Field Assessment of Forest Fire Severity

ForFireS

Manual

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1. Introduction

The European Union and the Member States have committed themselves to implementing actions which have been the subjects of international agreements in the field of forest conservation and protection.

The Council Regulation N° 2158/92 of 23 July 1992, on protection of the forests against fire, included in particular a financial contribution from the Community to the setting up by the Member States of an information system on forest fires. This Council Regulation having expired on 21 December 2002 the European Parliament and the Council of the European Union wished to continue and develop the forest monitoring activities which had been established according to the above mentioned regulation and to integrate them into Regulation N° 2152/2003 of 17 November 2003 called « Forest Focus ».

Article 6 of the regulation states that developing the scheme aims in particular to enhance the knowledge of the condition of forests and other wooded land as well as the relationship between their condition and natural and anthropogenic stress factors.

Information about the extent of forest fires having happened in the countries of the European Union are recorded in a database in a standardised form.

It has been decided to enrich this information with data about the severity of the most important fires, with an area above 50 ha, and for that purpose to establish a field assessment method which can be used in the Member States.

This Manual describes the method to be used, from preparing the sampling design to recording and exploiting the data. It is supplemented by a **practical guide for the field work** for use by the persons in charge of carrying it out. The **Field Guide** is designed to be used without reference to the Manual but to avoid repetitions not all the rules given in the Field Guide are written in the Manual. Thus, both documents are necessary to have a complete description of the method.

In this Manual and in the Field Guide the method is called **ForFireS**.

2. ForFireS Outlines

ForFireS is a method applicable to fires of forest lands and shrublands. The perimeter of the fire is assumed to be known. The method is designed to obtain, from a sample, data about the vegetation of the impacted land and the effects of the fire on this vegetation as well as on different environment factors, in order to assess the fire severity.

Fire severity is assessed through a combination of quantified indicators, the values of which are set according to data collected in the field. There are five indicators for forest stands, two of them being used for shrubland:

- I   Relative burnt volume   Forest
- II   One year survival probability of trees   Forest
- III   Importance of regeneration   Forest
- IV   Erosion aggravation risk   Forest and shrubland
- V   Fire intensity   Forest and shrubland

Forest and shrubland refer here to the vegetation before the fire.

Each indicator can take an integer value from 0 to 4. 0 means that the fire had little or no effect whereas 4 means that the fire had a very strong effect.

Indicator values are computed for each sampling point then combined to yield a general assessment of the fire severity.

The result is expressed in the same way from 0 to 4, with the following meaning:

- 0   Not burnt
- 1   Lightly burnt
- 2   Moderately burnt
- 3   Heavily burnt
- 4   Very heavily burnt

The collected data and the results of the assessment are recorded in a database which can be linked to the existing one for fire characteristics.

ForFireS does not impose that the field observations be carried out within a fixed minimum or maximum time after the fire. The time elapsed between the fire date and the observation date is something to take into account when analysing the results.

ForFireS must be implemented by a team of persons knowledgeable in forestry and geographic information systems (GIS) as well as database software.

To implement ForFireS on a given fire, date and perimeter of this fire must be known. It is assumed that geographic data is available in a digital form, if not it must be converted.

Once the fire perimeter is known, existing information about the vegetation on the territory is gathered to set up areas as homogeneous as possible but with a sufficient size to be assessed separately and which are the inventory strata. The information can be used to limit the geographic scope of the assessment.

The fire perimeter and the strata boundaries, if any, are then entered into a GIS.

The following step consists of setting up a sample for each stratum. The number of sampling points should be no less than 25 per stratum but doesn't need to exceed 30. They are laid out on the nodes of a square grid inside the fire perimeter. The orientation of the grid can be chosen freely and the size of the mesh depends on

the size of the stratum and the number of sampling points. The output is a list of sampling points, each one possessing an identifier and coordinates.

The data to be collected is then determined. For the assessment itself there is a closed list from which a choice can be made according to the means at disposal. It is possible to add local data but they cannot be stored in a standardised form.

After preparatory work has been done a crew is sent to carry out the field work. They have to reach the sampling points, install the sampling plots, make all prescribed measurements and observations, and enter the data on paper forms or computers.

Collected data are entered into a database using Microsoft ® Access software. These data are then used to assess the fire severity with the help of the same software.

3. Initial Data

3.1. Map Projection System

All geographic data stored in the database must use the European Terrestrial Reference System 1989 (ERTS89) based Lambert-Azimuthal Equal-Area (LAEA) projection system recommended by the Ispra Joint Research Centre. The LAEA projection system parameters are:

- Projected Coordinate System: ETRS_1989_LAEA
- Projection: Lambert Azimuthal Equal Area
- False Easting: 4321000.00000000
- False Northing: 3210000.00000000
- Central Meridian: 10.00000000
- Latitude of Origin: 52.00000000
- Linear Unit: Metre

- Geographic Coordinate System: GCS_ETRS_1989
- Datum: D_ETRS_1989
- Prime Meridian: Greenwich
- Angular Unit: Degree

The LAEA projection system preserves the area of individual polygons while simultaneously maintaining a true sense of direction from the centre.

Local projection systems may be used when it is deemed practical and when existing data make it unavoidable. Geographic co-ordinates used in a GPS receiver are computed according to the World Geodetic System 1984 (WGS84). The necessary conversions must be made.

3.2. Fire Characteristics

According to the "Forest Focus" regulation the following data are provided by the Member States for each forest fire:

Name	Description
FIREID	Fire identifier
DATEAL	Date of first alert
TIMEAL	Time of first alert
DATEIN	Date of first intervention
TIMEIN	Time of first intervention
DATEEX	Date of fire extinction
TIMEEX	Time of fire extinction
NUTS3	NUTS 3 Code from EC 1059/2003
CODECOM	NUTS 5 Code from EC 1059/2003
NAMECOM	Commune name
TBA	Total burned area (in ares)
FBA	Forested burned area (in ares)
NFBA	Not forested burned area (in ares)
CAUSE	Presumed cause

The same identifier shall be used for the fire characteristics and for the assessment of its severity. It must be entered into the database.

When the decision has been made to assess the severity of a given fire, the first task is to acquire the fire perimeter. This can be done using:

- Satellite pictures; the Ispra Joint Research Centre can under normal conditions provide the necessary data within a few weeks after a fire has occurred;
- GPS points; a person equipped with a GPS receiver can move along the fire perimeter and record the coordinates of the points where the main changes in direction take place;
- Other methods, such as mapping the fire perimeter from aerial pictures taken after the fire, matching outstanding landscape features on maps and pictures.

The relevant data must be entered into the GIS.

The fire perimeter source must be recorded in the database (§ 6.2.1).

3.3. Vegetation Data on the Burnt Area

Once the fire perimeter is known, it is possible to look for data about the vegetation on the burnt area prior to the fire.

Two types of sources might be available:

- Results from previous studies, which can be systematic in different countries, such as forest vegetation maps produced by national forest inventories or as output of forest planning; the Corine Land Cover database can always be used, the size of the smallest unit mapped is 25 ha;
- Aerial photographs or orthophotomaps, which can be interpreted for the assessment purpose.

The purpose is to determine whether the fire area:

- Extends over land which is agricultural or urbanised, to restrict the investigated area to forest land and shrubland;
- Can be spatially divided into units where the initial vegetation was homogeneous, for instance forest land and shrubland or, in case of very large fires, different forest vegetation according for instance to tree species, age classes, etc.

The vegetation data must be converted if necessary into digital form and entered into the GIS.

During the field work data will be collected to record:

- Whether a point is on agricultural or urbanised land;
- Whether traces of fire are visible or not.

This information can be used afterwards to correct the fire perimeter.

3.4. Stratification

Analysis of the vegetation can lead to a stratification of the fire perimeter, in order to survey the different strata separately. It must be taken into account that the higher the number of strata, the more important the means necessary to assess the fire severity will be. Thus stratification is never compulsory.

Stratification however can lead to a better assessment thanks to an increased number of plots, particularly if homogeneous vegetation reacted similarly to the fire. It makes it possible when analysing the results to link them to the vegetation and to improve our knowledge about vegetation reaction to fires.

The ForFireS method is applied to each stratum independently but the results for the different strata of the same fire can be used to give a general assessment. Each stratum must be given an identifier which must be unique for a given fire.

In the present state of the database, each stratum is considered as an independent fire.

If a fire is stratified, the different strata must be given identifiers which include the fire identifier followed by a sequential number, for instance: 2008_0001_1 for stratum nr 1 of the 2008_0001 fire.

4. Sampling Network

4.1. Sampling Points

The sampling network consists of points around which plots are installed where observations and measurements are carried out.

For a given stratum, there must be at least 25 sampling points but it is not necessary to have more than 30. This number ensures a sufficient accuracy. The sampling density varies according to the stratum area.

The network is based on a square grid. The grid is chosen freely. There must be only one for a given fire. It is recommended to set it along the co-ordinate system in use in the country or region where the survey is done so that the points are easy to locate on topographic maps.

The size of the grid depends on the total area of the stratum and the desired number of sampling points. The total area of the stratum is given by the GIS software. Dividing the total area by the number of points yields the mean extension area. The square root of this extension area is the distance between two points along the co-ordinate axis.

The set of points is entered into the GIS.

This calculation does not ensure that the real number of points inside the fire perimeter will match what was foreseen, because of its usually irregular shape. Therefore it is advised to start with a somewhat higher number than is wished and to check the result against what was expected. If necessary, a new attempt is made with a shorter distance between two points along the coordinate axis.

Example:

Figure 1 shows a fire perimeter in Southern France with a kilometre square grid laid along the Clarke 1880 RGS Lambert Conformal Conic coordinate system which is locally used.

On Figure 2 a 260-m grid has been added. The area of each square is 67,600 m². There are theoretically 28 nodes within the fire perimeter.
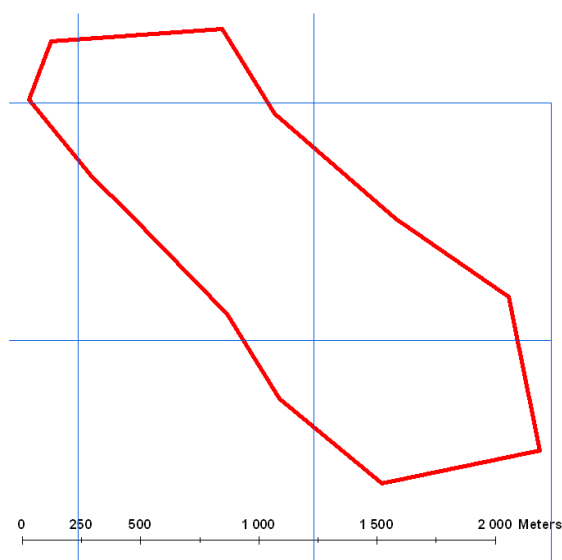
Figure 1: Fire perimeter (extent 190 ha) with kilometre grid
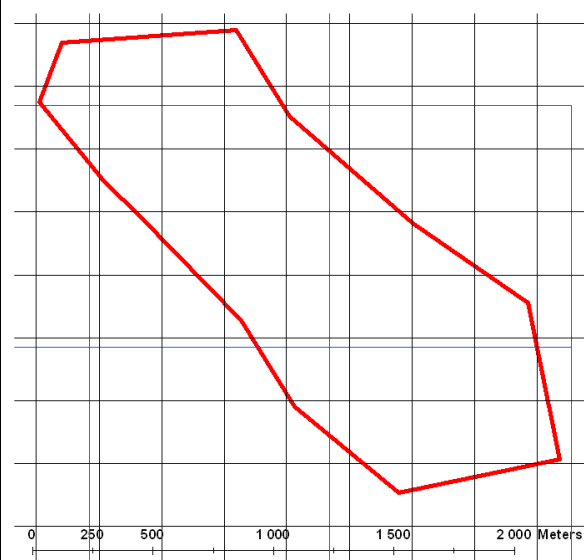
Figure 2:Fire perimeter, kilometre grid and 260-m grid

Figure 3 shows the 27 sampling points which lie inside the fire perimeter
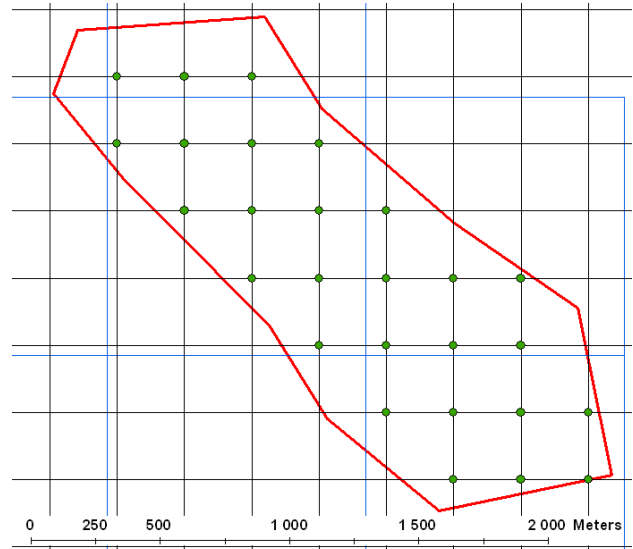
Figure 3: Actual sampling points

The sampling network side size is stored in the database. It is used to extrapolate plot data.

Each sampling point must be given an identifier which must be unique for a given stratum and the point co-ordinates must be entered into the GIS and the database.

The sampling points are reached by the field crews with the help of a Global Positioning System (GPS) receiver. The rectangular co-ordinates must be converted into geographic co-ordinates according to the World Geodetic System 1984 (WGS 84) and entered into the receiver. These geographic co-ordinates are called "theoretical geographic co-ordinates".

How to generate a sampling network

There may be different ways to generate the sampling network. The following steps are suggested. In case a fire is stratified, read "stratum" instead of "fire".

- Load the fire perimeter into the GIS (for instance GRASS, MapInfo, ESRI)
- Using the GIS, compute the fire extent and the point mean extension area
- Using the GIS, determine the highest and lowest values of the abscissa and ordinate of the fire perimeter points; the four values yield the co-ordinates of the north-west and south-east corner of a rectangle which envelops the fire; add or subtract 100 m to get a rectangle with a buffer around the fire
- Starting from the north-west corner and using a spreadsheet software, generate regularly spaced points, with a distance along each axis equal to the square root of the mean extension area, inside the rectangle; load the points into the GIS
- Using the GIS software, extract the points which are inside the fire perimeter and a 100-m buffer around it and count the ones which are inside the fire perimeter
- If the result does not lie between 25 and 30 generate another grid with a bigger or smaller distance between two neighbouring points
- Using the GIS software, compute the WGS84 latitude and longitude of the points which are within the fire perimeter and the buffer

Note: The presence and size of a buffer depends on the accuracy of the fire perimeter. If it is the result of a recent ground survey a buffer may not be useful. If it is derived from satellite pictures a buffer is probably necessary.

When the point is reached (in some cases described in the Field Guide the point will have to be moved from its initially computed position) the co-ordinates displayed by the GPS receiver are recorded. They are called "actual geographic co-ordinates".

Both sets of co-ordinates must be given in degrees to six decimal places. The unit expressed by the last digit to the right is thus 10^{-6} degree. One metre on an earth great circle such as a meridian is equivalent to about 9.10^{-6} degree and conversely 1.10^{-6} degree is equivalent to about 11 cm.

A fire severity assessment being a one-time operation, it is not foreseen that the sampling points are permanent. Should the authority or manager in charge of the operation wish to repeat observations at the same place in the future it is always possible to mark a point location with an iron bar.

4.2. Sampling Plots

4.2.1. Principle

Data are collected on sampling devices made of:

- A 500-square-metre plot for collecting general data and data pertaining to trees with a diameter at breast height above 7 cm;
- A 12-square-meter subplot for collecting data pertaining to trees with a lesser diameter which are called "regeneration".

In case the number of trees on a 500-square-metre plot exceeds 20 the size of the plot can be reduced following specific rules.

