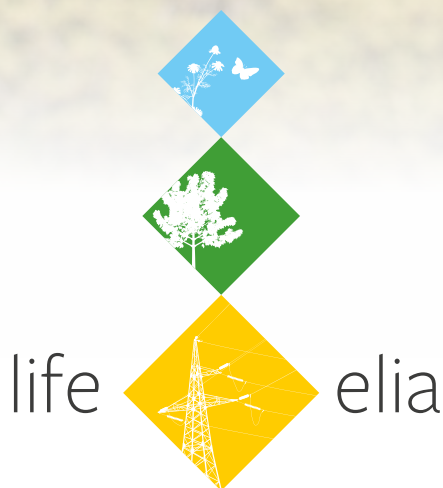


Brochure 01/10

‘Vegetation’ mapping of powerline corridors in forests



More information on:

www.life-elia.eu





The LIFE ELIA project is co-financed by the European Union's LIFE+ programme

LIFE-ELIA

Using electricity transmission network routes as active vectors for positive developments in biodiversity

EC Reference

LIFE10 NAT/BE/709

General Coordination

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Partenaires



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The purpose of the technical brochure presented here is to describe the tools set up specially for the LIFE-ELIA project.

We shall nevertheless endeavour to present them in such a way that they can be used by any power-transmission company in Europe who would like to incorporate one or other of these approaches into the management of its network and the active development of biodiversity in forest corridors created by the footprint of its high-tension lines.

The aims of integrated mapping

The mapping tool needs to provide a fully integrated perspective by making available to the project company the maximum amount of information, which it will be possible to cross-reference, during all of the following operations:

- Precise line location (line reference, siting and number of pylons, etc.),
- Line maintenance,
- Identification of the sections of corridors to be enlarged so as to ensure cable security
- Routine management of vegetation,
- Contact with landowners, site managers and other rural stakeholders,
- Analysis of natural habitats and species habitats (N2000)¹,
- Location of areas with nature-protection status,
- Tools to assist in decisions to manage or restore natural habitats,
- Setting up the monitoring of indicators (economic and biological),
- Etc.

1 Natura 2000

The Natura 2000 network is a group of natural or semi-natural sites within the European Union which are of high heritage value, due to the exceptional fauna and flora they contain. It is based on two European Directives: the Habitats Directive (92/43/EEC) and the Birds Directive (2009/147/EC)

The objective of Natura 2000 is to maintain and even restore biological diversity at sites, while taking account of economic, social, cultural and regional requirements in order to ensure sustainable development. The conservation of protected areas and of biodiversity also offers long-term economic benefit.

Setting up the mapping tool

The initial requirement is to understand and interpret the expectations of future users, who are those managing the natural environment (respect for or promotion of biodiversity), while not forgetting power companies (network security and continuity of power supplies) as well as landowners and site managers affected by the presence of forest corridors created by high-tension lines.

2.1. The mapping data used:

Setting up a relevant and objective mapping tool relies on a survey of the geographical data already available or which need to be created. Its purpose is to summarise those geographical data which are:

- freely available,
- charged for or subject to limited use,
- generated by the software used by the project team.

We will not discuss here the data available in each of the Member States. It would not actually be practicable to cover in this document all of the data available within European countries outside Belgium that can be used by power companies with a concern for managing their networks sustainably. It is better here to describe an applied methodology using the tools appropriate to one region but which can undoubtedly be widely employed elsewhere in terms of an action strategy.

2.1.1 Freely available data:

The examples of available data shown in the table below are data which may be downloaded free of charge, via the internet site stated, together with links to WMS ² servers which enable high-quality mapping data, like the georeferenced aerial photographs in Wallonia, known as PPNC’s ³, to be displayed.

Type of data	Description	Internet link
Download	Couche Natura 2000	http://environnement.wallonie.be/cartosig/telechargement/NATURA2000_DIFFUSION_BASE_MARS2010.zip
WMS server	PPNC 2002	http://cartopro1.wallonie.be/WMS/com.esri.wms.Esrimap/PPNC
	PPNC 2009	http://geoservices.wallonie.be/arcgis/services/IMAGERIE/ORTHO_2009_2010/MapServer/WMSServer
	IGN 1:10000	http://cartocit2.wallonie.be/arcgis/services/INFRASIG/ORTHOS_2009_2010/MapServer/WMSServer
	IGN 1:50000	http://www.ngi.be/testbed/wms/top10r_l72_fr http://www.ngi.be/testbed/wms/top50r_l72_fr

The Wallonian civil-service WMS server makes available recent aerial photos (2009-2010) accurate to between 1.6 and 3.2 metres. The accuracy of the information obtained can only be evaluated using an SIG [*Système d’Information Géographique* – Geographic Information System] interface which illustrates the importance of this type of data in assessing the natural habitats present prior to confirmation by a field visit.

