

## CHAPTER FOURTEEN – TUTORIAL IN CREATING A SIMPLE KNOWLEDGE BASE

This tutorial guides you through the creation of a small knowledge base and then invites you to try out different ways of exploring it. The knowledge represented is abstracted from Bandy, D.E., Garrity, D.P. and Sanchez, P.A. (1993) The worldwide problem of slash-and-burn agriculture. *Agroforestry Today* Vol. 5 (3), 2-6. The tutorial is only an introduction to AKT; please use chapters 7 – 12 to guide you when you require further information on AKT facilities.

### 14.1 OPENING AKT

Open the AKT application. An introductory title page will appear. Press **OK**. A new screen will appear with a series of menus in the top left-hand section. Select **KB**. In the ensuing drop-down menu, select **New KB**, give your new knowledge base an appropriate name (e.g. *slash\_and\_burn*) and save it.

Now that you have an empty knowledge base prepared to receive information, we will address the text on which your knowledge base is to be based.

### 14.2 KNOWLEDGE FROM THE SOURCE

For the purposes of this tutorial, we will make use of the following text as our source knowledge. It may be more usual however, for source knowledge to be a tape-recorded interview. The following are extracts from the source text:

*“...burning helps to control pests and diseases....the higher soil temperatures that follow clearing and burning also accelerate the decomposition of organic matter in the top layers of the soil.*

*About half of the nitrogen and phosphorus in the burnt material and nearly all the remaining nutrients are released to the soil from the ash after burning. These nutrients are flushed from the ash by the rain and have the effect of raising the pH of the upper layers of soil as well as incorporating the nutrients. Nutrients in concentrated form are thus available for one or two years after clearing. The quantity and quality of these nutrients depends on the native fertility of the soil...*

*Crops such as corn, rice, beans, cassava, yams and plantains are then planted....*

*As nutrients are removed by crop harvests or lost through leaching, soil fertility declines. At the same time, the relatively easily removed broad-leaved weeds are replaced by harder to manage grasses and increasing weed density quickly impedes further cropping. The fields are then abandoned for a period of fallow.*

*The secondary forest grows rapidly during the fallow, using nutrients remaining in the soil...Essential minerals (phosphorus, potassium, calcium, etc.) are extracted from lower soil layers during regrowth and brought to the surface by trees....*

*Soil erosion... is seldom a problem in shifting cultivation because the cleared areas are small and are always covered by some sort of vegetation. When unsustainable slash-and-burn is practised by newcomers, however, the soil is sometimes left uncovered. This can lead to major erosion problems, particularly in hilly areas....*

*When the soil is bare and erosion a problem, the siltation rate of the waterways is increased and this often has a negative effect upon aquatic life forms and fish production.*

*Neither are weeds a difficulty in the traditional method because the land is left to fallow as soon as they become a problem. In the subsequent fallow period, weeds soon die out as the crown of the secondary forest closes. Migrant farmers, however, will remove all vegetation and the roots and stumps of the felled trees from the areas they clear for intensive farming.*

*These practices mean that when the land is finally abandoned there are no rootstocks left from which the trees may grow and grasses are the most common invaders of the open areas. This means that clearing of land by migrant farmers generally results in the permanent destruction of the rain forest.”*

The intention behind creating a knowledge base in AKT is to represent knowledge that provides a description of the ecology of a particular agroforestry practice. This is achieved by abstracting a set of unitary statements from the source knowledge that, as a set, represent a coherent description of the ecology of the practice. This process of breaking down the source knowledge into a set of unitary statements may demand considerable interpretation. Relying too literally on the exact statements in the source knowledge will tend to result in many statements in the knowledge base that become very difficult to interpret.