4.2.2. Usual Case: Circular Plots

The main plot is usually a circular plot with a 12.62 m radius; the subplot is then circular, with the same centre and a 1.95 m radius. The sampling point is the centre of the main plot and of the subplot used for regeneration assessment.

See Figure 4.
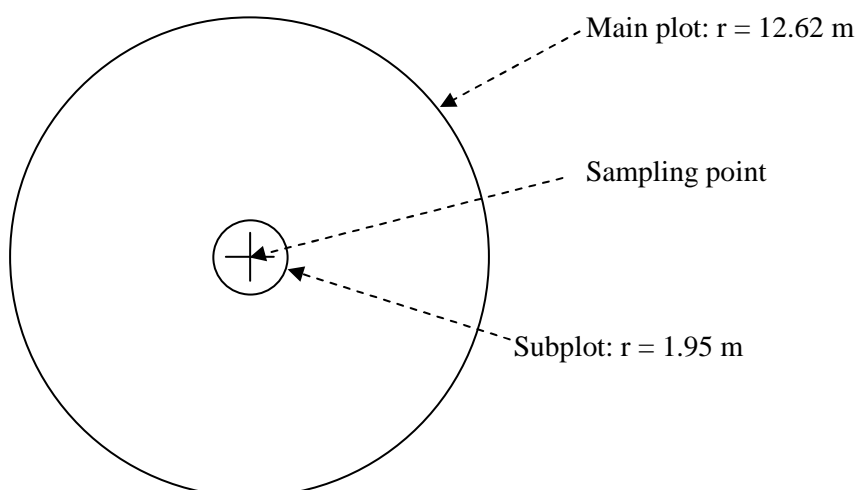
Figure 4: Circular plot layout

Such a plot is called "standard circular plot".

In case the number of trees on the 500-square-metre plot exceeds 20 the size of the plot can be reduced. It is referred to as a "non-standard circular plot".

4.2.3. Case of Terraced Ground: Rectangular Plots

When the sampling point is located on terraced ground rectangular plots may be installed as follows. Circular plots are allowed.

- The sampling point is the north-west corner of the main plot and of the subplot, the sides of which have common directions.
- Two sides of the rectangles are parallel to the terraces direction; the two other sides are perpendicular.
- The average width of the terraces is measured from bank base to bank base.
- The length of the sides of the main plot perpendicular to the terraces direction is equal to twice the terrace width (the plot is installed on two terraces).
- 500 are divided by twice this average width to obtain the length of the sides of the main plot parallel to the terraces direction.
  Example: if the average width is 8 m, the length of the sides of the main plot parallel to the terraces direction is 500/16 = 31.25 m.
- The width of a terrace is the length of the side of the subplot in the direction perpendicular to the terraces.
- 12 are divided by this width to obtain the length of the sides of the subplot along the terraces.
  Example: if the average width is 8 m, the length of the sides of the subplot parallel to the terraces direction is 12/8 = 1.5 m.

See Figure 5.

Plot shape and plot diameter in the case of a reduced circular plot are entered into the database.
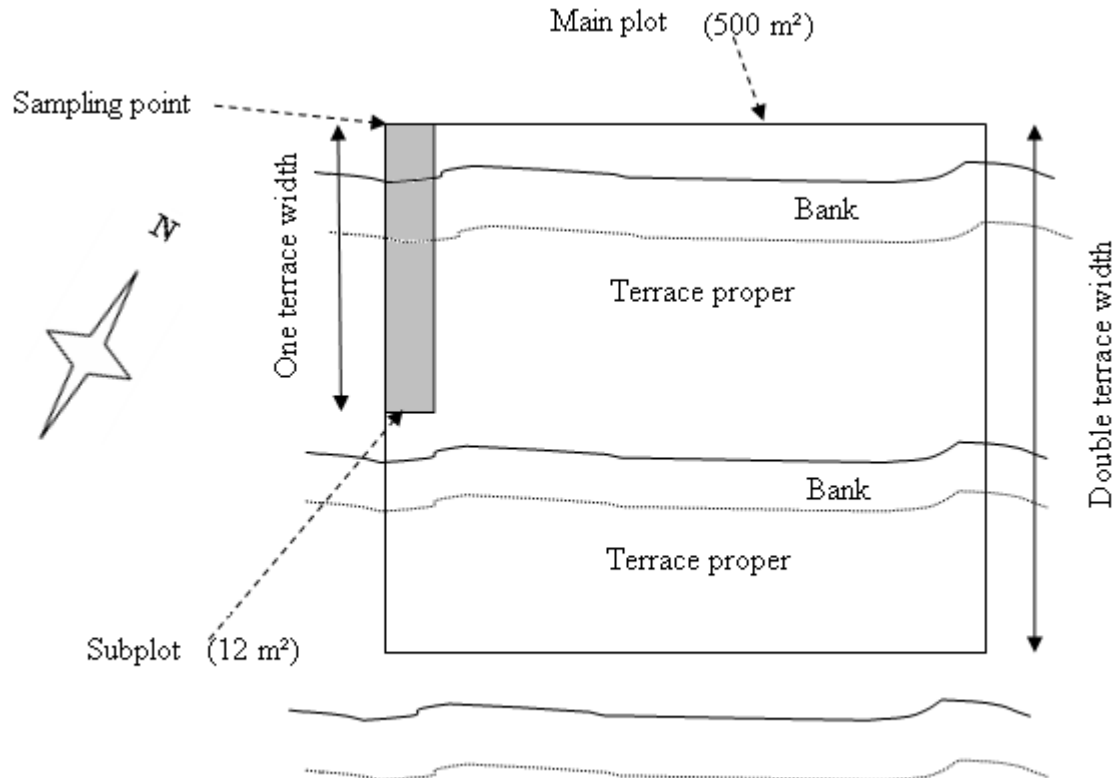
Figure 5: Rectangular plot layout

Rectangular plots are to be used when the terraces can be considered straight on a distance which matches their length. When their height is low, when they are eroded and, generally speaking, when it is not very difficult to move around the sampling point, it is advised to install a circular plot. If it is likely that there are more than 20 trees on a 500-square metre plot a circular plot should always be preferred.

Procedures for reaching sampling points and installing sampling plots are given in the **Field Guide** referred to in § 1. They concern:

- How to behave when a part of a plot is not accessible or is located on agricultural or urbanised land,
- In what order operations must be carried out,
- How to look for and mark trees, in particular when their number exceeds 20 on a standard circular plot.

5. Field Collected Data

5.1. Classification of Field Collected Data

Data collected in the field aim to determining severity in an analytic way. They comprise:

- Stand description data;
- Data to assess biomass before the fire;
- Data to assess the extent of biomass loss;
- Data about salvage cutting after the fire if any;
- Data about other effects (erosion).

In addition to the above mentioned ones, some data describe the conditions under which the field work was carried out. In particular they record the actual location of the sampling point, the absence of fire on the plot or the situation of the plot on agricultural or urbanised land. Those data can be used to correct the fire perimeter.

Besides computing indicator values it is possible to use the data to break down fire characteristics, either for the purpose of studying a given fire or for computing statistics about several fires.

Field collected data are related to objects. There are three object classes:

- Sampling points or sampling plots. If there can be a sampling point without a sampling plot the contrary cannot happen. Practically no difference is made.
- Trees. A tree is a ligneous plant from a species whose individuals are likely to reach a 5-m height on the considered site and its diameter at breast height must be at least 7 cm. Each tree whose data are recorded is given a number which is used as an identifier.
- Regenerations. Under regeneration is meant the set of trees with a height above 10 cm and, if they reach a 1.3-m height, with a diameter at breast height lesser than 7 cm, whatever their age, which can be found on a subplot. This set is divided into subsets defined by a species or a group of species. Each subset is identified by its species or group of species.

In the following sections data are sorted according to the object they are related to. **Specific determination procedures, practical hints and rules for recording, like code values, are given in the Field Guide referred to in § 1 and are not repeated in the present Manual**. Forms and cheat sheets for practical use are attached to the Field Guide.

5.2. Standards for Field Collected Data

Field collected data type can be character string, numerical, date or binary. It is detailed in the section about the database structure (§ 6). The database comprises tables of metadata with data description.

Possible values comprise usually one which expresses that there is nothing to observe or measure. A blank means that an operation was forgotten. However the location of a point on agricultural or urbanised land is recorded by an indicator and no further operation is carried out. The same thing happens when a point cannot be reached or when there is no trace of fire around a point.

The data description shows the ones which must be collected for severity assessment as **compulsory**.

5.3. Plot Related Data

5.3.1. Sampling Date

Definition: The sampling date is made of the year, the month and the day when the field work is carried out on the plot.

Use: The sampling date makes it possible to know the time elapsed since the fire date. It is also used for checking purposes.

Compulsory.

5.3.2. Crew Leader

Definition: The crew leader is the name of the person leading the crew which carries out the work on the plot.

Use: Determination of the person responsible for carrying out the work on the plot.

Possible values: Any character chain which can be an actual name or a code given by the assessment manager.

Compulsory.

5.3.3. Plot Shape or Size

Definition: The plot shape is the geometrical shape of the projection of the plot boundary on a horizontal plane.

Use: Determination of the sampling device in use and result computation.

Possible values: A code if a standard circular plot is installed, or a rectangular plot, or if no plot can be installed; the radius if a non-standard circular plot is installed.

Code	Plot shape
100	Circular plot
200	Rectangular plot
300	No plot installed
(Radius)	Circular plot, radius smaller than 12.62 m, value in whole centimetres

Compulsory.

5.3.4. Actual Sampling Point Latitude and Longitude

Definition: The actual sampling point latitude and longitude are the WGS84 geographic co-ordinates of the sampling point according to the device used to reach the point.

Use: The actual sampling point latitude and longitude are considered as the exact location of the sampling point. They will be later on converted as rectangular coordinates into the Lambert Azimuthal Equal Area projection recommended by the Ispra Joint Research Centre (LAEA).

Possible values: Decimal degrees to six decimal places.

Compulsory.

5.3.5. GPS Accuracy

Definition: The GPS accuracy is the estimate of the error between the point whose coordinates are displayed and the point actually installed.

Use: The GPS accuracy makes it possible to assess the accurateness of the point position. It is also used for checking purposes.

Possible values: Whole metres.

Compulsory.

5.3.6. Plot Cover before the Fire

Definition: The plot cover before the fire is the ground cover at the plot and its surroundings before the fire happened.

Use: The plot cover before the fire is used to record whether a point where no observations or measurements have been done was in forest or shrubland or on agricultural or urbanised land, or if it was not reachable.

Possible values: A code.

Code	Plot cover before the fire
100	Forest
200	Shrubland
300	Agricultural land
400	Urbanised land
500	Undetermined plot cover (unreachable point)

Compulsory.

5.3.7. Burnt – Not Burnt Indicator

Definition: The Burnt – Not burnt indicator records whether traces of a fire are visible on the sampling plot.

Use: The Burnt – Not burnt indicator is used to set out the points which have not been surveyed because no traces of fire are visible. It is recorded whenever possible, even if the point is on an agricultural or urbanised land or, if there is no doubt about its location, if the point cannot be reached.

Possible values: A code.

Code	Burnt – Not burnt indicator
100	Burnt
200	Not burnt

Compulsory.

5.3.8. Point Elevation

Definition: The point elevation is the distance between the horizontal plane (perpendicular to the Earth gravity) at the mean sea level and the horizontal plane passing through the point.

The elevation is taken in the office from large scale topographic maps or using a digital elevation model. If the map or digital elevation model accuracy is deemed not sufficient the elevation is taken form the GPS readings.

Use: The elevation can be used to break down various fire characteristics.

Possible values: Whole metres.

5.3.9. Slope

Definition: The ground slope is the angle made by the horizontal plane and the ground plane.

Use: The slope is used to evaluate the erosion aggravation risk indicator. It can also be used to break down various fire characteristics.

Possible values: Whole degrees.

Compulsory.

5.3.10. Aspect

Definition: The ground aspect is the orientation of the plot fall line compared with true north.

Use: The ground aspect can be used to break down various fire characteristics.

Possible values: Whole degrees. When the slope is lower than 5 degrees (flat ground) the value "999" is entered.

5.3.11. Relief Type

Definition: The relief type expresses the ground shape on the plot and its nearest surroundings.

Use: The relief type can be used to break down various fire characteristics.

Possible values: A code.

Code	Relief Type Description
100	**Flat land**: Slope below or equal to 5°; plains, plateaus, terraces, flat valley bottoms are classed here. See Figure 6
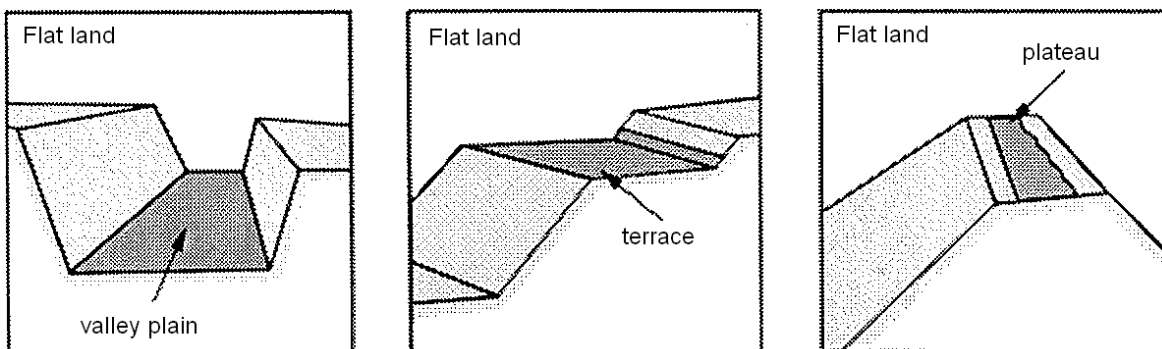
Figure 6: Flat land

Code	Relief Type Description
200	**Slope or comb bottom**: Lower parts of steep slopes, of hillsides, of steep comb, of combs, of ditches, of ravines. See Figure 7
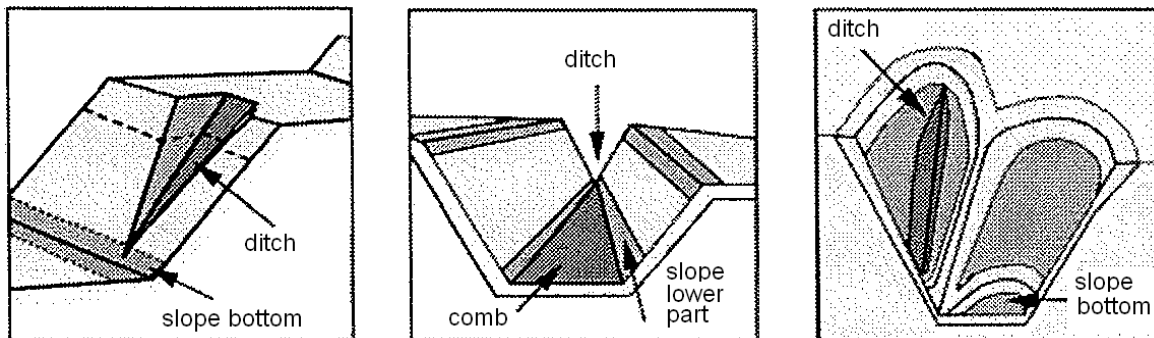
Figure 7: Slope bottom

