December 2017

Vade-mecum

Vegetation management best practices for Transmission System Operators

LIFE Elia-RTE (2011-2017)

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Powering a world in progress

Rte Le réseau de transport d'électricité

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Table of contents

LIFE Elia
Valorisation des emprises du réseau de transport d'électricité comme vecteurs actifs favorables à la Biodiversité

Référence CE
LIFE10 NAT/BE/709

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1 Foreword

The LIFE Elia-RTE project team is pleased to release this Vade-mecum of best practices for Transmission System Operators (TSO). The Latin name Vade-mecum means *go with me*. This will be the invitation, to go for a journey in the world of vegetation management in HV lines corridors in wooded area.

This document is a mix of experience gained all along the LIFE Elia-RTE project and contributions from 8 TSO in Europe. Its objective is to present and detail what are the main alternatives to traditional vegetation management. Main outcomes for the TSO, for the local stakeholder and for nature are also presented.

The LIFE Elia-RTE project took place in Belgium (along 155 km of lines) and France (7 sites) during 6,5 years (2011-2017). This 3 M€ project is part of the LIFE+ Programme[1] of the European Union. It was financed by the European Union, Elia (Belgian TSO), RTE (French TSO), and the Walloon Region.

The main objective of the LIFE Elia-RTE project was to find management vegetation methods that combine electrical safety and biodiversity. But dealing with vegetation under HV does not limit to vegetation growth. It implies a lot of other fields such as partnership with local stakeholders, negotiations, designing tools for mapping and monitoring, and last but not least, a cultural change within a company. This diversity of approaches makes this journey fascinating.

One should find in this document many reasons why the solutions implemented in France and in Belgium should not work in another European country. Nevertheless, there is always something to pick from a project like this one. Besides, the DG Environment has given a "Natura 2000 Award" to the project and the main element that spoke in favour of the project was its replicability in other Member States. Indeed, by adapting the actions to any other local context, a TSO can achieve a great job to enhance biodiversity, to increase social acceptability while ensuring a reliable and steady network.

The work on site is done hand in hand with local partners, which makes it an ecological challenge but also a real adventure. Considering the final objective of offering a better place for nature, it was a real happiness to work in such a context.

Enjoy the reading !

The LIFE Elia-RTE team

1 LIFE is the EU's financial instrument supporting environmental, nature conservation and climate action projects throughout the EU

2

Summary

Chapter 3 of this document describes the context in which the LIFE Elia-RTE project has evolved.

Chapter 4 gives an array of actions to implement in order to set up alternatives to the traditional vegetation management methods.

Chapter 5 details the complete methodology of the LIFE Elia-RTE project, describing all steps to be taken before and after carrying out actions for nature under HV lines, from initial mapping to management plans.

Chapter 6 provides an overview of critical points that deserve a close attention when implementing alternative methods.

Chapter 7 shows examples of alternative vegetation management methods from 8 TSO in Europe.

Chapter 8 gathers topics to be taken forward by TSO when considering implementing vegetation management alternative methods on a large scale. These topics are useful tools and tips.

Chapter 9 draws conclusions of this Vade-Mecum of vegetation management best practices.

3

The context of vegetation management

3.1. Electrical safety of the network, a major strategic issue

Transmission System Operators (TSO) throughout Europe are responsible for the electricity transmission at regional or, more often, national level. Infrastructures needed for electricity transmission are the backbone of the Energy sector: it transport high-voltage electricity from its production site to local or regional electricity distributor and to major clients. From there, electricity is distributed to households, its final destination. TSO are also supplying electricity directly to large clients such as industries.

As everyone expects a safe, secure and reliable supply of electricity, the electrical grid is therefore a crucial element. It ensures the electricity transmission along aerial or underground high-voltage (HV) lines. A failure on the network could not only impact households but also major companies relying on electricity, having important economical and therefore human consequences.

Such a key aspect of the national economy is framed by national regulatory agencies, which look after, among others, the management of the network, the price of electricity and the main costs and investments.