Consider, for example:

*“In the subsequent fallow period, weeds soon die out as the crown of the secondary forest closes.”*

A literal abstraction of information might result in the statements that:

*“Weeds soon die out in the fallow period”  
“Weeds die out when the crown of the secondary forest closes”*

Both statements are fairly literal abstractions and superficially reasonable and useful. However, as statements in a knowledge base they are problematic as both contain implicit information. The term ‘soon’ is relative to the rate of weed mortality on land, which is not fallowed. This is clear enough in the source knowledge but not as an explicit statement of ecological knowledge. Furthermore, in the second statement there is an implicit causality – however the statement only really identifies the coincidence of weed die back and canopy closure.

Interpretation might suggest that we should state instead that:

*Forest canopy closure causes weeds to die back*

and

*Forest canopy closure occurs during the fallow period*

Clearly this interpretation may require validation through further reference to the source knowledge. However, the knowledge expressed here is more fundamental and more useful than the above statements.

As a result of the interpretation involved, different sets of statements will be abstracted from the same source knowledge by different people with different objectives. It is important to realise that any abstraction of knowledge for representation in the knowledge base is open to debate. There can be no single correct abstraction, although there can certainly be incorrect

ones. The statements in Table 14.1 are an example of one set of statements abstracted from the text. These do not immediately and literally relate to the source knowledge but are designed to capture its ecological content. Some statements are speculative and demand validation while others can be expressed with more confidence.

**Table 14.1 Example set of statements abstracted from the text**

Burning causes a decrease in numbers of pests
Burning causes a decrease in crop disease levels
Clearing causes an increase in soil temperature
An increase in soil temperature causes an increase in the rate of decomposition of organic matter
Nutrient availability is high for two years after burning
Harvesting causes a reduction in soil nutrient levels
Leaching causes a reduction in soil nutrient levels
A reduction in soil nutrient levels causes a reduction in soil fertility
An increase in weed density causes a decrease in crop yield
Soil erosion is not a problem IF the soil is always covered with some type of vegetation
Soil erosion is severe IF soil is not covered with vegetation
Soil erosion is very severe on hills
An increase in soil erosion causes an increase in the siltation of waterways
An increase in the siltation of waterways reduces fish production
Weeds are not a problem IF land is regularly fallowed
Canopy closure causes the death of weeds

## 14.3 ENTERING KNOWLEDGE INTO THE KNOWLEDGE BASE

These statements can be entered into the knowledge base in two ways, through the **Show Kb Diagrams** interface in the main **Diagram** menu or through the **Statements** dialog box in the main **KB** menu.

### 14.3.1 ENTERING KNOWLEDGE THROUGH THE DIAGRAM INTERFACE

It is possible to enter all the statements in Table 14.1 into the knowledge base using the statement card. Alternatively, all the causal and link statements can be entered through the diagramming interface. We will start with the diagramming interface as this helps to ensure unambiguous connections between the individual statements (which is very important if a useful knowledge base is to result) and can be helpful to the beginner because statements entered through the diagramming interface are formalised automatically.

As an example of the use of the diagram interface we will enter the statements abstracted from the first paragraph of the text:

*“....burning helps to control pests and diseases ... the higher soil temperatures that follow clearing and burning also accelerate the decomposition of organic matter in the top layers of the soil.”*

Under the **Diagram** menu select **Show Kb Diagrams**. This will give you a blank diagram window with all the function buttons displayed on either side.

Entering a statement through the diagram interface demands some thought about the structure of that statement. For full details of the diagramming syntax see Chapter 4, section 4.4. The section on formal representation (Chapter 4, section 4.2) will also clarify the structures of statements supported.

The following five statements might be abstracted from this paragraph:

**Table 14.2 Statements abstracted from the first paragraph:**

- 1) Burning causes a decrease in pest numbers
- 2) Burning causes a decrease in disease levels
- 3) Clearing causes an increase in soil temperature
- 4) Burning causes an increase in soil temperature
- 5) An increase in soil temperature causes an increase in the rate of decomposition of organic matter

Each of these statements can be represented in the diagramming interface as a pair of nodes and a link between them. In the case of the first statement the two nodes are 'burning' –an action<sup>1</sup> – and 'number of pests' – an attribute (number) of an object (pests). To represent this statement;