Code	Relief Type Description
300	**Slope middle**: Middle part of mountain slopes, of hillsides, of heaps of fallen rocks or alluvial deposits and similar. See Figure 8
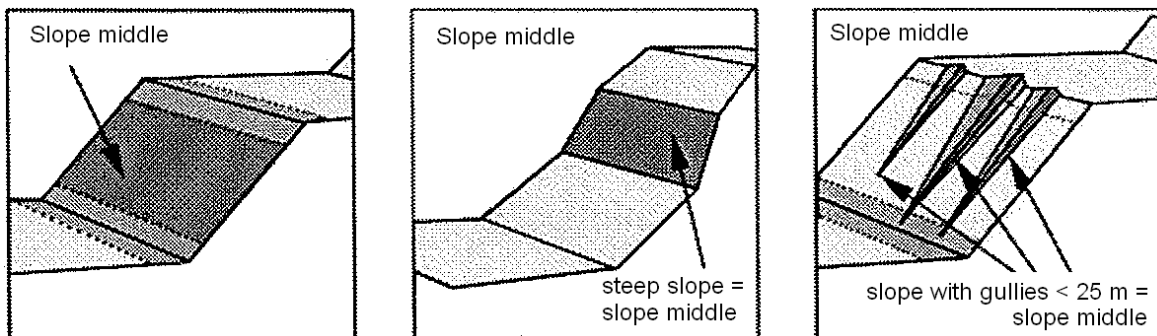
Figure 8: Slope middle

Code	Relief Type Description
400	**Hilltop, Slope top**: Hilltops, mountain tops, mountain ridges, mountain edges, places on slope edges in case of plateau or mountain terrace or moraine. See Figure 9
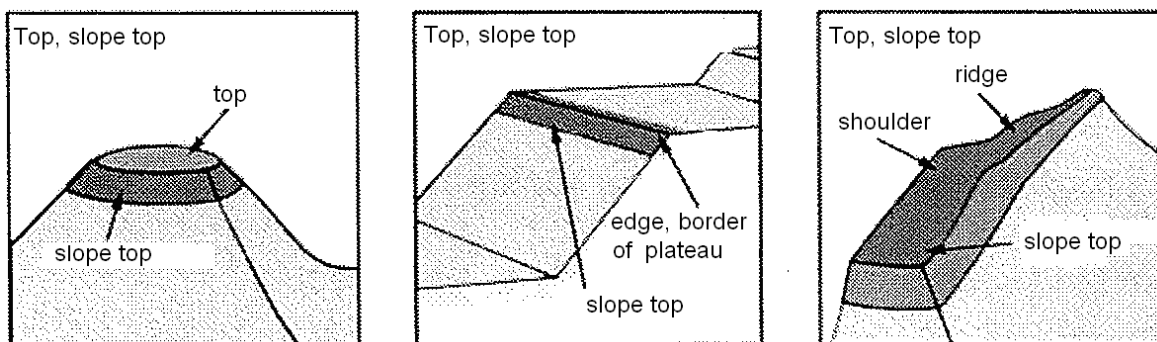
Figure 9: Slope top

Code	Relief Type Description
500	**Other**: Ground which cannot be classified in the 100 to 400 modes; for instance ground with rapidly changing slopes and aspects.

For classifying the situation of the plot in its surroundings is taken into account. See Figure 10.

100 Flat ground
200 Slope bottom
300 Slope middle
400 Slope top
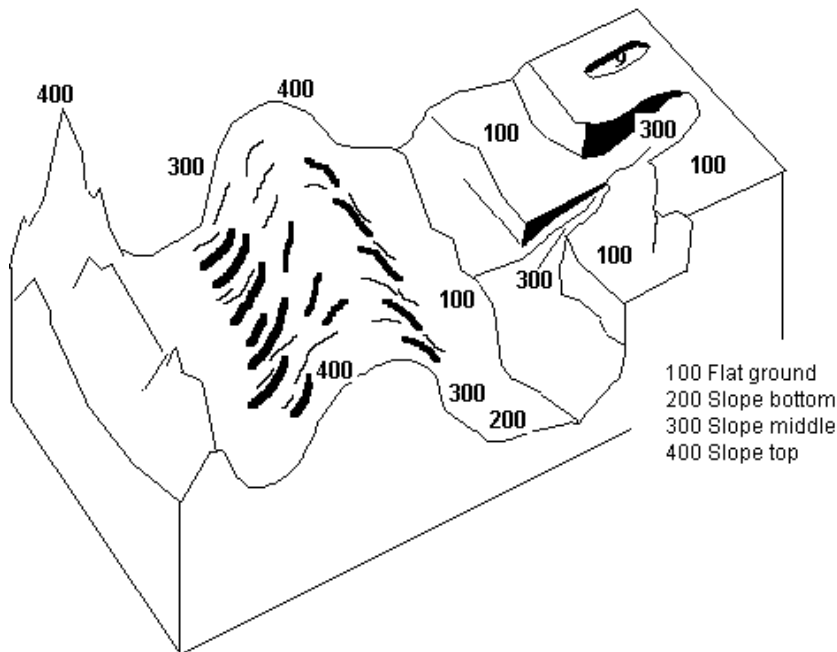
Figure 10: Relief type determination

5.3.12. Slope Shape

Definition: The slope shape expresses the shape of the plot fall line around the sampling point.

Use: The plot shape can be used to break down various fire characteristics.

Possible values: A code.

Code	Slope Shape
100	**Straight**: The fall line is practically a straight line near by the sampling point.
200	**Concave**: The fall line shows a regular concave shape near by the sampling point.
300	**Convex**: The fall line shows a regular convex shape near by the sampling point
400	**Terraces**: The fall line crosses artificial terraces near by the sampling point.
500	**Various**: The fall line is undulated near by the sampling point.
600	**Flat ground**
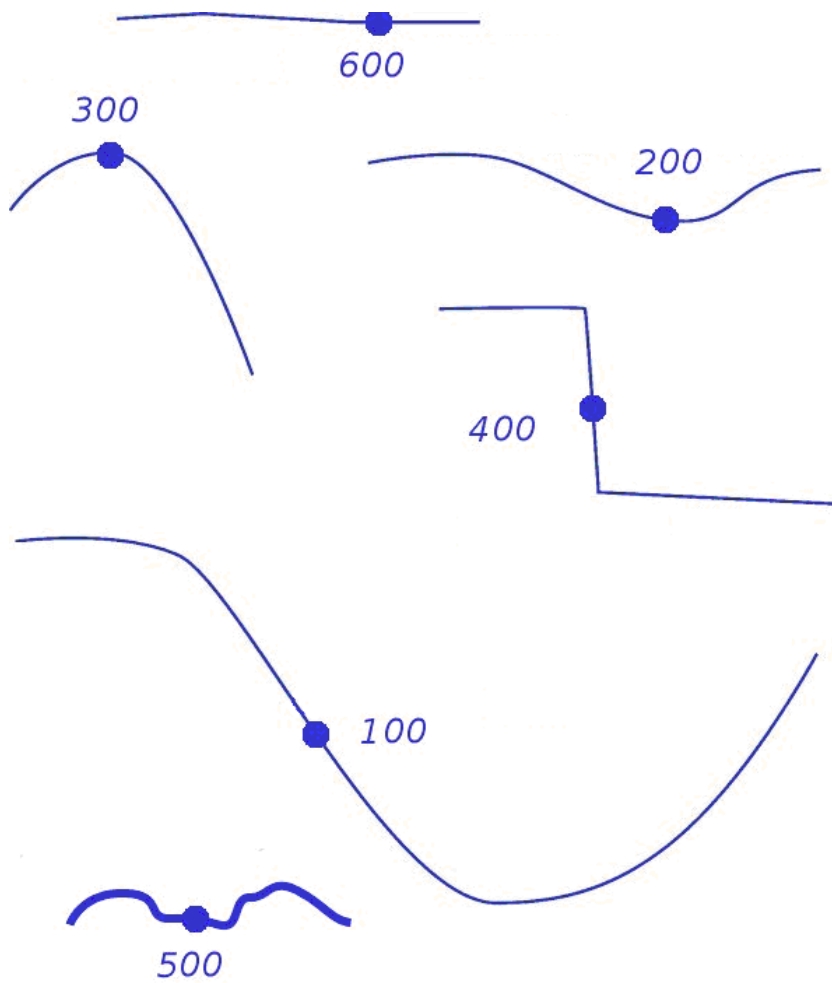
Figure 11: Fall line shape determination

5.3.13. Erosion Type

Definition: The erosion type expresses the main erosion factor and its consequences in the field.

Use: The erosion type can be used to break down various fire characteristics.

Possible values: A code.

Code	Erosion Type
100	**Water erosion, gully**: More or less visible gullies were water has flown are visible in the field.
200	**Water erosion, sheet**: No gullies are visible but superficial material has been washed. Material gathering can be seen at slope bottom.
300	**Wind erosion**: Superficial material has been blown away by the wind.
400	**Other**: Erosion is visible but is not due to water or wind (landslip).
500	**No erosion**
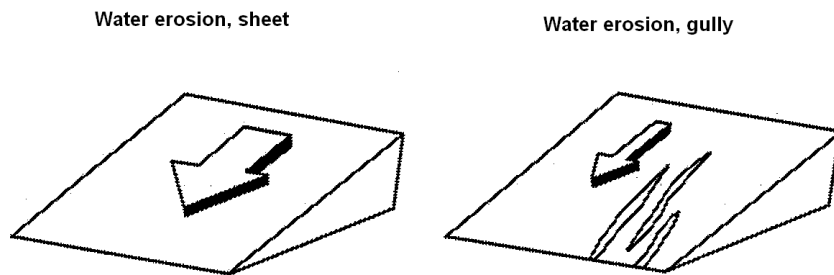
Figure 12: Erosion type

If several types are visible the most important one is recorded.

5.3.14. Erosion Severity

Definition: The erosion severity expresses the intensity of material removal or displacement which can be attributed to erosion.

Use: The erosion severity is used to evaluate the erosion aggravation risk indicator. It can also be used to break down various fire characteristics.

Possible values: A code.

Code	Erosion severity
100	**Low**: On average less than 25% of the upper 20 cm of soil surface have been lost across the plot.
200	**Moderate**: On average between 25 and 75% of the upper 20 cm of soil surface have been lost across the plot, possible small strongly eroded areas.
300	**High**: On average more than 75% of the upper 20 cm of soil surface have been lost across the plot, spots of visible lower soil horizons.
400	**No erosion**

Compulsory.

5.3.15. Erosion Aggravation after Fire

Definition: The erosion aggravation after fire expresses the fact that the erosion severity has increased as a consequence of the fire.

Use: The erosion aggravation after fire is used to evaluate the erosion aggravation risk indicator. It can also be used to break down various fire characteristics.

Possible values: A code.

Code	Erosion Aggravation after Fire
100	The erosion has increased after the fire.
200	The erosion has not increased after the fire.

Compulsory.

5.3.16. Visible Alteration of Rocks Caused by the Fire

Definition: The visible alteration of rocks caused by the fire expresses the possible effects of the fire on the bedrock.

Use: The visible alteration of rocks caused by the fire is used to evaluate the fire intensity indicator. It can also be used to break down various fire characteristics.

Possible values: A code.

Code	Visible Alteration of Rocks Caused by the Fire
100	**Splitting**: The heath has caused the rock to split.
200	**Texture change**: The bedrock has acquired a porous or powdery texture.
300	**Colour change**: Bedrock colour has changed at least locally.
400	**No alteration**

Compulsory.

5.3.17. Total Living Tree Cover Rate before the Fire

Definition: The total living tree cover rate before the fire is the ratio between the overall projection of living tree crowns on the plot and the plot area as this ratio was before the fire.

Use: The total living tree cover rate before the fire is used to evaluate the erosion aggravation risk indicator. It can also be used to break down various fire characteristics.

Possible values: The cover rate is entered in percent, rounded to the nearest 10 percent if the value is higher than 10 percent. The result cannot be above 100%.

5.3.18. Total Living Tree Cover Rate after the Fire

Definition: The total living tree cover rate after the fire is the ration between the overall projection of living tree crowns on the plot and the plot area as it is when the sampling is being done.

Use: The total living tree cover rate after the fire is used to evaluate the erosion aggravation risk indicator. It can also be used to break down various fire characteristics.

Possible values: The cover rate is entered in percent, rounded to the nearest 10 percent if the value is higher than 10 percent. The result cannot be above 100%.

5.3.19. Upper Dominant Tree Species

Definition: The upper dominant tree species is the tree species whose individuals 5-m high and above have the highest cover rate on the plot, whatever their vegetation state.

Use: The upper dominant tree species is used to break down several fire characteristics.

Possible values: A code (see § 5.4.2). If no tree higher than 5 m exists the code 3000 is entered.

5.3.20. Lower Dominant Tree Species

Definition: The lower dominant tree species is the tree species whose individuals 10-cm to 5-m high have the highest cover rate on the plot.

Use: The lower dominant tree species is used to break down several fire characteristics.

Possible values: A code (see § 5.4.2). If no tree smaller than 5 m exists the code 3000 is entered.

5.3.21. Total Living Shrub Cover Rate before the Fire

Definition: The total living shrub cover rate before the fire is the ratio between the overall projection of living shrub crowns (ligneous plants which are not likely to reach a 5-m height on the site) on the plot and the plot area as this ratio was before the fire.

Use: The total living shrub cover rate before the fire is used to evaluate the erosion aggravation risk indicator. It can also be used to break down various fire characteristics.

Possible values: The cover rate is entered in percent, rounded to the nearest 10 percent if the value is higher than 10 percent. The result cannot be above 100%.

5.3.22. Total Living Shrub Cover Rate after the Fire

Definition: The total living shrub cover rate after the fire is the ratio between the overall projection of living shrub crowns on the plot and the plot area as it is when the sampling is being done.

Use: The total living shrub cover rate after the fire is used to evaluate the erosion aggravation risk indicator. It can also be used to break down various fire characteristics.

Possible values: The cover rate is entered in percent, rounded to the nearest 10 percent if the value is higher than 10 percent. The result cannot be above 100%.

5.3.23. Shrub Height before the Fire

Definition: The shrub height before the fire equals three quarters of the maximum height above the ground reached by the shrubs before the fire.

Use: The shrub height before the fire is used to evaluate the fire intensity indicator.

Possible values: Whole decimetres.

Compulsory.

5.3.24. Shrub Height after the Fire

Definition: The shrub height after the fire equals three quarters of the maximum height above the ground reached by the shrubs after the fire.

Use: The shrub height after the fire is used to evaluate the fire intensity indicator.

Possible values: Whole decimetres.

Compulsory.

5.3.25. Total Living Ligneous Cover Rate before the Fire

Definition: The total living ligneous cover rate before the fire is the ratio between the area of the plot covered with ligneous vegetation (trees and shrubs) and the total plot area before the fire.

Use: The total living ligneous cover rate before the fire is used to evaluate the erosion aggravation risk indicator. It can also be used to break down various fire characteristics.

Possible values: The cover rate is entered in percent, rounded to the nearest 10 percent if the value is higher than 10 percent. The result cannot be above 100%.

Compulsory.

5.3.26. Total Living Ligneous Cover Rate after the Fire

Definition: The total living ligneous cover rate after the fire is the ratio between the area of the plot covered with ligneous vegetation (trees and shrubs) and the total plot area after the fire.

Use: The total living ligneous cover rate after the fire is used to evaluate the erosion aggravation risk indicator. It can also be used to break down various fire characteristics.

Possible values: The cover rate is entered in percent, rounded to the nearest 10 percent if the value is higher than 10 percent. The result cannot be above 100%.

Compulsory.

5.3.27. Herbaceous Cover Rate

Definition: The herbaceous cover rate is the ratio between the area of the plot covered with herbaceous vegetation and the total plot area.

Use: The herbaceous cover rate can be used to break down various fire characteristics.

Possible values: The cover rate is entered in percent, rounded to the nearest 10 percent if the value is higher than 10 percent. The result cannot be above 100%.

5.3.28. Salvage Logging Stock Rate

Definition: The salvage logging stock rate is the ratio between the total areas of tree stocks logged after the fire and the total area which would appear if all the trees had been logged after the fire.

Use: The salvage logging stock rate is used to evaluate the volume of the wood burnt by the fire.

Possible values: The rate is expressed in percent to the nearest 10 percent.

Compulsory.

5.3.29. Number of Burnt Stems Not Logged

Definition: The number of burnt stems not logged is the number of stems with traces of charring on the plot, whether they are standing or lying.

