro pastoral
ITypeSysProduct	agro sylvo pastoral	agro sylvo pastoral
ITypeSysProduct	pastoral	pastoral
ITypeSysProduct	sylvo-agricole	sylvo-agricole

- **List lTypeOccupationSol**

Names of numerical variables **Aucune** or **dureeAn** are the only choice of the field **CaracNumSuppl**.

NomListe	Valeur	DescValeur	CaracNumSuppl	ValeurCarac
lTypeOccupationSol	culture	culture	**Aucune**	
lTypeOccupationSol	Jachère1	jachère de 1 an	**dureeAn**	1
lTypeOccupationSol	Jachère10	jachère de plus de 10 ans	**dureeAn**	10
lTypeOccupationSol	Jachère2	jachère de 2 ans	**dureeAn**	2
lTypeOccupationSol	Jachère3	jachère de 3 ans	**dureeAn**	3
lTypeOccupationSol	Jachère4	jachère de 4 ans	**dureeAn**	4
lTypeOccupationSol	Jachère5	jachère de 5 ans	**dureeAn**	5
lTypeOccupationSol	Jachère610	Jachère entre 6 et 10 ans	**dureeAn**	8
lTypeOccupationSol	végétation naturelle	végétation naturelle	**Aucune**	

- **List lGroupStrat**

NomListe	Valeur	DescValeur
lGroupStrat	Agriculteur	Agriculteur
lGroupStrat	Gros Pasteur	Pasteur avec gros troupeau
lGroupStrat	Petit Pasteur	Pasteur avec petit troupeau

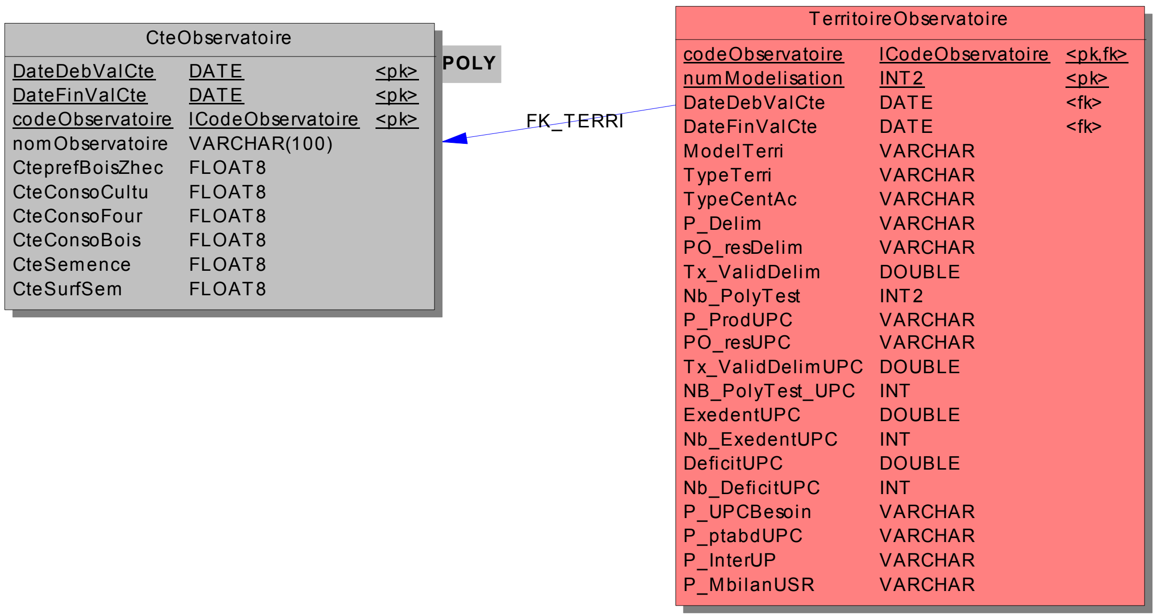
8.3.2. MODELLING DATA SPECIFICATION

The final dataset (after a complete modelling) is constituted of the entry dataset (minimum Kit) with added dataset obtained from the modelling steps. These added data is issued from :

- creation of geographic objects in layers (FeatureClass) gathered in a collection of layers (FeatureDataset) named after the observatory code and the modelling number.
- Updates of tables especially the table TerritoireObservatoire containing the modelling parameters.

In the following description only new tables added are shownwith their constraint references . A complete schema will be given at the end of the description.

8.3.2.1. Data model



When iniatilising a new LEIS either a copie of the database template `SIEL-KitMini.mdb` or a copie of of a former LEIS database is done and named SIEL-<codeObservatoire>.mdb. According to these two cases the table `TerritoireObservatoire` is either created empty or the actual one is emptied and a collection of layers (FeatureDataset) named `<codeObservatoire__numModelisation>` *e.g.* `NER_DT__1` is created.

Figure 38 :Table expressing the parameters of each modelling

The table `TerritoireObservatoire` describes for each modelling the set of parameters used at each modelling step.

8.3.2.2. step – delineation of exploitation territories

Modelling the functionning of the observatory starts at this step. A layer of points (or mulitpoints or lines or polygons) associated to the table CentreActivite determines the CA used (CA selection using the interface) which are stored as a FeatureClass with the name `CA__<nummodelisation>` in the FeatureDataset corresponding to the current modelling

The polygon featureclass of exploitation territories is also stored in the FeatureDataset; the name follows the strutucring activity used, Agricultural, Pastoral or Forestry: here `Agri__<nummodelisation>`. The table TerritoireObservatoire is updated for the fields : `TypeTerri`, `ModelTerri` and `P_Delim`.

The field Besoin_Agri is added later when computing the Need (Agricultural need here).