1. Select the **Action** button from the 'Add node' box on the left-hand side of the diagram screen.
2. Move your cursor onto the drawing area and click to create an action node. A dialog box will appear, asking for details of the action.
3. Enter the action name 'burning' and then look at the object boxes. (There are two options, 'One Object' or 'Two Objects'. In this case it is an action without a specified object but as all actions are accompanied by objects it is necessary to refer to the object being burnt. In this case 'site' or 'field' could be used).
4. Tick the 'One Object' box and enter 'site'.
5. Press **OK**. On the diagram screen a node appears bearing the legend 'site burning'.
6. Select the **Attribute** button from the 'Add node' box to create the second node. An 'attribute\_relation\_dialog' box appears. The attribute can relate to three things, objects, processes or actions. In this case it is related to an object (pests).
7. Tick the 'Object' box.
8. Press **OK**. An 'attribute\_object\_dialog' box then appears.
9. Specify 'number' as the attribute and 'pests' as the object.
10. Press **OK**.
11. Now select the **Link** button from the 'Add link' box.
12. Move the cursor to the 'site burning' node, left click and hold the mouse button down, drag the cursor to the 'pests number' node and release the mouse button.
13. A 'Choose Link' dialog box now appears. In this case for 'Link type' choose 'causes1way' and for 'Effect Value' in the 'Parameters' box choose 'decrease'.
14. Press **OK**. The 'Information Source' dialog box now appears.....

#### 14.3.1.a Entering the Information Source

No statement can be accepted by AKT without a source attached, so here goes...

1. In the 'New' box, select the **Reference** radio button and then press **New**. The dialog box 'Create a new reference source' appears.
2. Fill in the details of the authors, the name of the journal title and the name of the article as given at the beginning of this chapter<sup>2</sup>.
3. When you have completed filling in the details of the dialog box, press **Save**.
4. The statements sources dialog box reappears with the source highlighted. Press **OK**.

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<sup>1</sup> 'Burning' can be either a process or an action. If it is used as a management tool, it is an action, otherwise it is a process. In any knowledge base it can only be used as one or the other, it cannot be entered as both action and process. If some statements also refer to burning brought about by natural causes then another term must be found, either 'fire' as an object, or 'conflagration' as a process.

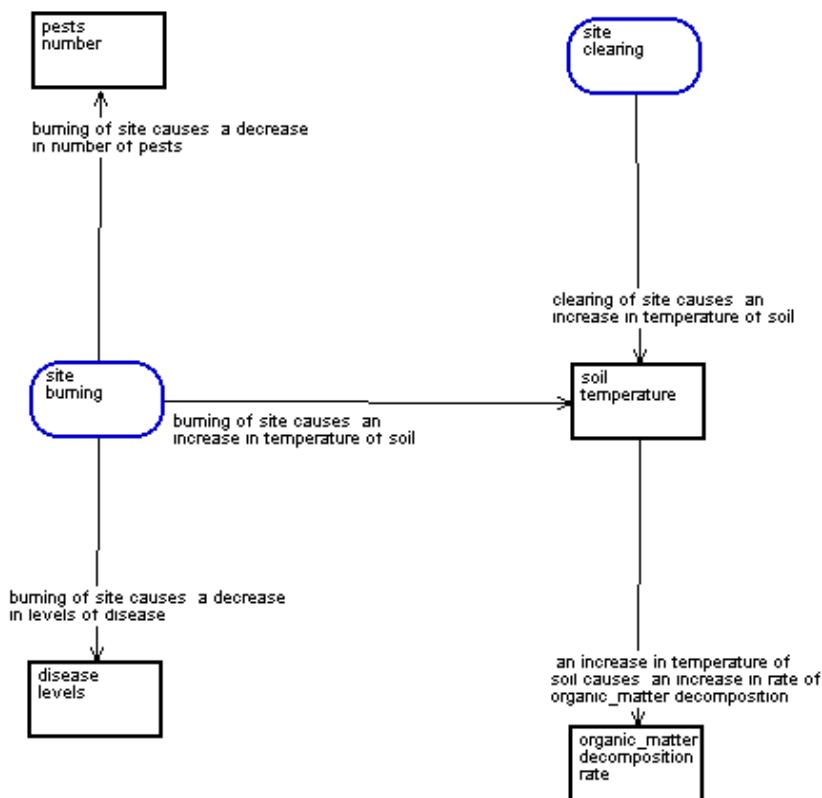
<sup>2</sup> In the case of an article, the name of the journal should go in the 'Name' box.

