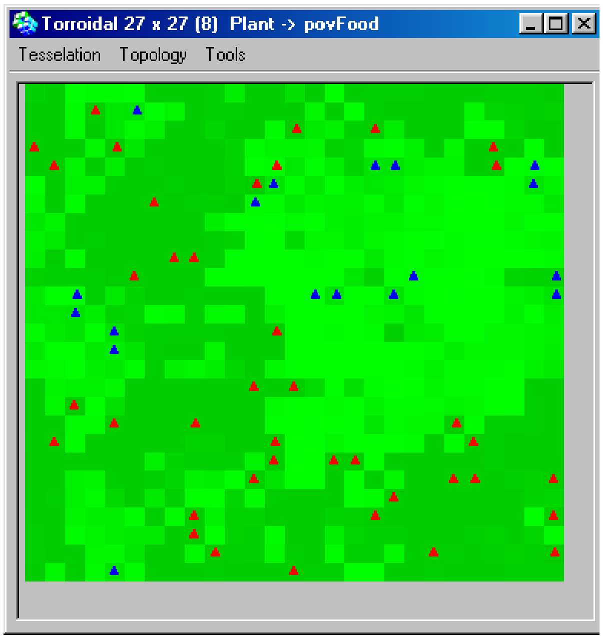
CIRAD

Land and Resources Program

CORMAS

Common-pool Resources and Multi-Agents Systems

Building a Cormas model from scratch step by step



December 2002

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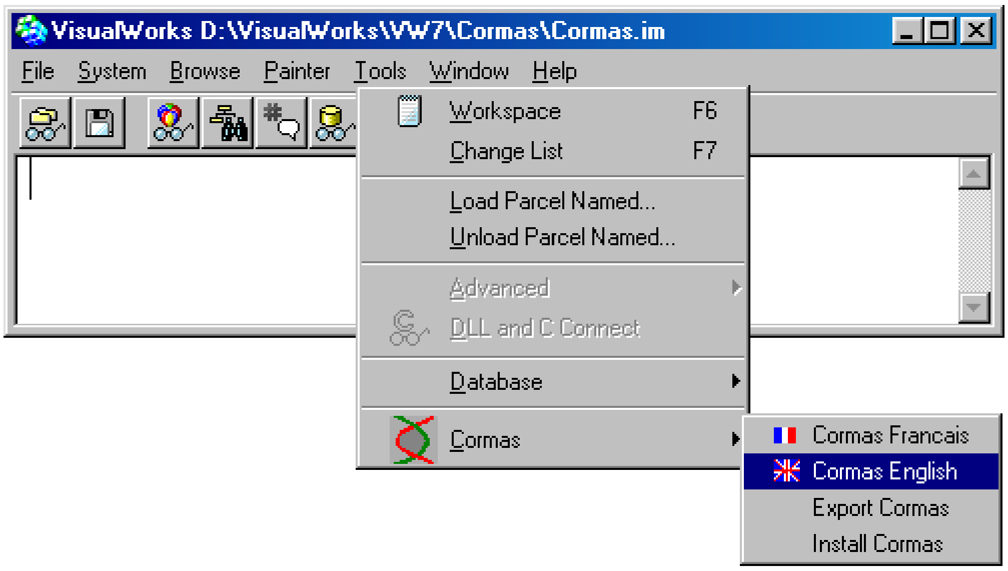
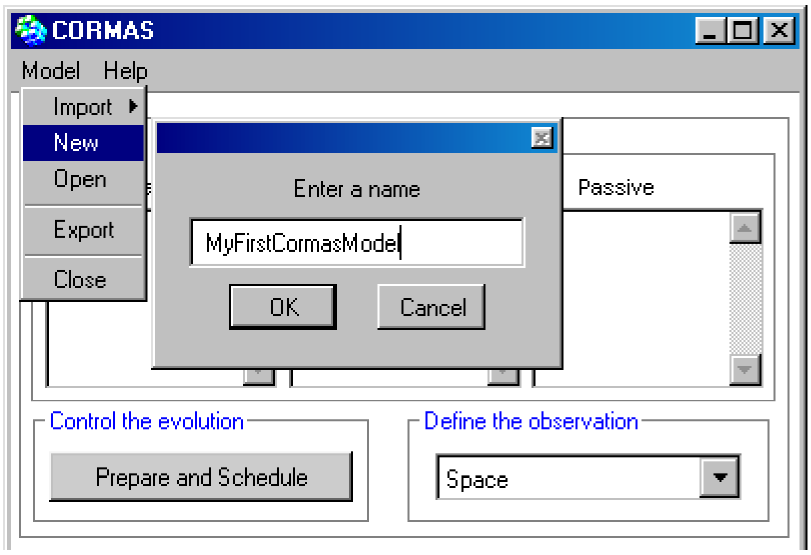
The model we present here and that you will build, is inspired from a paper by Pepper and Smuts, "Evolution of Cooperation in an Ecological Context". This ECEC model can be found on the Cormas web site: http://cormas.cirad.fr

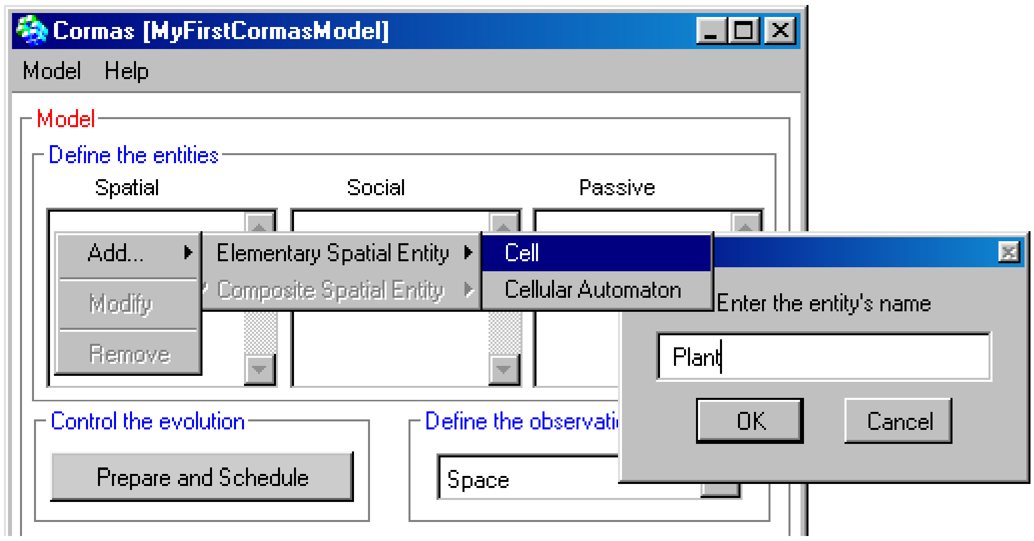
1. Opening Cormas

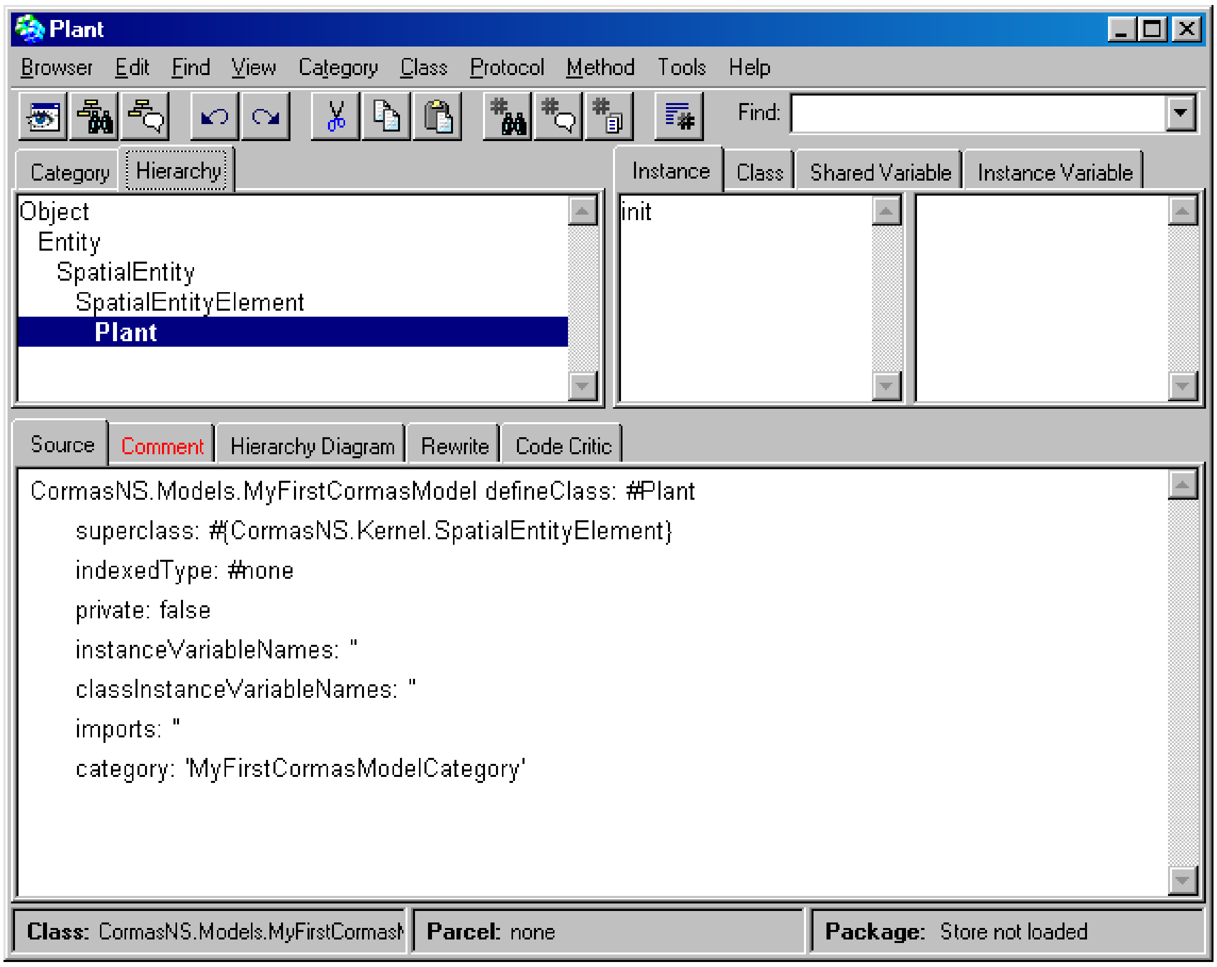


2. Creating a new Cormas model



3. Designing a spatial entity holding a renewable resource





```
CormasNS.Models.MyFirstCormasModel defineClass: #Plant
    superclass: #{CormasNS.Kernel.SpatialEntityElement}
    indexedType: #none
    private: false
    instanceVariableNames: ''
    classInstanceVariableNames: ''
    imports: ''
    category: 'MyFirstCormasModelCategory'
```

Class: CormasNS.Models.MyFirstCormasM **Parcel:** none **Package:** Store not loaded

3.1. Setting the parameters of a logistic growth

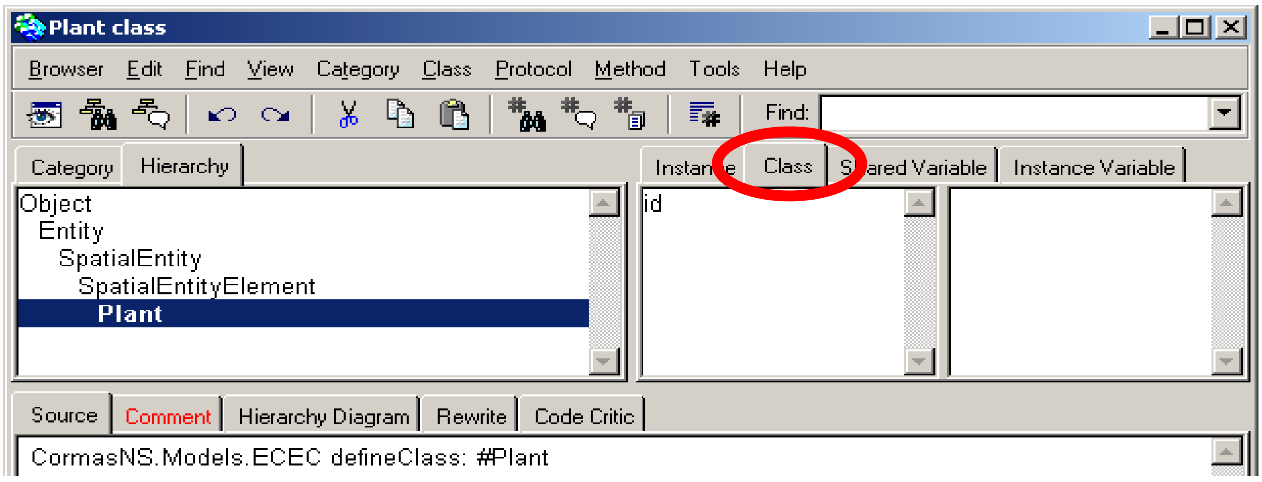
$$x_{t+1} = x_t + rx_t(1 - \frac{x_t}{K})$$

The logistic equation needs 2 parameters: the carrying capacity "*k*" and the growth rate "*r*".

The values of these parameters are equals for each Plant instances. We can defines them as class variables.

3.1.1. Create the new class variables with the contextual menu of the code editor

Switch from "Instance" to "Class".

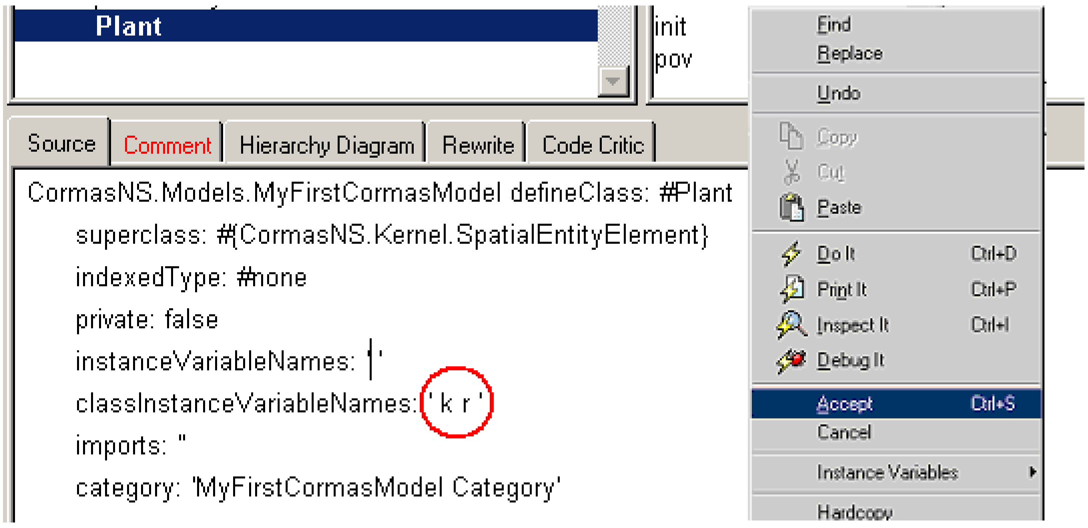

Plant class
Browser Edit Find View Category Class Protocol Method Tools Help
Find:
Category Hierarchy
Object
Entity
SpatialEntity
SpatialEntityElement
Plant
Instance Class Shared Variable Instance Variable
id
Source Comment Hierarchy Diagram Rewrite Code Critic

```
CormasNS.Models.ECEC defineClass: #Plant
```

3.1.2. Create the attributes

Create the carrying capacity "*k*" and "*r*":

- write them between the quotes on the line "classInstanceVariableNames:", then
- Accept : right click and select "Accept"



```
CormasNS.Models.MyFirstCormasModel defineClass: #Plant
    superclass: #{CormasNS.Kernel.SpatialEntityElement}
    indexedType: #none
    private: false
    instanceVariableNames: ''
    classInstanceVariableNames: 'k r '
    imports: ''
    category: 'MyFirstCormasModel Category'
```

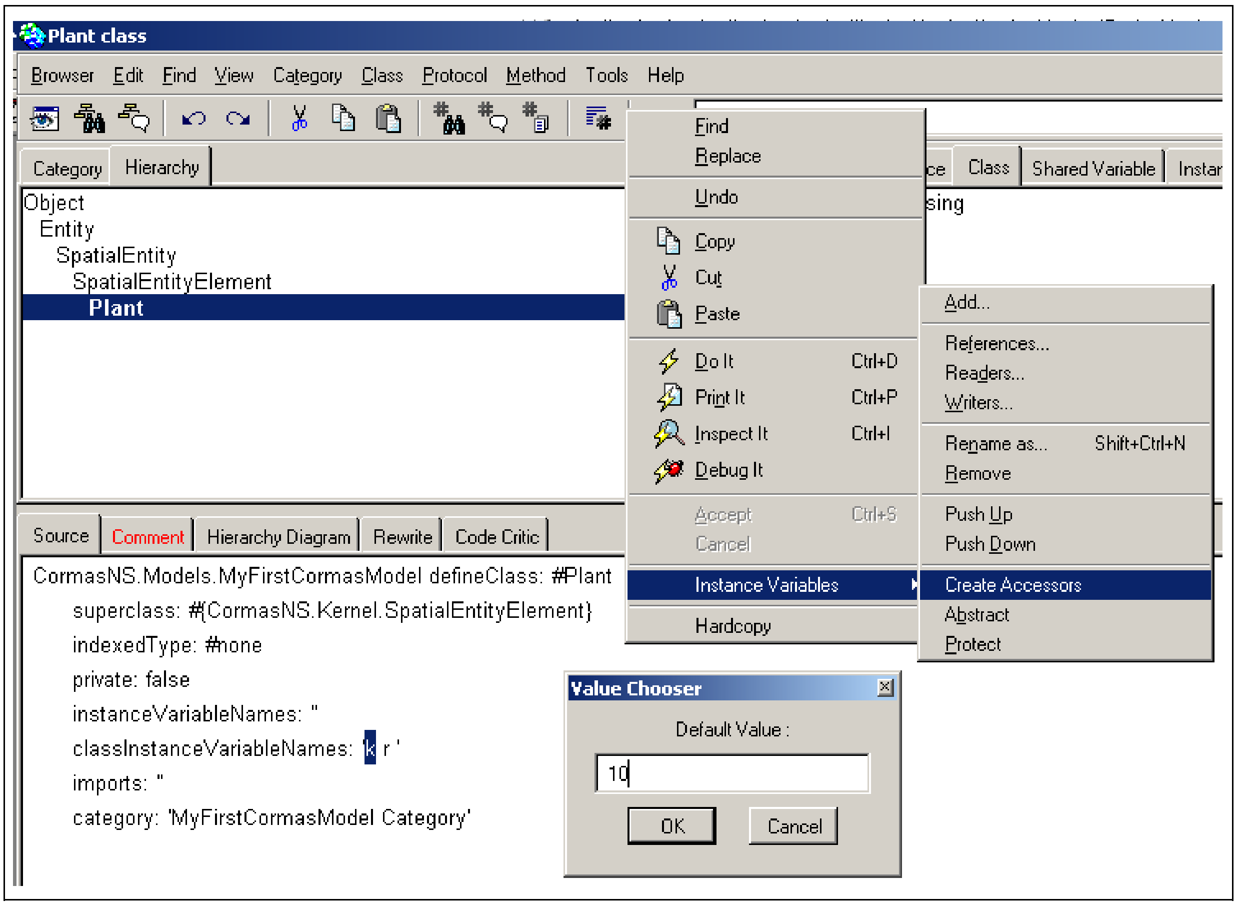
3.1.3. Create the accessing methods

Select the *k* variable then, with right button, select "Instance Variables" → "create Accessors". [1]

A new window pops up asking you to define the default value of this attribute *k*.