2 WMS

Or Web Map Service is a data exchange protocol enabling maps to be obtained from various data servers. A WMS is a service available on the Internet which allows client software (such as QGIS) to display files and/or images containing a geographical component, the files for which reside on one or more remote WMS servers. That enables a network of mapping servers to be set up, from which users or clients can construct interactive maps. A WMS service is used to send back an image that can be displayed on a computer screen. The server will make it possible to use maps in image formats such as JPEG or GIF

3 PPNC’s

Or Plans Photographiques Numériques Communaux [literally: Communal Digital Photographic Plans] are digital orthophotoplans in colour constructed during a succession of air cover operations during the periods 1994 to 2001 and 2009 to 2010.

→
left

Aerial photos (PPNC's)
<2006

→
right

Aerial photos (PPNC's)
2009-2010)



2.1.2. Charged for or limited-use data:

The cartographic data listed below are data which require a payment for making them available (the € symbol will be shown in brackets), or else data available from regional authorities which are subject to an agreement to make them available for a limited period of use (indicated by # in brackets).

Land-register data are essential within the context of a project to stimulate biodiversity for which direct contact with everyone owning plots of land lying beneath the route of the high-tension lines is imperative, with a view to providing them with information and obtaining their agreement concerning planned restoration works. As a company in Belgium, ELIA possesses all of those land-register data and has been able to make them immediately available to the LIFE project. That represents the saving of an unquantifiable amount of time in taking the further steps of making contact, disseminating information and drawing up contracts with landowners.

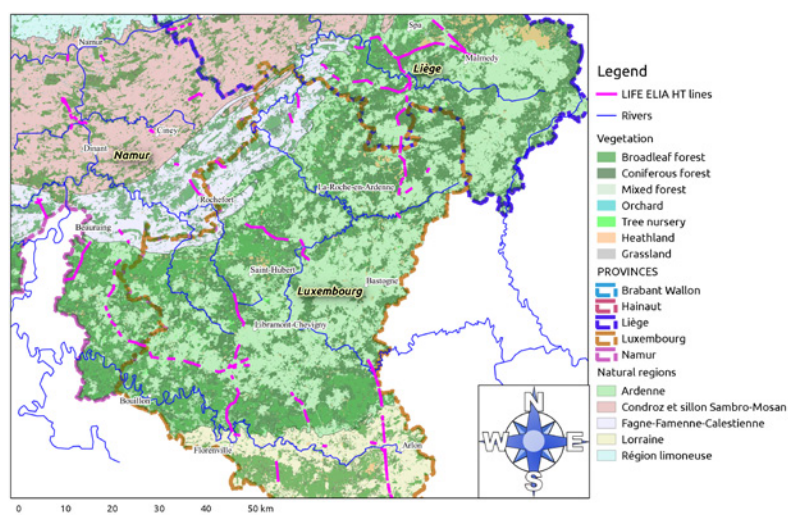


Type of data	Description	Data owner
Shapefile	Land register (€)	Ministry of Finance
Shapefile	IGN * <i>Sites de grand intérêt biologique</i> [Sites of significant biological importance] (SGIB) <i>Réserves naturelles</i> [Nature reserves] (RN) <i>Cantonnements DNF</i> ** [= Forestry Commission Land] High-tension network (ELIA) <i>Structure écologique principale</i> [= Nature Conservation Board] (SEP ****) (SEP ****)	IGN * DEMNA *** (Wallonia Civil Service)

Illustration of types of data



Administrative data
Cartographic data
provided by Wallonia
Region (DEMNA)



* IGN

Institut Géographique National – National Geographical Institute

** DNF

Département de la Nature et des Forêts – Department for Nature and Forests for Wallonia authority (*Service Public de Wallonie*: SPW – Wallonia Civil Service); it deals particularly with matters such as forestry management, nature conservation and hunting.