5. The screen now automatically brings up the ‘New Statement’ dialog box, giving both the formal language representation and the natural language representation of the nodes and link created in the diagram interface. Press **Save**.
6. The following message will then appear: “Are you sure you want to save this statement without a condition?” In this case the answer is ‘yes’ so press **Yes**.
7. Dialog boxes will then appear, asking if you wish to create new formal terms for the various terms just entered. Press **Yes** on each occasion.

The screen then reverts to the diagram interface and displays the two nodes connected by a link.

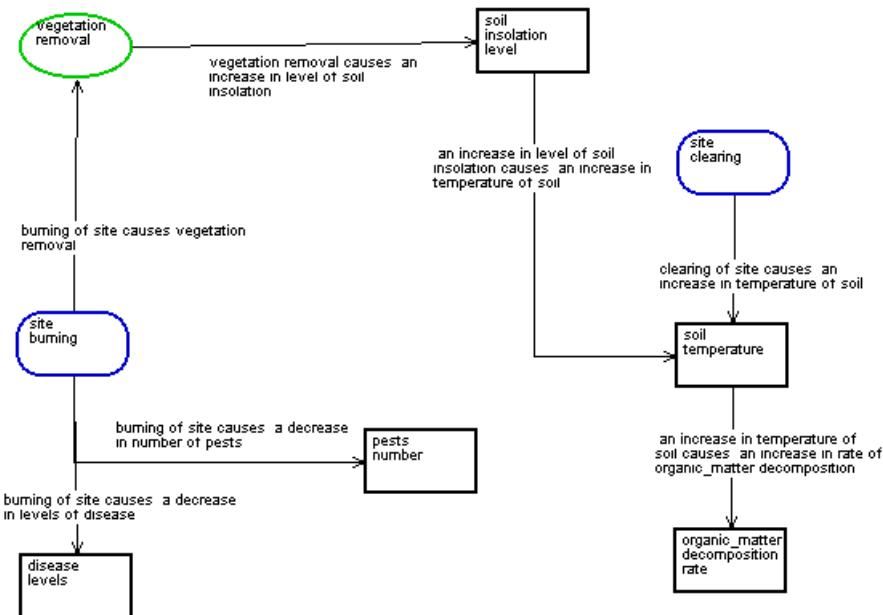
Try entering the other four statements via the **Diagram** interface. Note that ‘clearing’, like ‘burning’, is an action and therefore needs an object. In this case as well, ‘site’ would be a valid object.

After entering the first 5 statements, and pressing **Label Mode** on the right hand side of the screen twice to get the full statements, you should end up with a diagram something like Figure 14.1.



**Figure 14.1** Diagram constructed from the statements in Table 12.2

This example illustrates one of the most important features of the diagramming approach: the way that it helps you to identify ambiguity in the knowledge being represented. While the five statements individually appear reasonably intuitive, their combination into a diagram suggests that important information is missing. Burning will certainly raise soil temperatures but it is likely that the warming of the soil referred to in the text is not actually a direct consequence of burning but of the removal of vegetation as a result of burning and the consequent increase in insolation. Modification of the above diagram may better capture this interpreted meaning (see Figure 14.2 below).