Set the value of *k* equal to 10.

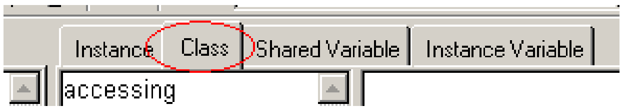
Then click on "OK". If you click on "Cancel" button, the accessors are created with *nil* as default value.



```
CormasNS.Models.MyFirstCormasModel defineClass: #Plant
	superclass: #{CormasNS.Kernel.SpatialEntityElement}
	indexedType: #none
	private: false
	instanceVariableNames: ''
	classInstanceVariableNames: 'k r '
	imports: ''
	category: 'MyFirstCormasModel Category'
```

In the same way, let the growth rate parameter "*r*" be equal to 0.2 (Select the *r* variable then, with right button, select "Instance Variables" → "create Accessors". In the new pop-up window set the default value of *r* equal to 0.2. Then click on "OK").

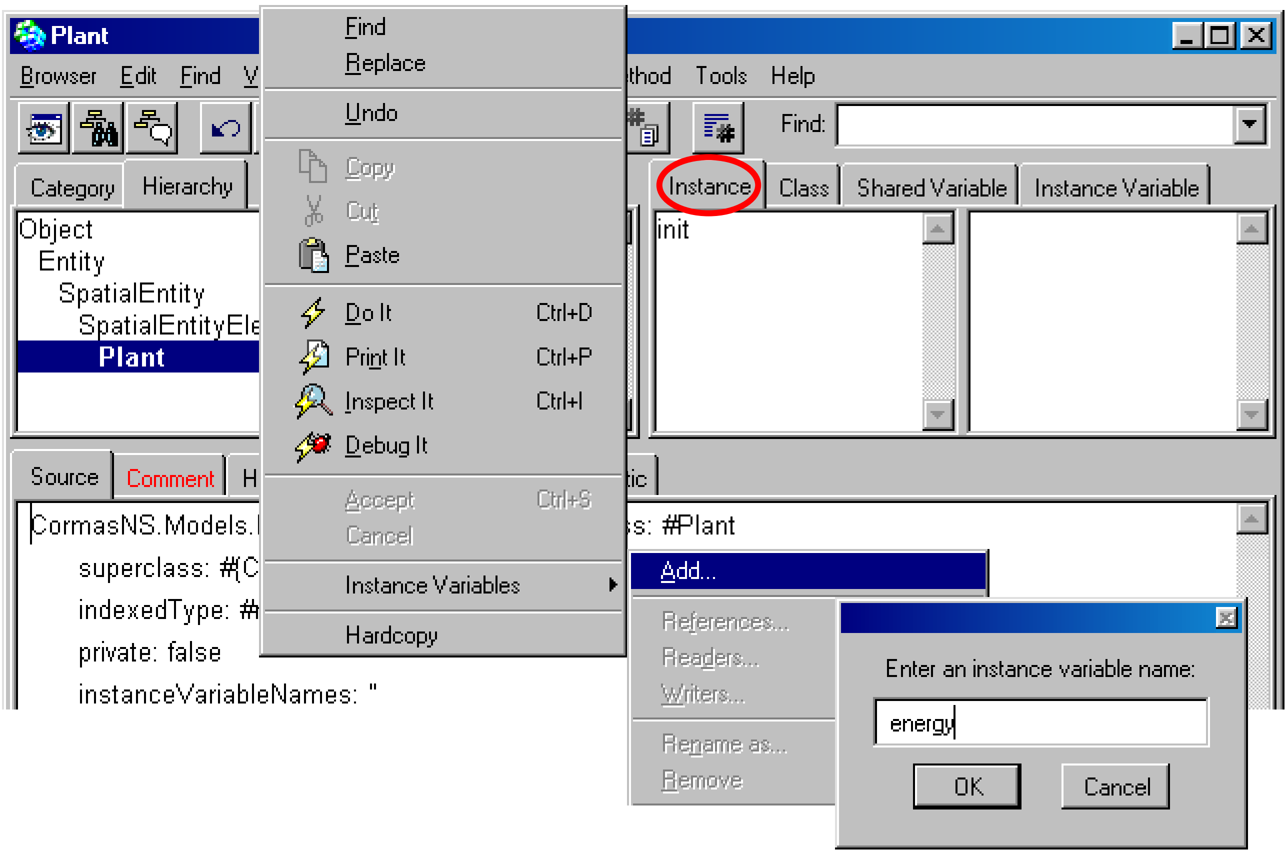
[1] The *Create Accessors* menu is activated for the class variables only when the Class tab is selected.



3.2. Adding a new attribute named “energy”

Switch back from the “Class” to the “Instance” level.

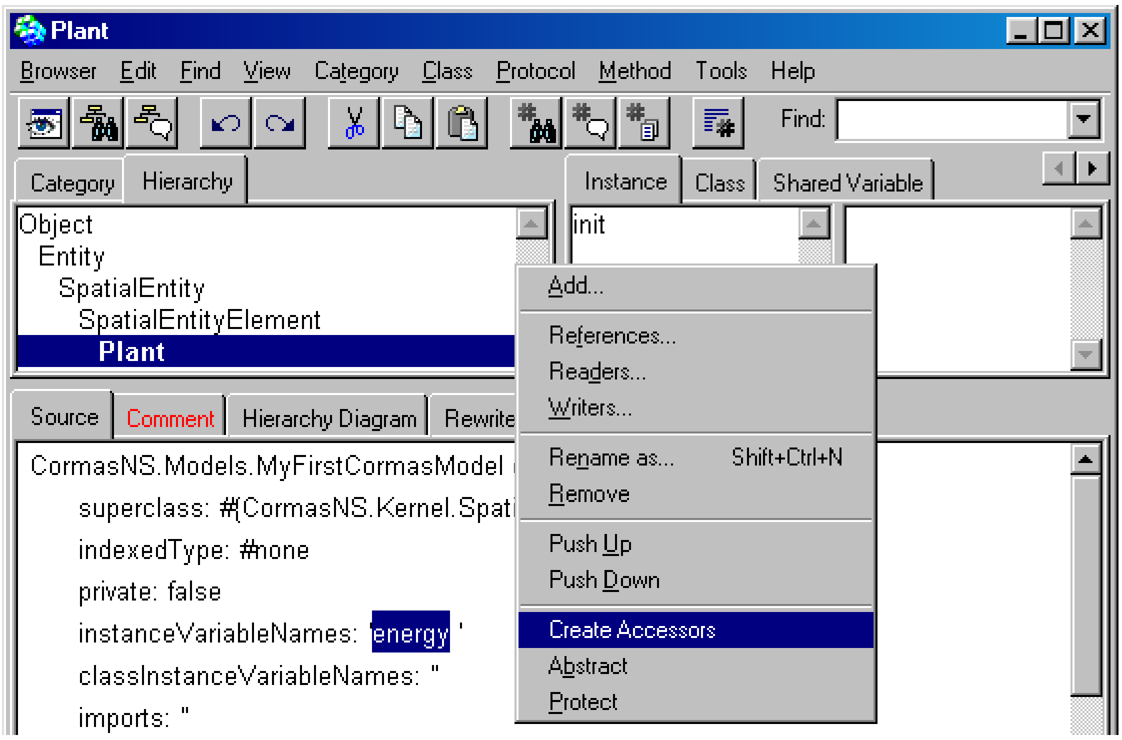
3.2.1. Create the new attribute with the contextual menu of the code editor



```
CormasNS.Models.I                    s: #Plant
    superclass: #C
    indexedType: #
    private: false
    instanceVariableNames: ''
```

3.2.2. Create the accessing methods

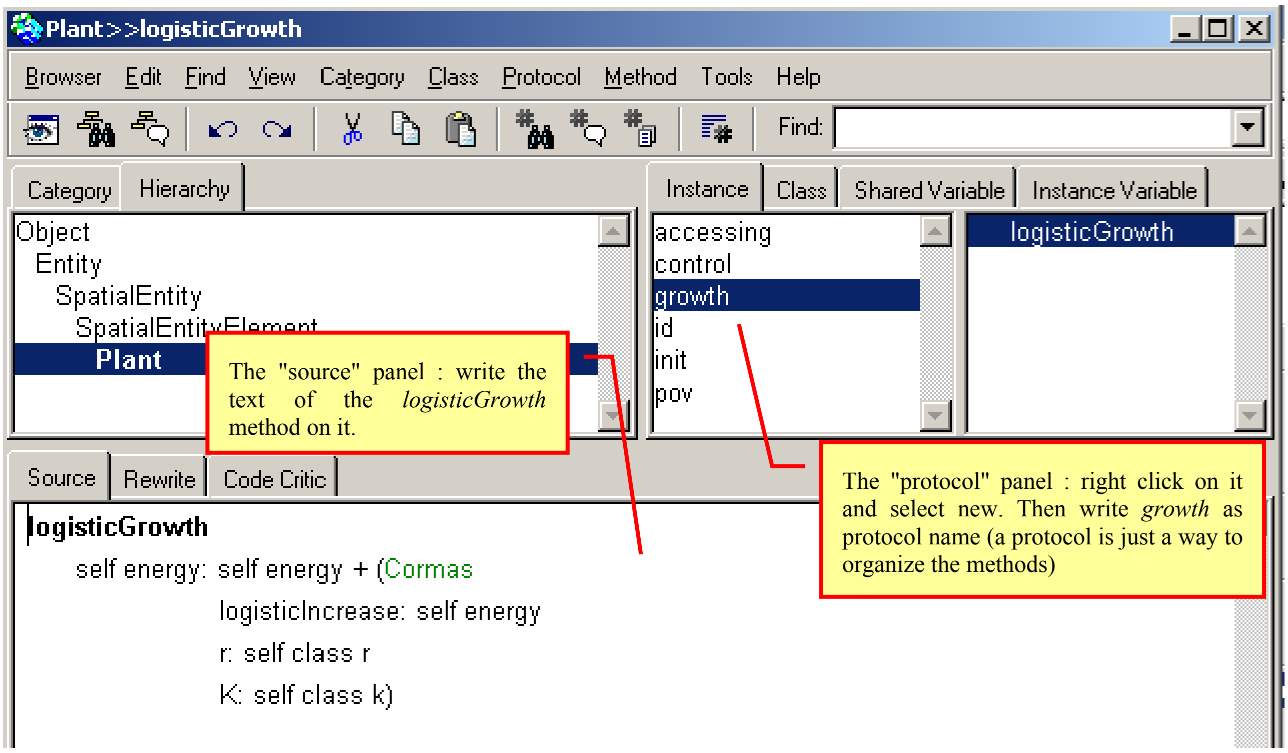
Create the accessing methods of the energy attribute and set the default value equals to 0.



```
CormasNS.Models.MyFirstCormasModel
	superclass: #{CormasNS.Kernel.Spati
	indexedType: #none
	private: false
	instanceVariableNames: 'energy '
	classInstanceVariableNames: ''
	imports: ''
```

3.3. Write a logistic growth method in a new protocol

A protocol is just a way to organize the methods. To create a new protocol, right click on the "protocol" panel and select "new". Then write *growth* as protocol name.



The "source" panel : write the text of the *logisticGrowth* method on it.

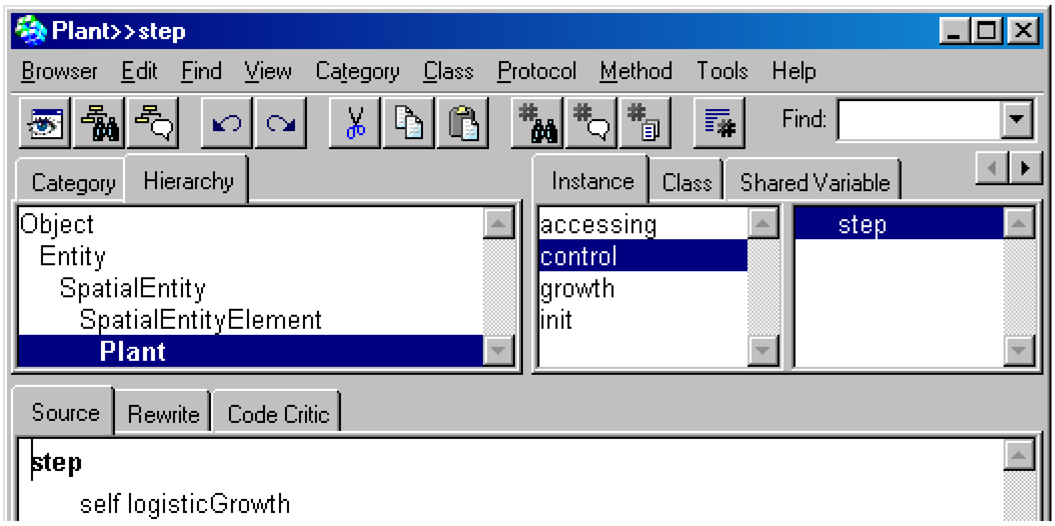
The "protocol" panel : right click on it and select new. Then write *growth* as protocol name (a protocol is just a way to organize the methods)

```
logisticGrowth
	self energy: self energy + (Cormas
				logisticIncrease: self energy
				r: self class r
				K: self class k)
```

To create a new method into the "growth" protocol, remove the text on the "source" panel and write your method on it, then accept (right button → Accept or Ctrl S). The *logisticGrowth* method uses a static method from Cormas class (logisticIncrease:r:K:).

3.4. Write the basic step method in the “control” protocol

In the same way as previously, create a new protocol called *control* and the *step* method in it.

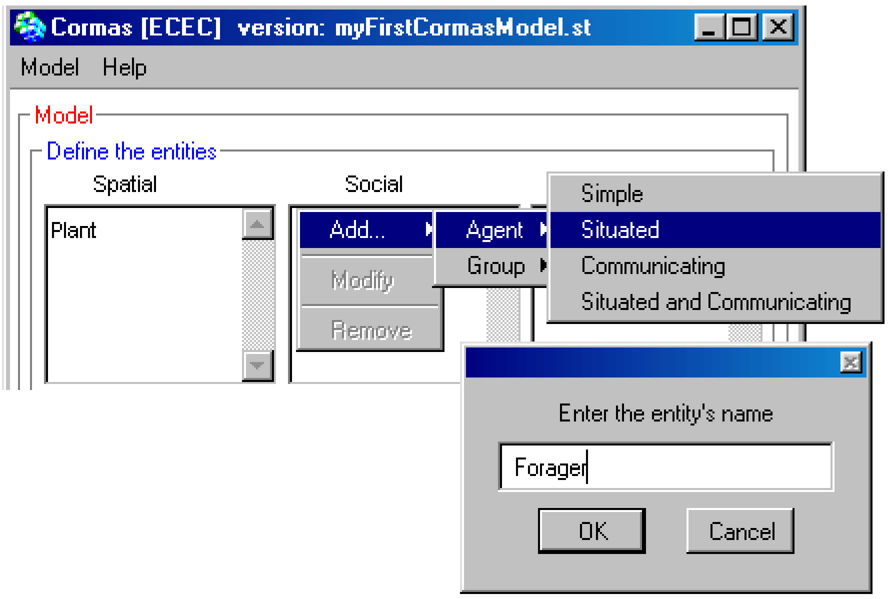

Plant>>step
Browser Edit Find View Category Class Protocol Method Tools Help
Find:
Category Hierarchy
Instance Class Shared Variable
Object
Entity
SpatialEntity
SpatialEntityElement
Plant
accessing
control
growth
init
step
Source Rewrite Code Critic

```
step
	self logisticGrowth
```

You can now close the browser "Plant".

4. Designing an agent foraging the resource

Let us define the Forager agent as a kind of situated agent :



Forager

As you can see in the new browser, Forager inherits from *AgentLocation*

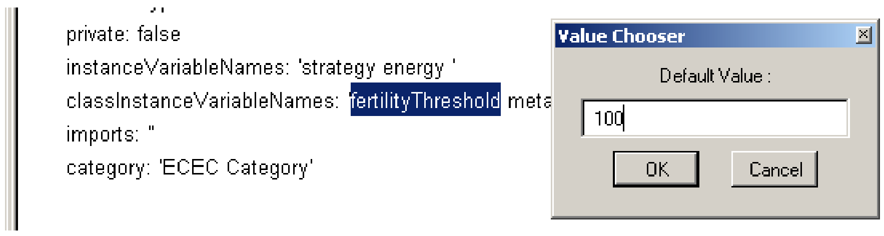
4.1. Setting the life-history parameters of any forager agent

The values of these parameters are equals for each agent. We can defines them as class variables as describe in chapter 1 (Setting the parameters of a logistic growth).