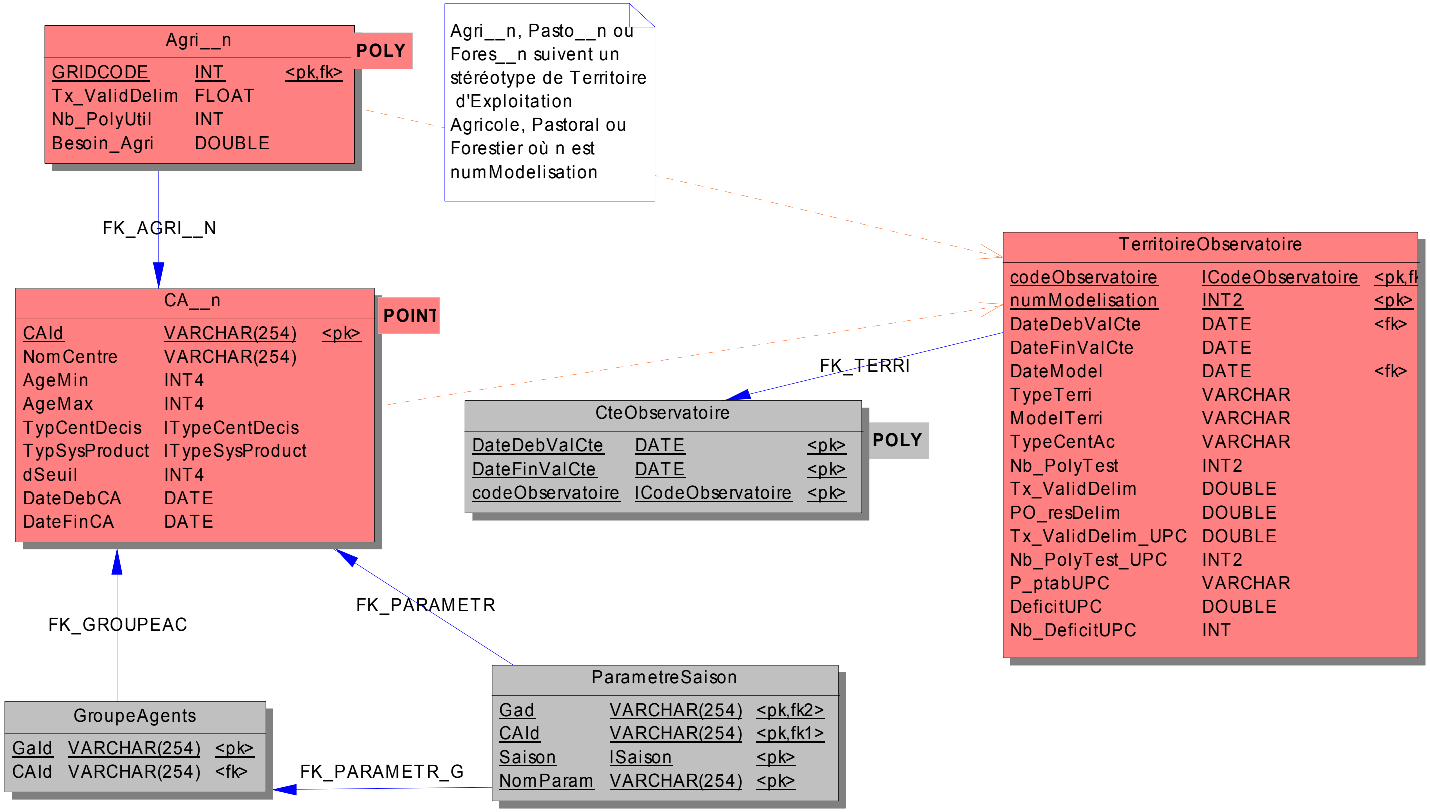


Figure 39 : Territories delineation

8.3.2.3. step – CPU delineation

When the CPU (Combined Pratice Units) layer is created other layers are produced during the process: `PraImax__<modelisation number>` the layer of the Combined Practices reaching maximum interest anywhere, `ProImax__<modelisation number>` the layer of the productions associated and the CPU envelop which will constraint the PraImax accoding to the need satisfied.