**Figure 14.2** Figure 14.1 modified to better capture the interpreted meaning

### 14.3.2 ENTERING KNOWLEDGE THROUGH THE STATEMENT CARD

Although statements entered through the diagram interface are formalised automatically, any statements entered through the statement card must be formalised manually. The process of formal representation requires some practice. Read through Chapter 4 (part 4.2), which takes you through formal representation step by step, then try to formalise the extracted statements given in Table 14.1. Table 14.3 gives a formal version for each of the statements in Table 14.1. There are no definitive, correct answers in formal representation, although there are certainly incorrect ones.

  
**NOTE:** Remember to use the underscore (\_), not a hyphen (-) when writing formalised statements, e.g. att\_value

**Table 14.3 Formal versions for each of the extracted statements in Table 14.1**

	Extracted Statements	Formalised Statements
1	Burning causes a decrease in numbers of pests	action(burning,site) causes1way att_value(pests,numbers,decrease)
2	Burning causes a decrease in crop disease level	action(burning,site) causes1way att_value(crops_disease, level, decrease)
3	Clearing causes an increase in soil temperature	action(clearing, site) causes1way att_value(soil,temperature,increase)
4	An increase in soil temperature causes an increase in the rate of decomposition of organic matter	att_value(soil,temperature,increase) causes2way att_value(process(organic_matter, decomposition),rate, increase)
5	Nutrient availability is high for two years after burning	att_value(site, nutrient_availability, high) IF att_value(site, time_since_burning,range('0 years', '2 years'))

6	Harvesting causes a reduction in soil nutrient levels	action(harvesting, crops) causes1way att_value(part(soil, nutrients),level,decrease)
7	Leaching causes a reduction in soil nutrient levels	process(leaching) causes1way att_value(part(soil, nutrients),level, decrease)
8	A reduction in soil nutrient levels causes a reduction in soil fertility	att_value(part(soil, nutrients),level, decrease) causes2way att_value(soil, fertility, decrease)
9	An increase in weed density causes a decrease in crop yield	att_value(weeds, density, increase) causes2way att_value(crops, yield, decrease)
10	Soil erosion is minimal IF the soil is always covered with some type of vegetation	att_value(process(soil, erosion), rate,minimal) IF link(covers, vegetation, soil)
11	Soil erosion is severe IF soil is not covered with vegetation	att_value(process(soil, erosion), rate, high) IF link(not_covers, vegetation, soil)
12	Soil erosion is very severe on hills	att_value(process(soil, erosion),rate, severe) IF att_value(process(soil, erosion), location, hillside) and att_value(site, vegetation_cover, bare)
13	An increase in soil erosion causes an increase in the siltation of waterways	att_value(process(soil, erosion), rate, increase) causes2way att_value(process(waterways, siltation), rate, increase)
14	An increase in the siltation of waterways reduces fish production	att_value(process(waterways, siltation),rate, increase) causes2way att_value(action(production,fish), rate, decrease)
15	The weed population does not become a problem when land is regularly left to fallow.	att_value(action(fallowing,land),frequency,regular) causes1way att_value(weeds, population,decrease)
16	Canopy closure causes the death of weeds	process(canopy,closure) causes1way process(weeds, death)

Select **Statements** from the main **KB** menu. Then press **New**. Enter the formalised version into the ‘Formal Language Statement’ box. Where there are conditions in the statement (as in statements 5, 10, 11, 12, and 15) the condition is entered in the second half of the box, headed ‘IF’. Press **Syntax Check** to check whether or not the syntax has been properly entered. Then press **Translate** to get a natural language version. When you are satisfied, press **Save**.

### Warning!

If you press **Close**, instead of **Save** you will lose the statement and it will have to be entered again.

## 14.4 PLAYING WITH THE KNOWLEDGE BASE

Now that you have created a mini knowledge base, the following section gives you suggestions on ways in which to enhance its usefulness and to explore it. In each section are numbers, underlined and in brackets. These are the chapters and paragraphs to which you should refer for instructions on how to carry out the tasks.