3.2. Containing vegetation in wooded area, a never-ending challenge

3.2.1. Safety issues in wooded areas

It is obvious for everyone that the high-voltage network is part of our landscape. We see pylons and HV lines crossing fields, forests and cities. If we take a closer look on the land use under the overhead HV lines, we can more or less classify two categories of places:

- Places where the vegetation is “under control”: agricultural areas, industrial areas...
- Places where the vegetation is a “threat”: forest areas and urban areas

Indeed, if nothing is done in wooded area, trees can quickly become, as they continuously grow, a major problem for the network safety. At the opposite, in agricultural and industrial areas most of the time the vegetation is controlled by human activities (farmer by grazing cattle or mowing meadows or industrial areas through territory development for example).

To ensure the security of the network in wooded areas and the subsequent safety of electricity supply, TSO should control the safety of the infrastructures: pylons, HV lines and substations. If we consider the pylons and the HV lines, we can see that they are at risk when vegetation may impact the HV lines, in the following situations:

- A tree falling on a HV line or a pylon
- A tree coming too close from a HV line
- Branches from the adjacent forest coming too close from a HV line

In every type of forest, a list of the species that could be a threat for the line can be established based on their average final height. We will find mainly the following species:

Specie	Latin Name	Final height (m)
Poplar	*Populus x canescens*	30
Black Alder	*Alnus glutinosa*	25
Black Cherry	*Prunus serotina*	15
Black Locust	*Robinia pseudiacacia*	25
Downy Birch	*Betula pubescens*	25
English Elm	*Ulmus glabra*	30
English Walnut	*Juglans regia*	25
European Ash	*Fraximus excelsior*	40
European Aspen	*Populus tremula*	20
European white Birch	*Betula pendula*	30
Eurpean Beech	*Fagus sylvatica*	40
Fiel Maple	*Acer campestre*	20
Hornbeam European	*Carpinus betulus*	25
Large-leaved Lime	*Tilia platyphyllos*	30
Norway Maple	*Acer platanoides*	30
Norway Spruce	*Picea abies*	40
Pedunculate Oak	*Quercus robur*	35
Sessile Oak	*Quercus petraea*	40
Small-leaved Lime	*Tilia cordata*	30
Sweet Chestnut	*Castanea sativa*	30
Sycamor Maple	*Acer pseudoplatanus*	30
White Poplar	*Populus alba*	30
White Willow	*Salix alba*	25
Wild Cherry	*Prunus avium*	25
Wych Elm	*Ulmus minor*	30

These species are growing in most productive forests in Europe, which are the majority of the forest.

3.2.2. Mulching and manual cuttings at early stages

To ensure maximal safety, most TSOs will favour an **early** and **regular** maintenance. The decision to take action will rely on:

- Expert judgment of lines patroller based on visual observation (terrestrial or aerial observation)
- Software calculations based on growth vegetation and HV line features, double checked with expert judgment of lines patroller based on visual observation

The challenge for maintenance team is to guarantee maximum safety while striving on saving costs. When it is acceptable for safety, maintenance operations will be postponed. On the contrary, maintenance operations will be scheduled ahead of timing if safety is at risk.

Mulching of young problematic trees

Early because cuttings are done when vegetation is still low and young, avoiding any risk of vegetation getting too close from the HV line, and also any risk of accident during maintenance operations. It is indeed easier to mulch small diameter stem from bushes than to fell a tree.

Regular because it is the best way to keep the vegetation low. Maintenance operations can occur every 3 to 12 years, depending on the vegetation growth. Various factors may have an impact on vegetation growth: vegetal species, altitude, type of soil, orientation...

Wherever it is possible, tractors that mulch the vegetation carry out maintenance operations. This technique is fast and efficient in terms of clearing the area, and is mostly used by TSO in Europe. When tractors cannot access the sites, due to steep or rocky areas, manual felling are undertaken to clear vegetation. In both case, the mulching and the small trees are left on site laying on the ground.

These techniques offer any Maintenance Department the feeling that the job is done. Maintenance operation results leave indeed a free-from trees area, which clearly contributes to the network safety.

3.2.3. Entering a vicious circle

The problem is that the mulching is having two main consequences:

- It creates an open space free from vegetation
- It enriches the soil by providing nutrients produced by the mulching

These two consequences are in fact the best way to promote the regrowth of the species the TSO is fighting against: the seeds from pioneers tree species coming from neighbouring forest will find a perfect place to germinate and to grow quickly, benefitting both from full enlighten and from the richness of the soil.