*** DEMNA

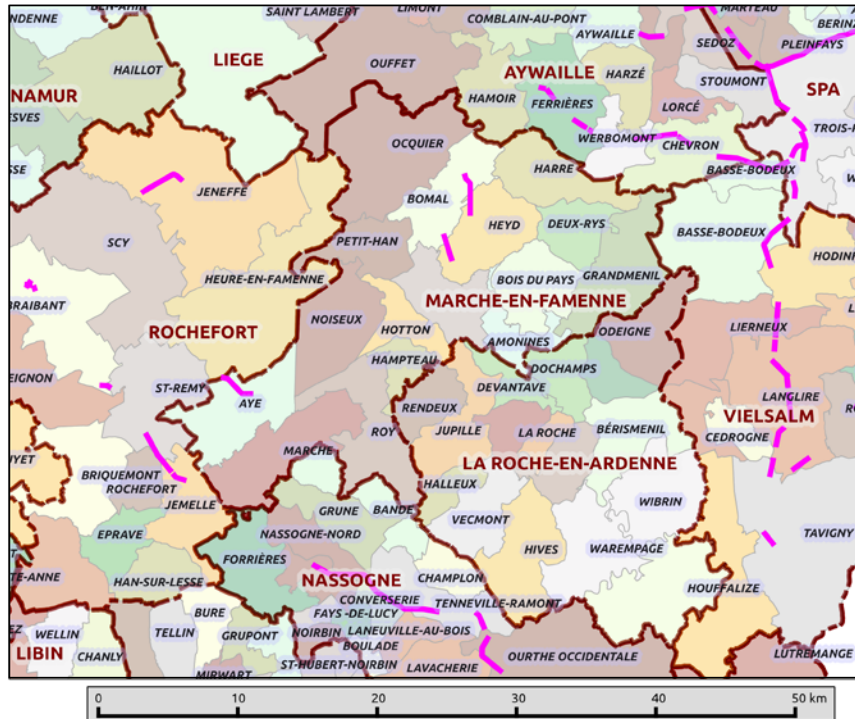
Département de l'étude du milieu naturel et de l'agriculture – Department for Study of the Natural Environment and Agriculture of Wallonia Civil Service. It develops and co-ordinates all programmes for the acquisition, validation, beneficial use and distribution of socio-economic and environmental data in the areas of agriculture and the natural environment.

**** Structure écologique principale (SEP) [= Nature Conservation board]

In Wallonia (Belgium), the aim of the SEP is to bring together all the land areas of current or potential biological significance under one coherent mapping system. It practises the concept of ecological infrastructure, ensuring that central nature conservation areas are maintained, together with a network linking them all together.



Limits of DNF
[= Forestry Commission]
forest ranges and beats
(land units)



2.1.3. Software used by the project team:

Based on the general mapping data available, the project team will overprint them with data collected in the field, concentrating not only on the state of security from vegetation for powerlines but also the potential for natural habitats and restoration of the ecology in the footprint of high-tension lines.

ArcGis/QGis:

The use and management of geographical field data can be conducted via multiple interfaces ranging from:

- a simple Viewer (for example: ArcExplorer®, Google Earth®, Google Maps®, etc.)
- to full management including manipulation, organisation, structuring and cross-referencing of geographical data with the aid of SIG software whether charged for (MapInfo®, ArcMap®, Autocad®, ArcGIS®, etc.) or free (QGis®, fGis®, GvSig®, etc.).



Screen capture of the LIFE ELIA project running QGIS: cartographic layer management, labelling configuration and database interrogation (here displaying all the data associated with a polygon).



Day-to-day management and the general organisation of operations to be performed in the field have steered the choice of all of the project team towards the use of two types of software: one which is impressive but charged for, such as ArcGIS, and a second which allows for the existence of a free interface made available to the public at large: QGIS (SIG OpenSource⁴ software).

Both software programs can be used at a static work-station for day-to-day processing in the office but also via a dynamic interface for use in the field by means of an encoding tablet with GPS tracking in real time. It is important to note that QGIS software benefits from regular updates and continuous upgrading making it ever more efficient to use.

4 OpenSource software

The Open Source designation applies to software for which the licence abides by criteria precisely laid down by the Open Source Initiative (a worldwide organisation ensuring the promotion of OpenSource software packages), i.e. offering free distribution, access to the source code and any derived work.