Use: The number of burnt stems not logged is used to evaluate the volume of the wood burnt by the fire. It takes into account lying stems about which no data are collected.

Possible values: A whole number.

Compulsory.

5.4. Tree Related Data

5.4.1. Diameter at 1.3-m Height

Definition: The diameter at 1.3-m height of a tree is given by the distance between two tangents to the perimeter of the tree, along a section perpendicular to the stem axis. It is measured at 1.3 m above the ground.

Use: The diameter at 1.3-m height is used to evaluate the volume of the wood burnt by the fire. It can also be used to break down various fire characteristics.

The diameter at 1.3-m height is also used to choose trees on which other observations or measurements are made or to classify them into the regeneration set.

Possible values: Whole centimetres.

Compulsory.

5.4.2. Species

Definition: Designation of the species or group of species the tree belongs to, represented by a numerical code.

Use: Tree species determination. It can also be used for various breakdowns.

Possible values: A code.

Code	Species or Species group
100	*Quercus* with deciduous leaves
200	*Quercus ilex*
300	*Quercus suber*
400	*Fagus sylvatica*
500	*Castanea sativa*
600	*Betula sp.*
700	*Fraxinus sp.*
800	*Populus sp.*
900	*Eucalyptus sp.*
1000	Other broad-leaved (likely to reach a 5-m height)
1100	*Pinus pinaster*
1200	*Pinus sylvestris*
1300	*Pinus nigra*
1400	*Pinus pinea*
1500	*Pinus halepensis*
1600	*Abies sp.*
1700	*Picea sp.*
1800	*Cedrus sp.*
1900	*Pinus canariensis*
2000	Other coniferous (likely to reach a 5-m height)

Compulsory.

5.4.3. Total Height

Definition: Vertical distance between the horizontal plane passing through the highest point of the tree and the horizontal plane passing through the tree stump. See Figure 13.
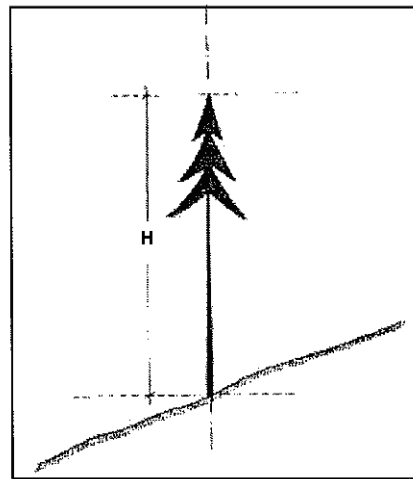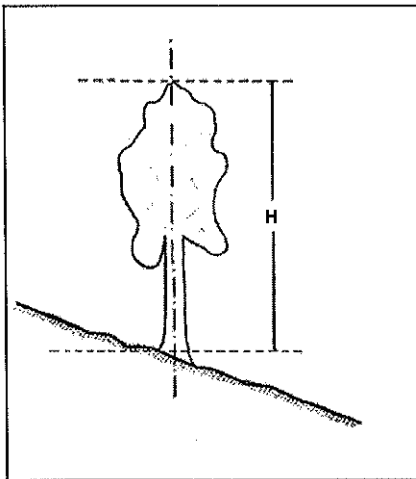
Figure 13 : Total height of a tree

Use: The total tree height is used to evaluate the volume of the wood burnt by the fire. It can also be used to break down various fire characteristics.

Possible values: Whole decimetres. When a tree is broken beneath the crown the value "999" is entered.

Compulsory.

5.4.4. Vegetation State

Definition: Characterisation of the fact that the tree is alive or dead.

Use: The vegetation state is used to evaluate the volume of the wood burnt by the fire. It is also used to assess the probability of survival of the whole stand.

Possible values: A code.

Code	Vegetation state
100	Living tree
200	Dead tree

Compulsory.

5.4.5. Social Status in the Stand

Definition: Expresses the state of the tree according to its position in the different stand storeys.

Use: The social status in the stand is used to break down various fire characteristics.

Possible values: A code.

Code	Social Status in the Stand
100	**Stand main storey**: A tree which belongs to the stand storey where the main economic production takes place (seed bearer, main stand).
200	**Stand secondary storey**: A tree which grows under shelter of the main stand or in a storey of quite different age or size. It belongs generally to the regeneration or to an undergrowth of importance for soil protection or shaping the stems in the main stand.
300	**Hold-over**: A tree which has been left from a previous stand, above the present main stand. It is an isolated stem.

5.4.6. Height of Charred Stem

Definition: Length of the highest char mark found on the tree.

Use: The height of charred stem is used to evaluate the volume of the wood burnt by the fire.

Possible values: Whole decimetres.

Compulsory.

5.4.7. Rate of Burnt Crown

Definition: Relative part of the crown that has been killed by the fire.

Use: The rate of burnt crown is used to assess the probability of survival of the whole stand.

Possible values: The rate of burnt crown is entered in percent to the nearest 10 percent.

Compulsory.

5.4.8. Stem Destruction Rate

Definition: Relative part of the stem wood volume that the fire has rendered improper to any use.

Use: The stem destruction rate is used to evaluate the volume of the wood burnt by the fire.

Possible values: A code.

Code	Stem Destruction Rate
100	Less than one third of the stem wood is destroyed.
200	On third to two thirds of the stem wood is destroyed.
300	More than two thirds of the stem wood is destroyed.

Compulsory.

5.5. Regeneration Related Data

5.5.1. Species

Definition: Designation of the species or group of species the seedling belongs to, represented by a numerical code.

Use: Regeneration species determination.

Possible values: A code (see § 5.4.2).

Compulsory.

5.5.2. Number Class of Stems in Each Species

Definition: Number of seedlings of the same species or group of species on the subplot used for regeneration assessment.

Use: Assessment of the regeneration importance.

Possible values: A code.

Code	Number Class
100	1 stem.
200	2 or 3 stems.
300	4 or 5 stems.
400	6 or 7 stems.
500	8 stems or more.

Compulsory.

6. Database Structure

6.1. General Description

ForFireS **data** are stored in standardised Microsoft® Access database **tables**. The data can be broken down into:

- Classes made up according to the objects to which they are related, as explained in § 5.1 about field collected data; to the three object classes
  ° "Sampling plot"
  ° "Tree"
  ° "Regeneration"
  the objet class
  ° "Fire" is added;

  Field names begin with the name of the objet they are related to: FIRE, PLOT, TREE, REG (for regeneration).

- Classes made up according to the way the data are acquired:
  ° Before the field work from
    – the European Forest Fire Information System;
    – other sources (fire perimeter and vegetation, §§ 3.2 and 3.3)
  ° While preparing the field work
  ° During the field work
  ° After the field work, as results from processing the collected data.

Two sets of table can be distinguished:

- Four tables for storing the data collected about the fires, whether before the field work or during it, one for each object class "Fire", "Sampling plot", "Tree" and "Regeneration",
- Three tables for storing the results from processing, one for each objet class "Fire", "Sampling plot" and "Tree".

Auxiliary tables are used during the processing phase.

Forms are available:

- For displaying the main menu,
- For creating new items, fire, sampling plot, tree, regeneration set, and entering their characteristics.

Queries are used to compute the results and enter them into the relevant tables. Macros are used to automate a series of actions.

ForFireS **metadata** are stored in two tables of the same database, which are described separately.

6.2. Tables for Collected Data

Field names are italicised when they are part of the key.

6.2.1. Table INCENDIA

Table INCENDIA contains fire related data. It has five fields:

Field Name	Data Type	Description
FIRE_ID	Text (11 characters)	EFFIS fire identifier and stratum number
FIRE_DATEAL	Date (YYYY/MM/DD)	EFFIS date of first alert
FIRE_COUNTRY	Text (2 characters)	Country ISO code
FIRE_AREA	Long integer	Fire extent in hectares
FIRE_PERIMETER_SOURCE	Text (255 characters)	Source of fire perimeter (satellite, survey)

6.2.2. Table AREAE

Table AREAE contains plot related data. It has 34 fields:

Field Name	Data Type	Description
FIRE_ID	Text	EFFIS fire identifier and stratum number (11 characters)
PLOT_ID	Integer	Plot identifier (unique for a given fire)
PLOT_DATE	Date/Time	Date of field work (yyyy/mm/dd)
PLOT_SHAPE	Single Real	Plot shape (code or radius)
PLOT_LATITUDE_THEORETICAL	Double Real	WGS84 geographic latitude according to the sampling design (decimal degrees)
PLOT_LONGITUDE_THEORETICAL	Double Real	WGS84 geographic longitude according to the sampling design (decimal degrees)
PLOT_LATITUDE_ACTUAL	Double Real	WGS84 geographic latitude recorded in the field (decimal degrees)
PLOT_LONGITUDE_ACTUAL	Double Real	WGS84 geographic longitude recorded in the field (decimal degrees)
PLOT_PRECISION	Integer	GPS receiver error estimate (whole metres)
PLOT_LANDCOVER	Integer	Plot cover before the fire (code)
PLOT_BURNTNOTBURNT	Integer	Indicator of fire signs on the plot (code)
PLOT_ELEVATION	Integer	Plot elevation (whole metres)
PLOT_SLOPE	Integer	Plot slope (whole degrees)
PLOT_ASPECT_MAG	Integer	Plot aspect magnetic north (whole degrees)
PLOT_RELIEF	Integer	Relief type around the plot (code)
PLOT_SLOPESHAPE	Integer	Shape of the plot fall line (code)
PLOT_EROSIONTYPE	Integer	Erosion factor and effects (code)
PLOT_EROSIONSEVERITY	Integer	Erosion severity (code)
PLOT_EROSIONAGGRAVATION	Integer	Erosion aggravation after fire (code)
PLOT_ROCKALTERATION	Integer	Visible alteration of rocks caused by the fire (code)
PLOT_TREECOVERBEFORE	Integer	Total living tree cover rate before the fire (percentage)
PLOT_TREECOVERAFTER	Integer	Total living tree cover rate after the fire (percentage)
PLOT_UPPERDOMINANT	Integer	Upper dominant – 5-m and above – tree species (code)

Field Name	Data Type	Description
PLOT_LOWERDOMINANT	Integer	Lower dominant – 10-cm to 5-m– tree species (code)
PLOT_SHRUBCOVERBEFORE	Integer	Total living shrub cover rate before the fire (percentage)
PLOT_SHRUBCOVERAFTER	Integer	Total living shrub cover rate after the fire (percentage)
PLOT_SHRUBHEIGHTBEFORE	Integer	Three quarters of maximum shrub height before the fire (whole meters)
PLOT_SHRUBHEIGHTAFTER	Integer	Three quarters of maximum shrub height after the fire (whole meters)
PLOT_LINEOUSCOVERBEFORE	Integer	Total living ligneous cover rate before the fire (percentage)
PLOT_LINEOUSCOVERAFTER	Integer	Total living ligneous cover rate after the fire (percentage)
PLOT_HERBCOVER	Integer	Total living cover rate of herbaceous vegetation (percentage)
PLOT_LOGGINGRATE	Integer	Salvage logging stock rate (percentage)
PLOT_LEFTSTEMS	Integer	Number of burnt stems not logged (count)
PLOT_COMMENT	Memo	Comments on the plot written by the crew leader

6.2.3. Table ARBORES

Table ARBORES contains tree related data. It has 12 fields:

Field Name	Data Type	Description
FIRE_ID	Text	EFFIS fire identifier and stratum number (11 characters)
PLOT_ID	Integer	Plot identifier (unique for a given fire)
TREE_ID	Integer	Tree identifier (unique for a given plot)
TREE_DIAMETER	Integer	Diameter at 1.3-m height – breast height – (whole centimetres)
TREE_SPECIES	Integer	Species (code)
TREE_HEIGHT	Integer	Total height (whole decimetres)
TREE_STATE	Integer	Vegetation state (code)
TREE_STATUS	Integer	Social status in the stand (code)
TREE_CHARHEIGHT	Integer	Height of charred stem (whole decimetres)
TREE_BURNTCROWN	Integer	Relative part of the crown killed by the fire (percentage)

Field Name	Data Type	Description
TREE_BURNTSTEM	Integer	Relative part of the stem wood volume destroyed by the fire (code)
TREE_COMMENT	Memo	Comments on the tree written by the crew leader

6.2.4. Table REGENERATIO

Table REGENERATIO contains regeneration related data. It has five fields:

Field Name	Data Type	Description
FIRE_ID	Text	EFFIS fire identifier and stratum number (11 characters)
PLOT_ID	Integer	Plot identifier (unique for a given fire)
REG_SPECIES	Integer	Species of the seedlings or shots (code)
REG_NUMBERCLASS	Integer	Number of seedlings or shots of the given species, in classes (code)
REG_COMMENT	Memo	Comments on the regeneration set written by the crew leader

6.3. Tables for Computed Data

6.3.1. Table INCENDIA_COMPUTATIO

Table INCENDIA_COMPUTATIO contains fire related data. It has three fields:

Field Name	Data Type	Description
FIRE_ID	Text (10 characters)	EFFIS fire identifier and stratum number
FIRE_SAMPLE_DISTANCE	Integer	Sampling network side size in metres
FIRE_SEVERITY	Byte	Fire severity indicator (computed)

6.3.2. Table AREAE_COMPUTATIO

Table AREAE_COMPUTATIO contains plot related data. It has 31 fields:

Field Name	Data Type	Description
FIRE_ID	Text	EFFIS fire identifier and stratum number (11 characters)
PLOT_ID	Integer	Plot identifier (unique for a given fire)
PLOT_LAEA_X	Double Real	Plot abscissa in the ETRS_1989_LAEA projected coordinate system (computed)
PLOT_LAEA_Y	Double Real	Plot ordinate in the ETRS_1989_LAEA projected coordinate system (computed)
PLOT_WOODSHRUB	Byte	Land cover class: woodland, shrubland, other
PLOT_NBUBT	Integer	Number of unburnt trees
PLOT_NBBT	Byte	Number of burnt trees
PLOT_NBT	Byte	Total number of trees
PLOT_TREEWEIGHT	Double Real	Weight of each tree
PLOT_GROSSVOLUMEAFTER	Double Real	Total volume of trees after the fire
PLOT_GROSSVOLUMEBEFORE	Double Real	Total volume of trees before the fire
PLOT_RBV	Real	Relative burnt volume
PLOT_IND_I	Integer	Indicator I (from 0 to 4)
PLOT_IND_II	Integer	Indicator II (from 0 to 4)
PLOT_SEEDLING	Integer	Total number of seedlings
PLOT_IND_III	Integer	Indicator III (from 0 to 4)
PLOT_TREECOVERLOSS	Integer	Loss of tree cover rate due to the fire
PLOT_TREECOVERLOSSCLASS	Integer	Class of loss of tree cover rate due to the fire (0 to 3)
PLOT_SHRUBCOVERLOSS	Integer	Loss of shrub cover rate due to the fire
PLOT_SHRUBCOVERLOSSCLASS	Integer	Class of loss of shrub cover rate due to the fire (woodland 0 to 3, shrubland 0, 2, 4, 6)
PLOT_LIGNEOUSCOVERLOSS	Integer	Loss of total ligneous cover rate due to the fire
PLOT_LIGNEOUSCOVERLOSSCLASS	Integer	Class of loss of total ligneous cover rate due to the fire (0, 2, 4, 6)
PLOT_EROSIONSEVERITYCLASS	Integer	Class of erosion severity

Field Name	Data Type	Description
PLOT_EROSIONAGGRAVATIONCLASS	Integer	Class of erosion aggravation due to the fire
PLOT_SLOPECLASS	Integer	Class of slope
PLOT_IND_IV	Integer	Indicator IV
PLOT_ROCKALTERATIONCLASS	Integer	Class of rock alteration due to the fire
PLOT_SHRUBRELATIVEHEIGHTLOSS	Integer	Relative loss of shrub height
PLOT_IND_V	Integer	Indicator V
PLOT_FIRESEVERITY	Integer	Plot fire severity index (intermediate result)
PLOT_FIRESEVERITYCLASS	Integer	Plot fire severity indicator (from 0 to 4)