This concept was at the very basis of the LIFE Elia-RTE project launched in 2011, whose main objective was to find alternative vegetation management methods to leave this vicious circle.

3.2.4. Towards a no man's land under HV lines

This vegetation management approach leads to an unavoidable no man's land feeling from local stakeholders. Since the TSO is handling the management of the forest corridor in a way that no other type of activity can be led on the land beneath HV lines, except maybe hunting activities.

Local stakeholders are therefore ending having that feeling that this land is out of their control and that they don't have anything to do or to expect since the TSO is having it under control. This lost of interest leads to a situation where the TSO is managing vegetation on forest areas without a lot of relation with local stakeholders expectations or interests.

3.3. Impacts of traditional vegetation management

Here is a list of impact traditional vegetation management may have on:

Landscape and Nature

- Landscape: Operations that are highly visible and not appreciated by locals
- Biodiversity: Negative impact in terms of destruction of plants, disturbance of species and soil degradation. Possible spreading of invasive species.

Social acceptability and communication

- Shared values with stakeholders: None
- Communication opportunities for the TSO (internal and external): None
- Local embedding: Subcontractors covering large areas with few positive benefits locally

Land use

- Bordering forests: Exposure to wind and sensitivity of forests to storms
- Added agricultural value: None
- Added value for ecology and game: Maintenance of open areas for game
- Added value of forests: none

Institutional, administrative and strategic aspects

- Relationships with institutions (Local authorities and Governments): "Simple" contractual contact with forest authorities
- Design and creation of overhead lines: Low acceptance due to the impact on landscape and nature
- Facilitation in obtaining permits: none

3.4. Landowners and land managers: different profiles for different expectations

Bare soil after mulching operations is sometimes leaving a high impact on the landscape

TSOs do not own the land under HV lines. If some landowners may show indifference towards mulching or manual felling operations, others will be reluctant to see these actions carried out on their property. Even though the TSO has the right to cut vegetation when the line is at risk, this opposition is sometimes time and energy-consuming to be soothe.

Most of the time, Maintenance teams are succeeding in planning the maintenance operations. But still, most of the time landowners do not feel involved in the choices and decisions made in terms of maintenance operation.

4 The alternatives

4.1. Shifting perceptions: considering vegetation as an ally

We have seen in chapter 3 how vegetation under HV lines in wooded areas can be a threat for the safety of the network. We have shown how TSO are handling this threat by finding efficient solution on site by early and regular clear-cuts. It is a fact that vegetation management is not in the core-business of a TSO. If the Environmental issues are more and more took into account these last decades, one should admit that such companies are more focused on electrical engineering, grid planning, infrastructure designing and market operations among others.

The idea followed by the LIFE Elia-RTE project is that we can change our point of view and consider vegetation as an ally rather than as an enemy. This implies a drastic shift of perceptions. By a set of alternative actions, the project has proved the value of considering the vegetation management from another angle. Of course it implies important adaptations for the TSO, but this aspect will be further developed in chapter 6.

This chapter 4 is dedicated to alternative vegetation methods in order to replace traditional mulching or manual felling.

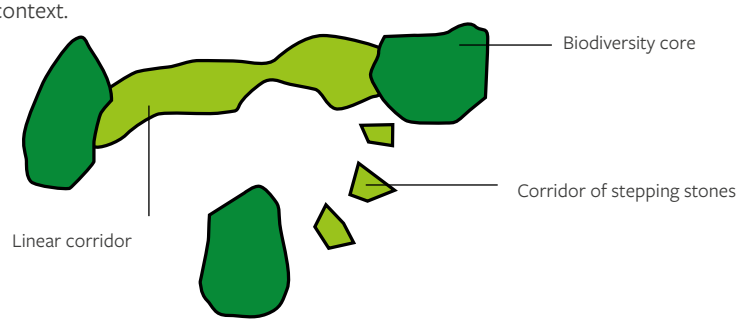
4.2. Theory of ecological connectivity

In the Ecological network, species move mostly from a core area of biodiversity to another core area of biodiversity. These movements are done along linear corridor or passing by stepping-stones.

In terms of linear corridor, HV lines are very well suited to host biodiversity. Whereas railways or roads have an impact on land use with the presence of rails or tarmac, HV lines leaves the ground available for the development of nature.