Pragmatically speaking, Open Source software is considered to be a free software program, which can be freely downloaded and regularly updated. Important support can be provided by discussion and exchange forums, allowing users to undergo self-training.

2.2. Site mapping:

2.2.1. Running mapping files – e.g.: QGIS⁵:

The interface offered by QGIS makes it possible to display all of the geographical data, so that the layers of information needed can be displayed and analysed for the purposes of planning the project and taking a reasoned decision. Data accessible via the internet, WMS, WFS, etc., together with the existing data, high-tension network, land register, legal obligations, etc. and data collected in the field, make it possible to provide the most objective presentation possible of the facts. Spatial crossreferencing and the combination of all of these geographical data ensure that decisions are taken as objectively as possible by including all the information judged to be relevant. Two complementary stages in the organisation of the layers of information can be identified: office-based preparation of the data to be loaded on to the GPS device and the actual field survey.

2.2.2. Pre-survey data and space planning:

The in-house preparation stage is essential for good future management of the information collected during the field survey.

First comes the 'project'. This is the file that defines the structure of the layers and their parameters (formatting, labelling, etc.)

Different layers are structured in this draft and these can be raster layers (images) or vector layers (polygons, lines or points).

The raster layers are stored in a single folder which will be updated in the office before each day in the field (see Hints and Tips box).

The vector layers may be consultable data (land register plots, power lines, pylons, etc.) or editable data forming the subject of the survey. It is helpful to separate these, since consultable data must absolutely not be changed in the field.

Finally, as a precaution, editable data will be routinely backed up on another machine after each day in the field.

⁵ Installation de QGIS pour toutes les plateformes à partir du lien:
<http://www.qgis.org/en/site/forusers/download.html>





HINTS AND TIPS:

There are several methods for transferring data from the static work-station in the office to the tablet used in the field: storage and transfer via a USB memory stick, Bluetooth connection or cable. A WiFi connection and the installation of a synchronisation, storage and sharing software program (e.g. DropBox®) enables these three operations to be conducted simply by turning on the machine on returning from the field. The WiFi network is detected automatically, synchronisation of the amended files starts up and the data are synchronised simultaneously on the static office work-station and also for all users sharing these directories and on a server with routine backup of the various versions. When preparing for a field day, it is more comfortable to work on the static work-station. The 'project' is thus formatted with the layers needed stored in advance in the synchronised directories. All you have to do then is to turn on the tablet some time before going out into the field in order to have all the latest modifications available.

Via the QGIS interface, existing mapping data are selected and integrated into the GPS device in order to ensure maximum efficiency during the field trip:

- High-tension network,
- Pylon numbers,
- Aerial views,
- Baseline of maps from IGN [*Institut Géographique National – National Geographical Institute*] with a scale of 1:10.000

and their straightforward use while identifying situations encountered at each site.

The whole of these data is exported to the tablet computer which is equipped with a georeferencing device allowing mapping in real time, immediately and on-site. In order to ensure full mapping, a dictionary (in the form of a drop-down menu integrated into the tablet) was created by the LIFE team so as to make the mapping teams' encoding work easier. That dictionary listed the following information:

- Information on the situation regarding corridor security: vegetation risk present or absent, its extent if present, the type of adjacent forest and its height. This vegetation risk and drawing up contracts for the enlargement of corridors will be the subject of the second technical brochure which will be placed online on this site.

- Information on natural habitats and vegetation present beneath HT lines: Tall-herbs associations⁶, *Bracken stands*⁷, Forest colonisation, Wet heathland, Dry heathland⁸, Types of species (represented in the form of polygons) and the type of site condition, illustrated by a soil moisture gradient,
- Identification of existing forest edges or those needing to be constructed as the construction of tiered edges constitutes a strong objective for LIFE ELIA.
- Siting of wetlands, either existing or to be constructed
- Finally, the presence of invasive plant species: extent of colonisation, species found, risk of propagation

One last piece of information was being collected which consisted of assessing the possibilities of inserting our various restoration measures into an ecologically coherent strategy, of critical size for sustainable After-LIFE management, involving identified partners in order to safeguard that management.