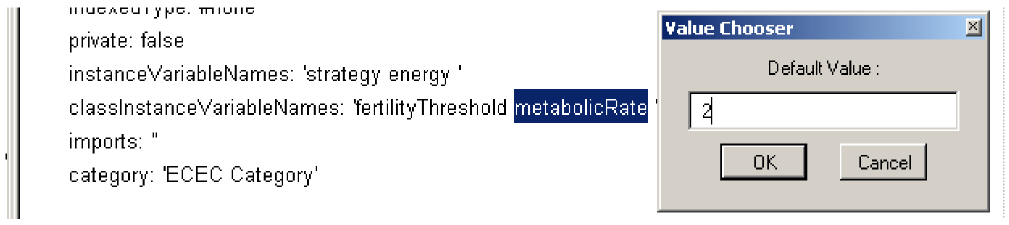
4.1.1. Create the new class variables with the contextual menu of the code editor

Switch from “Instance” to “Class”. At this Class level, create the new class variables *fertilityThreshold* and *metabolicRate* (write them between the quotes on the line "classInstanceVariableNames:" and accept).

Then create the accessors with 100 as default value for *fertilityThreshold* and 2 for *metabolicRate* (Select the variable then, with right button, select "Instance Variables" → "create Accessors". In the new pop-up window set the default value of *fertilityThreshold* equal to 100. Then click on "OK")[2].



```
private: false
instanceVariableNames: 'strategy energy '
classInstanceVariableNames: 'fertilityThreshold meta
imports: ''
category: 'ECEC Category'
```



```
private: false
instanceVariableNames: 'strategy energy '
classInstanceVariableNames: 'fertilityThreshold metabolicRate '
imports: ''
category: 'ECEC Category'
```

4.1.2. Add two attributes named “energy” and “strategy” and create their accessors

Proceed like in section 3.2.

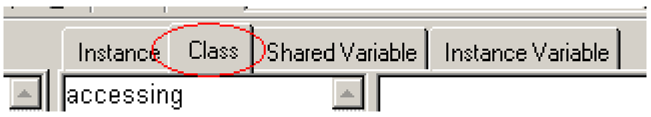
Set the default value of *energy* equal to 50.

Click on Cancel for the default value of *strategy*.

4.2. Create a new protocol named “biology” and write the biological methods

```
harvestRate
    self strategy = #unrestrained ifTrue: [^0.99].
    self strategy = #restrained ifTrue: [^0.5]
```

[2] Remember that the *Create Accessors* menu is activated for the class variables only when the Class tab is selected.



```
eat
| qty |
    qty := self patch energy * self harvestRate.
    self energy: self energy + qty.
    self patch energy: self patch energy - qty
```

```
move
    (self patch neighboursMaxOf: #energy) < self class metabolicRate
        ifTrue: [self randomWalkConstrainedBy: [:c | c noOccupant]]
        ifFalse: [self walkToMaxOf: #energy constrainedBy: [:c | c noOccupant]]
```

```
reproduce
| newForager |
    self energy > self class fertilityThreshold
        ifTrue:
            [newForager := self class new.
            newForager strategy: self strategy.
            self energy: self energy - newForager energy.
            newForager moveTo: self nearestEmptyLocation].
    ^newForager
```

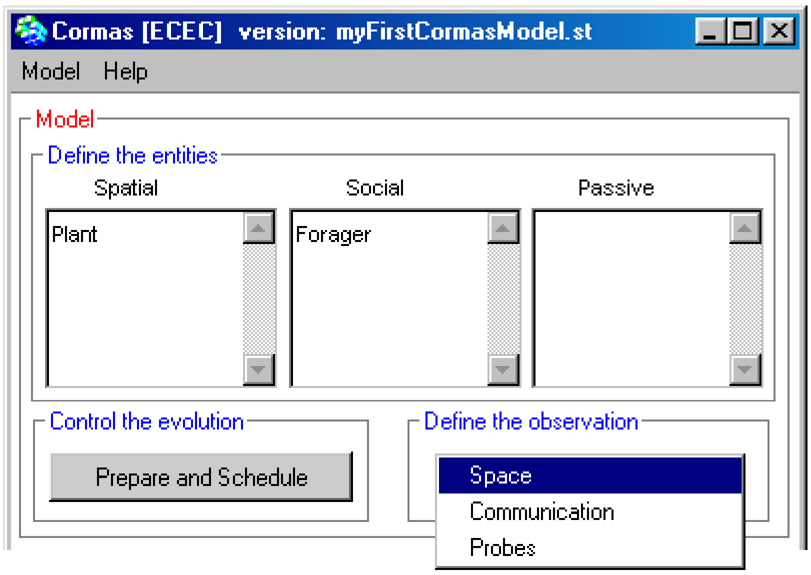
```
die
    self energy <= 0 ifTrue: [self dead: true].
```

```
updateEnergy
    self energy: self energy - self class metabolicRate
```

4.3. Create a protocol named “control” and write the “step” method of the forager agent

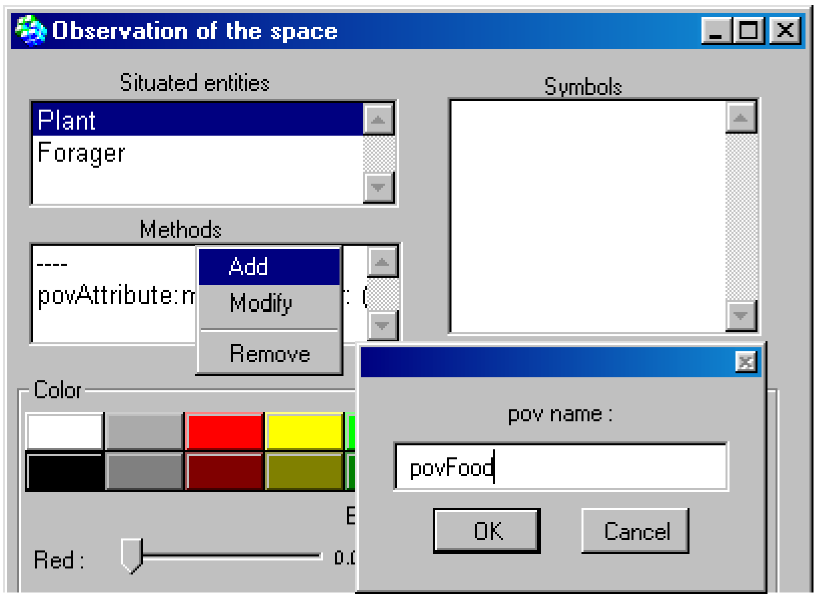
```
step
| newForager |
    self updateEnergy.
    self move.
    self eat.
    newForager := self reproduce.
    self die.
    ^newForager
```

5. Designing methods to observe the entities



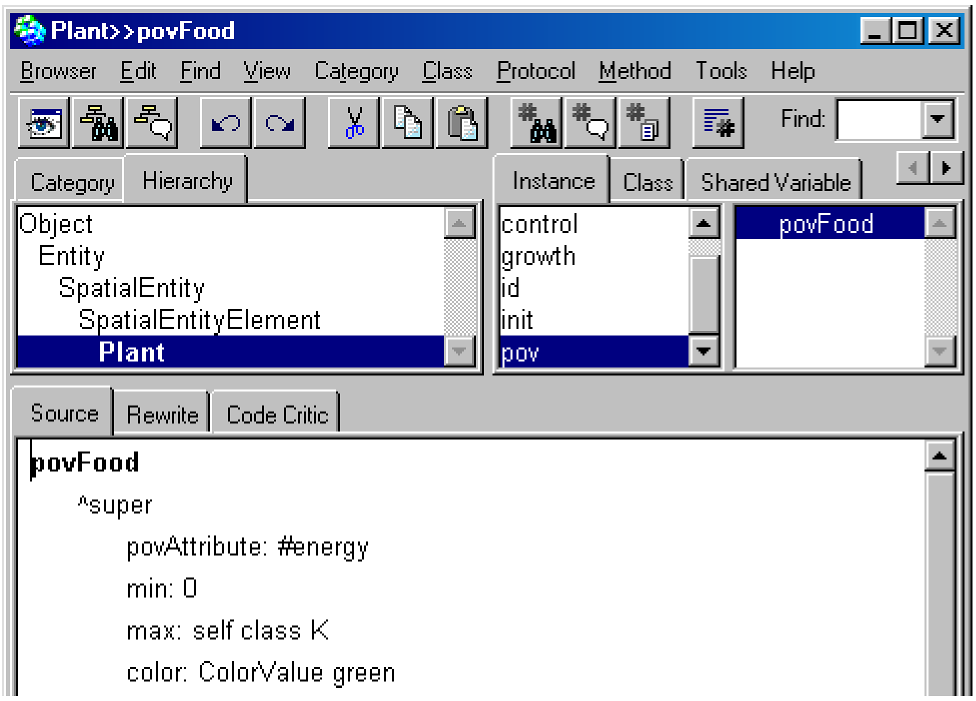
5.1. Assigning a green intensity according to the energy level of the plant

5.1.1. Add a "point of view" method named "povFood"



5.1.2. Write the code of the "povFood" method

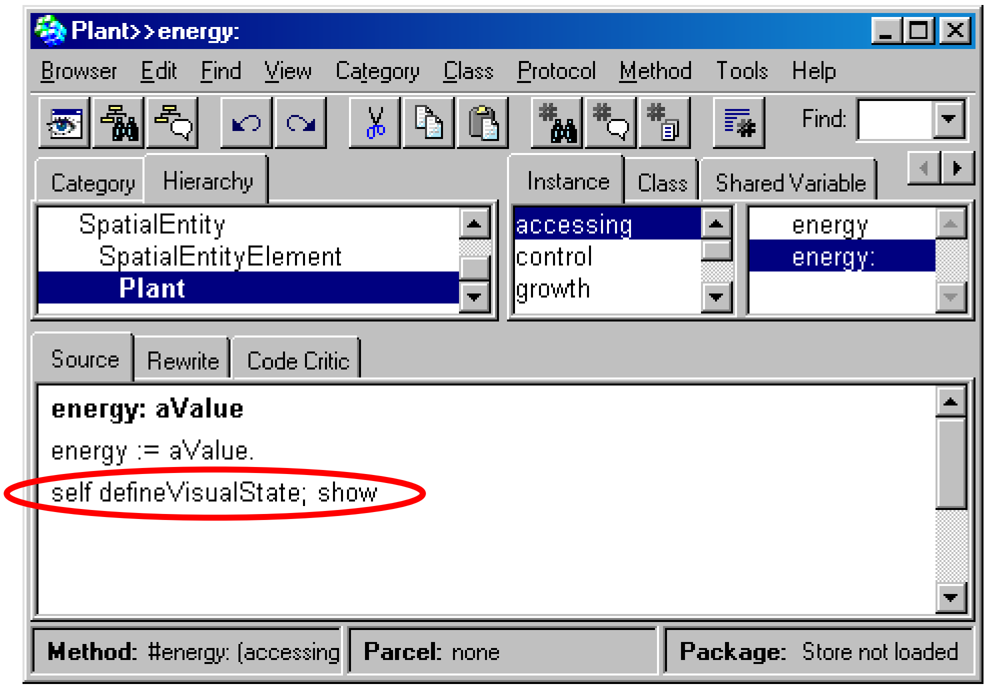
A "pov" method has to return symbols, which needs to be associated to corresponding colours via the palette tool. This classical way of writing "pov" methods will be presented in section 5.2. Here, another way is used: "pov" methods may return directly colour values. Cormas provides a generic method that relates the brightness of a base colour to the value of a quantitative attribute.


Plant>>povFood
Browser Edit Find View Category Class Protocol Method Tools Help
Find:
Category Hierarchy
Instance Class Shared Variable
Object
Entity
SpatialEntity
SpatialEntityElement
Plant
control
growth
id
init
pov
povFood
Source Rewrite Code Critic

```
povFood
    ^super
        povAttribute: #energy
        min: 0
        max: self class K
        color: ColorValue green
```

5.1.3. Adjust the write-access method of all the attributes involved in “pov” methods

The only attribute involved in a “pov” method of the Plant entity is “energy”. To ensure that the visualization will be updated each time a new value of energy will be assigned to a plant, you need to add a specific instruction at the end of the corresponding write-access method :


Plant>>energy:
Browser Edit Find View Category Class Protocol Method Tools Help
Find:
Category Hierarchy
Instance Class Shared Variable
SpatialEntity
SpatialEntityElement
Plant
accessing
control
growth
energy
energy:
Source Rewrite Code Critic

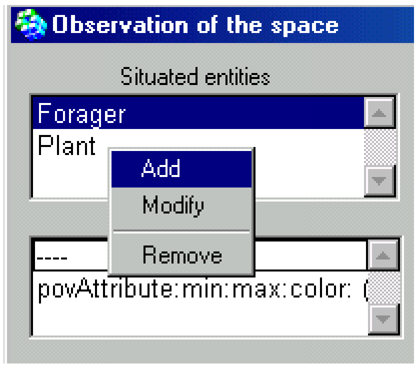
```
energy: aValue
energy := aValue.
self defineVisualState; show
```

Method: #energy: (accessing Parcel: none Package: Store not loaded

5.2. Assigning a colour to distinguish foragers according to their strategy

5.2.1. Add a "pov" method named "povStrategy"

Click on the Forager object and 'Add a new method' in the list of methods, and then type the code below:



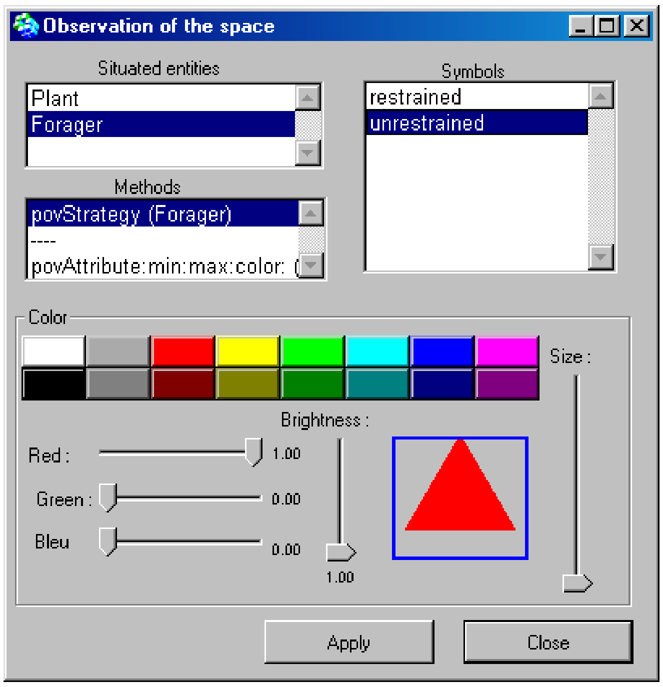
```
povStrategy
    ^self strategy
```

5.2.2. Add the symbols that may be returned by the "pov" method

You need to add, in the "Symbols" window, all the possible symbols that may be returned by any "pov" methods of the selected entity. Here, povStrategy will be the only "pov" method of the Forager entity. This method is returning the strategy of a forager agent. The possible values of a forager's strategy are #restrained and #unrestrained. When you enter these values in the list of symbols, do not include the initial # character, and use exactly the same spelling (be careful, smalltalk is case-sensitive !).

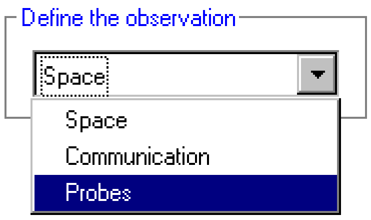
5.2.3. To each added symbol, associate a colour and a shape

Use the palette or the Red, Green and Blue sliders to choose a colour. Use the contextual menu within the blue squared to choose a polygonal shape. Do not forget to apply after each choice !