6.3.3. Table ARBORES_COMPUTATIO

Table ARBORES_COMPUTATIO contains tree related data. It has 6 fields:

Field Name	Data Type	Description
FIRE_ID	Text	EFFIS fire identifier and stratum number (11 characters)
PLOT_ID	Integer	Plot identifier (unique for a given fire)
TREE_NR	Integer	Tree number (unique for a given plot)
TREE_GROSSVOLUME	Double real	Tree gross volume after the fire in cubic metres
TREE_SURVIVAL	Integer	Tree survival probability index
TREE_DETAILEDBURNTSTEM	Integer	Tree stem destruction rate as a fraction of the stem volume set to 0 for not burnt trees

6.4. Relationships between the Tables

INCENDIA

FIRE_ID
FIRE_DATEAL
FIRE_COUNTRY
FIRE_AREA
FIRE_PERIMETER_SOURCE

INCENDIA_COMPUTATIO

FIRE_ID
FIRE_SAMPLE_DISTANCE
FIRE_SEVERITY

AREAE

FIRE_ID
PLOT_ID
PLOT_DATE
PLOT_CREW
PLOT_SHAPE
PLOT_LATITUDE_THEORETICAL
PLOT_LONGITUDE_THEORETICAL
PLOT_LATITUDE_ACTUAL
PLOT_LONGITUDE_ACTUAL
PLOT_PRECISION
PLOT_LANDCOVER
PLOT_BURNTNOTBURNT
PLOT_ELEVATION
PLOT_SLOPE
PLOT_ASPECT_MAG
PLOT_RELIEF
PLOT_SLOPESHAPE
PLOT_EROSIONTYPE
PLOT_EROSIONSEVERITY
PLOT_EROSIONAGGRAVATION
PLOT_ROCKALTERATION
PLOT_TREECOVERBEFORE
PLOT_TREECOVERAFTER
PLOT_UPPERDOMINANT
PLOT_LOWERDOMINANT
PLOT_SHRUBCOVERBEFORE
PLOT_SHRUBCOVERAFTER
PLOT_SHRUBHEIGHTBEFORE
PLOT_SHRUBHEIGHTAFTER
PLOT_LIGNEOUSCOVERBEFORE
PLOT_LIGNEOUSCOVERAFTER
PLOT_HERBCOVER
PLOT_LOGGINGRATE
PLOT_LEFTSTEMS
PLOT_COMMENT

ARBORES

FIRE_ID
PLOT_ID
TREE_NR
TREE_DIAMETER
TREE_SPECIES
TREE_HEIGHT
TREE_STATE
TREE_STATUS
TREE_CHARHEIGHT
TREE_BURNTCROWN
TREE_BURNTSTEM
TREE_COMMENT

REGENERATIO

FIRE_ID
PLOT_ID
REG_SPECIES
REG_NUMBERCLASS
REG_COMMENT

ARBORES_COMPUTATIO

FIRE_ID
PLOT_ID
TREE_NR
TREE_GROSSVOLUME
TREE_SURVIVAL
TREE_DETAILEDBURNTSTEM

AREAE_COMPUTATIO

FIRE_ID
PLOT_ID
PLOT_LAEA_X
PLOT_LAEA_Y
PLOT_WOODSHRUB
PLOT_NBUBT
PLOT_NBBT
PLOT_NBT
PLOT_TREEWEIGHT
PLOT_GROSSVOLUMEAFTER
PLOT_GROSSVOLUMEBEFORE
PLOT_RBV
PLOT_IND_I
PLOT_IND_II
PLOT_SEEDLING
PLOT_IND_III
PLOT_TREECOVERLOSS
PLOT_TREECOVERLOSSCLASS
PLOT_SHRUBCOVERLOSS
PLOT_SHRUBCOVERLOSSCLASS
PLOT_LIGNEOUSCOVERLOSS
PLOT_LIGNEOUSCOVERLOSSCLASS
PLOT_EROSIONSEVERITYCLASS
PLOT_EROSIONAGGRAVATIONCLASS
PLOT_SLOPECLASS
PLOT_IND_IV
PLOT_ROCKALTERATIONCLASS
PLOT_SHRUBRELATIVEHEIGHTLOSS
PLOT_IND_V
PLOT_FIRESEVERITY
PLOT_FIRESEVERITYCLASS

6.5. Auxiliary tables

Eight auxiliary tables are used for temporarily storing intermediary results when the field collected data are processed.

Name	Data temporarily stored
FIRE_BEING_PROCESSED	Identifier of the fire or stratum (one record)
Unburnt_trees	Number of unburnt trees on each plot (one record per plot with such trees)
Burnt_trees	Number of burnt trees on each plot (one record per plot with such trees)
Gross_volume	Total volume of the trees on each plot (one record per plot with trees)
Relative_burnt_volume	Relative burnt volume on each plot (one record per plot with trees)
Plot_survival	Survival probability indicator of each plot (one record per plot with trees)
Plot_seedling_number	Conversion of seedling number classes into seedling numbers (one record per plot with regeneration)
Incendium_severity	Severity indicator

The auxiliary table Regeneration_Conversion stores permanently parameters used to convert classes of seedling numbers into estimated seedling counts.

6.6. Forms

6.6.1. Main Menu

The Main Menu form opens up when the application is started. As long as it is opened it is not possible to access the database window but it can be closed by clicking on a button.

This form shows a list of the fire identifiers together with the date of alert and country which are present in the INCENDIA table.

From this menu it is possible by clicking on the appropriate button:

- To enter a new fire into the INCENDIA table
- To enter the field data of a fire (plot, tree and regeneration characteristics)
- To process the field data to assess its severity
- To close the main menu and return to the database window
- To quit the database.

6.6.2. Entering new fire

The "Entering new fire form" opens up when clicking on the first button of the main menu. The fields are blank and after they have been filled a new record is created into the INCENDIA table by clicking on the "next record" arrow or depressing the "TAB" key (both actions allow to enter a new fire) or by closing the form.

6.6.3. Data AREAE, Data ARBORUM et REGENERATIONIS

The Data AREAE form opens up when clicking on the second button of the main menu. The upper part of the form shows the fire characteristics. It is possible to choose a fire using the selector at the bottom.

Through an AREA subform nested in the Data AREAE form the value of the plot related data can be entered. The selector button at the bottom of the subform allows to navigate between the plots and to create a new one.

Once a plot has been created trees and regeneration can be added by clicking on the ARBORES REGENERATIO button which opens another form, Data ARBORUM et REGENERATIONIS. The upper part of this form displays the fire and plot identifiers. The nested ARBORES subform is used to enter the trees. They are displayed as a table like on the field paper form. The nested REGENERATIO subform looks the same way. Upon completion clicking on the STOP button closes the whole form and returns to the Data AREA form. A STOP button closes the form.

6.6.4. Fire to Process, Sampling Network Side Size, Fire Severity Class Assessment

The "Fire to Process form" opens up when clicking on the third button of the main menu. A list of the fire identifiers from the INCENDIA table appears at the right. Clicking on an identifier fills the blank field and the record is created in the previously cleared FIRE_BEING_PROCESSED table when the form is closed.

The "Sampling Network Side Size" form opens up. The value in metres can be entered into the blank field to be inserted into the matching field of the INCENDIA_COMPUTATIO table.

After processing, the "Fire Severity Class Assessment" form opens up and displays the fire identifier together with the fire severity class estimate, which is recorded in the INCENDIA_COMPUTATION table. Clicking on the Exit button terminates the processing.

6.7. Tables for the Metadata

ForFireS metadata are stored in two tables, one for the data and one for the units used to express their values.

All data names used in ForFireS (initial data, field collected data and computed data) can be found in the METADATA_DATA table. Its fields are:

- DATA_CODE: the field names used in the tables
- DATA_DESCRIPTION: the description given in the present Manual
- DATA_TYPE: the data type given in the present Manual
- DATA_UNIT: the unit used to express the data values.

A unit can be a conventional unit such as metre for lengths or degree for angles. It can also been void when what is expressed is a number of database objects such as trees. When the values are expressed by codes, they are given in the METADATA_UNIT table.

For instance the species of a measured tree (TREE_SPECIES) on a sampling plot as well as the upper dominant species on the plot (PLOT_UPPERDOMINANT) are expressed by the same codes. They are expressed in the UNIT_SPECIES unit.

The fields of the METADATA_UNIT table are:

- DATA_UNIT
- UNIT_MODE: a possible value for the unit
- UNIT_MODE_DESCRIPTION: the meaning of the mode.

7. Assessment of the Fire Severity from the Data

As stated in § 2 the indicator values are first computed for each sampling point then combined to yield an assessment for the fire (or stratum).

The variable names used hereafter are the field names found in §§ 6.2 and 6.3.

The SQL queries can be found in § 11.

7.1. Distinction between Forest and Shrubland

As the indicators used differ according to the land cover before the fire to each plot a property is attached to show whether this land cover is forest, shrubland or another class. In the latter case no indicator is computed.

We have:

$$\text{PLOT\_LANDCOVER} \neq 100 \wedge \text{PLOT\_LANDCOVER} \neq 200 \Rightarrow \text{PLOT\_WOODSHRUB} = 2$$
$$\text{PLOT\_LANDCOVER} = 100 \Rightarrow \text{PLOT\_WOODSHRUB} = 1$$
$$\text{PLOT\_LANDCOVER} = 200 \Rightarrow \text{PLOT\_WOODSHRUB} = 0$$

7.2. Indicator I – Relative burnt volume

7.2.1. Principle

During the field work the stem destruction rate of each standing tree is assessed in three classes, 100, 200 or 300, meaning that less than one third, one third to two thirds or more than two thirds of the stem wood has been destroyed by the fire.

The height of charred stem is measured. If this height is equal to zero the tree is said to be not burnt and it can be considered that the stem wood destruction rate is also equal to zero.

We call "detailed stem destruction rate" a characteristic equal to zero for not burnt trees and to the class of stem destruction rate divided by 100 for the burnt trees (1, 2 or 3).

The relative burnt volume on the plot is equal to the weighted average of the detailed stem destruction rate for all the trees present on the plot, using the squared tree diameter as a weight. The best weight would be the volume but the basal area, to which as a weight the square diameter is equivalent, is deemed sufficient.

The result for the plot lies between 0 (in case not any tree is burnt) and 3. The final value of indicator I is set as follows:

- From 0 to 0.6   0
- From 0.6 to 1.2   1
- From 1.2 to 1.8   2
- From 1.8 to 2.4   3
- From 2.4 to 3   4

If all the trees have been logged after the fire, the indicator value is supposed to be 2.

7.2.2. Computation

$$\text{TREE\_CHARHEIGHT} = 0 \Rightarrow \text{TREE\_DETAILEDBURNTSTEM} = 0$$

$$\text{TREE\_CHARHEIGHT} \neq 0 \Rightarrow \text{TREE\_DETAILEDBURNTSTEM} = \frac{\text{TREE\_BURNTSTEM}}{100}$$

$$\text{PLOT\_RBV} = \frac{\sum_{\text{All trees}} \text{TREE\_DIAMETER}^2 \cdot \text{TREE\_BURNTSTEM}}{\sum_{\text{All trees}} \text{TREE\_DIAMETER}^2}$$

$$\text{PLOT\_RBV} \in [0, 0.6] \Rightarrow \text{PLOT\_IND\_I} = 0$$
$$\text{PLOT\_RBV} \in]0.6, 1.2] \Rightarrow \text{PLOT\_IND\_I} = 1$$
$$\text{PLOT\_RBV} \in]1.2, 1.8] \Rightarrow \text{PLOT\_IND\_I} = 2$$
$$\text{PLOT\_RBV} \in]1.8, 2.4] \Rightarrow \text{PLOT\_IND\_I} = 3$$
$$\text{PLOT\_RBV} \in]2.4, 3] \Rightarrow \text{PLOT\_IND\_I} = 4$$
$$\text{PLOT\_LOGGINGRATE} = 100 \Rightarrow \text{PLOT\_IND\_I} = 2$$

7.2.3. Related computations

Although it is not directly used to assess the fire severity, estimates of the wood volume on the plot before and after the fire are computed and recorded in the database.

The volume of a measured tree is supposed equal to:

$$\text{TREE\_GROSSVOLUME} = \frac{1}{3} \frac{\pi d^2 h}{4}$$

With: d diameter at breast height TREE_DIAMETER
h total height TREE_HEIGHT (if a stem is broken – recorded value "999" – its height is set to 5 m).

The volume of a tree is thus considered equal to the volume of a cone whose base would be its basal area and height its total height.

The volume of the trees left on the plot after the fire is assessed using the measurements made on the sole trees standing after the fire and the number of burnt stems not logged, whether they are standing or lying, which is recorded separately as PLOT_LEFTSTEMS.

To take into account lying trees, each measured tree is assigned a weight PLOT_TREEWEIGHT, unique for a given plot, equal to:

$$\frac{\text{PLOT\_LEFTSTEMS}}{\text{PLOT\_NBBT}}$$

PLOT_NBBT being the number of burnt trees standing on the plot, whose height of charred stem is not equal to zero.

This value is used for all the trees, burnt or not. It is a plot property.

The wood volume after the fire PLOT_VOLUMEAFTER is thus equal to:

$$\text{PLOT\_TREEWEIGHT} \sum_{\text{All trees}} \text{TREE\_GROSSVOLUME}$$

To compute the wood volume before the fire PLOT_VOLUMEBEFORE we take into account the salvage logging stock rate estimated on the plot PLOT_LOGGINGRATE. PLOT_VOLUMEBEFORE is equal to:

$$\frac{\text{PLOT\_VOLUMEAFTER}}{\text{PLOT\_LOGGINGRATE}}$$

All volumes are expressed in cubic metres.

7.3. Indicator II – One year survival probability of trees

7.3.1. Principle

Computing Indicator II, one year survival probability of trees, is done at the tree level and then at the plot level.

At the tree level this indicator is based on the tree state and the rate of burnt crown. Its value varies from 0 (very high survival probability) to (4 low survival probability) and is set as follows:

- Dead tree   4
- Living tree, according to the rate of burnt crown
    - From 0 to 20   0
    - From 21 to 40   1
    - From 41 to 60   2
    - From 61 to 80   3
    - From 81 to 100 4

At the plot level the mean value for all trees, rounded to the nearest integer, is the indicator value.

If all the trees have been logged after the fire, the indicator value is supposed to be 4.

7.3.2. Computation

$TREE\_STATE = 200 \Rightarrow TREE\_SURVIVAL = 4$

$(TREE\_STATE = 100) \wedge (TREE\_BURNTCROWN \in [0,20]) \Rightarrow TREE\_SURVIVAL = 0$

$(TREE\_STATE = 100) \wedge (TREE\_BURNTCROWN \in [21,40]) \Rightarrow TREE\_SURVIVAL = 1$

$(TREE\_STATE = 100) \wedge (TREE\_BURNTCROWN \in [41,60]) \Rightarrow TREE\_SURVIVAL = 2$

$(TREE\_STATE = 100) \wedge (TREE\_BURNTCROWN \in [61,80]) \Rightarrow TREE\_SURVIVAL = 3$

$(TREE\_STATE = 100) \wedge (TREE\_BURNTCROWN \in [81,100]) \Rightarrow TREE\_SURVIVAL = 4$

$$PLOT\_IND\_II = \frac{\sum_{1}^{n} TREE\_SURVIVAL}{n}$$ n being the number of measured trees.

$PLOT\_LOGGINGRATE = 100 \Rightarrow PLOT\_IND\_II = 4$

7.4. Indicator III – Importance of regeneration

7.4.1. Principle

Indicator III, importance of regeneration, is based on the number of seedlings present on the subplot.

One seedling on a 12-square-meter subplot represents 833 seedlings per hectare.