HINTS AND TIPS:

Raster images (PPNC and IGN) are large files. In order to allow them to be used quickly in the field and prevent them clogging up the machine's memory capacity unnecessarily, screen shots should be made only of the areas prospected. SIG software programs enable screen shots with spatial references to be made. Using QGIS, select 'Save as image' in the 'File' tab. The image on the screen is then stored in the required format (JPG format uses the least amount of memory) with a linked file showing the georeferencing coordinates for the image. To obtain adequate resolution, a zoom higher than 1:2000 is desirable. See the example below.

6 Tall-herbs association

This is a natural habitat generally consisting of tall perennial herbaceous plants (1.5 to 2 m high). Generally situated in an alluvial area, on cool, non-acidic soil, it may be flooded for brief periods.

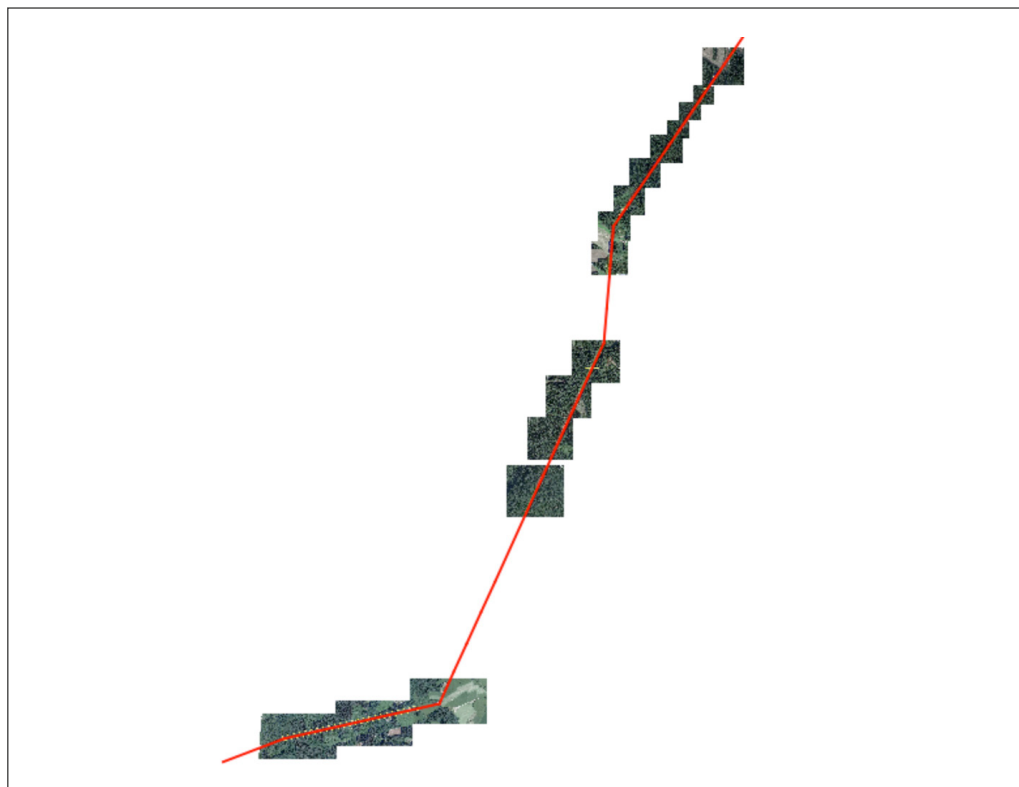
7 Bracken stands

A plant formation mainly consisting of bracken (*Pteridium aquilinum*).

8 Wet or dry heathland

Heathlands are low shrubby formations, located on poor, acidic soils, natural habitats which are barren from an agricultural viewpoint (due to reduced growth) but ecologically speaking are very rich.

The various types of heathland can be distinguished by the heathers seen there: bell heather (*Erica cinerea*) for dry heathland, Dorset heath (*Erica ciliaris*) on moderately wet heathland and cross-leaved heather (*Erica tetralix*) for wet heathland.



As a reminder, these seven restoration activities are as follows:

1. Creation or restoration of forest edges,
2. Planting of conservation orchards,
3. Restoration of heathland, peat bogs or hay meadows,
4. Construction of ponds,
5. Management of invasive plant species,
6. Installation of infrastructure for grazing and mowing,
7. Creation of wildflower meadows.