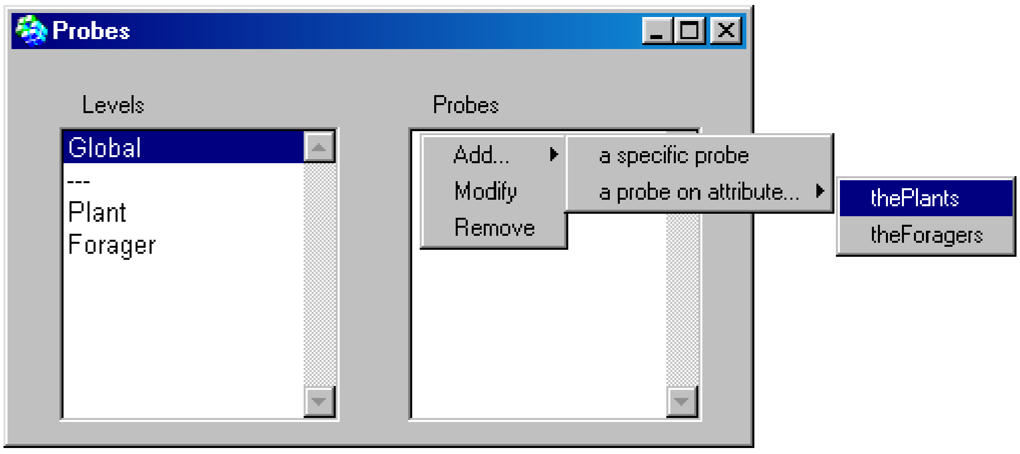


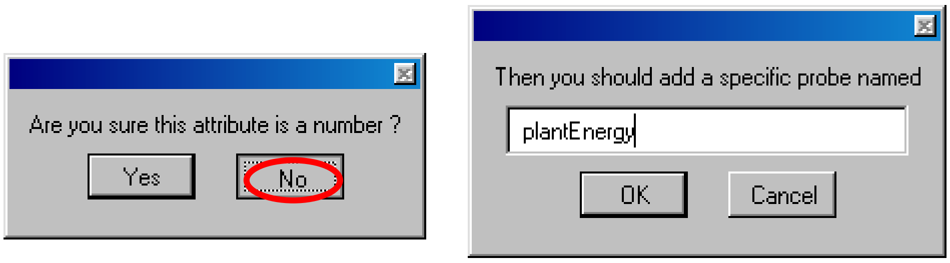
6. Designing “probes” to record the variations of markers

6.1. Open the “probes” definition window from the main Cormas interface



6.2. Add probes based on attributes of the model (global level)



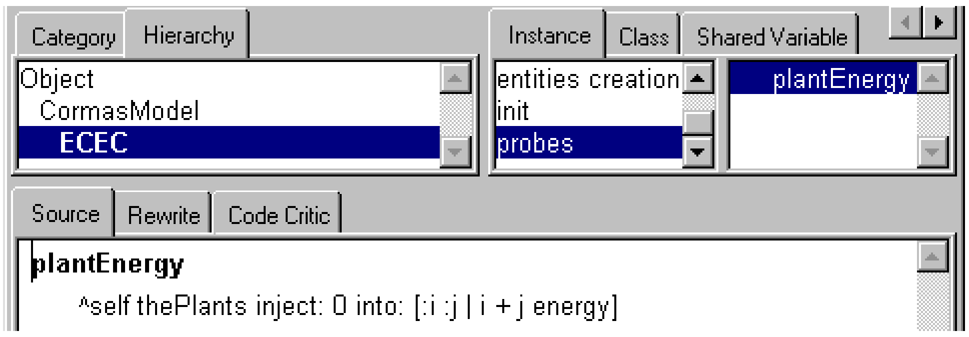

Are you sure this attribute is a number ?

Yes [✓ No]

Then you should add a specific probe named

plantEnergy

6.3. Write the code for the first one: a cumulative value over a collection



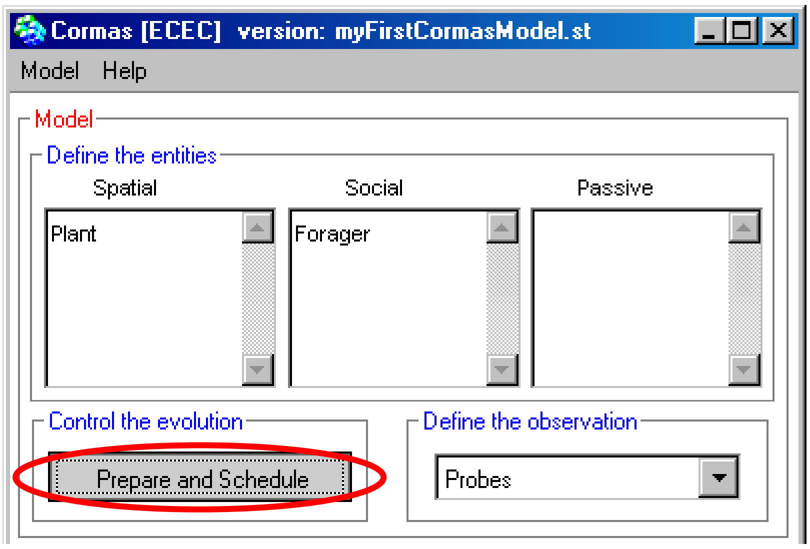
```
plantEnergy
    ^self thePlants inject: 0 into: [:i :j | i + j energy]
```

6.4. Define 2 other probes : the number of restrained and unrestrained foragers

```
restrained
    ^(self theForagers select: [:f |
        f strategy = #restrained]) size
```

```
unrestrained
    ^(self theForagers select: [:f |
        f strategy = #unrestrained]) size
```

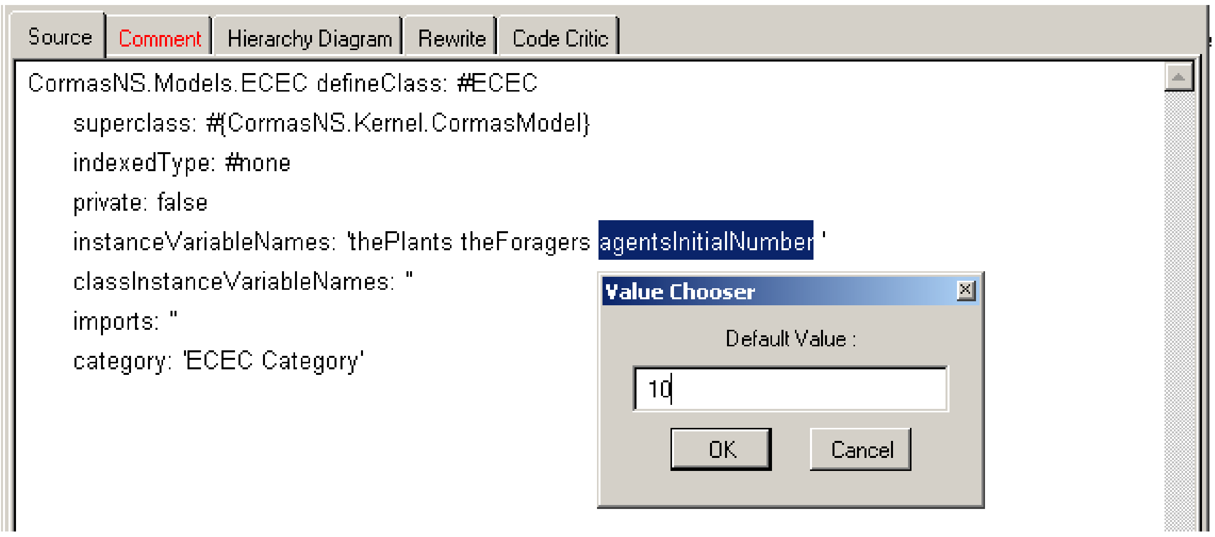
7. Designing control methods for the scheduling of simulation experiments



7.1. Create attribute agentsInitialNumber

Create the *agentsInitialNumber* attribute which allows user to choose the initial number of Foragers having each strategy.

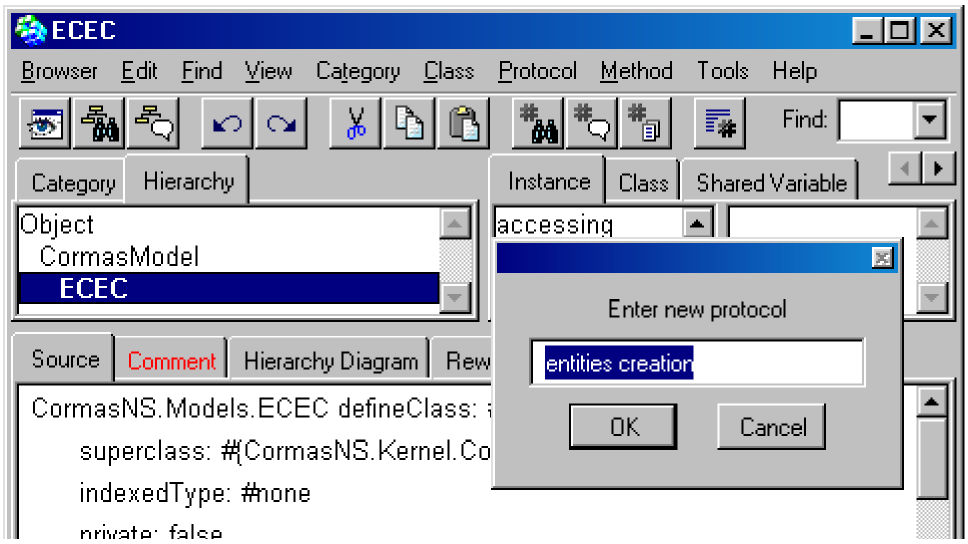
Set the default number equals to 10.



```
CormasNS.Models.ECEC defineClass: #ECEC
    superclass: #{CormasNS.Kernel.CormasModel}
    indexedType: #none
    private: false
    instanceVariableNames: 'thePlants theForagers agentsInitialNumber '
    classInstanceVariableNames: ''
    imports: ''
    category: 'ECEC Category'
```

Default Value : 10

7.2. Write, in a new protocol ("entities creation"), a method to create the forager agents


ECEC
Browser Edit Find View Category Class Protocol Method Tools Help
Find:
Category Hierarchy
Instance Class Shared Variable
Object
CormasModel
ECEC
accessing
Source Comment Hierarchy Diagram Rew
OK
Cancel

Enter new protocol

entities creation

```
CormasNS.Models.ECEC defineClass: #
    superclass: #{CormasNS.Kernel.Co
    indexedType: #none
    private: false
```

Write the initForagers methods :

```
initForagers
"initialize 'agentsInitialNumber' foragers with restrained strategy and 'agentsInitialNumber' foragers with
unrestrained strategy"
    super initAgents.
    self setRandomlyLocatedAloneAgents: Forager
        n: self agentsInitialNumber
        initMethod: #strategy:
        arguments: #(#restrained).
    self setRandomlyLocatedAloneAgents: Forager
        n: self agentsInitialNumber
        initMethod: #strategy:
        arguments: #(#unrestrained)
```

7.3. Write (in the "init" protocol) 3 different methods to be used as initial situations for simulation experiments

```
noForagers
    self spaceModel loadEnvironmentFromFile: 'poor.env' withPov: #povFood.
    super initCells.
    super initAgents.
```

```
homogeneousEnv
    self spaceModel loadEnvironmentFromFile: 'random.env' withPov: #povFood.
    super initCells.
    self initForagers.


fragmentedEnv
    self spaceModel loadEnvironmentFromFile: 'fragmented.env' withPov: #povFood.
    super initCells.
    self initForagers.
```

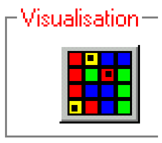
7.4. Write (in the "control" protocol) a step method to be executed at each time-step of simulation

```
step: t
"Resource dynamics"
    super stepEntities: self thePlants.
"Agents dynamics"
    super stepDynPop: self theForagers.
```

8. Simulating the model

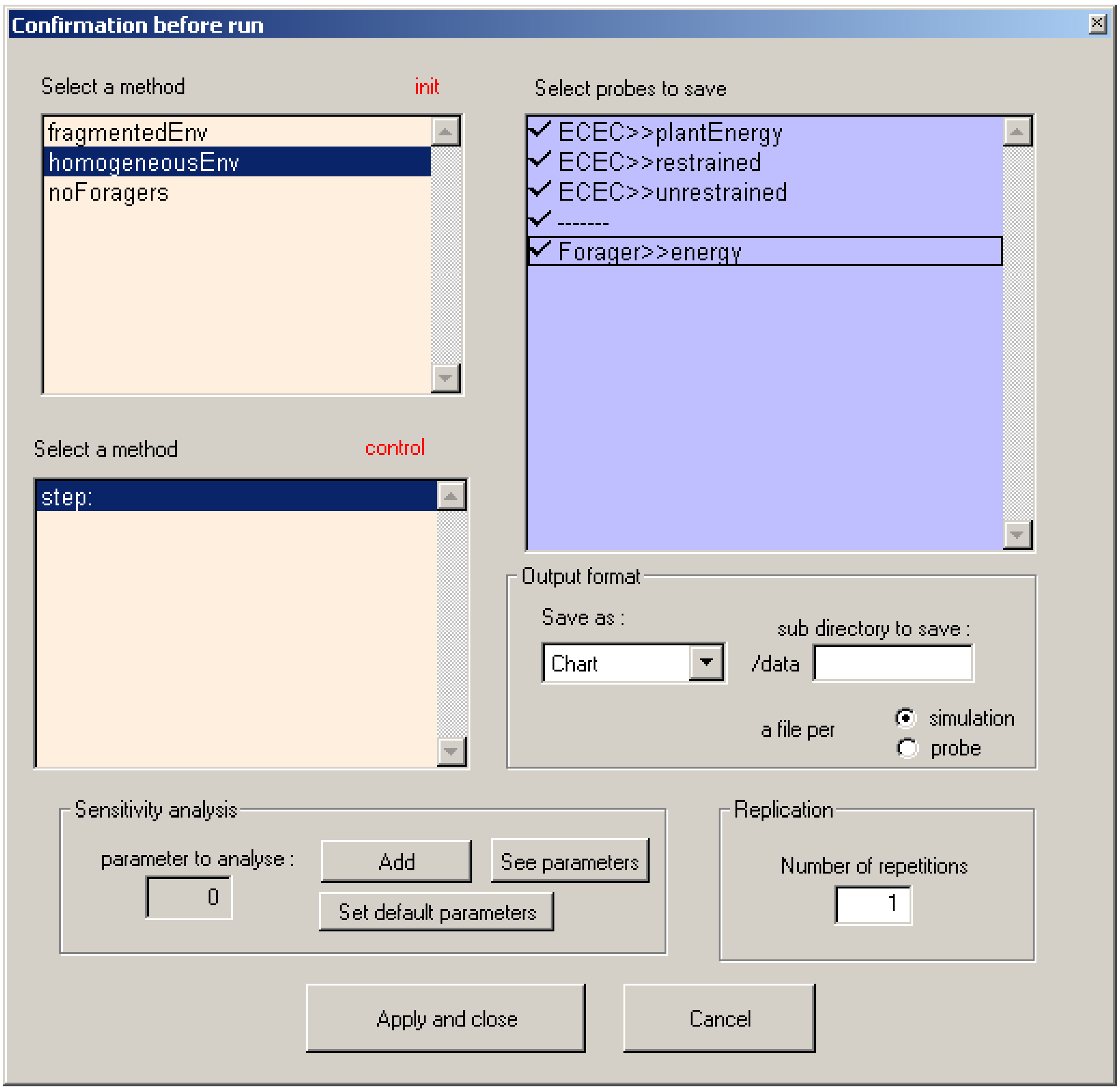
First of all you have to export your model. This creates a "MyFirstCormasModel" directory under "cormas/models". Within this new models directory, create a sub-directory "maps" and put into that directory the files 'poor.env', 'random.env' and 'fragmented.env'.

Then you have to open the spatial grid interface to be able to visualize the simulation. Click on :



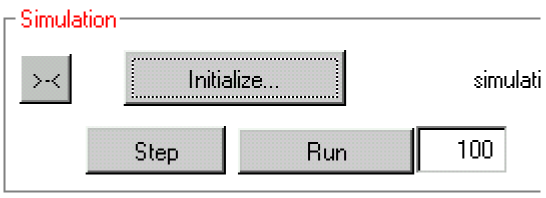
Back to Cormas main interface, you can click on the "Initialize…" button. A window will open where you have to choose an initialisation method and a control method. You can also check the probes you would like to save[3].

[3] To select all the probes, click on the first one and shift click on the last one.

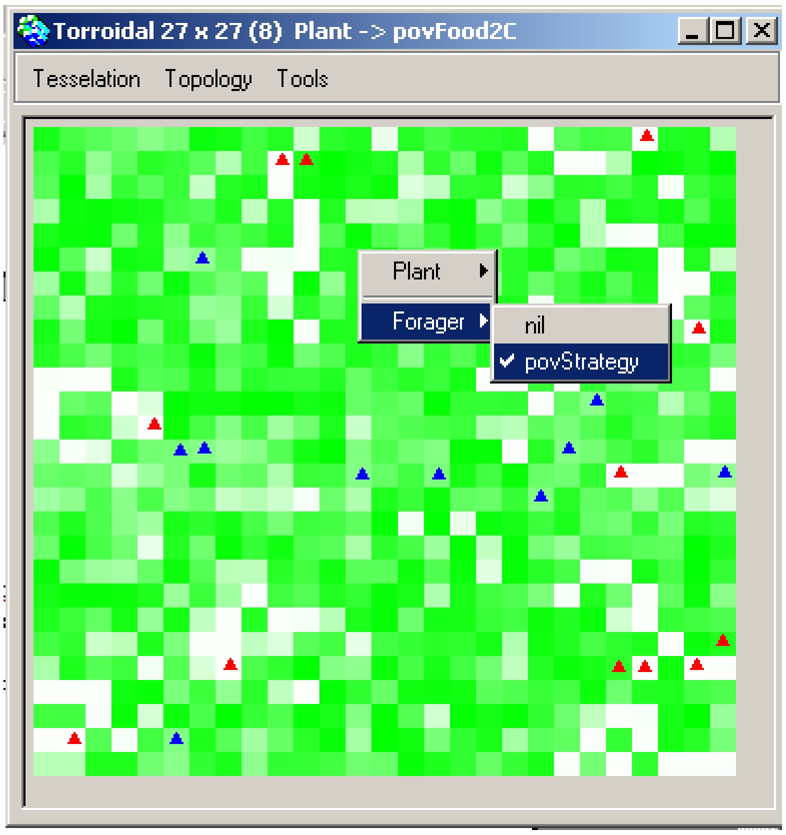


Then click on *Apply and close* button.