The indicator value is set as follows:

- 8 or more (6,667 or more per hectare)   0
- 6 or 7 (5,000 to 5,833 per hectare)   1
- 4 or 5 (3,333 to 4,167 per hectare)   2
- 2 or 3 (1,667 to 2,500 per hectare)   3
- 1 (833 per hectare)   4

During the field work, the crew leader enters for each species or group of species present in the regeneration (if any) a code according to the same classes. The codes cannot be simply added to one another and they are first converted into theoretical numbers as follows:

- 100   1
- 200   2.5
- 300   4.5
- 400   6.5
- 500   8

The nearest integer to the sum on the plot is then used to obtain the indicator value. If no regeneration has been recorded the number of seedlings is equal to zero.

7.4.2. Computation

Let us call CONV_SEEDLING the function which converts REG_NUMBERCLASS for a given plot and a given species or group of species into a theoretical number of seedlings.

We have:

$$\text{PLOT\_SEEDLING} = \left\| \sum_{\text{All species}} \text{CONV\_SEEDLING(REG\_NUMBERCLASS)} \right\|$$

$$\text{PLOT\_SEEDLING} \geq 8 \Rightarrow \text{PLOT\_IND\_III} = 0$$

$$\text{PLOT\_SEEDLING} \in \{6,7\} \Rightarrow \text{PLOT\_IND\_III} = 1$$

$$\text{PLOT\_SEEDLING} \in \{4,5\} \Rightarrow \text{PLOT\_IND\_III} = 2$$

$$\text{PLOT\_SEEDLING} \in \{2,3\} \Rightarrow \text{PLOT\_IND\_III} = 3$$

$$\text{PLOT\_SEEDLING} \in \{0,1\} \Rightarrow \text{PLOT\_IND\_III} = 4$$

7.5. Indicator IV – Erosion aggravation risk

7.5.1. Principle

Indicator IV, erosion aggravation risk, is based on the loss of total ligneous cover rate caused by the fire, the erosion severity observed on the plot during the field work and the plot slope.

Each one of these characteristics is expressed as a sub-indicator with the following values:

- Plot ligneous cover loss
    - 0% to 20%   0
    - 21% to 40%   2
    - 41% to 60%   4
    - 61% to 100%   6
- Plot erosion severity, according to the code entered during the field word
    - 400   0
    - 100   1
    - 200   2
    - 300   3
- Plot erosion aggravation, according to the code entered during the field word
    - 100   0
    - 200   3
- Plot slope
    - 0° to 10°   0
    - 11° to 20°   1

  ○   21° to 30°   2
  ○   31° to 40°   3
  ○   41° or more   4

The different values for these sub-indicators are added up. The maximum value is 16. The result is divided by 4 and rounded to the nearest integer to give the value of Indicator IV.

7.5.2. Computation

$PLOT\_LIGNEOUSCOVERLOSS = PLOT\_LIGNEOUSCOVERAFTER - PLOT\_LIGNEOUSCOVERBEFORE$

$PLOT\_LIGNEOUSCOVERLOSS \in [0,20] \Rightarrow PLOT\_LIGNEOUSCOVERLOSSCLASS = 0$

$PLOT\_LIGNEOUSCOVERLOSS \in [21,40] \Rightarrow PLOT\_LIGNEOUSCOVERLOSSCLASS = 1$

$PLOT\_LIGNEOUSCOVERLOSS \in [41,60] \Rightarrow PLOT\_LIGNEOUSCOVERLOSSCLASS = 2$

$PLOT\_LIGNEOUSCOVERLOSS \in [61,100] \Rightarrow PLOT\_LIGNEOUSCOVERLOSSCLASS = 3$

$PLOT\_EROSIONSEVERITY = 400 \Rightarrow PLOT\_EROSIONSEVERITYCLASS = 0$

$PLOT\_EROSIONSEVERITY = 100 \Rightarrow PLOT\_EROSIONSEVERITYCLASS = 1$

$PLOT\_EROSIONSEVERITY = 200 \Rightarrow PLOT\_EROSIONSEVERITYCLASS = 2$

$PLOT\_EROSIONSEVERITY = 300 \Rightarrow PLOT\_EROSIONSEVERITYCLASS = 3$

$PLOT\_EROSIONAGGRAVATION = 100 \Rightarrow PLOT\_EROSIONAGGRAVATIONCLASS = 0$

$PLOT\_EROSIONAGGRAVATION = 200 \Rightarrow PLOT\_EROSIONAGGRAVATIONCLASS = 3$

$PLOT\_SLOPE \in [0,10] \Rightarrow PLOT\_SLOPECLASS = 0$

$PLOT\_SLOPE \in [11,20] \Rightarrow PLOT\_SLOPECLASS = 1$

$PLOT\_SLOPE \in [21,30] \Rightarrow PLOT\_SLOPECLASS = 2$

$PLOT\_SLOPE \in [31,40] \Rightarrow PLOT\_SLOPECLASS = 3$

$PLOT\_SLOPE \geq 41 \Rightarrow PLOT\_SLOPECLASS = 4$

If we call the four sub-indicators SI_IV_1, SI_IV_2, SI_IV_3 and SI_IV_4 we have:

$$PLOT\_IND\_IV = \left\| \frac{SI\_IV\_1 + SI\_IV\_2 + SI\_IV\_3 + SI\_IV\_4}{4} \right\|$$

7.5.3. Related computations

The total loss of ligneous cover rate can be used for woodland and shrubland.

As the tree cover rate before and after the fire, in woodland, and the shrub cover rate before and after the fire, in both woodland and shrubland, are assessed separately during the field work, they might be used for computing a value of indicator IV.

In the present state of the database, PLOT_TREECOVERLOSS, PLOT_TREECOVERLOSSCLASS, PLOT_SHRUBCOVERLOSS and PLOT_SHRUBCOVERLOSSCLASS are computed in the same way as PLOT_LIGNEOUSCOVERLOSS and PLOT_LIGNEOUSCOVERLOSSCLASS and stored in table AREAE_COMPUTATIO.

7.6. Indicator V – Fire intensity

7.6.1. Principle

Indicator V, fire intensity, is based on the visible alteration of rock and the relative loss of shrub height, if the shrub height before the fire was not equal to zero, caused by the fire.

Both characteristics are used as sub-indicators with the following values:

- Visible alteration of rock, according to the code entered during the field work
  - ° 400   0
  - ° 300   1
  - ° 200   3
  - ° 100   4
- Relative loss of shrub height
  - ° 0% to 20%   0
  - ° 21% to 40%   1
  - ° 41% to 60%   2
  - ° 61% to 80%   3
  - ° 81% to 100%   4

The mean value of these sub-indicators, rounded to the nearest integer, gives the value of Indicator V. If the shrub height before the fire was equal to zero, the value of the first sub-indicator is used.

7.6.2. Computation

$$\text{PLOT\_ROCKALTERATION} = 400 \Rightarrow \text{PLOT\_ROCKALTERATIONCLASS} = 0$$

$$\text{PLOT\_ROCKALTERATION} = 300 \Rightarrow \text{PLOT\_ROCKALTERATIONCLASS} = 1$$

$$\text{PLOT\_ROCKALTERATION} = 200 \Rightarrow \text{PLOT\_ROCKALTERATIONCLASS} = 3$$

$$\text{PLOT\_ROCKALTERATION} = 100 \Rightarrow \text{PLOT\_ROCKALTERATIONCLASS} = 4$$

$$\text{PLOT\_SHRUBHEIGHTBEFORE} \neq 0 \Rightarrow$$

$$\text{PLOT\_SHRUBRELATIVEHEIGHTLOSS} = \left\lfloor \frac{\text{PLOT\_SHRUBHEIGHTBEFORE - PLOT\_SHRUBHEIGHTAFTER}}{\text{PLOT\_SHRUBHEIGHTBEFORE}} \cdot \frac{1}{4} \right\rfloor$$

$$\text{PLOT\_SHRUBHEIGHTBEFORE} = 0 \Rightarrow \text{PLOT\_IND\_V} = \text{PLOT\_ROCKALTERATIONCLASS}$$

$$\text{PLOT\_SHRUBHEIGHTBEFORE} \neq 0 \Rightarrow$$

$$\text{PLOT\_IND\_V} = \left\| \frac{\text{PLOT\_ROCKALTERATIONCLASS} + \text{PLOT\_SHRUBRELATIVEHEIGHTLOSS}}{4} \right\|$$

7.7. Fire Severity Assessment at the Plot Level

7.7.1. Principle

All the indicator values are added.

In the case of woodland, five indicators are used and the result lies between 0 and 16, whereas in case of woodland two indicators are used and the result lies between 0 and 8.

Fire severity for the plot is set as follows:

- Woodland:
  - ° 0   Not burnt   0
  - ° 1 to 5   Lightly burnt   1
  - ° 6 to 10   Moderately burnt   2
  - ° 11 to 15   Heavily burnt   3
  - ° 16 to 20   Very heavily burnt   4

- Shrubland:

°	0	Not burnt	0
°	1 or 2	Lightly burnt	1
°	3 or 4	Moderately burnt	2
°	5 or 6	Heavily burnt	3
°	7 or 8	Very heavily burnt	4

If the field work has shown that the plot was not burnt, no indicator value is available and the fire severity is equal to 0.

No value is computed for plots where the land cover was neither woodland nor shrubland.

7.7.2. Computation

$\text{PLOT\_WOODSHRUB} = 2 \Rightarrow \text{PLOT\_FIRESEVERITYCLASS} = \text{Null}$

$(\text{PLOT\_WOODSHRUB} \in \{0,1\}) \wedge (\text{PLOT\_BURNTNOTBURNT} = 200) \Rightarrow \text{PLOT\_FIRESEVERITYCLASS} = 0$

$\text{PLOT\_FIRESEVERITY} = 0 \Rightarrow \text{PLOT\_FIRESEVERITYCLASS} = 0$

$(\text{PLOT\_WOODSHRUB} = 1) \wedge (\text{PLOT\_FIRESEVERITY} \in [1,5]) \Rightarrow \text{PLOT\_FIRESEVERITYCLASS} = 1$

$(\text{PLOT\_WOODSHRUB} = 1) \wedge (\text{PLOT\_FIRESEVERITY} \in [6,10]) \Rightarrow \text{PLOT\_FIRESEVERITYCLASS} = 2$

$(\text{PLOT\_WOODSHRUB} = 1) \wedge (\text{PLOT\_FIRESEVERITY} \in [11,15]) \Rightarrow \text{PLOT\_FIRESEVERITYCLASS} = 3$

$(\text{PLOT\_WOODSHRUB} = 1) \wedge (\text{PLOT\_FIRESEVERITY} \in [16,20]) \Rightarrow \text{PLOT\_FIRESEVERITYCLASS} = 4$

$(\text{PLOT\_WOODSHRUB} = 0) \wedge (\text{PLOT\_FIRESEVERITY} \in \{1,2\}) \Rightarrow \text{PLOT\_FIRESEVERITYCLASS} = 1$

$(\text{PLOT\_WOODSHRUB} = 0) \wedge (\text{PLOT\_FIRESEVERITY} \in \{3,4\}) \Rightarrow \text{PLOT\_FIRESEVERITYCLASS} = 2$

$(\text{PLOT\_WOODSHRUB} = 0) \wedge (\text{PLOT\_FIRESEVERITY} \in \{5,6\}) \Rightarrow \text{PLOT\_FIRESEVERITYCLASS} = 3$

$(\text{PLOT\_WOODSHRUB} = 0) \wedge (\text{PLOT\_FIRESEVERITY} \in \{7,8\}) \Rightarrow \text{PLOT\_FIRESEVERITYCLASS} = 4$

7.8. Fire Severity Assessment at the Fire Level

7.8.1. Principle

Fire severity at the fire level is defined as the mean value of the plot indicators at the plot level, rounded to the nearest integer.

The plots taken into account are the plots where the land cover before the fire is woodland or shrubland, whether the field work has shown that they were burnt or not.

If the fire perimeter is modified to take into account the information given by the field work, the points which are no longer inside the perimeter should be removed from the database as it is described in the present Manual. It is of course possible to add a table with the data pertaining to these points.

7.8.2. Computation

$$\text{FIRE\_SEVERITY} = \left\| \frac{\sum_{\text{All plots with woodland or shrubland landcover}} \text{PLOT\_FIRESEVERITYCLASS}}{n} \right\|$$

n being the number of plots with woodland or shrubland landcover

8. Other computations

8.1. Fire Sample Distance

The fire sample distance is the size of a side of the sampling grid upon which the sampling network is built. Although it is not computed while processing the field data it is stored in the INCENDIA_COMPUTATIO table. It must be entered when processing the fire data to assess its severity.

8.2. Plot Co-ordinates in the ETRS_1989_LAEA Projection System

Geographic co-ordinates are used as intermediates after the sampling network has been designed on the basis of a local projection system.

Theoretical geographic co-ordinates and actual geographic co-ordinates are stored in the AREAE table.

The latter must be used to compute the co-ordinates in the ETRS_1989_LAEA projection system.

9. Practical Workflow

- Acquiring the fire data from the EFFIS database (can be postponed but a temporary fire identifier must be given)

- Creating the fire in the ForFireS database

- Acquiring the fire perimeter, from the Ispra Joint Research Center or an independent survey

- Entering the fire perimeter into a geographic information system

- Collecting information about vegetation on the burnt area

- Making a decision about stratification and implementing it

- Designing the sampling network

- Deciding which non compulsory data will be collected

- Setting up a crew

- Preparing the equipment

- Entering the sampling point co-ordinates into the GPS receiver

- Carrying out the field work

- Checking the collected data as early as possible to allow for corrections

- Entering the field collected data into the ForFireS database

- Processing the data

- Transferring the results to the Ispra Joint Research Center

10. Equipment for Field Work

GPS receiver
Compass
Graduated tape for measuring distances (at least 20 m)
Pole (1.5 m or 2 m)
Machete, clearing knife
Pruning saw
Drawing-pins or stapler
Reusable numbered tags
Clinometer
Forest calliper
Graduated tape for measuring diameters
Hypsometer (Vertex, Blume-Leiss, Suunto)
Forest flora
Sampling forms
Clipboard
Pencils, eraser

11. Database Queries

The name of each query as it appears on the application main window is written above the query.