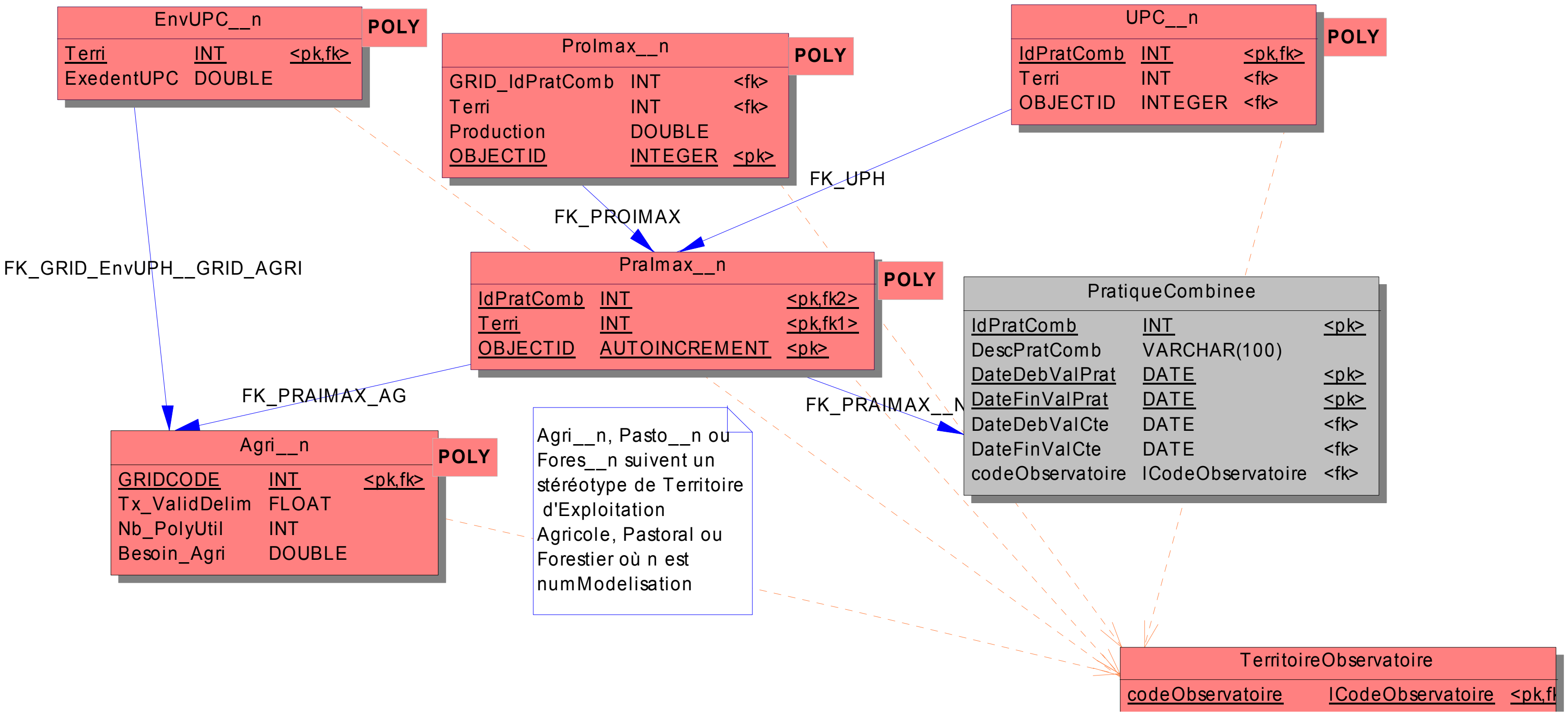


Figure 40 : CPU construction step

8.3.2.3.1. step – SRU construction

The SRU are obtained by intersepting the CPU and the Landscape Units (LU or UP french).

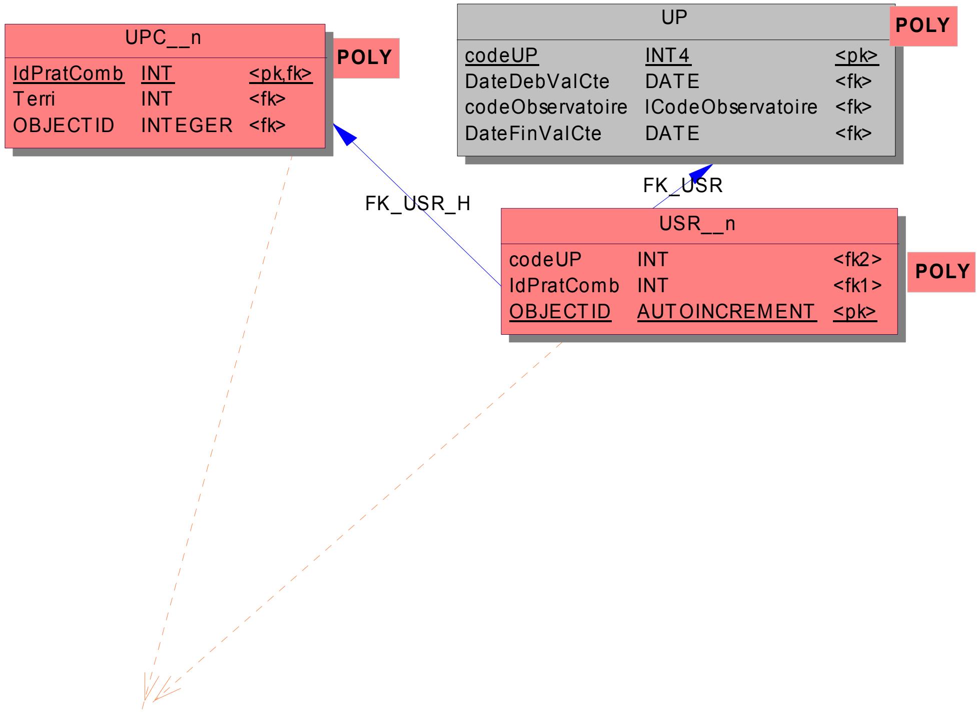


Figure 41 : SRU final constructionstep

8.3.2.4. step – multi-use balances computation

After completing balance computation a table named after the ressource used (Veg) and the modelling number is created as well as a layer called MultiUsage__<n> being the result of a joint between SRU and this table. Notice that the BilanVeg__n is linked externaly (no reference constaint) to TerritoireObservatoire by n the modelling.

.