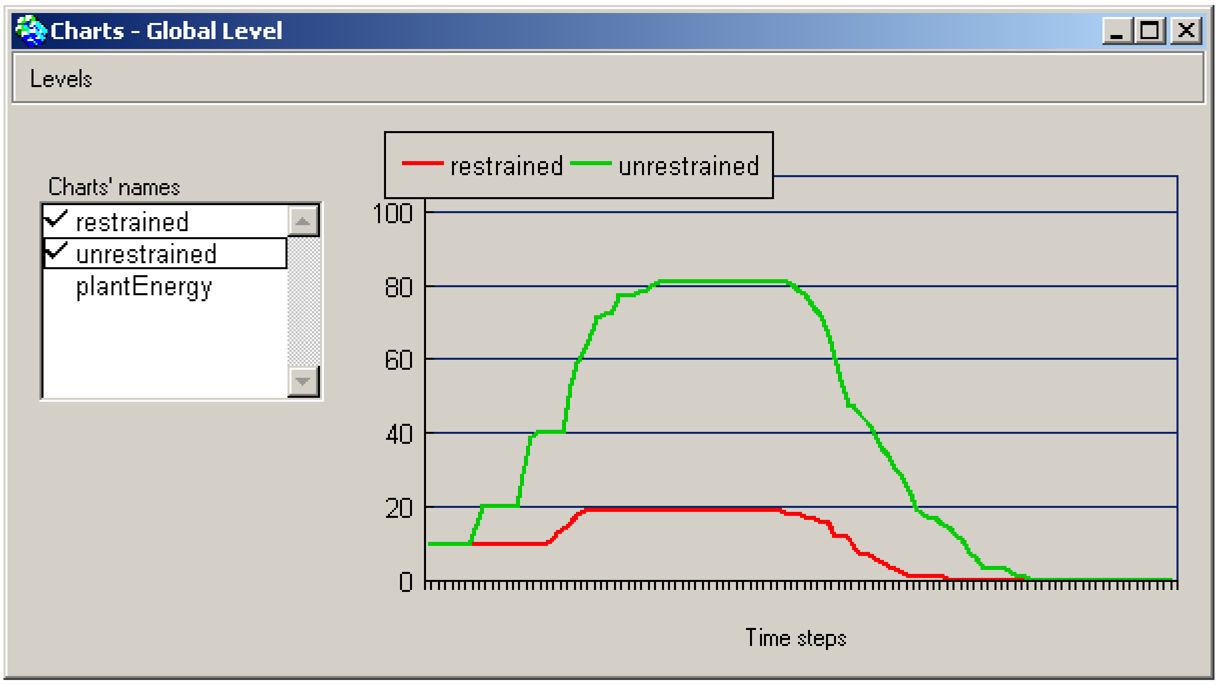
You can now simulate by clicking on the "Step" button or on the "Run" button once you have typed a duration.



In order to see also the foragers on the map, right click on the grid and select the Forager → povStrategy.



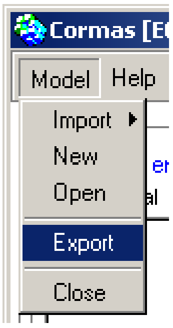
In order to see the resulting curves of the simulation, click on the *Charts* button . Then click on the probe you want to see. If you want to see several probes at once, select them with Ctrl key.



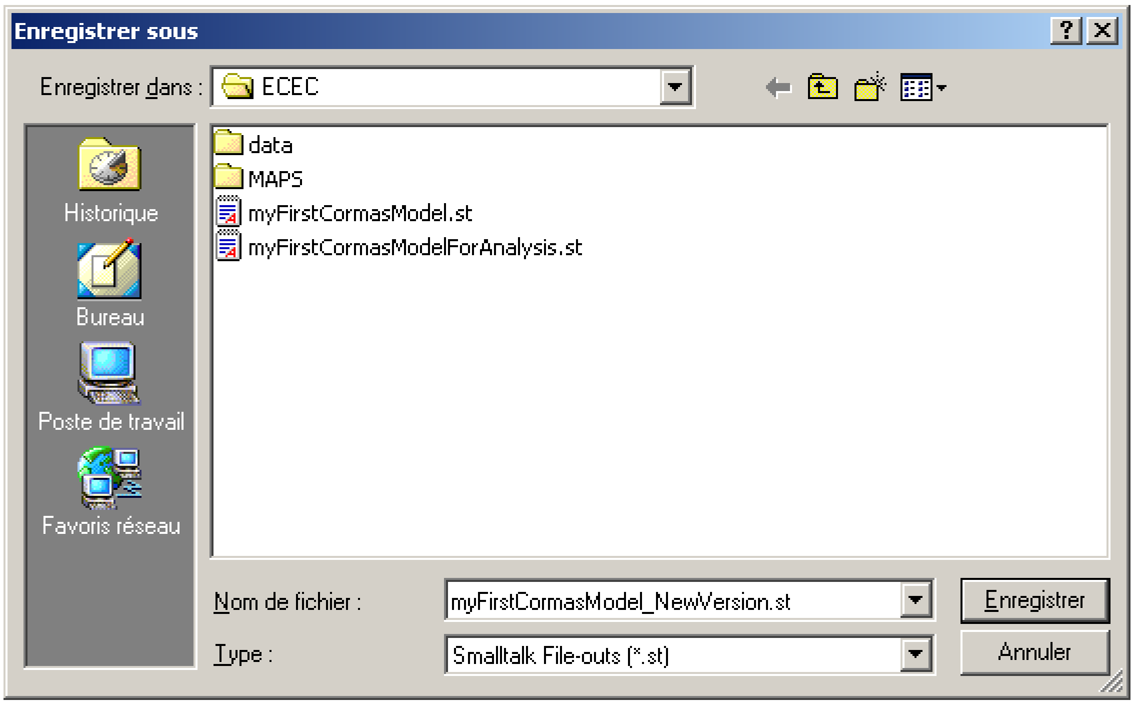
9. Saving, loading and versioning the model

9.1. Saving and versioning

When you want to save your model, click on Model → Export



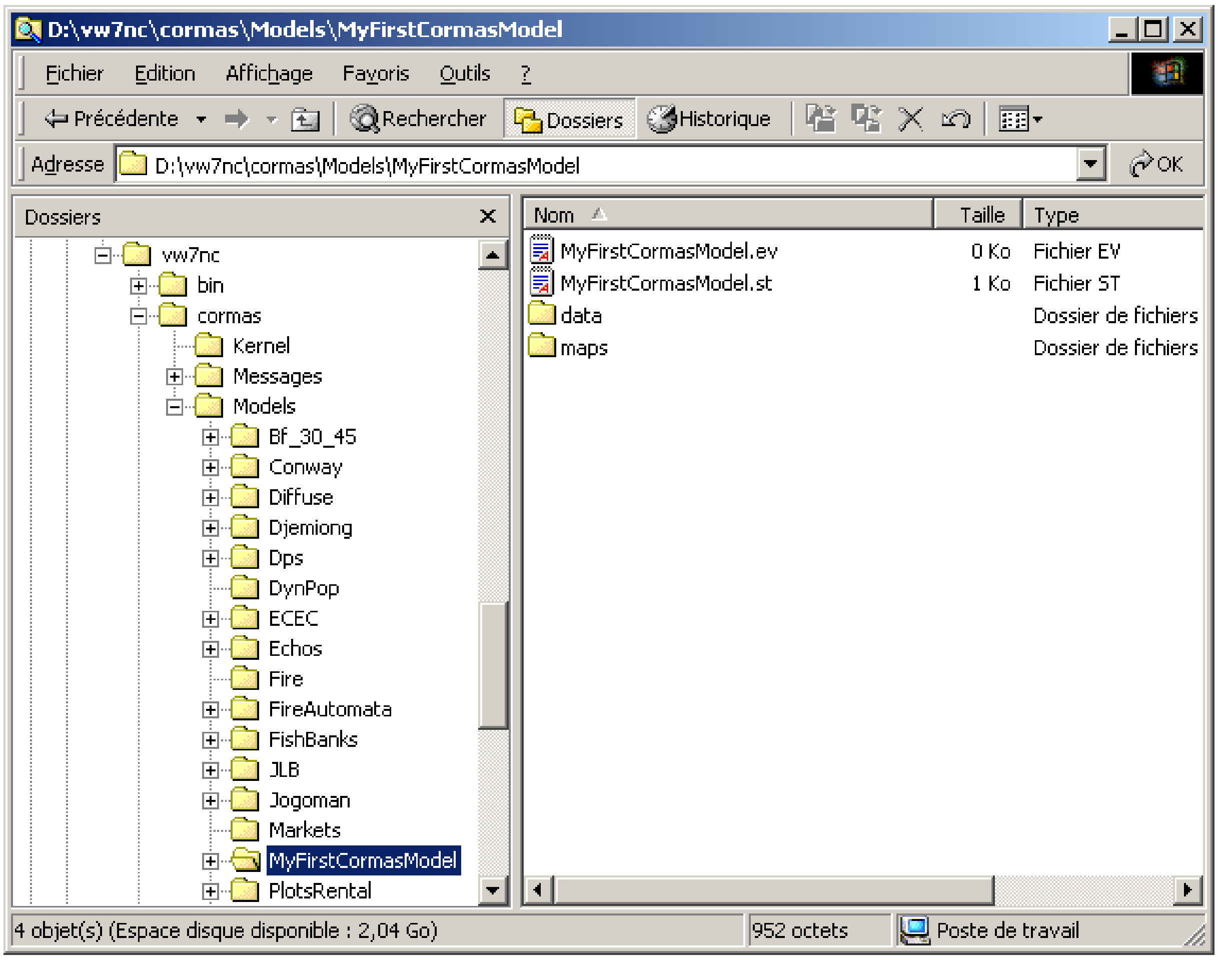
You can then choose the version of your model, for example "myFirstModel_newVersion.st" :



Nom de fichier : myFirstCormasModel_NewVersion.st

Type : Smalltalk File-outs (*.st)

The model is then saved on the disk as a file with .ST extension (ST for SmallTalk). Cormas has created a directory for your model. You should get the following architecture :



D:\vw7nc\cormas\Models\MyFirstCormasModel

Fichier Edition Affichage Favoris Outils ?

Précédente Rechercher Dossiers Historique

Adresse D:\vw7nc\cormas\Models\MyFirstCormasModel

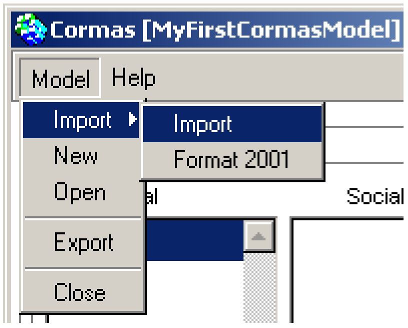
Dossiers

- vw7nc
  - bin
  - cormas
    - Kernel
    - Messages
    - Models
      - Bf_30_45
      - Conway
      - Diffuse
      - Djemiong
      - Dps
      - DynPop
      - ECEC
      - Echos
      - Fire
      - FireAutomata
      - FishBanks
      - JLB
      - Jogoman
      - Markets
      - MyFirstCormasModel
      - PlotsRental

Nom	Taille	Type
MyFirstCormasModel.ev	0 Ko	Fichier EV
MyFirstCormasModel.st	1 Ko	Fichier ST
data		Dossier de fichiers
maps		Dossier de fichiers

4 objet(s) (Espace disque disponible : 2,04 Go) 952 octets Poste de travail

9.2. Loading the model



Then choose the version you want to load.

10. Analysing the model

We present now the ways to conduct *sensitivity analysis* with Cormas. Analysing is a an important part of the modelling activity and should not be forget.

Cormas don't propose analyse tools; it just allows to launch many simulations according to parameters values and to export the data of the simulations in different kinds of files :

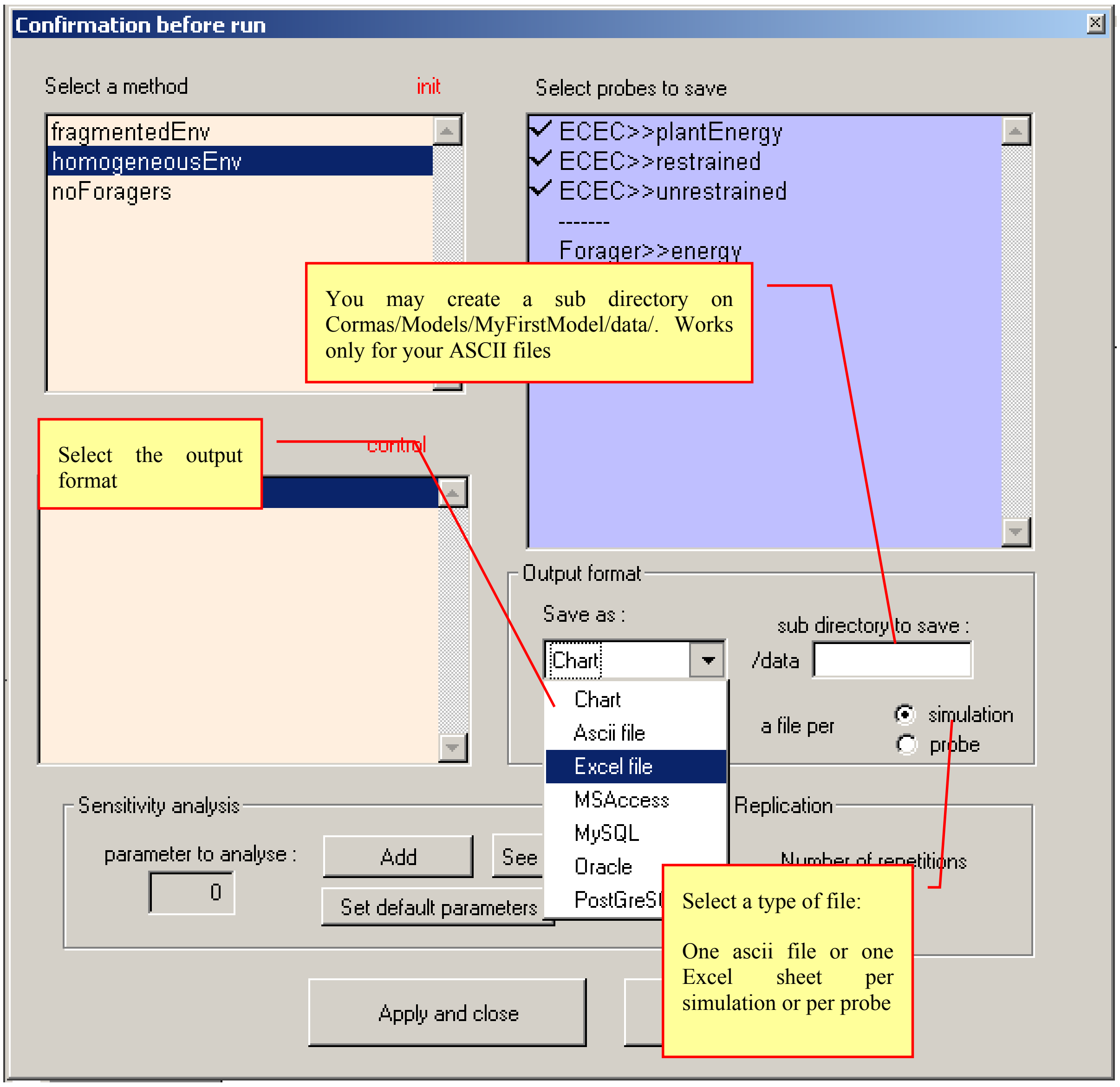
ASCII files,

Excel files or

into data bases.

You can then analyse your data with your favourite software…

Select the output format of the files :

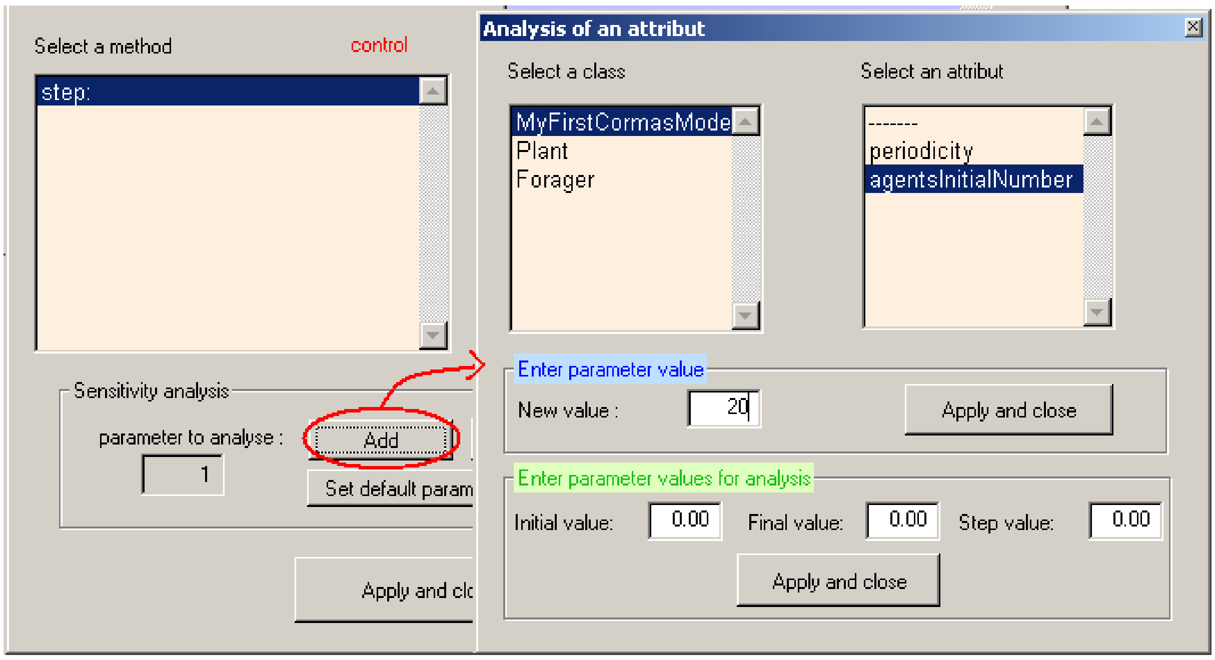


To get more information about the output format, see the Output format section below (page 27).

10.1. Choose the parameter's values

Click on the *Add* button on the *Sensitivity analysis* panel.