11.1. Distinction between Forest and Shrubland

PLOT_WOODSHRUB

UPDATE (AREAE INNER JOIN Fire_being_processed ON
AREAE.FIRE_ID = Fire_being_processed.FIRE_ID) INNER JOIN AREAE_COMPUTATIO ON
(AREAE.PLOT_ID = AREAE_COMPUTATIO.PLOT_ID) AND
(AREAE.FIRE_ID = AREAE_COMPUTATIO.FIRE_ID)
SET AREAE_COMPUTATIO.PLOT_WOODSHRUB =
IIf(AREAE.PLOT_LANDCOVER=200,0,IIf(AREAE.PLOT_LANDCOVER=100,1,2))
WHERE (((AREAE.FIRE_ID)=Fire_being_processed.FIRE_ID));

11.2. Indicator I – Relative burnt volume

11.2.1. Setting the rate of stem destruction for each tree

TREE_DETAILEDBURNTSTEM

UPDATE ARBORES INNER JOIN (ARBORES_COMPUTATIO INNER JOIN Fire_being_processed ON
ARBORES_COMPUTATIO.FIRE_ID = Fire_being_processed.FIRE_ID) ON
(ARBORES.TREE_NR = ARBORES_COMPUTATIO.TREE_NR) AND
(ARBORES.PLOT_ID = ARBORES_COMPUTATIO.PLOT_ID) AND
(ARBORES.FIRE_ID = ARBORES_COMPUTATIO.FIRE_ID)
SET ARBORES_COMPUTATIO.TREE_DETAILEDBURNTSTEM =
IIf(ARBORES.TREE_CHARHEIGHT=0,0,ARBORES.TREE_BURNTSTEM/100)
WHERE (((ARBORES.FIRE_ID)=Fire_being_processed.FIRE_ID));

11.2.2. Computing and recording the relative burnt volume for the plot

Compute_relative_burnt_volume

SELECT ARBORES.FIRE_ID, ARBORES_COMPUTATIO.PLOT_ID,
Sum(ARBORES.TREE_DIAMETER*ARBORES.TREE_DIAMETER*
ARBORES_COMPUTATIO.TREE_DETAILEDBURNTSTEM)/
Sum(ARBORES.TREE_DIAMETER*ARBORES.TREE_DIAMETER) AS Relative_burnt_volume INTO
Relative_burnt_volume
FROM (ARBORES INNER JOIN Fire_being_processed ON
ARBORES.FIRE_ID = Fire_being_processed.FIRE_ID) INNER JOIN ARBORES_COMPUTATIO ON
(ARBORES.TREE_NR = ARBORES_COMPUTATIO.TREE_NR) AND
(ARBORES.PLOT_ID = ARBORES_COMPUTATIO.PLOT_ID) AND
(ARBORES.FIRE_ID = ARBORES_COMPUTATIO.FIRE_ID)
WHERE (((ARBORES.FIRE_ID)=Fire_being_processed.FIRE_ID))
GROUP BY ARBORES.FIRE_ID, ARBORES_COMPUTATIO.PLOT_ID;

PLOT_RBV

UPDATE AREAE_COMPUTATIO INNER JOIN Relative_burnt_volume ON
(AREAE_COMPUTATIO.PLOT_ID = Relative_burnt_volume.PLOT_ID) AND
(AREAE_COMPUTATIO.FIRE_ID = Relative_burnt_volume.FIRE_ID)
SET AREAE_COMPUTATIO.PLOT_RBV = Relative_burnt_volume.Relative_burnt_volume;

11.2.3. Computing and recording Indicator I
PLOT_IND_I

UPDATE AREAE INNER JOIN (Fire_being_processed INNER JOIN AREAE_COMPUTATIO ON
Fire_being_processed.FIRE_ID = AREAE_COMPUTATIO.FIRE_ID) ON
(AREAE.PLOT_ID = AREAE_COMPUTATIO.PLOT_ID) AND
(AREAE.FIRE_ID = AREAE_COMPUTATIO.FIRE_ID) AND
(AREAE.FIRE_ID = Fire_being_processed.FIRE_ID)
SET AREAE_COMPUTATIO.PLOT_IND_I =
IIf(AREAE.PLOT_LOGGINGRATE=100,2,
IIf(AREAE_COMPUTATIO.PLOT_RBV Is Null,Null,
IIf(AREAE_COMPUTATIO.PLOT_RBV<0.605,0,
IIf(AREAE_COMPUTATIO.PLOT_RBV<1.205,1,
IIf(AREAE_COMPUTATIO.PLOT_RBV<1.805,2,
IIf(AREAE_COMPUTATIO.PLOT_RBV<2.405,3,4))))))
WHERE (((AREAE_COMPUTATIO.FIRE_ID)=Fire_being_processed.FIRE_ID));

11.2.4. Computing the gross volume of each tree
TREE_GROSSVOLUME

UPDATE (ARBORES INNER JOIN Fire_being_processed ON
ARBORES.FIRE_ID = Fire_being_processed.FIRE_ID) INNER JOIN ARBORES_COMPUTATIO ON
(ARBORES.TREE_NR = ARBORES_COMPUTATIO.TREE_NR) AND
(ARBORES.PLOT_ID = ARBORES_COMPUTATIO.PLOT_ID) AND
(ARBORES.FIRE_ID = ARBORES_COMPUTATIO.FIRE_ID)
SET ARBORES_COMPUTATIO.TREE_GROSSVOLUME =
IIf(ARBORES.TREE_HEIGHT<>999,
3.14159*ARBORES.TREE_DIAMETER*ARBORES.TREE_DIAMETER*ARBORES.TREE_HEIGHT/1200000,
3.14159*ARBORES.TREE_DIAMETER*ARBORES.TREE_DIAMETER*50/1200000)
WHERE (((ARBORES.FIRE_ID)=Fire_being_processed.FIRE_ID));

11.2.5. Counting and recording unburnt trees
Count_unburnt_trees

SELECT ARBORES.FIRE_ID, ARBORES.PLOT_ID, Count(ARBORES.TREE_NR) AS Compte
INTO Unburnt_trees
FROM Fire_being_processed INNER JOIN ARBORES ON
Fire_being_processed.FIRE_ID=ARBORES.FIRE_ID
WHERE (((ARBORES.TREE_CHARHEIGHT)=0) AND
((ARBORES.FIRE_ID)=Fire_being_processed.FIRE_ID))
GROUP BY ARBORES.FIRE_ID, ARBORES.PLOT_ID;

PLOT_NBUBT

UPDATE AREAE_COMPUTATIO INNER JOIN Unburnt_trees ON
(AREAE_COMPUTATIO.PLOT_ID=Unburnt_trees.PLOT_ID) AND
(AREAE_COMPUTATIO.FIRE_ID=Unburnt_trees.FIRE_ID)
SET AREAE_COMPUTATIO.PLOT_NBUBT = Unburnt_trees.Compte;

11.2.6. Counting and recording burnt trees

Count_burnt_trees

SELECT ARBORES.FIRE_ID, ARBORES.PLOT_ID, Count(ARBORES.TREE_NR) AS Compte
INTO Burnt_trees
FROM Fire_being_processed INNER JOIN ARBORES ON
Fire_being_processed.FIRE_ID=ARBORES.FIRE_ID
WHERE (((ARBORES.TREE_CHARHEIGHT)<>0) AND
((ARBORES.FIRE_ID)=Fire_being_processed.FIRE_ID))
GROUP BY ARBORES.FIRE_ID, ARBORES.PLOT_ID;

PLOT_NBBT

UPDATE AREAE_COMPUTATIO INNER JOIN Burnt_trees ON
(AREAE_COMPUTATIO.PLOT_ID=Burnt_trees.PLOT_ID) AND
(AREAE_COMPUTATIO.FIRE_ID=Burnt_trees.FIRE_ID)
SET AREAE_COMPUTATIO.PLOT_NBBT = Burnt_trees.Compte;

11.2.7. Recording the total number of trees

PLOT_NBT

UPDATE Fire_being_processed INNER JOIN AREAE_COMPUTATIO ON
Fire_being_processed.FIRE_ID = AREAE_COMPUTATIO.FIRE_ID
SET AREAE_COMPUTATIO.PLOT_NBT =
AREAE_COMPUTATIO.PLOT_NBUBT+AREAE_COMPUTATIO.PLOT_NBBT
WHERE (((AREAE_COMPUTATIO.FIRE_ID)=Fire_being_processed.FIRE_ID));

11.2.8. Computing the weight of each tree

PLOT_TREEWEIGHT

UPDATE AREAE INNER JOIN (AREAE_COMPUTATIO INNER JOIN Fire_being_processed ON
AREAE_COMPUTATIO.FIRE_ID = Fire_being_processed.FIRE_ID) ON
(AREAE.PLOT_ID = AREAE_COMPUTATIO.PLOT_ID) AND
(AREAE.FIRE_ID = AREAE_COMPUTATIO.FIRE_ID)
SET AREAE_COMPUTATIO.PLOT_TREEWEIGHT = IIf(AREAE_COMPUTATIO.PLOT_NBBT<>0,
AREAE.PLOT_LEFTSTEMS/AREAE_COMPUTATIO.PLOT_NBBT,Null)
WHERE (((AREAE.FIRE_ID)=Fire_being_processed.FIRE_ID));

11.2.9. Computing and recording the gross volume on the plot after the fire

Compute_sum_tree_gross_volume

SELECT ARBORES_COMPUTATIO.FIRE_ID, ARBORES_COMPUTATIO.PLOT_ID,
Sum(ARBORES_COMPUTATIO.TREE_GROSSVOLUME) AS Gross_volume INTO Gross_volume
FROM Fire_being_processed INNER JOIN ARBORES_COMPUTATIO ON
Fire_being_processed.FIRE_ID = ARBORES_COMPUTATIO.FIRE_ID
WHERE (((ARBORES_COMPUTATIO.FIRE_ID)=Fire_being_processed.FIRE_ID))
GROUP BY ARBORES_COMPUTATIO.FIRE_ID, ARBORES_COMPUTATIO.PLOT_ID;

PLOT_GROSSVOLUMEAFTER

UPDATE AREAE_COMPUTATIO INNER JOIN Gross_volume ON
(AREAE_COMPUTATIO.FIRE_ID = Gross_volume.FIRE_ID) AND
(AREAE_COMPUTATIO.PLOT_ID = Gross_volume.PLOT_ID)
SET AREAE_COMPUTATIO.PLOT_GROSSVOLUMEAFTER =
AREAE_COMPUTATIO.PLOT_TREEWEIGHT*Gross_volume.Gross_volume;

11.2.10. Computing and recording the gross volume on the plot before the fire
PLOT_GROSSVOLUMEBEFORE

UPDATE AREAE INNER JOIN (AREAE_COMPUTATIO INNER JOIN Fire_being_processed ON
AREAE_COMPUTATIO.FIRE_ID = Fire_being_processed.FIRE_ID) ON
(AREAE.PLOT_ID = AREAE_COMPUTATIO.PLOT_ID) AND
(AREAE.FIRE_ID = AREAE_COMPUTATIO.FIRE_ID)
SET AREAE_COMPUTATIO.PLOT_GROSSVOLUMEBEFORE =
IIf(AREAE.PLOT_LOGGINGRATE<>100,
AREAE_COMPUTATIO.PLOT_GROSSVOLUMEAFTER/(1-AREAE.PLOT_LOGGINGRATE/100),
Null)
WHERE (((AREAE.FIRE_ID)=Fire_being_processed.FIRE_ID));

11.3. Indicator II – One year survival probability of trees

11.3.1. Computing the survival probability of each tree
TREE_SURVIVAL

UPDATE (ARBORES INNER JOIN Fire_being_processed ON
ARBORES.FIRE_ID = Fire_being_processed.FIRE_ID) INNER JOIN ARBORES_COMPUTATIO ON
(ARBORES.TREE_NR = ARBORES_COMPUTATIO.TREE_NR) AND
(ARBORES.PLOT_ID = ARBORES_COMPUTATIO.PLOT_ID) AND
(ARBORES.FIRE_ID = ARBORES_COMPUTATIO.FIRE_ID)
SET ARBORES_COMPUTATIO.TREE_SURVIVAL =
IIf(ARBORES.TREE_STATE=200,4,
IIf(ARBORES.TREE_BURNTCROWN<21,0,
IIf(ARBORES.TREE_BURNTCROWN<41,1,
IIf(ARBORES.TREE_BURNTCROWN<61,2,
IIf(ARBORES.TREE_BURNTCROWN<81,3,4)))))
WHERE (((ARBORES.FIRE_ID)=Fire_being_processed.FIRE_ID));

11.3.2. Computing and recording Indicator II
Compute_plot_survival

SELECT ARBORES_COMPUTATIO.FIRE_ID, ARBORES_COMPUTATIO.PLOT_ID,
Round(Avg(ARBORES_COMPUTATIO.TREE_SURVIVAL)) AS Plot_survival INTO Plot_survival
FROM Fire_being_processed INNER JOIN ARBORES_COMPUTATIO ON
Fire_being_processed.FIRE_ID = ARBORES_COMPUTATIO.FIRE_ID
WHERE (((ARBORES_COMPUTATIO.FIRE_ID)=Fire_being_processed.FIRE_ID))
GROUP BY ARBORES_COMPUTATIO.FIRE_ID, ARBORES_COMPUTATIO.PLOT_ID;

PLOT_IND_II

UPDATE (FIRE_BEING_PROCESSED INNER JOIN AREAE ON
FIRE_BEING_PROCESSED.FIRE_ID = AREAE.FIRE_ID)
INNER JOIN (AREAE_COMPUTATIO LEFT JOIN Plot_survival ON
(AREAE_COMPUTATIO.PLOT_ID = Plot_survival.PLOT_ID) AND
(AREAE_COMPUTATIO.FIRE_ID = Plot_survival.FIRE_ID)) ON
(AREAE.PLOT_ID = AREAE_COMPUTATIO.PLOT_ID) AND
(AREAE.FIRE_ID = AREAE_COMPUTATIO.FIRE_ID)
SET AREAE_COMPUTATIO.PLOT_IND_II =
IIf(AREAE.PLOT_LOGGINGRATE=100,4,Plot_survival.Plot_survival);

11.4. Indicator III – Importance of regeneration

11.4.1. Computing and recording a theoretical number of seedlings on the subplot
Compute_plot_seedling

SELECT REGENERATIO.FIRE_ID, REGENERATIO.PLOT_ID,
Int(Sum(Regeneration_Conversion.REG_NUMBER)) AS Plot_seedling INTO Plot_seedling_number
FROM (REGENERATIO INNER JOIN Fire_being_processed ON
REGENERATIO.FIRE_ID = Fire_being_processed.FIRE_ID) INNER JOIN Regeneration_Conversion ON
REGENERATIO.REG_NUMBERCLASS = Regeneration_Conversion.REG_NUMBERCLASS
WHERE (((REGENERATIO.FIRE_ID)=Fire_being_processed.FIRE_ID))
GROUP BY REGENERATIO.FIRE_ID, REGENERATIO.PLOT_ID;

PLOT_SEEDLING

UPDATE AREAE_COMPUTATIO INNER JOIN Plot_seedling_number ON
(AREAE_COMPUTATIO.FIRE_ID = Plot_seedling_number.FIRE_ID) AND
(AREAE_COMPUTATIO.PLOT_ID = Plot_seedling_number.PLOT_ID)
SET AREAE_COMPUTATIO.PLOT_SEEDLING = Plot_seedling_number.Plot_seedling;

11.4.2. Computing and recording Indicator III
PLOT_IND_III

UPDATE AREAE INNER JOIN (Fire_being_processed INNER JOIN AREAE_COMPUTATIO ON
Fire_being_processed.FIRE_ID = AREAE_COMPUTATIO.FIRE_ID) ON
(AREAE.PLOT_ID = AREAE_COMPUTATIO.PLOT_ID) AND
(AREAE.FIRE_ID = AREAE_COMPUTATIO.FIRE_ID) AND
(AREAE.FIRE_ID = Fire_being_processed.FIRE_ID)
SET AREAE_COMPUTATIO.PLOT_IND_III =
IIf(AREAE_COMPUTATIO.PLOT_WOODSHRUB=0,Null,
IIf(AREAE_COMPUTATIO.PLOT_WOODSHRUB=2,Null,
IIf(AREAE_COMPUTATIO.PLOT_SEEDLING Is Null,4,
IIf(AREAE_COMPUTATIO.PLOT_SEEDLING<2,4,
IIf(AREAE_COMPUTATIO.PLOT_SEEDLING<4,3,
IIf(AREAE_COMPUTATIO.PLOT_SEEDLING<6,2,
IIf(AREAE_COMPUTATIO.PLOT_SEEDLING<8,1,0)))))))
WHERE (((AREAE_COMPUTATIO.FIRE_ID)=Fire_being_processed.FIRE_ID) AND
((AREAE.PLOT_BURNTNOTBURNT)=100));

11.5. Indicator IV – Erosion aggravation risk

11.5.1. Computing and recording the plot ligneous cover rate loss
PLOT_LIGNEOUSCOVERLOSS

UPDATE AREAE INNER JOIN (AREAE_COMPUTATIO INNER JOIN Fire_being_processed ON
AREAE_COMPUTATIO.FIRE_ID = Fire_being_processed.FIRE_ID) ON
(AREAE.PLOT_ID = AREAE_COMPUTATIO.PLOT_ID) AND
(AREAE.FIRE_ID = AREAE_COMPUTATIO.FIRE_ID)
SET AREAE_COMPUTATIO.PLOT_LIGNEOUSCOVERLOSS =
IIf(AREAE_COMPUTATIO.PLOT_WOODSHRUB=2,Null,
AREAE.PLOT_LIGNEOUSCOVERBEFORE-AREAE.PLOT_LIGNEOUSCOVERAFTER)
WHERE (((AREAE.FIRE_ID)=Fire_being_processed.FIRE_ID));