2.2.3. Field surveys:

Prior to any field visit, landowners and site managers are contacted to let them know that the cartographers will be passing by.

Two stages of cartographic field survey have been utilised.

The first in autumn, which allowed the security situation of the network to be assessed and feasibility of the measures planned by LIFE to be checked using a brief description of the broad categories of vegetation present.

The second stage was conducted during the growing period in order to evaluate, in greater detail (EUNIS codes⁹), the natural habitats present and at the same time confirm the identification of plant species present with estate value, while also ensuring that there was a search concentrating on invasive species. This stage of the survey in the spring also enabled the feasibility of the operations initially planned to be assessed and their choices of location, which would then be put to landowners and managers, to be definitively ratified.



TRUCS et ASTUCES

Il est opportun d'avoir une vérification des données principales directement après leur encodage. En effet, les onglets déroulants sont très pratiques mais les conditions de terrain, mains froides, port de gants, reflet dans l'écran,..., causent parfois des erreurs. L'utilisation d'un code de couleur dépendant de la donnée enregistrée permet cette vérification. Par exemple, un peuplement voisin peut être symbolisée en vert si il n'y a aucun risque, en rouge si il y a un risque présent.

List of data included in the dictionary integrated into the field-mapping tablet:

In the form of lines:

- Existing fence, track, ditch, hedgerow
- Forest edge bordering the HT line:
 - level of risk: no risk to the line, existing risk, future risk (with forest growth), risk requiring priority management
 - type of species involved
 - current height of forest
 - distance of forest edge from the central axis of the line
 - height of spread at lowest point
- Possibility for restoration or creation of a second-tier edge

9 EUNIS [European Nature Information System] code

Classification system for European natural habitats



In the form of points:

- Relating to ponds:
 - potential site for the construction of a pond
 - size category for future pond (<25 m², > 25 m², > 100 m²)
 - type of construction: digging, blocking up drains, clearing out
 - identification number for inputting permit applications
- Relating to invasive plants:
 - Latin name of species
 - number of plants of the species or size of invaded area

In the form of polygons:

- Relating to natural habitats: peat bogs, heathland, meadows
- Relating to constructed habitats: intensive pastureland
- Listing among the seven most appropriate LIFE restoration measures to be taken in each polygon
- Polygons are also described by a scale level relating to the direction of their exposition (N, S, E, W) and the degree of slope in relation to the axis of the line (a factor that may exclude some types of future management such as mechanised mowing)

This comprehensive tool, as created by the project team, greatly simplifies decision-making at the various stages of the project: information concerning landowners and managers, agreement of the power company as regards projected works and their siting, drawing up of restoration plans, specifications for restoration works, drawing up plans for future management, etc.

The database of georeferenced photographs

So as to derive maximum benefit from their mapping visits in the field, the project team routinely used cameras which permitted the georeferencing of their photos. Shots were systematically taken, for example, at the foot of each pylon, facing in both directions, following the axis of the High Tension line. These photos make it possible to illustrate the field location at each field visit or each time the site is revisited: state of vegetation, types of natural habitat, level of line security, etc.. This set of photos can be managed using straightforward interfaces available to the public at large, such as Google Earth®. Such photographs are extremely useful both for sharing easily among the project team (those tasked with working in the field and in the office) but also for comparing the impressions of the project team with those of power-company linesmen and even of landowners and managers.

For the purposes of this project, the photos are placed online on the website: www.life-elia.eu



HINTS AND TIPS:

The large amount of data to be stored in various forms (points, lines and polygons) together with the taking of photos, requires some special methodology. For example, leaving the vehicle at one end of the corridor and the operative following a there-and-back route. Georeferenced photos and the mapping of adjacent forest are done on the way out. Mapping of the habitats and action-planning is conducted on the way back. The outward route thus allows the area to be displayed in order to obtain an overall view, making it is easier to define the limits of the polygons on the way back.