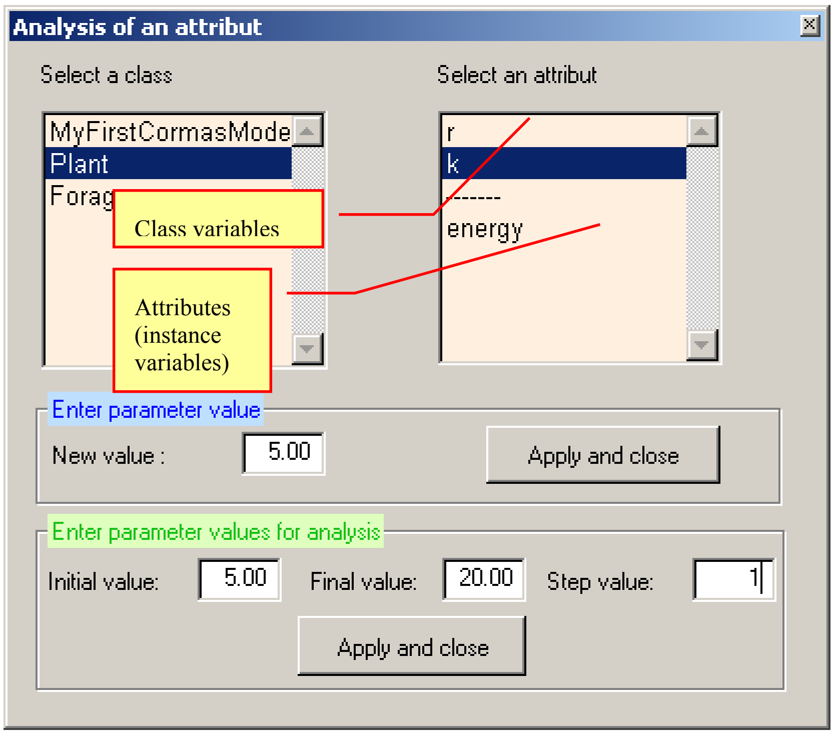
10.1.1. Choose one value



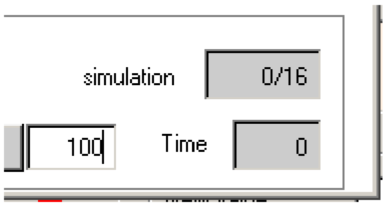
On the "Analysis of an attribute" window, select the class (ex. MyFirstCormasModel) of the parameter you want to choose and then, select the attribute (ex: agentsInitialNumber). You can now enter a new value (ex: 20), then *Apply and close*.

10.1.2. Choose a set of values

The figure below shows how to analyse the model according to different values of K, the class variable of Plant (from 5 to 20 by step 1) :

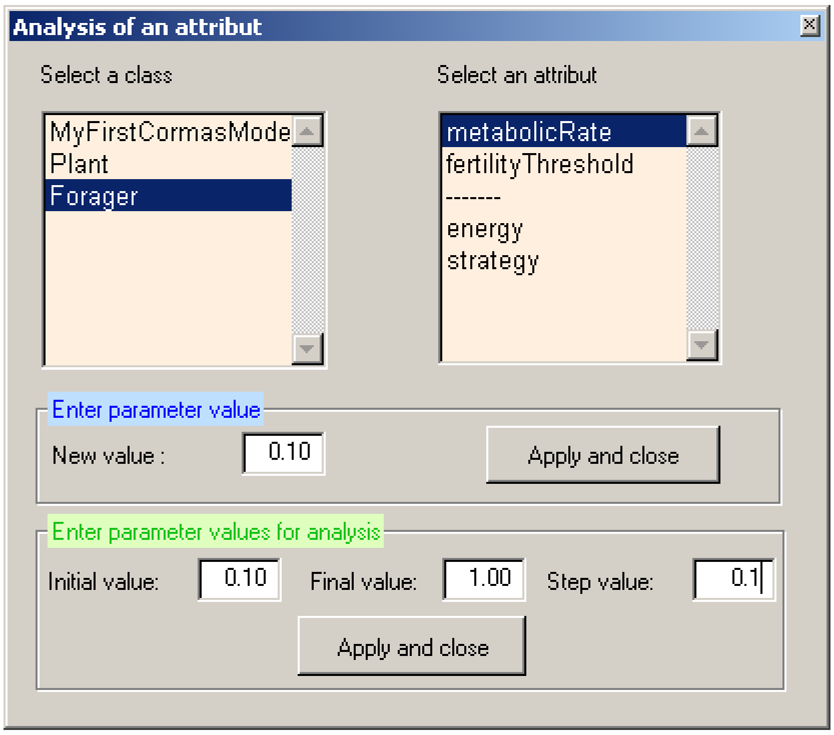


If you accept now, you can see that you can run 16 simulations (5 to 20 by step 1 = 16 simulations).


simulation 0/16

100 Time 0

If you want to add a new parameter to analyse to this 16 simulations, click again on *Initialize* button, then *Add* button then choose another set of values. Example: metabolicRate, from 0,1 to 1 by step of 0,1.


Analysis of an attribut

Select a class: MyFirstCormasMode, Plant, Forager (selected)

Select an attribut: metabolicRate (selected), fertilityThreshold, -------, energy, strategy

Enter parameter value

New value : 0.10

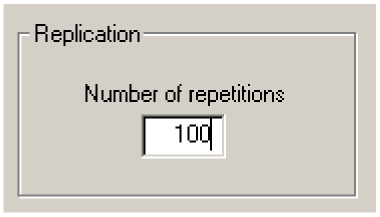
Enter parameter values for analysis

Initial value: 0.10 Final value: 1.00 Step value: 0.1

The number of simulations is now equal to 160 : 16 (for the first set of parameter) x 10 (for the second set of parameter).

The previous parameters have been kept in memory.

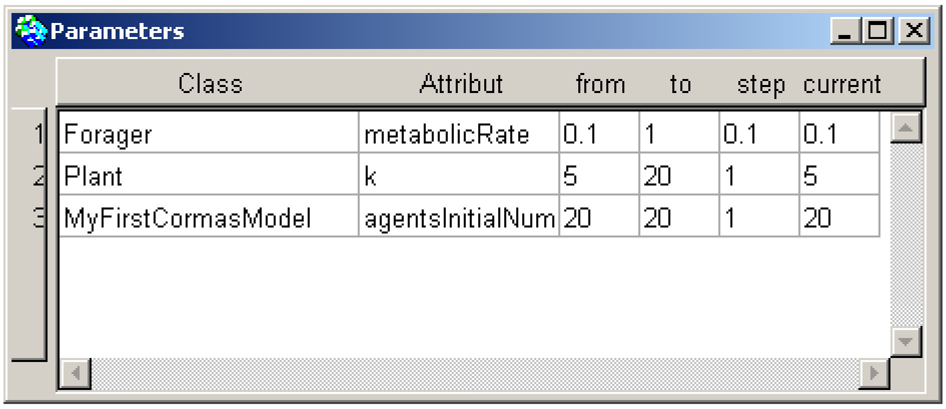
If your model contains randomness, you can choose to repeat the same simulation for each set of parameters. Click again on *Initialize* button, then choose a value for the *Number of repetitions* :


Replication

Number of repetitions: 100

Now, the number of simulations is 16000 !

To see the parameter values you entered, click on button.



	Class	Attribut	from	to	step	current
1	Forager	metabolicRate	0.1	1	0.1	0.1
2	Plant	k	5	20	1	5
3	MyFirstCormasModel	agentsInitialNum	20	20	1	20

To forget the parameter's sets, click on the Set default parameters button. This action reset the default values of the parameters.

10.2. Output format

By default, the probes are "saved" as charts. Be careful : this option shows only the last simulation data.

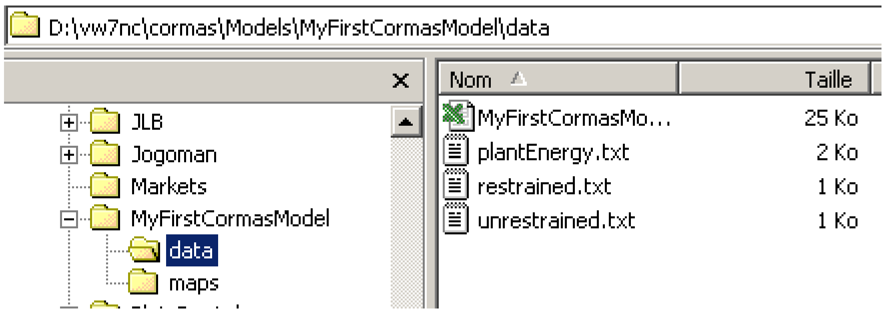
10.2.1. Ascii or Excel format

If you choose to save the probe's data as Ascii files or Excel sheets, Cormas will only save the global probes.

If you want to save also the instance's information, you should use data base format (see below).

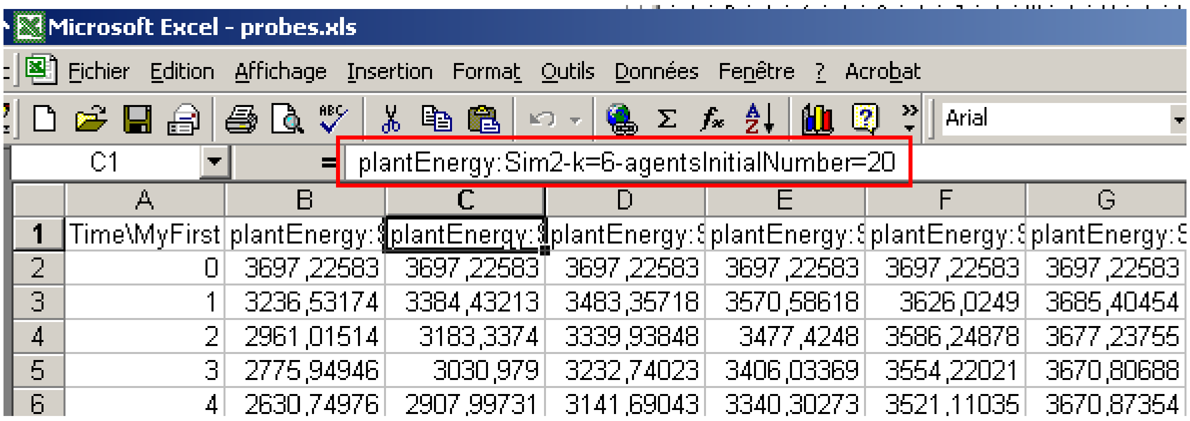
With these format, you can choose to save a file (or an Excel sheet) per simulation or per probe.

If you select a file per probe, you will obtain 3 files as following :



Nom	Taille
MyFirstCormasMo...	25 Ko
plantEnergy.txt	2 Ko
restrained.txt	1 Ko
unrestrained.txt	1 Ko

or 3 Excel sheets :

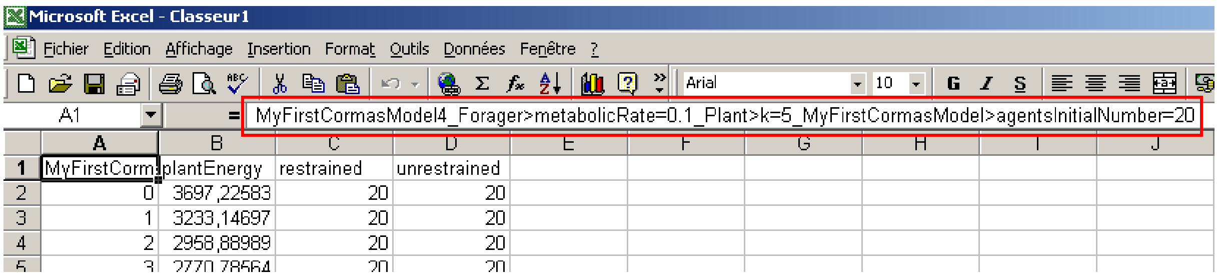

Microsoft Excel - probes.xls
Fichier Edition Affichage Insertion Format Outils Données Fenêtre ? Acrobat
Arial

C1 = plantEnergy:Sim2-k=6-agentsInitialNumber=20

	A	B	C	D	E	F	G
1	Time\MyFirst	plantEnergy:S	plantEnergy:S	plantEnergy:S	plantEnergy:S	plantEnergy:S	plantEnergy:S
2	0	3697,22583	3697,22583	3697,22583	3697,22583	3697,22583	3697,22583
3	1	3236,53174	3384,43213	3483,35718	3570,58618	3626,0249	3685,40454
4	2	2961,01514	3183,3374	3339,93848	3477,4248	3586,24878	3677,23755
5	3	2775,94946	3030,979	3232,74023	3406,03369	3554,22021	3670,80688
6	4	2630,74976	2907,99731	3141,69043	3340,30273	3521,11035	3670,87354

The first cell of each column contains the probe name, the simulation number, and the name of the parameters and their initial value for this simulation.

If you select a file per simulation, you will obtain an Ascii file per simulation (16000 files !) or an Excel sheet per simulation :


Microsoft Excel - Classeur1
Fichier Edition Affichage Insertion Format Outils Données Fenêtre ?
Arial
10

A1 = MyFirstCormasModel4_Forager>metabolicRate=0.1_Plant>k=5_MyFirstCormasModel>agentsInitialNumber=20

	A	B	C	D	E	F	G	H	I	J
1	MyFirstCorm	plantEnergy	restrained	unrestrained						
2	0	3697,22583	20	20						
3	1	3233,14697	20	20						
4	2	2958,88989	20	20						
5	3	2770,78564	20	20						

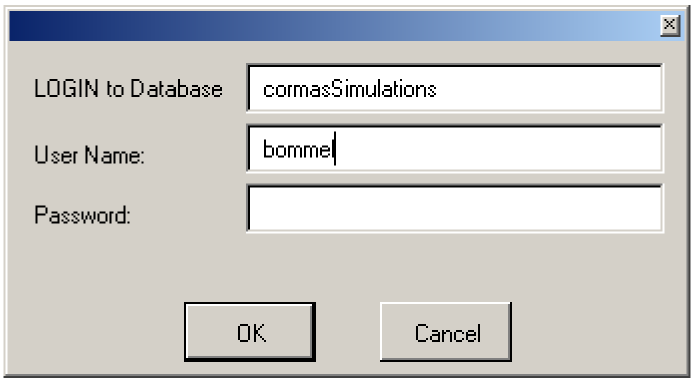
The first Excel cell contains information about the simulation :

The name of the model, the current repeat number and the parameter's current value.

10.2.2. Data base format

10.2.3. Launching the ODBC connection

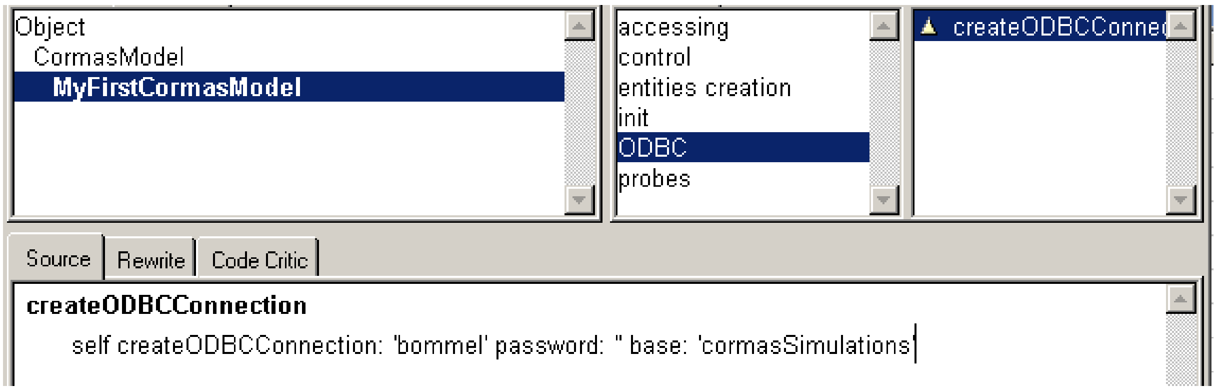
If you select a data base as output format, you are invited to complete a form :



LOGIN to Database	cormasSimulations
User Name:	bommel
Password:	

To set up the ODBC bridge under Windows, please see the end notes (Appendices p.33).

If you don't want to have this form for each analysis session, add a method in your model (you can create a new protocol "ODBC") :

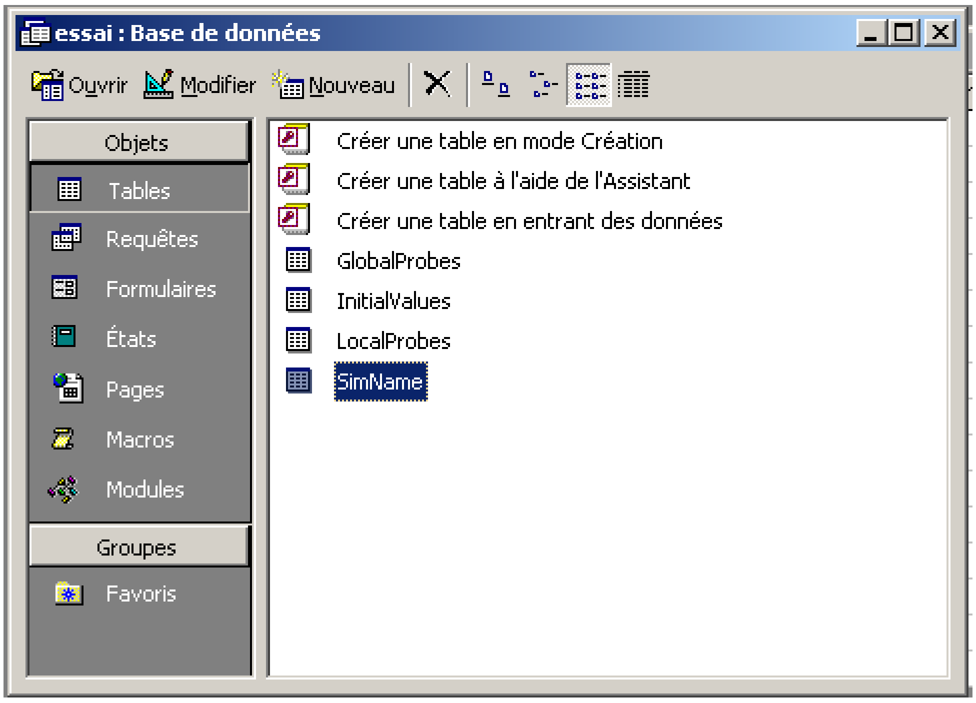


```
createODBCConnection
	self createODBCConnection: 'bommel' password: '' base: 'cormasSimulations'
```

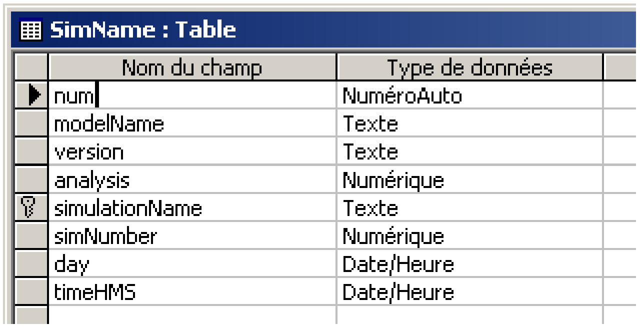
Of course, you should define it with the right data base (<String>) and your username (<String>) and your password (<String>).