If we consider the European Natura 2000 network, we can be struck by the similarity between this nature network with the European HV lines network. Even at European level, HV lines can be considered as real asset for the biodiversity network.

Besides, electrical corridors in forest offer a habitat diversity through the presence of open areas and edges in a forest context.



4.3. Involving local partners

In Europe, none of the TSOs own the land below HV lines. Therefore, experts when implementing alternative vegetation management methods must contact landowners. Agreements should be signed before actions can take place. To facilitate contacts with the landowners, but also to establish a relevant long-term management, TSO have a lot to gain to develop local partnerships.

Although looking a bit time-consuming to establish a personal contact at first, contacts will help saving lot of time afterwards. It also increase local acceptance of new management techniques and guarantee a potential long-term management of actions carried out on site.

All information on partnership is available at http://www.life-elia.eu/en/Brochure-n-8-Local-partnerships.

4.4. Alternative vegetation management methods

For all the reasons listed before, alternative vegetation management methods can be implemented under HV lines in wooded areas. It will be maybe not possible to carry out actions on the entire network crossing wooded areas, but a first screening will help TSO to choose the best sections of the network (see chapter 6).

In total, 7 actions have been implemented within the LIFE Elia-RTE project. Two of them are not really an alternative to traditional vegetation management, but rather an action for biodiversity: creation of natural ponds and fight against invasive plants. They will be mentioned at chapter 4.5.

The following actions were established just after the last traditional management operation done by Elia. They are all targeting at enhancing biodiversity while keeping as a main objective the electrical safety of the network.

4.4.1. Structured forest edges

Definition

The forest edge is considered to be a transition zone between:

- a "closed" environment like forests of hardwood or coniferous,
- an "open" environment like meadows or crops.

Forest edges on both sides of the electrical corridor

These edges can thus be located on the periphery of wooded areas when the forest adjoins agricultural areas, for example, or in their midst when the forest is interrupted by a non-wooded area (clearing, trail, high-voltage line, etc.).

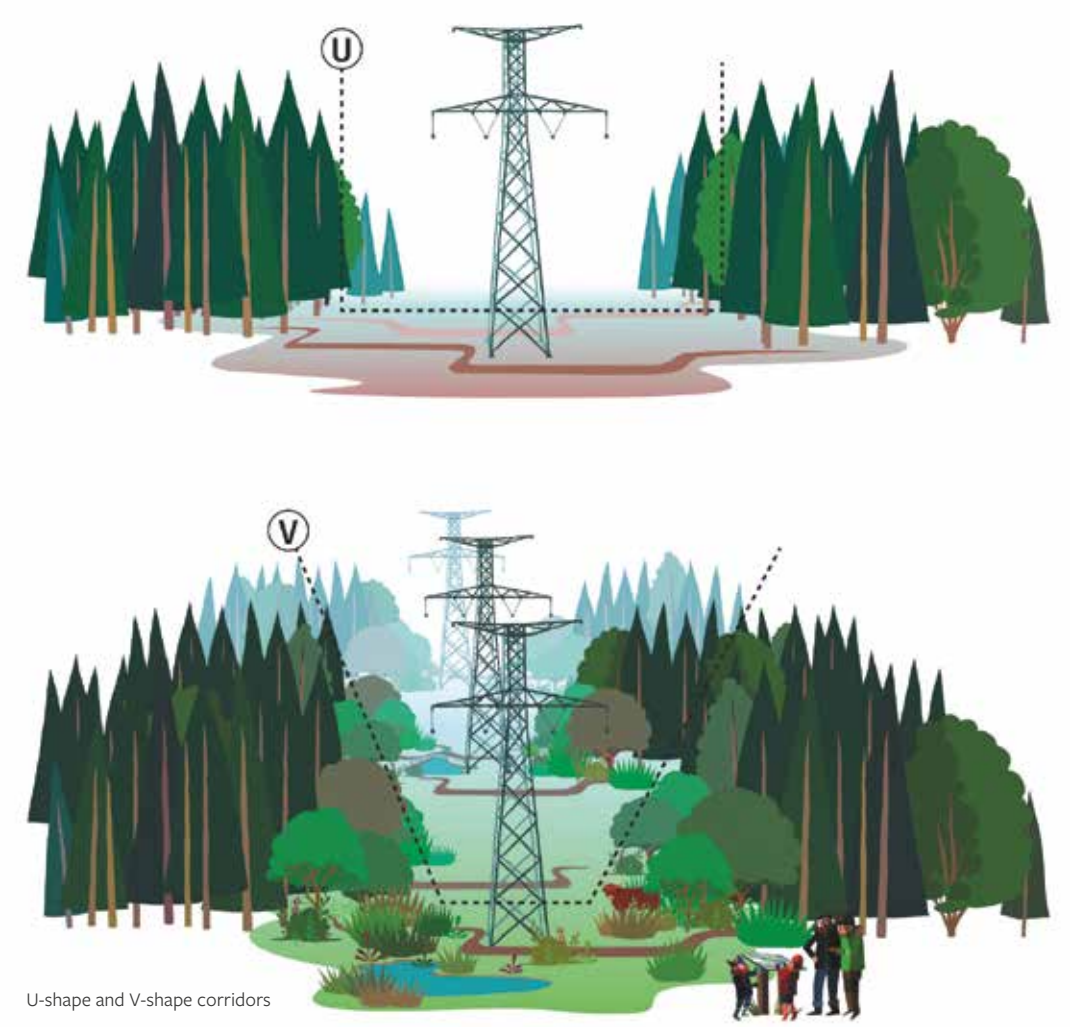
The edge is called "tiered" when it is composed of several strata of different heights.