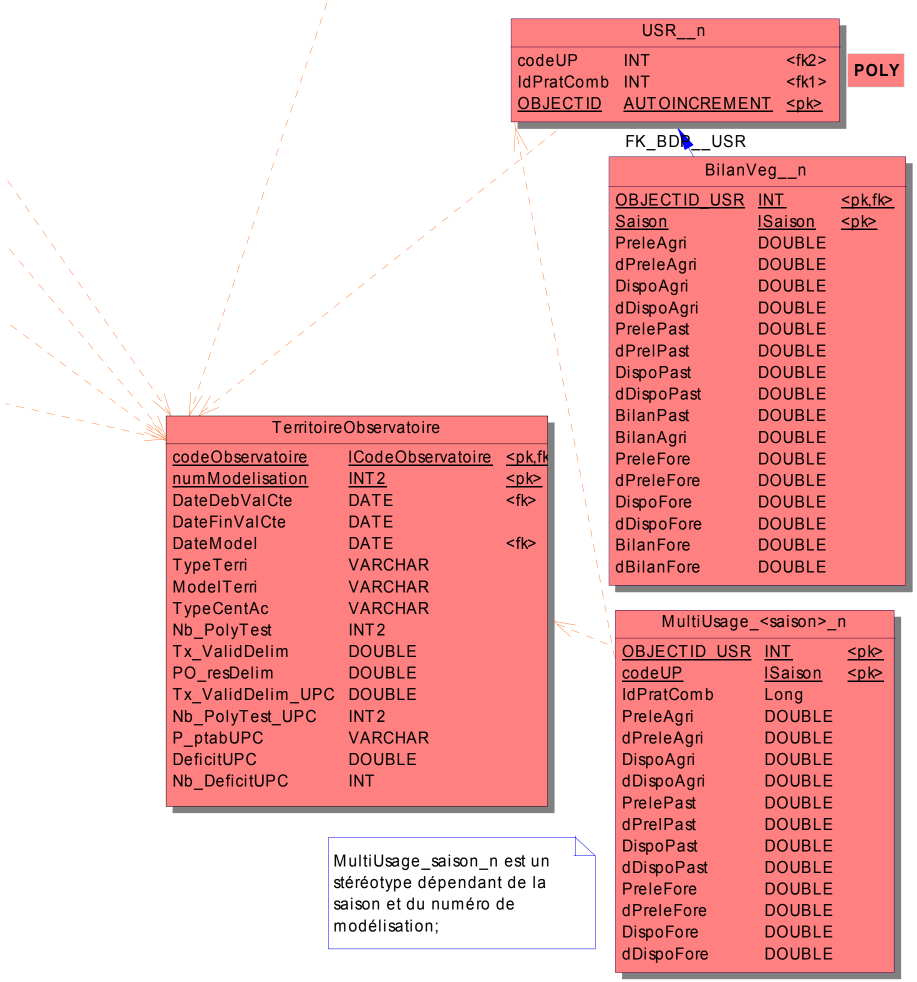


Figure 42 : Balance step, stereotype tables

8.3.2.5. LEIS GeoDataBase

The database containing at least one modelling up to the balances computation looks like the figure below.

The database is always named SIEL_<codeObservatoire>.mdb *e.g.* SIEL_NER_DT.mdb.

The figure given below shows an hypothetic modelling number **n** only but as much copies of these tables as the number of different modelling could exist. Here only connections links with the entry tables are shonw but all the other entry tables should be considered as part of the LEIS geodatabase.

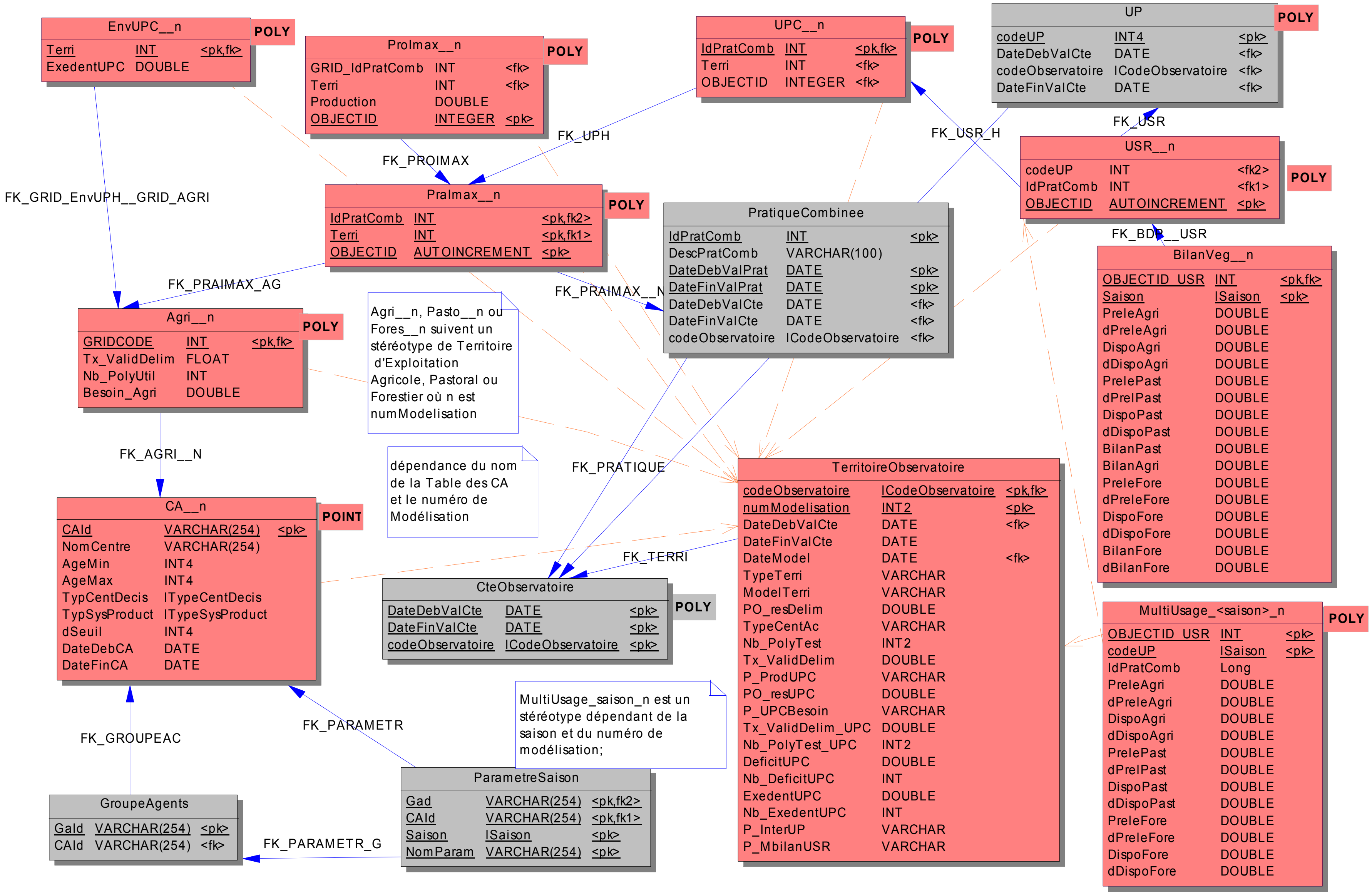


Figure 43 : LEIS GeoDataBase after a modelling

8.3.3. LEIS GEODATABASE AND FORECAST ANALYSIS

When starts a prospective analysis two new entities are added to the geodatabase: a table `Scenario` keeping track of each scenario, and a layer of results `MultiUsagePros__<n>` containing the prospective balances and indicators. The later layer is identical in geometry to the SRU obtained after applying the scenario and is similar to a layer MultiUsage__<saison>__<n> but with the fields `Saison, IdScenar, Id_Pas, Ressource`.