10.2.4. Data base description

The 4 tables of the data base (Access) :



The main table is called "SimName"; it contains information about the simulations :

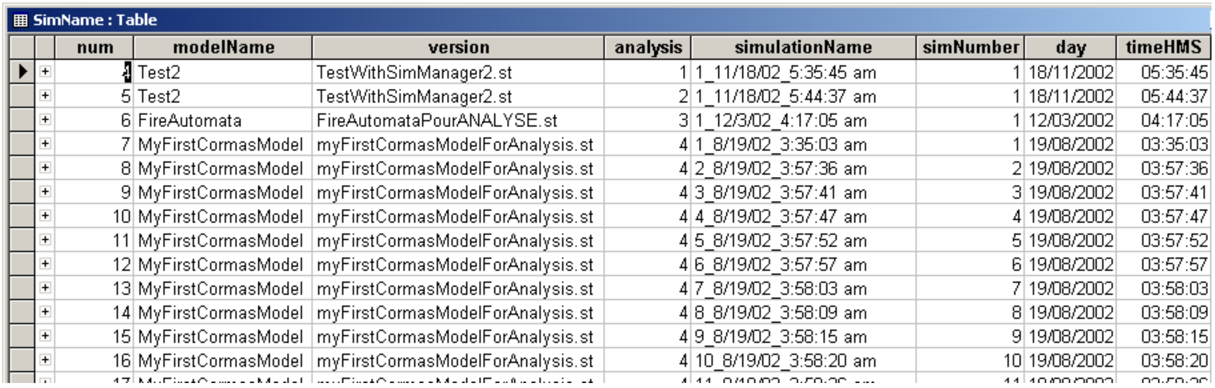

SimName : Table

Nom du champ	Type de données
num	NuméroAuto
modelName	Texte
version	Texte
analysis	Numérique
simulationName	Texte
simNumber	Numérique
day	Date/Heure
timeHMS	Date/Heure

- simulationName: a non ambiguous name with the simulation number, plus the date and the time (ex: 6_8/19/02_7:30:55 am),

- modelName: example 'MyFirstCormasModel'
- version: the version of the model, ie. the ST file (ex: myFirstCormasModelForAnalysis.st)
- analysis: the number of the current analysis session
- simNumber: the number of the current simulation of this analysis session
- day
- time

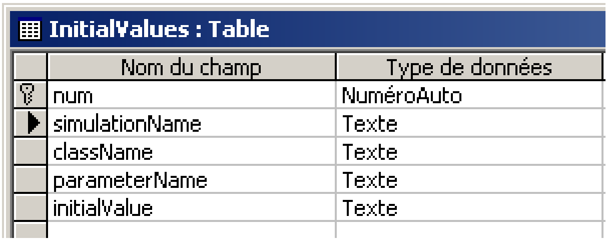
Example :



SimName : Table

num	modelName	version	analysis	simulationName	simNumber	day	timeHMS
4	Test2	TestWithSimManager2.st	1	1_11/18/02_5:35:45 am	1	18/11/2002	05:35:45
5	Test2	TestWithSimManager2.st	2	1_11/18/02_5:44:37 am	1	18/11/2002	05:44:37
6	FireAutomata	FireAutomataPourANALYSE.st	3	1_12/3/02_4:17:05 am	1	12/03/2002	04:17:05
7	MyFirstCormasModel	myFirstCormasModelForAnalysis.st	4	1_8/19/02_3:35:03 am	1	19/08/2002	03:35:03
8	MyFirstCormasModel	myFirstCormasModelForAnalysis.st	4	2_8/19/02_3:57:36 am	2	19/08/2002	03:57:36
9	MyFirstCormasModel	myFirstCormasModelForAnalysis.st	4	3_8/19/02_3:57:41 am	3	19/08/2002	03:57:41
10	MyFirstCormasModel	myFirstCormasModelForAnalysis.st	4	4_8/19/02_3:57:47 am	4	19/08/2002	03:57:47
11	MyFirstCormasModel	myFirstCormasModelForAnalysis.st	4	5_8/19/02_3:57:52 am	5	19/08/2002	03:57:52
12	MyFirstCormasModel	myFirstCormasModelForAnalysis.st	4	6_8/19/02_3:57:57 am	6	19/08/2002	03:57:57
13	MyFirstCormasModel	myFirstCormasModelForAnalysis.st	4	7_8/19/02_3:58:03 am	7	19/08/2002	03:58:03
14	MyFirstCormasModel	myFirstCormasModelForAnalysis.st	4	8_8/19/02_3:58:09 am	8	19/08/2002	03:58:09
15	MyFirstCormasModel	myFirstCormasModelForAnalysis.st	4	9_8/19/02_3:58:15 am	9	19/08/2002	03:58:15
16	MyFirstCormasModel	myFirstCormasModelForAnalysis.st	4	10_8/19/02_3:58:20 am	10	19/08/2002	03:58:20

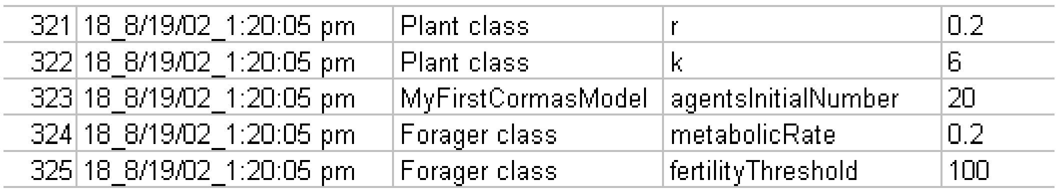
The "InitialValues" table contains 5 fields :



InitialValues : Table

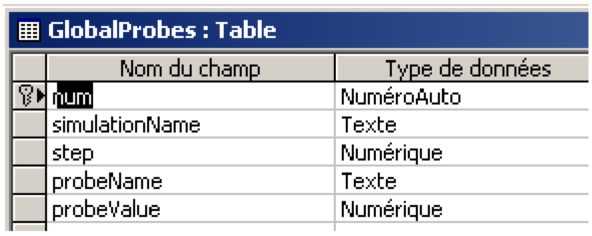
Nom du champ	Type de données
num	NuméroAuto
simulationName	Texte
className	Texte
parameterName	Texte
initialValue	Texte

- num: a unique value of the table
- simulationName: the foreign key associated to the primary key of SimName table
- className: example 'MyFirstCormasModel' or ' Plant class' for the class variable value
- parameterName: the name of the attribute
- initialValue: the value of the parameter for the current

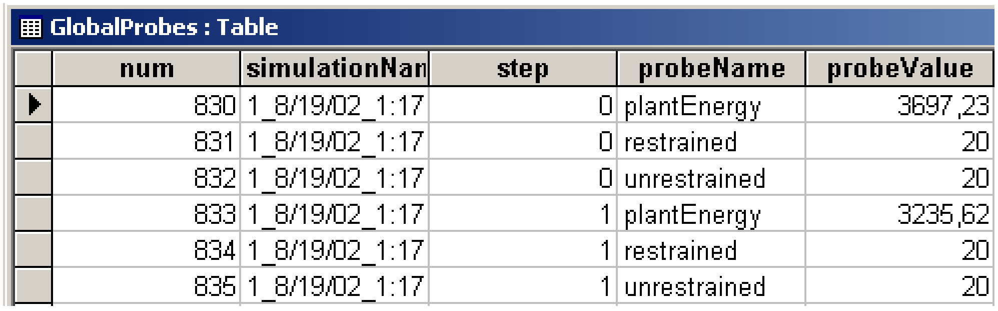


321	18_8/19/02_1:20:05 pm	Plant class	r	0.2
322	18_8/19/02_1:20:05 pm	Plant class	k	6
323	18_8/19/02_1:20:05 pm	MyFirstCormasModel	agentsInitialNumber	20
324	18_8/19/02_1:20:05 pm	Forager class	metabolicRate	0.2
325	18_8/19/02_1:20:05 pm	Forager class	fertilityThreshold	100

The "GlobalProbes" table contains 5 fields :

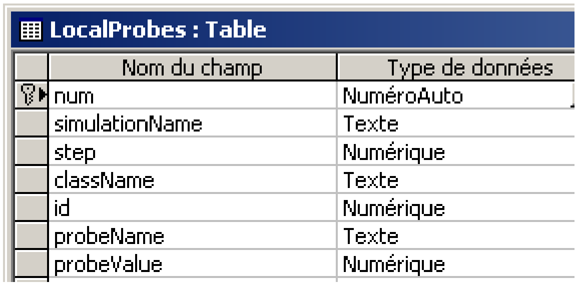


Nom du champ	Type de données
num	NuméroAuto
simulationName	Texte
step	Numérique
probeName	Texte
probeValue	Numérique

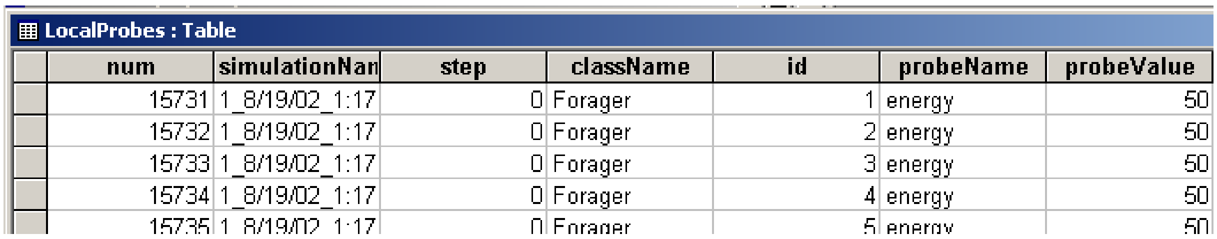


num	simulationNan	step	probeName	probeValue
830	1_8/19/02_1:17	0	plantEnergy	3697,23
831	1_8/19/02_1:17	0	restrained	20
832	1_8/19/02_1:17	0	unrestrained	20
833	1_8/19/02_1:17	1	plantEnergy	3235,62
834	1_8/19/02_1:17	1	restrained	20
835	1_8/19/02_1:17	1	unrestrained	20

The "LocalProbes" table contains 7 fields :

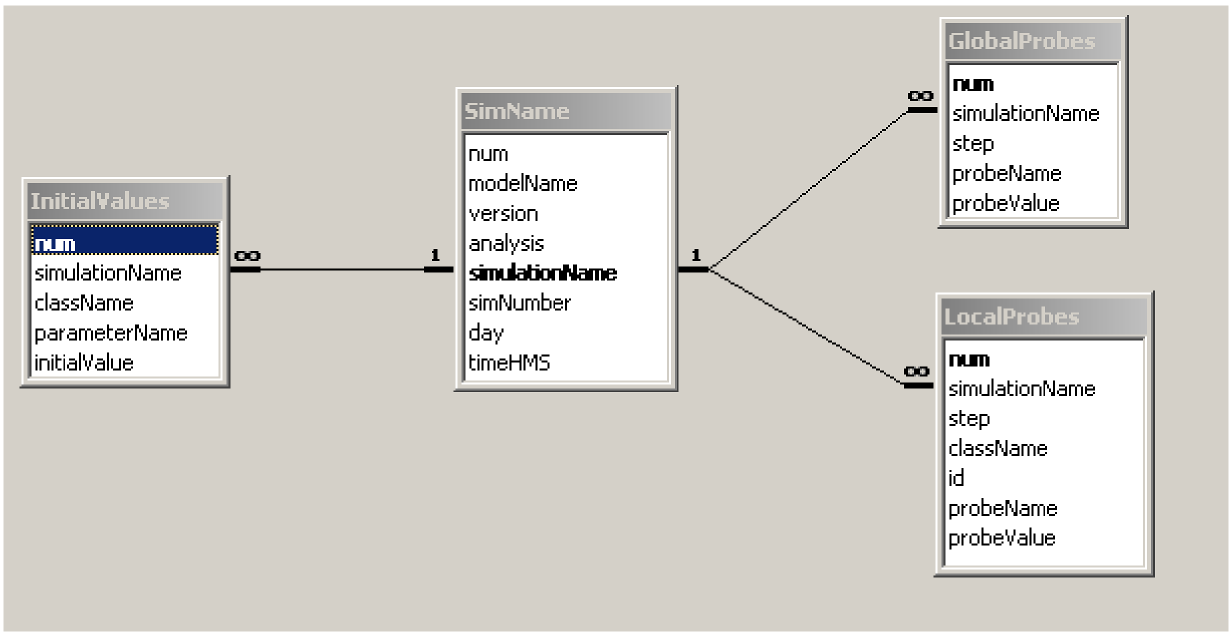


Nom du champ	Type de données
num	NuméroAuto
simulationName	Texte
step	Numérique
className	Texte
id	Numérique
probeName	Texte
probeValue	Numérique



num	simulationNan	step	className	id	probeName	probeValue
15731	1_8/19/02_1:17	0	Forager	1	energy	50
15732	1_8/19/02_1:17	0	Forager	2	energy	50
15733	1_8/19/02_1:17	0	Forager	3	energy	50
15734	1_8/19/02_1:17	0	Forager	4	energy	50
15735	1_8/19/02_1:17	0	Forager	5	energy	50

The graph below shows the relations (foreign keys and primary keys) between the 4 tables and their field names.


InitialValues
num
simulationName
className
parameterName
initialValue
∞
1
SimName
num
modelName
version
analysis
simulationName
simNumber
day
timeHMS
1
∞
GlobalProbes
num
simulationName
step
probeName
probeValue
∞
LocalProbes
num
simulationName
step
className
id
probeName
probeValue

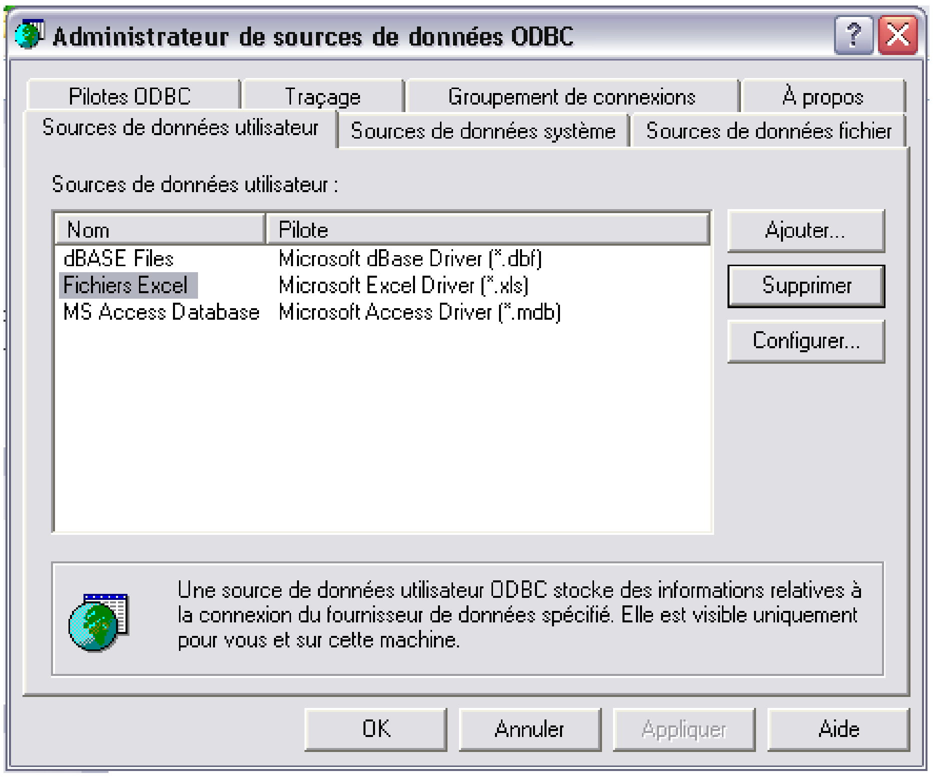
11. Appendices

11.1. How to connect VisualWorks to Access

11.1.1. Set up the ODBC driver ODBC

First of all, create an ACCESS file in the directory VW7\cormas\DataBase. Call it ***cormasSimulations.mdb***.

Launch now the « Data Sources (ODBC) » tool, located in the configuration pannel → Administration tools (or directly launch file "\system32\odbcad32.exe").