What are the benefits of a forest edge?

The main idea in establishing forest edges in the forest corridors of high-voltage lines lies in the fact that they:

- will not be a problem for the HV line if the species in the forest edge are selected regarding their low height at maturity,
- very greatly reduce the possibility of growth of tree species that are problematic due to their height at maturity (beeches, birches, poplars, spruces, oaks, ashes, etc.) since the selected species will occupy the space and reduce the amount of light reaching the ground.

It allows to shift from a U-shaped corridor (classical vegetation management) to a V-shaped corridor.



U-shape and V-shape corridors

Which species should be selected?

Vegetal species selected are the ones that:

- → do not grow too high at maturity,
- → are adapted to local conditions (altitude, soil, humidity, exposure...),
- → provide flowers and fruits for insects, birds and other animals.

Example of selected specie: Alder buckthorn (*Frangula alnus*)

Example of selected specie: Cranberry bush (*Viburnum opulus*)

This selection will differ from a place to another in Europe, but the main concept to choose the species will be the same. Therefore, this action can be adapted anywhere in Europe.

For an example, here are the species selected in Belgium:

Common name	Latin name	%	Advantages	Max. height (m)	Three inner lines	Two outer lines
Single-seeded hawthorn	Crataegus monogyna	20	Good resistance to grazing thanks to its thorns	10	x	x
Common hazel	Corylus avellana	20	Good ground coverage, rapid growth, good resistance to grazing, no thorns	4	x	x
Alder buckthorn	Frangula alnus	10	Rapid coverage, ability to multiply by root suckers	5	x	x
Common dogwood	Cornus sanguinea	10	Rapid coverage, very low species	5	x	
Blackthorn	Prunus spinosa	10	Rapid coverage, resistance to grazing thanks to its thorns, ability to multiply by root suckers	4	x	
Eared willow	Salix aurita	10	Rapid coverage, adapted to wet soils, can propagate by cutting and natural layering	3	x	x
Rowan	Sorbus aucuparia	5	Tree of moderate height with flowers and fruits	10-20		x
Black elder	Sambucus nigra	5	Rapid coverage, shrub with flowers and fruits	10	x	
Red elderberry	Sambucus racemosa	5	Rapid coverage, shrub with flowers and fruits	4	x	
Guelder rose	Viburnum opulus	5	Rapid coverage, shrub with flowers and fruits	4	x	
European crab apple	Malus sylvestris	Depending on opportunity	Tree of moderate size with flowers and fruit. Produces small high-quality logs and is genetic reservoir of a species in decline.	6-10		x
European wild pear	Pyrus pyraster	Depending on opportunity	Tree of moderate size with flowers and fruit. Produces small high-quality logs and is genetic reservoir of a species in decline.	8-20		x

These species are so-called “secondary” species because they are not used to produce wood. Of lesser size, they participate in the ecological balance of the natural forests as they are found in natural forest habitats.