11.5.2. Computing and recording the plot ligneous cover rate loss class
PLOT_LIGNEOUSCOVERLOSSCLASS

UPDATE AREAE_COMPUTATIO INNER JOIN Fire_being_processed ON
AREAE_COMPUTATIO.FIRE_ID = Fire_being_processed.FIRE_ID
SET AREAE_COMPUTATIO.PLOT_LIGNEOUSCOVERLOSSCLASS =
IIf(AREAE_COMPUTATIO.PLOT_WOODSHRUB=2,Null,
IIf(AREAE_COMPUTATIO.PLOT_LIGNEOUSCOVERLOSS<21,0,
IIf(AREAE_COMPUTATIO.PLOT_LIGNEOUSCOVERLOSS<41,2,
IIf(AREAE_COMPUTATIO.PLOT_LIGNEOUSCOVERLOSS<61,4,6))))
WHERE (((AREAE_COMPUTATIO.FIRE_ID)=Fire_being_processed.FIRE_ID));

11.5.3. Computing and recording the erosion sub-indicator value
PLOT_EROSION

UPDATE AREAE INNER JOIN (AREAE_COMPUTATIO INNER JOIN Fire_being_processed ON
AREAE_COMPUTATIO.FIRE_ID = Fire_being_processed.FIRE_ID) ON
(AREAE.PLOT_ID = AREAE_COMPUTATIO.PLOT_ID) AND
(AREAE.FIRE_ID = AREAE_COMPUTATIO.FIRE_ID)
SET AREAE_COMPUTATIO.PLOT_EROSIONSEVERITYCLASS =
IIf(AREAE.PLOT_EROSIONSEVERITY=400,0,
IIf(AREAE.PLOT_EROSIONSEVERITY=100,1,
IIf(AREAE.PLOT_EROSIONSEVERITY=200,2,
IIf(AREAE.PLOT_EROSIONSEVERITY=300,3,Null)))),
AREAE_COMPUTATIO.PLOT_EROSIONAGGRAVATIONCLASS =
IIf(AREAE.PLOT_EROSIONAGGRAVATION=100,0,
IIf(AREAE.PLOT_EROSIONAGGRAVATION=200,3,Null)),
AREAE_COMPUTATIO.PLOT_SLOPECLASS =
IIf(AREAE.PLOT_SLOPE=999,Null,
IIf(AREAE.PLOT_SLOPE<11,0,IIf(AREAE.PLOT_SLOPE<21,1,
IIf(AREAE.PLOT_SLOPE<31,2,IIf(AREAE.PLOT_SLOPE<41,3,4)))))
WHERE (((AREAE.FIRE_ID)=Fire_being_processed.FIRE_ID) AND
((AREAE.PLOT_BURNTNOTBURNT)=100) AND ((AREAE_COMPUTATIO.PLOT_WOODSHRUB)=0
OR (AREAE_COMPUTATIO.PLOT_WOODSHRUB)=1));

11.5.4. Computing and recording Indicator IV
PLOT_IND_IV_L

UPDATE AREAE_COMPUTATIO INNER JOIN FIRE_BEING_PROCESSED ON
AREAE_COMPUTATIO.FIRE_ID = FIRE_BEING_PROCESSED.FIRE_ID
SET AREAE_COMPUTATIO.PLOT_IND_IV =
Round((AREAE_COMPUTATIO.PLOT_LIGNEOUSCOVERLOSSCLASS+
AREAE_COMPUTATIO.PLOT_EROSIONSEVERITYCLASS+
AREAE_COMPUTATIO.PLOT_EROSIONAGGRAVATIONCLASS+
AREAE_COMPUTATIO.PLOT_SLOPECLASS)/4)
WHERE (((AREAE_COMPUTATIO.FIRE_ID)=FIRE_BEING_PROCESSED.FIRE_ID));

11.5.5. Computing and recording the plot tree cover rate loss
PLOT_TREECOVERLOSS

UPDATE AREAE INNER JOIN (AREAE_COMPUTATIO INNER JOIN Fire_being_processed ON
AREAE_COMPUTATIO.FIRE_ID = Fire_being_processed.FIRE_ID) ON
(AREAE.PLOT_ID = AREAE_COMPUTATIO.PLOT_ID) AND
(AREAE.FIRE_ID = AREAE_COMPUTATIO.FIRE_ID)
SET AREAE_COMPUTATIO.PLOT_TREECOVERLOSS =
IIf(AREAE_COMPUTATIO.PLOT_WOODSHRUB=1,
AREAE.PLOT_TREECOVERBEFORE-AREAE.PLOT_TREECOVERAFTER,Null)
WHERE (((AREAE.FIRE_ID)=Fire_being_processed.FIRE_ID));

11.5.6. Computing and recording the plot tree cover rate loss class
PLOT_TREECOVERLOSSCLASS

UPDATE Fire_being_processed INNER JOIN AREAE_COMPUTATIO ON
Fire_being_processed.FIRE_ID = AREAE_COMPUTATIO.FIRE_ID
SET AREAE_COMPUTATIO.PLOT_TREECOVERLOSSCLASS =
IIf(AREAE_COMPUTATIO.PLOT_TREECOVERLOSS Is Null,0,
IIf(AREAE_COMPUTATIO.PLOT_TREECOVERLOSS<21,0,
IIf(AREAE_COMPUTATIO.PLOT_TREECOVERLOSS<41,1,
IIf(AREAE_COMPUTATIO.PLOT_TREECOVERLOSS<61,2,3))))
WHERE (((AREAE_COMPUTATIO.FIRE_ID)=Fire_being_processed.FIRE_ID));

11.5.7. Computing and recording the plot shrub cover rate loss
PLOT_SHRUBCOVERLOSS

UPDATE AREAE INNER JOIN (AREAE_COMPUTATIO INNER JOIN Fire_being_processed ON
AREAE_COMPUTATIO.FIRE_ID = Fire_being_processed.FIRE_ID) ON
(AREAE.PLOT_ID = AREAE_COMPUTATIO.PLOT_ID) AND
(AREAE.FIRE_ID = AREAE_COMPUTATIO.FIRE_ID)
SET AREAE_COMPUTATIO.PLOT_SHRUBCOVERLOSS =
IIf(AREAE_COMPUTATIO.PLOT_WOODSHRUB=2,Null,
AREAE.PLOT_SHRUBCOVERBEFORE-AREAE.PLOT_SHRUBCOVERAFTER)
WHERE (((AREAE.FIRE_ID)=Fire_being_processed.FIRE_ID));

11.5.8. Computing and recording the plot shrub cover rate loss class
PLOT_SHRUBCOVERLOSSCLASS

UPDATE AREAE_COMPUTATIO INNER JOIN Fire_being_processed ON
AREAE_COMPUTATIO.FIRE_ID = Fire_being_processed.FIRE_ID
SET AREAE_COMPUTATIO.PLOT_SHRUBCOVERLOSSCLASS =
IIf(AREAE_COMPUTATIO.PLOT_WOODSHRUB=2,Null,
IIf(AREAE_COMPUTATIO.PLOT_WOODSHRUB=1,
IIf(AREAE_COMPUTATIO.PLOT_SHRUBCOVERLOSS<21,0,
IIf(AREAE_COMPUTATIO.PLOT_SHRUBCOVERLOSS<41,1,
IIf(AREAE_COMPUTATIO.PLOT_SHRUBCOVERLOSS<61,2,3))),
IIf(AREAE_COMPUTATIO.PLOT_SHRUBCOVERLOSS<21,0,
IIf(AREAE_COMPUTATIO.PLOT_SHRUBCOVERLOSS<41,2,
IIf(AREAE_COMPUTATIO.PLOT_SHRUBCOVERLOSS<61,4,6)))))
WHERE (((AREAE_COMPUTATIO.FIRE_ID)=Fire_being_processed.FIRE_ID));

11.5.9. Computing and recording Indicator IV from tree and shrub cover losses (not used)
PLOT_IND_IV_TS

UPDATE AREAE_COMPUTATIO INNER JOIN FIRE_BEING_PROCESSED ON
AREAE_COMPUTATIO.FIRE_ID = FIRE_BEING_PROCESSED.FIRE_ID
SET AREAE_COMPUTATIO.PLOT_IND_IV =
Round((AREAE_COMPUTATIO.PLOT_TREECOVERLOSSCLASS+
AREAE_COMPUTATIO.PLOT_SHRUBCOVERLOSSCLASS+
AREAE_COMPUTATIO.PLOT_EROSIONSEVERITYCLASS+
AREAE_COMPUTATIO.PLOT_EROSIONAGGRAVATIONCLASS+
AREAE_COMPUTATIO.PLOT_SLOPECLASS)/4)
WHERE (((AREAE_COMPUTATIO.FIRE_ID)=FIRE_BEING_PROCESSED.FIRE_ID));

11.6. Indicator V – Fire intensity

11.6.1. Computing and recording the plot rock alteration and shrub height loss indexes
PLOT_FIRE_INTENSITY

UPDATE AREAE INNER JOIN (AREAE_COMPUTATIO INNER JOIN Fire_being_processed ON
AREAE_COMPUTATIO.FIRE_ID = Fire_being_processed.FIRE_ID) ON
(AREAE.PLOT_ID = AREAE_COMPUTATIO.PLOT_ID) AND
(AREAE.FIRE_ID = AREAE_COMPUTATIO.FIRE_ID)
SET AREAE_COMPUTATIO.PLOT_ROCKALTERATIONCLASS =
IIf(AREAE.PLOT_ROCKALTERATION=400,0,
IIf(AREAE.PLOT_ROCKALTERATION=100,4,
IIf(AREAE.PLOT_ROCKALTERATION=200,3,
IIf(AREAE.PLOT_ROCKALTERATION=300,1,Null)))),
AREAE_COMPUTATIO.PLOT_SHRUBRELATIVEHEIGHTLOSS =
IIf((AREAE.PLOT_SHRUBHEIGHTBEFORE Is Null) OR (AREAE.PLOT_SHRUBHEIGHTBEFORE=0)
OR (AREAE.PLOT_SHRUBHEIGHTBEFORE=999),Null,
Fix((AREAE.PLOT_SHRUBHEIGHTBEFORE-AREAE.PLOT_SHRUBHEIGHTAFTER)/
AREAE.PLOT_SHRUBHEIGHTBEFORE*4))
WHERE (((AREAE.FIRE_ID)=Fire_being_processed.FIRE_ID) AND
((AREAE.PLOT_BURNTNOTBURNT)=100));

11.6.2. Computing and recording Indicator V
PLOT_IND_V

UPDATE AREAE INNER JOIN (AREAE_COMPUTATIO INNER JOIN Fire_being_processed ON
AREAE_COMPUTATIO.FIRE_ID = Fire_being_processed.FIRE_ID) ON
(AREAE.PLOT_ID = AREAE_COMPUTATIO.PLOT_ID) AND
(AREAE.FIRE_ID = AREAE_COMPUTATIO.FIRE_ID) AND
(AREAE.FIRE_ID = Fire_being_processed.FIRE_ID)
SET AREAE_COMPUTATIO.PLOT_IND_V =
IIf(AREAE_COMPUTATIO.PLOT_SHRUBRELATIVEHEIGHTLOSS Is Null,
AREAE_COMPUTATIO.PLOT_ROCKALTERATIONCLASS,
Round((AREAE_COMPUTATIO.PLOT_ROCKALTERATIONCLASS+
AREAE_COMPUTATIO.PLOT_SHRUBRELATIVEHEIGHTLOSS)/2))
WHERE (((AREAE_COMPUTATIO.FIRE_ID)=Fire_being_processed.FIRE_ID) AND
((AREAE.PLOT_BURNTNOTBURNT)=100));

11.7. Fire Severity Assessment at the Plot Level

PLOT_FIRESEVERITY

UPDATE AREAE_COMPUTATIO INNER JOIN Fire_being_processed ON
AREAE_COMPUTATIO.FIRE_ID = Fire_being_processed.FIRE_ID
SET AREAE_COMPUTATIO.PLOT_FIRESEVERITY =
IIf(AREAE_COMPUTATIO.PLOT_WOODSHRUB<>2,
(IIf(AREAE_COMPUTATIO.PLOT_IND_I Is Not Null,AREAE_COMPUTATIO.PLOT_IND_I,0)+
IIf(AREAE_COMPUTATIO.PLOT_IND_II Is Not Null,AREAE_COMPUTATIO.PLOT_IND_II,0)+
IIf(AREAE_COMPUTATIO.PLOT_IND_III Is Not Null,AREAE_COMPUTATIO.PLOT_IND_III,0)+
IIf(AREAE_COMPUTATIO.PLOT_IND_IV Is Not Null,AREAE_COMPUTATIO.PLOT_IND_IV,0)+
IIf(AREAE_COMPUTATIO.PLOT_IND_V Is Not Null,AREAE_COMPUTATIO.PLOT_IND_V,0)),
Null)
WHERE ((AREAE_COMPUTATIO.FIRE_ID)=Fire_being_processed.FIRE_ID);

PLOT_FIRESEVERITYCLASS

UPDATE AREAE_COMPUTATIO INNER JOIN Fire_being_processed ON
AREAE_COMPUTATIO.FIRE_ID = Fire_being_processed.FIRE_ID
SET AREAE_COMPUTATIO.PLOT_FIRESEVERITYCLASS =
IIf(AREAE_COMPUTATIO.PLOT_WOODSHRUB=2,Null,
(IIf(AREAE_COMPUTATIO.PLOT_WOODSHRUB=0,
IIf(AREAE_COMPUTATIO.PLOT_FIRESEVERITY>6,4,
IIf(AREAE_COMPUTATIO.PLOT_FIRESEVERITY>4,3,
IIf(AREAE_COMPUTATIO.PLOT_FIRESEVERITY>2,2,
IIf(AREAE_COMPUTATIO.PLOT_FIRESEVERITY>0,1,0)))),
IIf(AREAE_COMPUTATIO.PLOT_FIRESEVERITY>15,4,
IIf(AREAE_COMPUTATIO.PLOT_FIRESEVERITY>10,3,
IIf(AREAE_COMPUTATIO.PLOT_FIRESEVERITY>5,2,
IIf(AREAE_COMPUTATIO.PLOT_FIRESEVERITY>0,1,0)))))))
WHERE ((AREAE_COMPUTATIO.FIRE_ID)=Fire_being_processed.FIRE_ID);

11.8. Fire Severity Assessment at the Fire Level

11.8.1. Computing the mean value of the plot fire severity indicators

Compute_incendium_severity

SELECT Fire_being_processed.FIRE_ID,
Round(Avg(AREAE_COMPUTATIO.PLOT_FIRESEVERITYCLASS)) AS Incendium_severity INTO
Incendium_severity
FROM AREAE INNER JOIN (Fire_being_processed INNER JOIN AREAE_COMPUTATIO ON
Fire_being_processed.FIRE_ID = AREAE_COMPUTATIO.FIRE_ID) ON
(AREAE.PLOT_ID = AREAE_COMPUTATIO.PLOT_ID) AND
(AREAE.FIRE_ID = AREAE_COMPUTATIO.FIRE_ID) AND
(AREAE.FIRE_ID = Fire_being_processed.FIRE_ID)
WHERE (((AREAE.PLOT_LANDCOVER)=100 OR (AREAE.PLOT_LANDCOVER)=200))
GROUP BY Fire_being_processed.FIRE_ID;

11.8.2. Recording the fire severity indicator

INCENDIA_SEVERITY

UPDATE INCENDIA_COMPUTATIO INNER JOIN Incendium_severity ON
INCENDIA_COMPUTATIO.FIRE_ID = Incendium_severity.FIRE_ID
SET INCENDIA_COMPUTATIO.FIRE_SEVERITY = Incendium_severity.Incendium_severity;