A detail of each scenario is in the tables `ScenarioUsage, ScenarioRessource, ScenarioGlobal`.
We find fields with change in percent (fieldname starting with Pct) or fields with change in value:

- One value indicates percent of change for each step.
- An array of value indicates either the series of the values either the series of percent of change. The parameter can be represented by on variable or more or with factors making this array a vector, a matrix, or a multiarray.

And fields expressing cartographic evolutions (their fieldname start with `chemin`) giving the path to the layer containing theses objects (the layer has necessary the two fields IdScenar et Id_Pas to recognise the evolutions of objects.

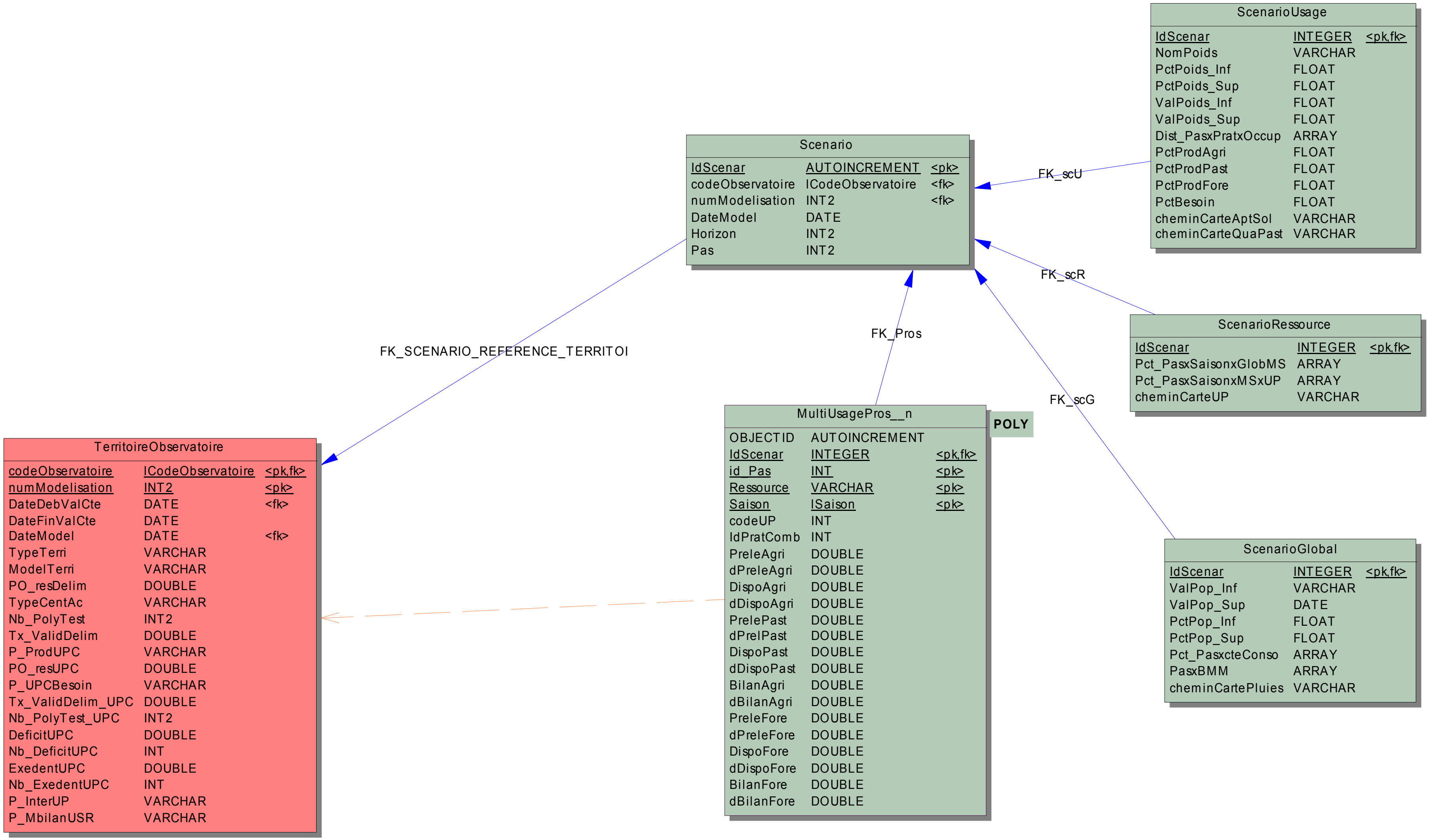


Figure 44 : LEIS & Forecast Analysis aspect

8.3.4. FINAL DICTIONNARY

8.3.4.1. new entities

Name of the entity	Commentary	Type
Agri__n	Agricultural territories of exploitation	Pattern POLY <stereotype >
BilanVeg__n	Table des bilans végétation	Attribute Table < stereotype >
CA__n	Centre d'activité de la modélisation	Pattern POINT or MULTIPOINT or LINE or POLYGON
EnvUPC__n	CPU envelope	Pattern POLY
MultiUsagePros__n	Prospective balances layer identical to MultiUsage__season__n but with the season in attribute and identification of the scneario	Pattern POLY
MultiUsage__saison__n	Layer of Balances and indicators	Pattern POLY
PraImax__n	Combined Pratices linked to maximum interest anywhere	Pattern POLY
ProImax__n	Production associated to PraImax	Pattern POLY
Scenario	General description of a scenario	Attribute Table
ScenarioUsage	Scenario parameters with the aspect Usage	Attribute Table
ScenarioRessource	Scenario parameters with the aspect Ressource	Attribute Table
ScenarioGlobal	Global parameters (climat, socio-démographique, stratégie-expertise) du scénario	Attribute Table
TerritoireObservatoire	History of Modelling	Attribute Table
UPC__n	Combined Pratice Units	Pattern POLY

USR__n	Unités Spatiales de référence	Pattern POLY

8.3.4.2. Attributes list

The values of attributes are either read, automatic, or computed.