The provision of information for various stakeholders

Integration of all the data within the cartography makes it into a multi-use tool. In fact it has allowed a set of documents to be created which can transfer information to various sections of the public for a range of purposes:

- To power companies: state of security of the high-tension network over the whole of the lines covered by the project, ratification of restoration projects put forward by the project team
- To landowners: a list of actions to be proposed on their land, beneath the High-Tension network (among the seven restoration measures included in the project)
- To site managers (essentially the bodies responsible for the natural environment): ratification of the restoration proposals and integration into their own databases (N2000, Structure écologique principale [= Nature Conservation Board in Wallonia], etc.)
- Within the project team: tool for planning restorations, drawing up specifications, setting up indicators for monitoring the results of the project: bird-listening posts, sites for monitoring butterflies, dragonflies, bats and plants, post-project management



Upgradeable tool

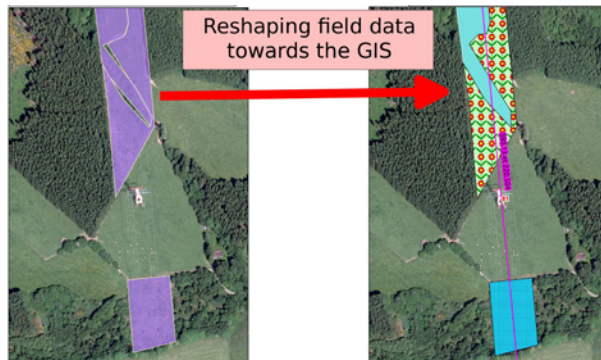
The cartography is undergoing continuous development. The initial, descriptive form of cartography has been succeeded by the data-use stage, necessitating corrections and adjustments. The information available on the cartographic interface on the website is therefore already partially out of date, in spring 2013. Polygon drawings will be continuously updated throughout the project, enabling its development to be monitored.

→
left

First step of mapping as
exported from GPS

→
right

Reshaped polygons
(based on PPNC
and IGN layers)



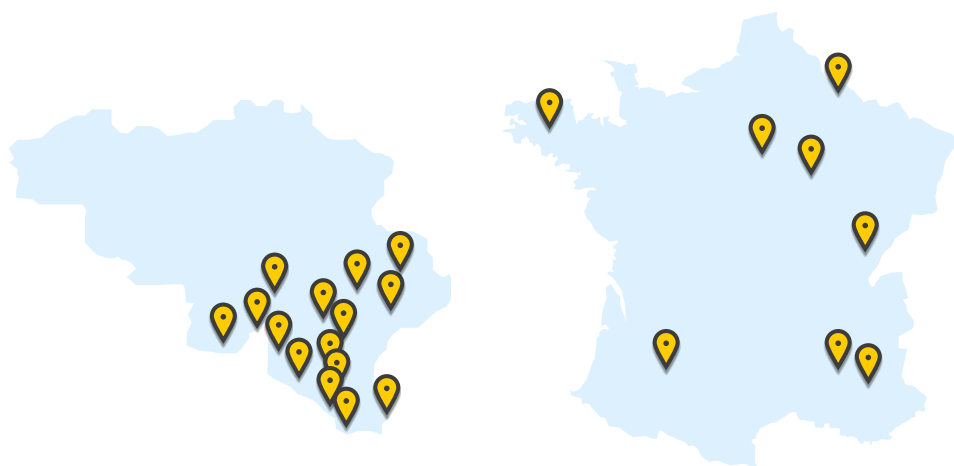
Between a mapping session in the field and the use of data on the computer, a vital correction stage is needed. Caused by certain inaccuracies linked to the actual conditions under which GPS is used and the practical difficulties of digitalisation in the field, the geometry of a cartographic layer needs to be reworked when it is exported from GPS tools. On this occasion, by overlaying other helpful data (land register, Natura 2000, aerial photos, etc.) the project team has been able to redefine the contours in a way that is more accurate and above all can be interpreted most effectively in the field.

A further improvement in accuracy will occur when the specifications are drawn up as these will require accurate remeasuring in the field. Without changing the guidelines, the project cartography will again be partially readjusted.



HINTS AND TIPS:

In order to directly achieve operational cartography and minimise the revision work described above, the mapping software allows angle points to be snapped to points of other layers. This option thus allows vertices (angle points) to be located on an angle or segment in another layer, if the latter is located nearby (configurable distance).



Places where the restoration of natural areas under power lines are implemented

In Belgium (Wallonia):

- 150 km of high voltage power lines

In France:

8 sites are spread throughout different biogeographic regions

- Atlantic: Finistère, Seine-et-Marne, Aquitaine
- Continental: Aube, Ardennes, Doubs
- Mediterranean: Drôme
- Alpine: Hautes Alpes



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