Restore or plant forest edges ?

There are two techniques for establishing forest edges: restoration and planting.

If the presence and the diversity of bushy species on a site is sufficient, restoration of the edges will be preferred. This choice is motivated mainly by economic reasons, as restoration is less expensive for the Transmission System Operator, but also to promote local species already present and well-adapted to the site.

In the absence of these shrubbery species, preference will be given to planting edges.

Methods to restore forest edges

This technique can be applied by different ways:

1. when ensuring the safety of a line by felling populations located at the edge of the corridor with an accompanying understory, mature trees will be cut while bushy species with a final height that will not present a hazard to the cables are kept.

2. if a natural seedling stand of woody species is present, careful examination of the species will allow management to be oriented toward natural development of this vegetation to a sufficiently advanced stage for selection of seedlings. Otherwise, the management method used can be rotary cutting followed by planting.
3. if a thicket is already present at a sufficiently advanced stage (the foliage being mainly located above the line of sight of the operator), it is then possible to penetrate into the vegetation.

Methods to plant forest edges

In-line plantation of low-height selected species to create a structured forest edges

The "forest edges" action consists of planting naturally shrub-like species, of low height and advantageous for biodiversity (species with flowers, berries, etc.).

The experience of the LIFE project has shown that regrowth of planted edges is better when preparation of the ground precedes planting. This preparation consists of:

- superficial rotary cutting of the ground over the entire surface to be planted (fully). The ideal is then to take advantage of last standard vegetation maintenance by rotary cutting to carry out planting,
- loosening the soil only along the lines for planting over a width of approximately 70 cm and a depth of several tens of cm, which facilitates planting and rooting of the plants.

The plants are planted in lines parallel to the electrical line. The spacing between plants must be small enough so that the shrubs touch quickly due to their lateral growth and provide cover, thus preventing germination of natural seedlings of tall species. The diagram shows the planting method as it is applied in the LIFE project.

To ensure rapid saturation of the edges, we have chosen to set the distances between plants at 1.5 m in the planting lines and to space these lines 2 m apart. A space of 3 m between two lines (line 3 and 4 starting from the central part of the corridor) is maintained free to allow future maintenance of the edge by facilitating access to the thicket for the management operator. The last planting line is located at least 5 m from the forest trees at the edge of the corridor to facilitate maintenance of the planting and allow use of the trees of the population, and to avoid plantings in an area that is too shaded.

Plants origin and protection against the game

Two main other aspects need to be taken into account:

- origin of the plants: better use plants from local origin;
- protection of the plants: in some places, the pressure of the game is so high that plants need to be protected from damages the game could cause.

These two aspects are developed in the Brochure named "Forest edges and orchards under high-voltage lines".

4.4.2. Pasturing under HV lines

Management by grazing consists of confining herbivorous animals in the forest high-voltage line corridors so that they graze the vegetation.

Grazing thus allows young tree shoots growth to be controlled. Vegetation turns into a more grassy vegetation due to repeated passage of the animals. This grazing most often involves hardy animals that demand very little care (veterinary treatment, deworming and food supplements, for example) and have an undemanding diet.

A herd of Highlands to graze vegetation under HV lines

Management of these grazing areas is entrusted to local breeders who work with:

- Cows
- Horses
- Sheep
- Goats

Conditions

Grazing can be implemented under most of the conditions encountered in forest corridors. The soil can be wet, stony or steep, conditions that sometimes make this alternative management the sole method that can be applied.

It must nonetheless always be ensured that sufficiently large areas (more than approximately 1 ha) are available, in relatively immediate proximity of villages and easily accessible. In addition, given the linear nature of the safety corridors, grazing will be recommended in sufficiently wide corridors. In this context, parallel double lines have an attractive advantage in terms of grazing areas, as they offer a wide safety corridor. As an example, a length of 200 m will be needed to reach an area of one hectare for an electrical corridor 50 m wide.

Fences to contain animals

The fences can be either fixed or mobile.