Administrateur de sources de données ODBC
Pilotes ODBC
Traçage
Groupement de connexions
À propos
Sources de données utilisateur
Sources de données système
Sources de données fichier
Ajouter...
Supprimer
Configurer...
OK
Annuler
Appliquer
Aide

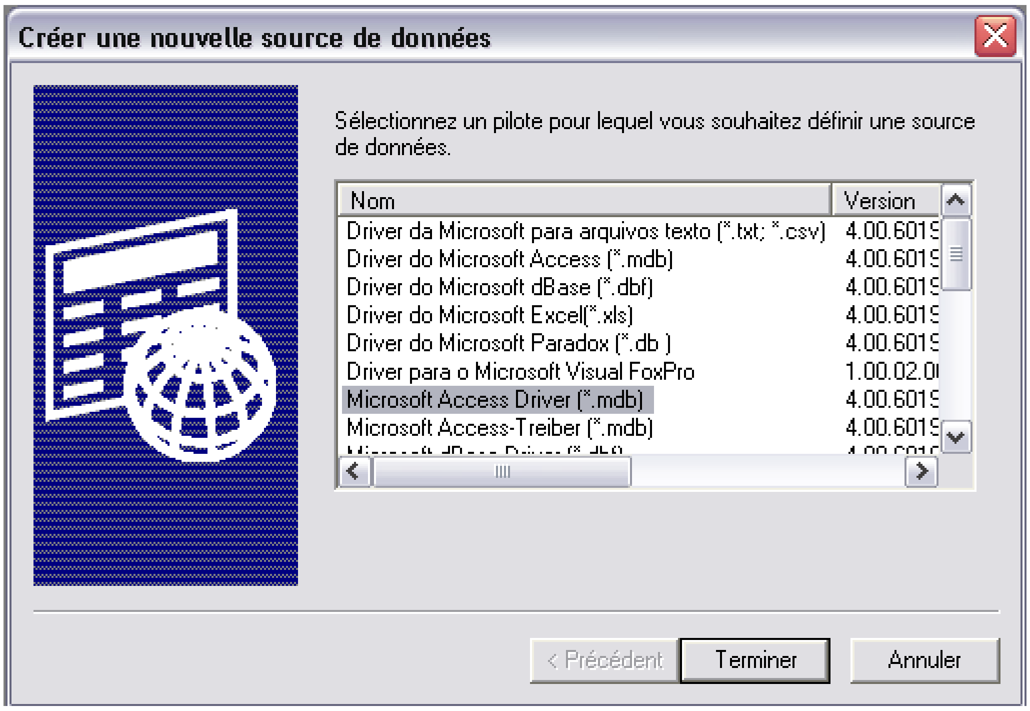
Sources de données utilisateur :

Nom	Pilote
dBASE Files	Microsoft dBase Driver (*.dbf)
Fichiers Excel	Microsoft Excel Driver (*.xls)
MS Access Database	Microsoft Access Driver (*.mdb)

Une source de données utilisateur ODBC stocke des informations relatives à la connexion du fournisseur de données spécifié. Elle est visible uniquement pour vous et sur cette machine.

Create now a link for your database with a logical name : Click on « Add » button.

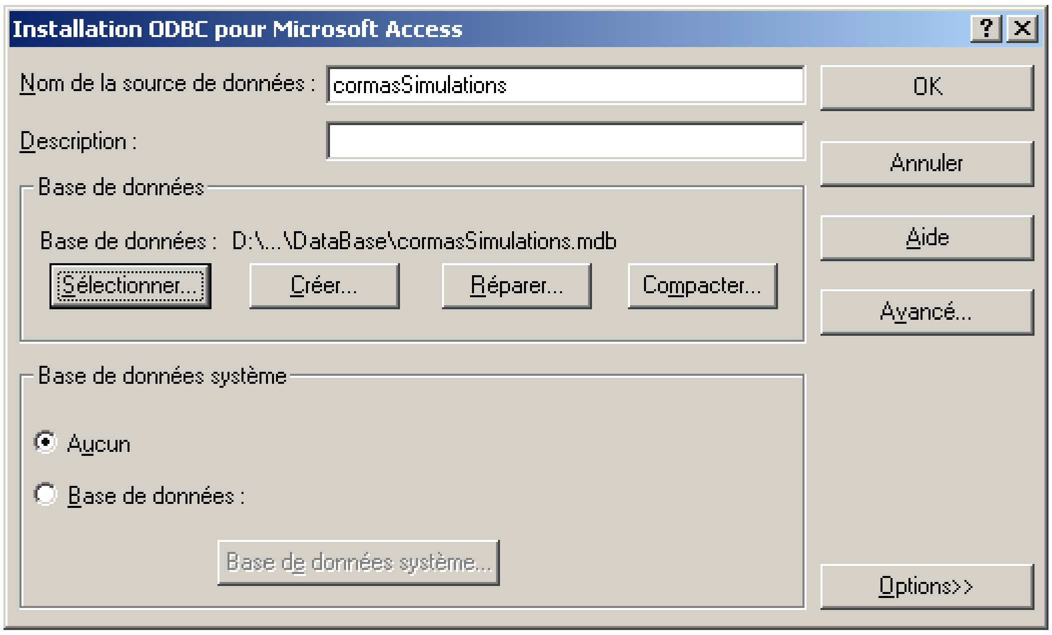
Select the « Microsoft Access Driver (*.mdb) driver, as shown below :


Créer une nouvelle source de données
Sélectionnez un pilote pour lequel vous souhaitez définir une source de données.
< Précédent
Terminer
Annuler

Nom	Version
Driver da Microsoft para arquivos texto (*.txt; *.csv)	4.00.6019
Driver do Microsoft Access (*.mdb)	4.00.6019
Driver do Microsoft dBase (*.dbf)	4.00.6019
Driver do Microsoft Excel(*.xls)	4.00.6019
Driver do Microsoft Paradox (*.db)	4.00.6019
Driver para o Microsoft Visual FoxPro	1.00.02.0
Microsoft Access Driver (*.mdb)	4.00.6019
Microsoft Access-Treiber (*.mdb)	4.00.6019

Click on « Finish » .

A new window pops up :



Nom de la source de données : cormasSimulations

Description :

Base de données

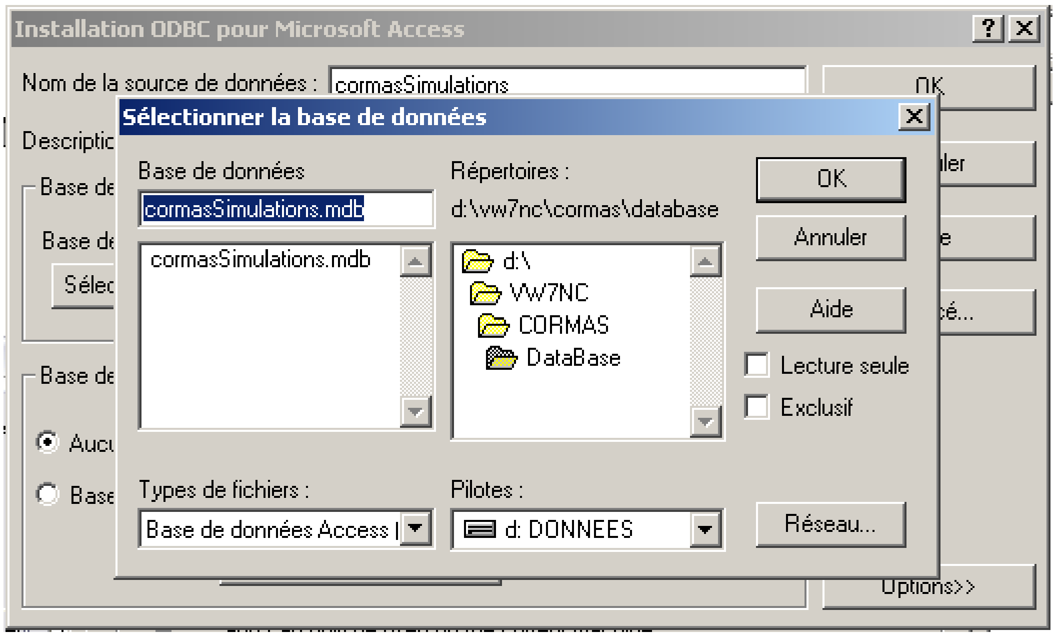
Base de données : D:\...\DataBase\cormasSimulations.mdb

Base de données système

[✓ Aucun] Base de données :

In the field « Data source name », write the logical name of the link. This name will be used in VisualWorks to identify the database.

Click on « Select… » button.



Installation ODBC pour Microsoft Access

Nom de la source de données : cormasSimulations

Sélectionner la base de données

Base de données

cormasSimulations.mdb

cormasSimulations.mdb

Répertoires :

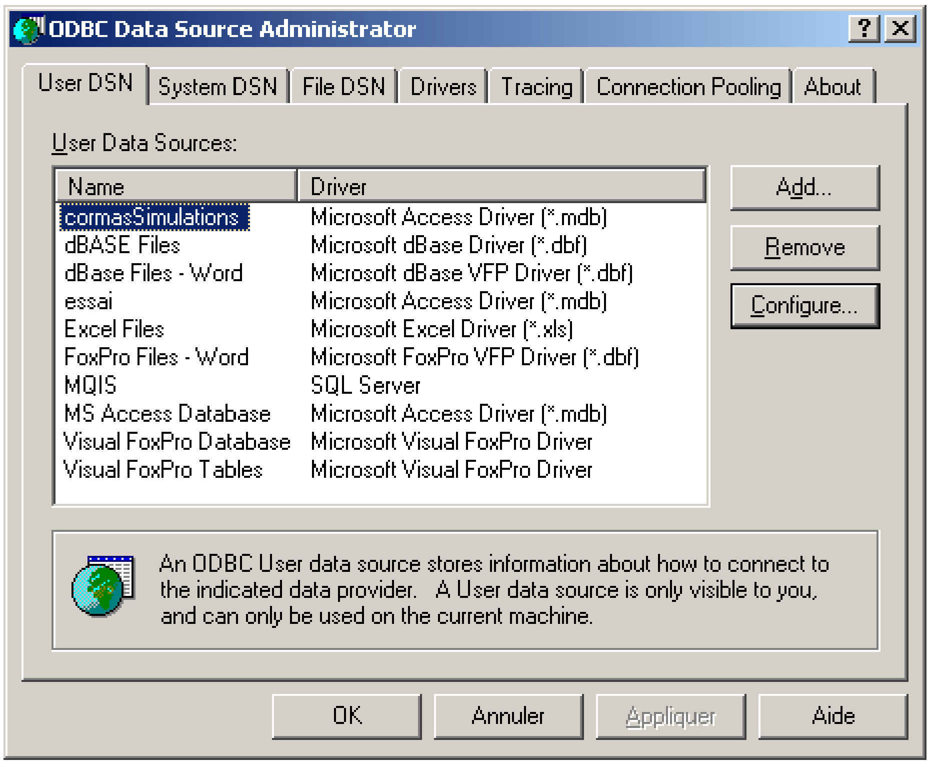
d:\vw7nc\cormas\database

d:\
VW7NC
CORMAS
DataBase

Types de fichiers : Base de données Access |

Pilotes : d: DONNEES

Select the Access file called « cormasSimulations.mdb ».



ODBC Data Source Administrator

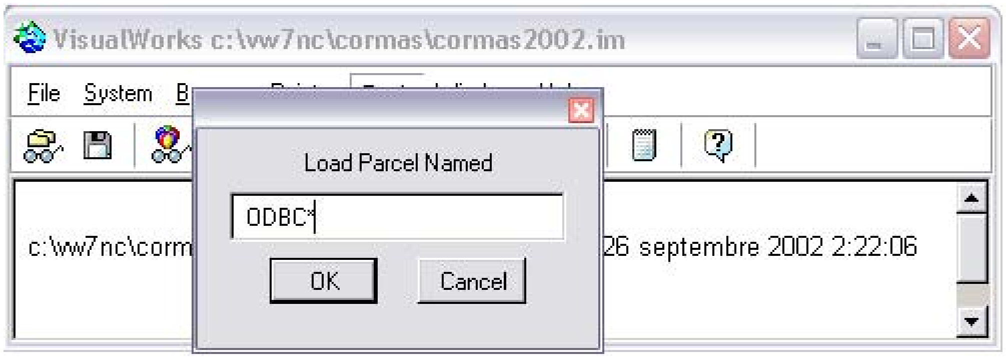
User Data Sources:

Name	Driver
cormasSimulations	Microsoft Access Driver (*.mdb)
dBASE Files	Microsoft dBase Driver (*.dbf)
dBase Files - Word	Microsoft dBase VFP Driver (*.dbf)
essai	Microsoft Access Driver (*.mdb)
Excel Files	Microsoft Excel Driver (*.xls)
FoxPro Files - Word	Microsoft FoxPro VFP Driver (*.dbf)
MQIS	SQL Server
MS Access Database	Microsoft Access Driver (*.mdb)
Visual FoxPro Database	Microsoft Visual FoxPro Driver
Visual FoxPro Tables	Microsoft Visual FoxPro Driver

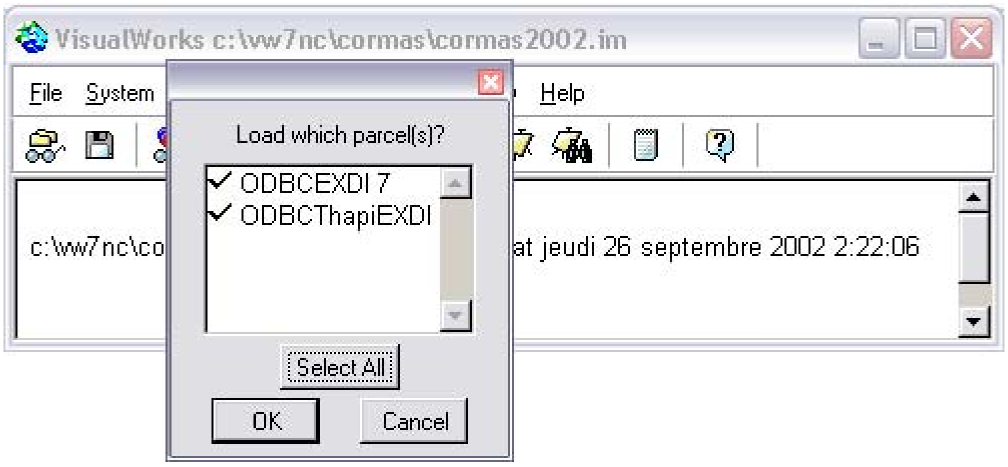
An ODBC User data source stores information about how to connect to the indicated data provider. A User data source is only visible to you, and can only be used on the current machine.

Click on « OK ». That's it !

To use this connection, you must verify that the right parcels are loaded in VisualWorks. Tools → Load Parcel Named… and write « ODBC* ».

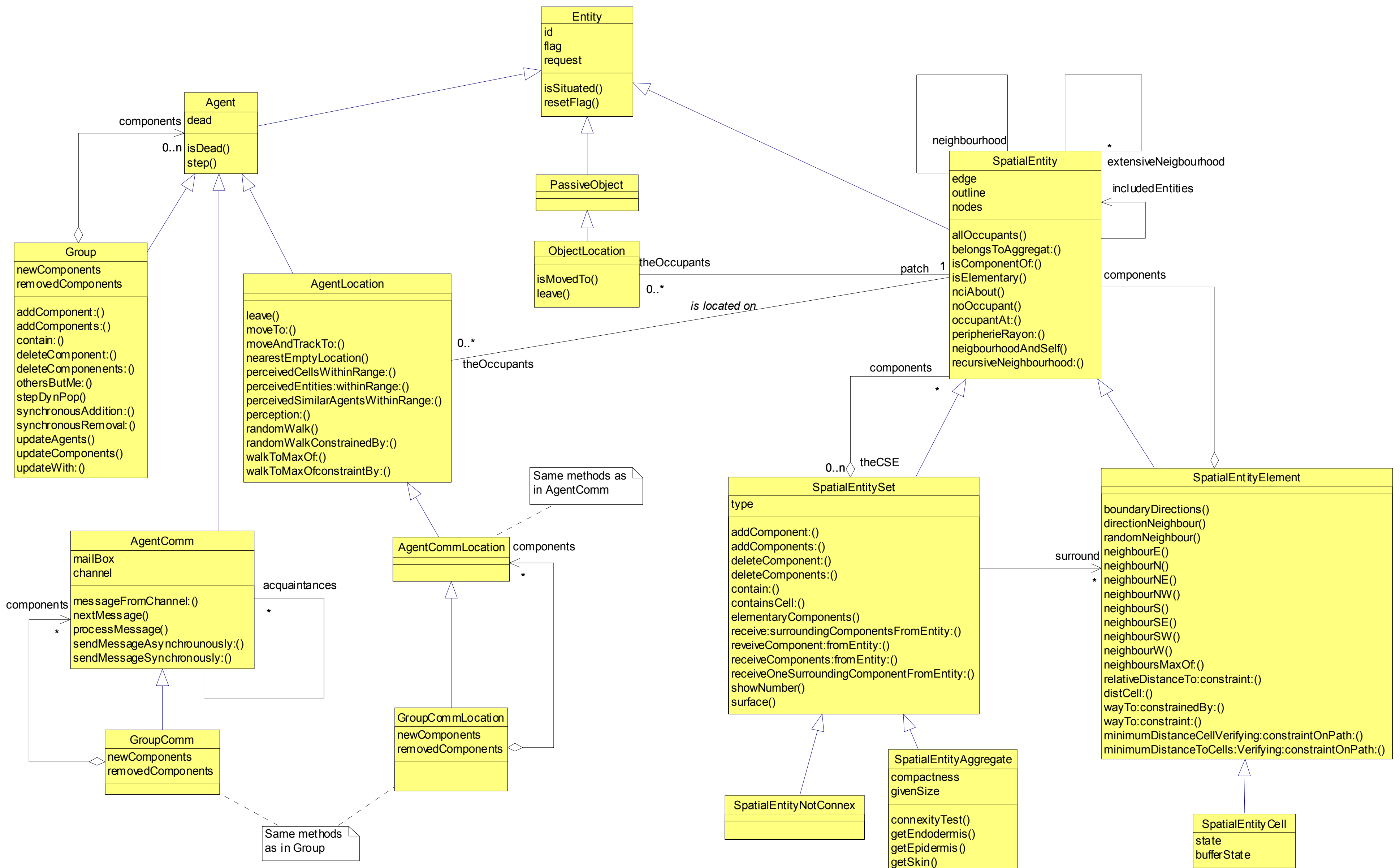

VisualWorks c:\vw7nc\cormas\cormas2002.im
File
System
Load Parcel Named
ODBC*
OK
Cancel
c:\vw7nc\corm
26 septembre 2002 2:22:06

If « ODBCEXDI 7 » and « ODBCThapiEXDI » parcels are not loaded, select them and click OK :



Don't forget to save VisualWorks.

11.2. UML : Class diagram of Cormas - Entities category



Class diagram of Cormas - Entities category