### Defining formal terms (7.4.3.a)

You should always take care to define your formal terms clearly. Even simple terms should be defined as two people may understand something quite different under the same term. For example the action ‘clearing’ could mean clearing of undergrowth, clearing of weeds or complete clearing of a site. Let us assume that in this case ‘clearing’ means ‘the complete removal of vegetation from the site’:

1. Go to the main **KB** menu.
2. Select **Formal Terms**.
3. In the ‘Type’ box select ‘action’.
4. Highlight *clearing* and press **Details**. You can now enter the definition into the definition box.
5. Press **Save**.

### Creating an object hierarchy (7.5.1)

You should wherever possible, structure the objects to identify any hierarchical relationships between them. The creation of object hierarchies allows you to develop a compact knowledge base because they allow knowledge to be recorded at its most general level of application, yet be used to consider more specific instances.

Two of the objects in the knowledge base you are creating here **vegetation** and **crops** clearly can be hierarchically associated. Furthermore, it is obvious from the source text that beans, cassava, corn, plantains, rice and yams are types of crop.

1. Select **Object Hierarchies** in the main **KB** menu.
2. Select **New**.
3. In the ‘New Hierarchy Name’ box, enter a name for the object hierarchy. You can either enter a name of your own choosing, (in this case we have called the hierarchy ‘plants’), or select an object from the ‘KB objects’ list to act as the hierarchy name.
4. Press **Save**. The hierarchy name ‘plants’ now appears in the ‘Object Hierarchies’ list in the ‘Object Hierarchies’ dialog box.

### Appending objects to the object hierarchy

1. Highlight the name of your new Object Hierarchy.
2. In the ‘Selected Object’ box press **Append to**. A list of all the objects in the knowledge base then appears.
3. Select ‘vegetation’.
4. Press **Append**. The formal term ‘vegetation’ then appears in the object hierarchy ‘plants’ as an immediate sub-object of ‘plants’.

### Building up object hierarchies (7.5.3.)

Add the following statements to your knowledge base

*Beans fix nitrogen  
Corn does not fix nitrogen  
Rice does not fix nitrogen*

Now practise creating another level in the ‘plants’ object hierarchy:

1. Highlight **vegetation**, so that it appears in the ‘Object’ box of the ‘Hierarchy Structure’ section.
2. Press **Append To**.
3. In the ‘Append Object’ dialog box, select ‘crops’ from the ‘Objects’ list and press **Append**.
4. You now have an object hierarchy in which the formal term ‘vegetation’ has the parent ‘plants’ and the child ‘crops’.

5. Try incorporating ‘beans’, ‘corn’ and ‘rice’ in the object hierarchy ‘plants’ as subobjects of ‘crops’ by highlighting ‘crops’ so that it appears in the ‘Object’ box of the ‘Hierarchy Structure’ section and then pressing **Append To**.
6. Continue as above.

The principal advantage of the hierarchy you have just created is that it can now be recognised during reasoning that because:

*Soil erosion is not a problem if the soil is always covered with some type of vegetation*

and

*Rice is a type of vegetation*

(information from the hierarchy) then:

*soil erosion on a site covered in rice should not be a problem.*

## **Conducting an Boolean Search (7.10.1)**

A knowledge base may often contain many hundreds of statements (see for example, the knowledge base ‘treefodd’). Consequently, exploring the contents of a large knowledge base through **Statements** in the main **KB** menu, or even via the **Diagram** interface becomes very demanding and confusing. However, AKT contains a **Boolean Search** facility that allows you to retrieve sets of statements that correspond to particular criteria.

Practise searching on an object using the Boolean Search:

1. Select **Boolean Search** from the main **KB** menu.
2. From the ‘Display Kb terms of type’ drop-down menu select ‘object’.
3. From the list of objects displayed, highlight *crops* and press **Select**.
4. The term *crops* will appear in the ‘Boolean Search String’ at the bottom of the dialog box. Press **Search**.
5. A ‘Search Results’ dialog box then appears, giving all the statements retrieved containing the formal term ‘crops’.