Fixed fences are fine-meshed fences of Ursus® type from 1.2 to 1.4 m high and from 2 to 3 mm in diameter. A barbed wire can also be placed inside the enclosure as close to the ground as possible to prevent the sheep forcing the fence. The posts used are of oak, chestnut or acacia, and are split or round, sunk every 3 m. On the most difficult terrain, metallic corner pieces can also be used to be able to penetrate the ground. They also increase the durability of the fence.

Mobile fences are temporary installations allowing a herd to be moved quickly. They are made of electrified meshes connected to a generator, itself connected to a battery that can be coupled to a solar panel. These fences are moved depending on the availability of food. Their installation requires meticulous brush clearing of the perimeter to be enclosed. These fences have a very limited impact on the landscape over time and prove to be an alternative in the event that an owner/manager/hunter is reluctant to install a fixed fence.

Choice of the livestock the fences

The table below summarises some land characteristics for the types of livestock:

	Dampness	Slope	Type of fence
Cow and horses	Several breeds adapted to humid areas	Preferably on flat or hilly land	Barbed-wire fence
Sheep	Most breeds are sensitive to humidity	Highly suitable for important slopes, cliffs, etc.	Fairly costly Ursus® fence, hinders the circulation of wild fauna and farming Gallagher type mobile fence

4.4.3. Sowing and mowing under HV lines

Meadow sowed with a mix of seeds rich in diversity

Management by mowing consists of mowing the grassy vegetation each year. This mowing is done by a local farmer who can have the hay, or by a hunter wanting to maintain a feeding ground or a firing line.

To obtain greater plant diversity, the ideal is to export the hay. This contributes to soil depletion, allowing establishment of more diversified vegetation.

All information on mowing and grazing is available at http://www.life-elia.eu/en/Brochure-n-3-Grazing-and-mowing.

Local farming

Forest soils are less productive for animal breeders. The agricultural yields derived do not always allow them to generate a substantial income there.

This is why the farmers showing their interest for areas under high-voltage lines have small farms for the most part and are often already involved in a management type that is 'gentler' and more respectful of nature.

Additionally, the low yield of the land, and so lower economic return, can be offset by agroenvironmental subsidies if the conditions necessary for granting them are fulfilled.

Conditions for mowing

To be able to mow an area, the following three conditions must apply at a minimum:

- flat or gently sloping land
- soil sufficiently dry and load-bearing at the right period
- the absence of large rocks, debris from branches or other obstacles

Preparation of the site

If a hayfield is established in a wooded area, the wood must be felled and the branches removed first, with the aim of removing a maximum of organic matter. The wood will be recovered insofar as possible and the branches will be either heaped nearby (offering shelter for microfauna) or exported in chips and used as energy biomass (this operation is most often expensive, but can be self-financed in some cases by the value of the wood).

Then, a rotary cutter must be passed over the cut area to remove the last sprouts of woody species and level and break up the stumps and superficial roots as much as possible.

Harrowing, sowing, rolling

The in-depth cultivation of the soil is followed by harrowing to level the soil and break up the clods of earth. This operation is most often performed by a farm tractor also equipped with a seeder and Packer roller allowing the depth of operation of the harrow to be regulated, the soil to be compacted a first time, the earth to be more finely broken up and possibly the seeds to be lightly covered. In a single passage, the soil is thus harrowed, sown and rolled.

Finally, it is sometimes recommended that the soil be rolled with a smooth heavy roller when the soil has been worked in depth (over 10 cm). The upwelling of water that occurs naturally by capillary action is in fact broken up by cultivation. Passage of the roller slightly decompacts the soil and so recreates moisture conditions favourable to germination and development of seedlings.

For sowing, given that various seeds harvested in meadows of high biological value (see harvesting the seeds below) are involved, it is recommended that broadcast sowing be done with a seeder of Vicon centrifuge type or a pendulum seeder. The use of a pneumatic seed drill often proves difficult, given the risk of jamming caused by the lack of grading of the seeds. Over small areas, sowing can also be done traditionally, by hand.

4.4.4. Restoring natural habitats

A natural habitat is a homogeneous space from the point of view of ecological conditions (especially soil and climate) and its vegetation (herbaceous, shrub and tree). It hosts a certain fauna, with species having all or part of their various vital activities in this space.