Name	Table	Commentary	Type
Besoin_Agri	Agri__n	Agricultural need (Besoin_Past would be the field for Past__n for territories under pastoral structuring activity)	Real (double)
CAId	Agri__n	Idtifier a CA	
GRIDCODE	Agri__n	System value	integer
Nb_PolyUtil	Agri__n	Number of plots found in the polygon	integer
Tx_ValidDelim	Agri__n	Validity rate	Real
DmPAgri	BilanVeg__n	Balance Availability (D) – Extraction (P) in kg of dry matter for the agricultural usage	Real
DmPFore	BilanVeg__n	Idem for forestry usage	Real
DmPPast	BilanVeg__n	Idem for pastoral usage	Real
dDmPFore	BilanVeg__n	Balance for forestry usage in density (kg/ha)	Real
dDmPPast	BilanVeg__n	Balance for pastoral usage in density (kg/ha)	Real
dDmPAgri	BilanVeg__n	Balance for agricultural usage in density (kg/ha)	Real
dDispoAgri	BilanVeg__n	Availability in density (Kg/ha) under agricultural usage	Real
dDispoFore	BilanVeg__n	Availability in density (Kg/ha) under forestry usage	Real
dDispoPast	BilanVeg__n	Availability in density (Kg/ha) under pastoral usage	Real
DispoAgri	BilanVeg__n	Availability in quantity (Kg) under agricultural usage	Real

DispoFore	BilanVeg__n	Availability in quantity (Kg) under forestry usage)	Real
DispoPast	BilanVeg__n	Availability in quantity (Kg) under pastoral usage	Real
dPreleAgri	BilanVeg__n	extraction in density (Kg/ha) under agricultural usage	Real
dPreleFore	BilanVeg__n	extraction in density (Kg/ha) under forestry usage	Real
dPrelPast	BilanVeg__n	extraction in density (Kg/ha) under pastoral usage	Real
OBJECTID_USR	BilanVeg__n	Identifier of SRU	integer
PreleAgri	BilanVeg__n	extraction in quantity (Kg) under agricultural usage	Real
PreleFore	BilanVeg__n	extraction in quantity (Kg) under forestry usage	Real
PrelePast	BilanVeg__n	extraction in quantity (Kg) under pastoral usage	Real
Saison	BilanVeg__n	Name of the season	lSaison
ExedentUPC	EnvUPC__n	excess in production (deficit if negative)	Real
Terri	EnvUPC__n	GRIDCODE of the territories Agri__n	integer
EI__A (IP_A in French)	MultiUsage__saison__n	IExtraction index for vegetal for agricultural usage	Real
EI__AF (IP_AF in French)	MultiUsage__saison__n	Summary index of EI__A and EI__F (arithmetic mean or geometric mean or simple product)	Real
EIg_A (IPg_A in French)	MultiUsage__saison__n	Relative index of agricultural extraction for global homogeneity	Real
EIu_A (IPu_A in French)	MultiUsage__saison__n	Relative index of agricultural extraction for SRU classes homogeneity	Real
EIg_AF	MultiUsage__saison__n	Summary index of EIg_A and	Real

(IPg_AF in French)		EIg_F	
EIu_AF (IPu_AF in French	MultiUsage__saison__n	Summary index of EIu_A and EIu_F	Real
IdPratComb	PraImax__n	Combine pratice identifier	integer
Production	ProImax__n	Production pour les secteurs fixés dans le calcul de l'UPC	Real
codeObservatoire	TerritoireObservatoire	Observatory code	ICodeObservatoire
DateDebValCte	TerritoireObservatoire	Beginning validity date of constants	date
DateFinValCte	TerritoireObservatoire	Ending validity date of constants	date
DateModel	TerritoireObservatoire	Modelling date	date
TypeTerri	TerritoireObservatoire	Structuring activity	« Agri__ » « Past__ » « Fore__ »
ModelTerri	TerritoireObservatoire	Delineation model	« Centré » « Distribué »
PO_ResDelim	TerritoireObservatoire	Pixel size in meters used for dlineation	« Centré » « Distribué »
TypeCentAc	TerritoireObservatoire	list of Activity centre types used	texte
DeficitUPC	TerritoireObservatoire	Global deficit before redistributing	Real
ExedentUPC	TerritoireObservatoire	Excédent après redistribution des productions	Real
Nb_DeficitUPC	TerritoireObservatoire	Number of territories in deficit before redistributing production	integer
Nb_ExedentUPC	TerritoireObservatoire	Number of territories in excess before redistributing	integer
Nb_PolyTest	TerritoireObservatoire	Number of territories with at least nb_ParDelim plots in the validation	integer
Nb_PolyTest_UPC	TerritoireObservatoire	Number of CPU with at least nb_ParUPC plots in the validation	integer
P_UPCBesoin	TerritoireObservatoire	Need calculus parameters	texte
numModelisation	TerritoireObservatoire	Modelling number	integer
P_Delim	TerritoireObservatoire	Delineation parameters	texte
P_MBilanUSR	TerritoireObservatoire	Balances computation parameters	texte
P_InterUP	TerritoireObservatoire	LU computation parameters	texte

P_ProdUPC	TerritoireObservatoire	CPU computation parameters	texte
Tx_ValidDelim	TerritoireObservatoire	Mean validity rate over Nb_Polytest territories	Real
Tx_ValidDelim_UPC	TerritoireObservatoire	Mean validity rate over Nb_Polytest_UPC units	Real
IdScenar	Scenario	Autoincrement	Autoincrement
codeObservatoire	Scenario	Observatory code	IcodeObservatoire
numModelisation	Scenario	Modelling number	integer
DateModel	Scenario	Date of model	date
Horizon	Scenario	Horizon of the prospective scenario	integer
Pas	Scenario	Pas de temps entre deux étapes prospectives	integer
IdScenar	ScenarioUsage	Autoincrement	Autoincrement
NomPoids	ScenarioUsage	Filedname of the weight used for delineation	texte
PctPoids_Inf	ScenarioUsage	Percent of change for each time step for weight values lower than the inferior value	Real (0-100)
PctPoids_Sup	ScenarioUsage	Percent of change for each time step for weight values higher than the superior value	integer
ValPoids_Sup	ScenarioUsage	Superior value of splitting weight	integer
ValPoids_Inf	ScenarioUsage	Inferior value of splitting weight	integer
Dist_PasxPratxOccup	ScenarioUsage	Array of land uses percents by combined practices and time step (all lexcografic ordered on their identifier)	tableau
PctProdAgri	ScenarioUsage	Percent of change of the agricultural production for each time step	Real (0-100)
PctProdPast	ScenarioUsage	Percent of change of the pastoral production for each time step	Real (0-100)