## **Boolean searches using and and/or or (7.10.1.a)**

Boolean searches can include combinations of formal terms linked with **and** and/or **or**. Try it out on the formal terms *pests* and *disease*

6. Select **Boolean Search** from the main **KB** menu.
7. From the ‘Display Kb terms of type’ drop-down menu select ‘object’.
8. From the list of objects displayed, highlight *pests* and press **Select**.
9. The term *pests* will appear in the ‘Boolean Search String’ at the bottom of the dialog box.
10. Press the **OR** button from the ‘Boolean Options’ box.
11. Now find the term ‘disease’, highlight it and press **Select**.
12. In the ‘Boolean Search String’ at the bottom of the dialog box should be ‘*pests* or *disease*’. Now press **Search**.
13. You will be presented with all the statements in your knowledge base containing either the term ‘*disease*’ or the term ‘*pests*’.
14. If you repeat this process but select the term **AND** instead of **OR**, no statements will be found as there are no statements in the knowledge base which contain both the term ‘*disease*’ and the term ‘*pests*’.

When undertaking searches combining ‘and’ and ‘or’ it is necessary to use brackets as one does in algebra to give the order of precedence in the search. Experiment with ‘burning’ and ‘pests’ or ‘burning’ and ‘disease’. To get all the statements mentioning either ‘burning’ and ‘pests’ or ‘burning’ and ‘disease’ the Boolean Search String should include brackets, thus:

(burning and pests) or (burning and disease)

The searches which we have practised so far have retrieved only statements that contain the specified formal term. However, because we have additional information about object terms in the form of the hierarchies, we can use alternative search strategies.

In the ‘Search Options’ box, it is possible to select:

- 1) ‘object’,
- 2) ‘superobject’
- 3) ‘subobjects’

in any combination.

Now try out all the different search options, one at a time. The first option will give you only the statements containing the word ‘crops’. The second option will give you all the statements containing ‘crops’ or any of the subobjects, ‘rice’, ‘beans’ or ‘corn’. The third option will give you all the statements containing any of the objects in the object hierarchy ‘plants’.

## Creating Topics (7.11.1)

You may wish to save a particular Boolean Search String to create a permanent subset of statements in your knowledge base. These subsets of knowledge are called **Topics** and are created in the same way as any Boolean Search String, the difference being that they are then saved as a topic.

Try creating a topic entitled ‘management actions’, from a Boolean Search String containing the terms ‘burning’ **or** ‘clearing’ **or** ‘harvesting’.

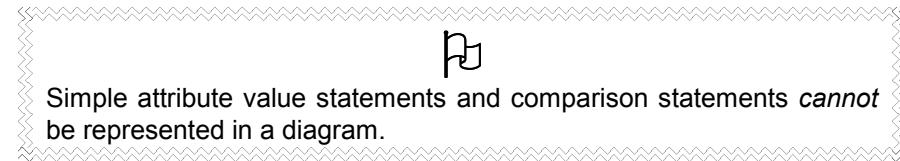
1. Create the Boolean Search String.
2. In the box marked ‘Name of new topic’ type in *management actions*.
3. Now press **Save** in the ‘Save search selection’ box.
4. In the Topic Details box press **Save** once more.

Go to **Topics** via the main **KB** menu and select *management actions*. When the Search Results appear, try out the different buttons on the ‘Diagram Selection Type’ at the bottom of the dialog box ([7.10.1.c](#))

## DIAGRAM GENERATION (8)

Diagramming was used earlier in the tutorial as a means of creating a knowledge base. You can also use diagramming as a means of exploring the content of a knowledge base.

1. Open the diagram interface (by selecting the **Diagram** from the main menu).
2. Try to build up sub diagrams by using the **Show Paths (8.3.1)**, **Navigate (8.3.2.)** and the **Cause and Effect (8.3.3.)** buttons.
3. Move between the different diagrams ([8.5](#))
4. Give each diagram a different label ([8.6.1.](#)).