PctProdFore	ScenarioUsage	Pourcentage d'évolution de la production forestière à chaque pas de temps (0-100)	Real
PctBesoin	ScenarioUsage	Pourcentage d'évolution du besoin calculé à chaque pas de temps (0-100)	Real
cheminCarteAptSol	ScenarioUsage	Chemin de la couche contenant les différentes Aptitudes du sol par pas de temps (couche similaire à couche des aptitudes du sol avec en plus `IdScenar`, `Id_Pas`)	texte
cheminQuaPast	ScenarioUsage	Chemin de la couche contenant les différentes qualités pastorales par pas de temps (couche similaire à couche des qualités pastorales avec en plus `IdScenar`, `Id_Pas`)	texte
IdScenar	ScenarioRessource	Autoincrement	Autoincrement
Pct_PasxSaisonxGlobMS	ScenarioRessource	Tableau des pourcentages d'évolution à chaque pas et par saison des Matières Sèches (indépendamment de l'UP)	tableau
Pct_PasxSaisonxMSxUP	ScenarioRessource	Tableau des pourcentages d'évolution à chaque pas et par saison des Matières Sèches pour chaque catégories d'UP	tableau
cheminCarteUP	ScenarioRessource	Chemin de la couche contenant les différentes UP par pas de temps (couche similaire à la couche UP a avec en plus `IdScenar`, `Id_Pas`)	texte
IdScenar	ScenarioGlobal	Identifiant du scénario	Autoincrement
ValPop_Inf	ScenarioGlobal	Borne inférieure de découpage des valeurs de la population	integer
ValPop_Inf	ScenarioGlobal	Borne inférieure de découpage des	integer

		valeurs de la population	
PctPop_Inf	ScenarioGlobal	Pourcentage d'évolution à chaque pas de temps en deçà de la valeur inférieure (0-100)	integer
PctPop_Sup	SenarioGlobal	Pourcentage d'évolution à chaque pas de temps au delà de la valeur inférieure (0-100)	
Pct_PasxcteConso	ScenarioGlobal	Tableau des pourcentages d'évolution à chaque pas des constantes de consommation	tableau
PctxBMM	ScenarioGlobal	Tableau (vecteur) des qualifiant Bon,Mauvais,Moyen à chaque pas de temps pour la « prévision subjective» des productions	tableau
IdPratComb	UPC__n	Identifiant du numéro de Pratique Combinée	integer
Terri	UPC__n		integer

9. GLOSSAIRE

Aptitude des sols pour la mise en culture (ou potentialité des sols à la mise en culture) = aptitude des sols pour la mise en culture des espèces localement cultivées avec les techniques agricoles utilisées. Elle est le résultat de l'interprétation du scientifique des qualités géo-morpho-pédologiques des sols et de la perception paysanne de ces sols. A chaque aptitude des sols peut être associée une série de rendements agricoles selon les pratiques combinées appliquées.
ArcCatalog™ = Une des application d'ArcGIS™ permettant la gestion des géodatabases. Voir aussi géodatabase.
ArcMap™ = Une des application d'ArcGIS™ permettant l'affichage et la manipulation des données géographiques, voir aussi ArcCatalog™, ArcToolbox
ArcToolbox = Boite à outils de fonctionnalités spécifiques à l'information géographique.
Besoin = exprime la demande (en qualité et quantité) d'une population, quelle qu'elle soit et ou qu'elle habite, sur les ressources utiles du territoire d'exploitation ; demande que les groupes d'acteurs doivent satisfaire.
Base des Données Modèle = la base des données vide contenant la structure du modèle SIEL.
Centre d'Activité = un élément fixe du territoire d'observatoire (coordonnées géographiques) autour duquel un ou plusieurs groupe(s) d'acteurs organise(nt) l'exploitation des ressources naturelles. Ce peut être un village ou un campement dans le cas d'une exploitation agricole ou forestière des ressources ; ce peut être un point d'eau ou un campement dans le cas d'une exploitation pastorale des ressources. Il y a donc plusieurs types de centre d'activité. Chaque centre d'activité, selon des périodes déterminées, est associé à un type d'activité principal. Enfin, un centre d'activité a une durée de vie.*Caractérisé par : un code, un nom, une date début (précision date-début), une date fin, un type, type d'activité dominante, un type de besoin.*
Clé étrangère = uplet de champs de la table se référant (pour leurs valeurs) dans une autre table où ce uplet constitue une clé primaire.
Clé primaire = uplet de champs de la table assurant l'unicité de l'enregistrement (ligne de la table)
DataFrame = une collection de couches est représentée dans ArcMap™ ; une association thématique de l'utilisateur.
Degré d'artificialisation = degré d'intervention de l'homme sur le milieu. Il est associé à chaque type de pratiques combinées. Il est d'autant plus élevé que l'intervention de l'homme est importante. Sa valeur est comprise entre 0 et 1. Un degré d'artificialisation est calculé, selon la même méthode, pour chaque type de pratiques combinées. Cette méthode est spécifique à chaque territoire d'observatoire.
Caractérisé par : un identifiant, un type de méthode utilisé (construction à partir d'une combinaison des pratiques qui composent la classe de pratiques combinées)
Effort lié aux pratiques = effort fournit par un ou plusieurs groupe(s) d'acteurs pour appliquer un type de pratiques combinées, selon les techniques utilisées, quelle que soit la qualité de la ressource utile (géo-morpho-pédo dans le cas de l'agriculture, végétation dans le cas de l'élevage, etc.) et son accessibilité (distance, foncier). Il se calcule selon une méthode appropriée aux spécificités de l'observatoire, de ses habitants et de leurs pratiques. La valeur de l'effort est d'autant plus élevée que les pratiques appliquées sont artificialisées et la zone d'application éloignée du centre d'activité. Sa valeur est comprise entre 1 et 2. Un effort est calculé, selon la même méthode, pour chaque type de pratiques combinées.
Caractérisé par : un identifiant, un type de méthode utilisée, une liste de paramètres utilisés.
Effort = effort fournit par un ou plusieurs groupe(s) d'acteurs pour appliquer un type de pratiques combinées, selon la qualité de la ressource utile (sol dans le cas de l'agriculture, végétation dans le cas de l'élevage, etc.) et son accessibilité (distance, foncier).
Data Frame = ou bloc de données est une collection de couches géographiques rassemblées dans le « viewer » ArcMap™.

FeatureClass = nom donné chez Esri aux couches vecteurs stockées dans une géodatabase.
FeatureDataset = collection virtuelle dans la Géodatabase de « couches géograpiques » (appelée FeatureClass dans la géodatabase). Les couches ont la même référence spatiale.
GéoDataBase = Système de Gestion de Base de Données prenant en compte l'information géographique : terme définie par ESRI.
Groupe d'Acteurs = un ensemble d'individus (population humaine) ou d'animaux (cheptel), exprimé respectivement en nombre d'habitants ou en UBT, qui se regroupent pour exploiter et prélever les ressources naturelles du territoire de l'observatoire autour d'un ou plusieurs centres d'activité, pour satisfaire un type de besoin. Un groupe d'acteurs peut avoir plusieurs types de liens avec les centres d'activités. Un ou plusieurs groupent d'acteurs peuvent habiter dans un ou plusieurs centres d'activité, successivement dans le temps. Un ou plusieurs groupe(s) d'acteurs peuvent utiliser un ou plusieurs centre(s) d'activité pour exploiter les ressources naturelles selon différentes activités, selon les périodes.
Caractérisé par : un code, un nom (facultatif), un type d'activité, un effectif (précision-effectif) associé à une date.
MDweb = nom de l'outil de gestion et de production des métadonnées : MetaData sur le web crée par l'opératuer régional.
Modélisation = Suite des choix et paramètres intervenant dans la structuration de l'observatoire à travers les étapes de construction des USR dans l'outil SIEL-ROSELT. Une modélisation est identifiée dans la géodatabase par le code de l'observatoire la et le numéro de modélisation. Le numéro fait notamment référence à la période de référence du Kit minimum de données.
.mxd = extension des fichiers associées à ArcMap™. Ces fichiers contiennent une vue d'informations géographiques : le projet SIG.
Pratiques combinées = chaque type de « pratiques combinées » du territoire de l'observatoire combine (associe) des pratiques d'exploitation des ressources naturelles (généralement liées à l'activité structurante de l'observatoire) qui structurent fondamentalement le territoire de l'observatoire (délimitation d'unités spatiales homogènes dont les autres activités et pratiques qui en découlent vont dépendre), et qui sont appliquées ensemble au même endroit par un ou plusieurs groupes d'acteurs, selon la même logique d'exploitation autour d'un centre d'activité. Il y a plusieurs types de pratiques combinées pour un territoire d'observatoire.
L'application de chaque type de pratiques combinées détermine un pourcentage de type d'occupation des sols sur un même espace. A chaque type de pratiques combinées est associé un degré d'artificialisation, c'est à dire un degré d'intervention de l'homme sur le milieu.
Caractérisées par : un identifiant, une description (caractérisation des pratiques qui la composent), une date-début, une date-fin, plusieurs types d'occupation des sols associés à des pourcentages, un degré d'artificialisation.
Production= exprime le résultat moyen (moyenne pluri-annuelle) de l'application d'un type de pratiques combinées sur le territoire d'exploitation en terme de produits utiles à la vie du ou des groupes d'acteurs : par exemple la moyenne des rendements agricoles sur un cycle de culture, y inclus les années de jachères avec un rendement nulle.
Shapefile = format public d'une couche vecteur défini par Esri
SIG = Système d'Information Géographique : Logiciel et organisation de l'information permettant la manipulation de représentations thématiques de l'espace géographique afin de réaliser des cartes.
Territoire d'exploitation = une aire d'exploitation potentielle des ressources naturelles autour d'un ou plusieurs centres d'activité utilisés pour une période donnée. Ces limites sont liées à la répartition spatiale des centres d'activités voisins et au poids (effectif, ancienneté, etc) du ou des groupes d'acteurs qui exploitent ces ressources naturelles autour de ce ou ces centres d'activité. L'agrégation de tous les territoires d'exploitation re-constitue le territoire de l'observatoire sur une période donnée. Sa construction se fait à partir de modèles : modèles centrés (un seul centre d'activités déterminant) ; modèles distribués

(plusieurs centres d'activités déterminants).*Caractérisé par* : un code, une durée, une aptitude des sols, un besoin, etc.
Territoire d'observatoire = zone rurale (pouvant inclure des centres urbains, c'est à dire >2000 habitants, mais considérés alors comme centre d'activité et comme objet d'études), aride ou semi-aride, avec des règles de fonctionnement biophysique et socio-économique relativement homogènes. Il est caractérisé par une activité structurante d'exploitation des ressources.
Plusieurs groupes d'acteurs exploitent les ressources naturelles du territoire de l'observatoire autour de un à plusieurs centres d'activité.
Thiessen = mathématicien ayant donné son nom à cet algorithme de tesselisation (mozaïque, découpage) les milieux (isobarycentres) d'une série de points pris deux à deux. La version pondérée considèrera des barycentres avec poids différenciés.

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