## Printing diagrams (8.11)

You may want to print a diagram to illustrate a point – just press **Print Window** on the right hand side of the diagram screen. Or if you want to transfer it to another package before printing it out, press **Copy to Clipboard (8.6.3)**

## **Printing Statements (7.13)**

Often it may be useful to print out some of the content of the knowledge base in order to help you in its exploration. Or you may wish to save your statements to another package and print them out from there. Try printing out all the statements in your Topic ‘management actions’;

1. Select the main **KB** menu.
2. Select **Topics**.
3. Select ‘management actions’.
4. Press **Search**.
5. Print the **Print Statements** button at the bottom of the ‘Search Results’ dialog box.
6. Try printing the statements directly and try saving them as a text file as well.

## **USING TOOLS (9 and 10)**

As this is a tutorial for beginners and the knowledge base ‘slash and burn’ is only very small, you would not normally need the tools at this stage. However, just to give you a little taster of what tools can do, here are two for you to try out.

The following is a little exercise to introduce you to some of the tools and what they do. To get started select the main **Tools** menu and then press **Tools**, **Systems Tools** and finally **Knowledge Evaluation**.

1. The tool **kb\_report(Kb)** gives you a summary of the categories of statements in your knowledge base. Press **Run**. A dialog box appears, requesting the name of the knowledge base. Enter the name of your knowledge base and press **Continue**. The tool output will give you the following output;

Total number of statements	22 of which 5 are conditional.
Number of attribute statements	5 of which 5 are conditional.
Number of causal statements	14 of which 0 are conditional.
Number of comparison statements	0 of which 0 are conditional.
Number of link statements	3 of which 0 are conditional.

Remaining within the **Systems Tools** category, go to **Knowledge Exploration**.

2. The tool **species\_report/2** extracts information from the knowledge base about a particular species<sup>3</sup>. Press **Run**. An input parameter dialog box appears requesting the name of the knowledge base and of the species to be extracted. Enter the name of your knowledge base and enter ‘crops’ in the ‘species’ box. Then press **Continue**. You should get the following output;

Kb = slash\_and\_burn

Species= crops

INFORMATION SHEET FOR : crops

HIERARCHY : plants

  vegetation

  crops

ATTRIBUTE STATEMENTS :

  none

CAUSAL STATEMENTS :

  harvesting of crops causes a decrease in level of soil nutrients

COMPARISON STATEMENTS :

  none

LINK STATEMENTS :

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<sup>3</sup> Species in this context can mean any object in the knowledge base.

none

CONDITIONAL STATEMENTS :

none

DERIVED STATEMENTS :

the erosion of soil rate is minimal if crops covers soil

the rate of erosion of soil is high if crops not\_covers soil

burning of site causes removal of crops

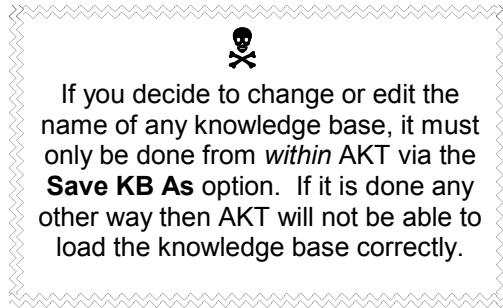
removal of crops causes an increase in level of insolation of soil

This tool not only tells you all about the selected ‘species’ (in this case ‘crops’) but it also gives you all the statements derived via the object hierarchy as well.

## CLOSING YOUR KNOWLEDGE BASE (7.14)

Now has come the time to close your knowledge base. Before closing it, you must decide if you want to save the changes you have made to it or not.

If you **do** wish to save the changes, then select **Save KB** or **Save KB As** from the main **KB** menu. Once you have saved the knowledge base, select **Close KB** from the main **KB** menu.



If you **do not** wish to save the changes you have made, then go straight to **Close KB**. Once you have closed the knowledge base go to the main **File** menu and click on **Exit AKT**.

## YOUR TUTORIAL IS AT AN END



**THE CHALLENGE IS NOW TO MAKE A KNOWLEDGE BASE  
OF YOUR OWN!**