The main natural habitats covered by the LIFE Elia-RTE project are: peatlands, moors, chalky grasslands and lean meadows. These environments, by their scarcity and the diversity of species they host, require special protection. They are classified as “of community interest” by the European Commission. It has compiled a complete list of these endangered natural habitats. This means that at the European scale it is necessary to protect them or, better, restore them to improve their state of conservation or increase their areas.

Many other natural habitats car be restored in Europe. The Natura 2000 network, established by Europe, encompasses a large part of these natural habitats. This network includes a group of sites located in each Member State. The sites have been selected because they host species of community interest and/or habitats of community interest. Any actions likely to destroy them (draining peatlands, use of phytopharmaceutical products or fertilisers on lean meadows, overgrazing...) are prohibited! In Belgium, the Natura 2000 network covers 13% of the territory. This figure is similar in France if referring solely to territorial lands.

The interest of restoring natural habitats

The natural habitats dealt with in this booklet are of maximum biological interest when the management applied to them obtains a stable plant community. Natural habitats restored as part of this LIFE project have been selected because the height of the vegetation growing there remains low, which is compatible with the issue of electrical safety. For a dry moor, for example, the plant community dominated by the Common Heath (*Calluna vulgaris*) will expand to the point where other woody species will have difficulty germinating and thus growing.

There is therefore a real interest for the electricity Transmission System Operator. In terms of future management, the efforts to be provided by the TSO to prevent any electrical accidents are greatly reduced.

All information on restoration and management of natural habitats is available at http://www.life-elia.eu/en/Brochure-n-6-Restoring-natural-habitats.

Restoration of peatlands

Two main techniques can be used:

→ **Blocking of drainage:**

Under the forest electrical grid, one of the first actions to implement to restore peaty environments is blocking of old drainage ditches. The purpose of this operation is to ensure a rise in the water level of the peatland by removing the old flow.

When this is possible, blocking must be total, by filling the drainage completely with peat or white clay.

→ **Tillage:**

Degraded peatlands gradually dry out and constitute terrain increasingly favourable for the establishment of moorgrass, a grass that forms dense monospecific carpets then allows establishment of woods.

When this drying out is confirmed, restoration of the peatland can involve tillage, which is a scraping of the superficial layer of the soil. This operation consists of baring the soil and reactivating the dormant seed bank. This technique makes it possible to retrieve the original natural habitat fairly quickly.

Restoration of heathlands

Tillage to restore heathlands by removing the top layer of the soil

Moors are temporary habitats, even more so when they are dry, since the establishment of trees and shrubs is then facilitated and they can quickly smother the typical small species of the moor.

Before undertaking the work of restoring a moor, it may be necessary to ensure the site's potential for regeneration. This potential is reflected in the nutrient-poor soil and by the presence of seed plants in the immediate vicinity of the work area.

As with peatlands, an effective method for restoring a moor is tillage. The presence of trees and shrubs of less than 4 meters height and a diameter of about fifteen centimetres does not hinder tillage, provided that the specification has provided for this and that the operator has therefore been able to take equipment appropriate for this work.

Restoration of calcareous grasslands

Orchids are typical from calcareous grasslands. The can develop with appropriate vegetation management.

Chalky grasslands are transient environments which, without human intervention, will progressively evolve towards bushy stages and then to forest.

Restoration of chalky habitats therefore requires the elimination of most of the shrubs in place.

It can be done either by brush clearing if there are few shrubs or if the terrain is inaccessible by a machine, or with the help of a rotary cutter. In this case, it is advisable to carry out mulching above ground in order to preserve the herbaceous flora already in place.

Long-term management of restored natural habitats

Most of the time, restored natural habitat will be managed by:

- Grazing: see chapter 4.4.2. It will be adapted in terms of timing and frequency to the natural habitats requirements.
- Mowing: see chapter 4.4.3. It will be adapted in terms of timing and frequency to the natural habitats requirements.
- Manual tilling of undesired tree species

4.5. Others actions

4.5.1. Planting conservatory orchards

Little apples from a wild Apple tree

Secondary species not prized for their economic value, some fruit trees have become very scarce in our European forests. For example, in Belgium, this is the case for the species of wild fruit trees: the European apple tree (*Malus sylvestris*), the wild pear (*Pyrus pyraster*), and the medlar (*Mespilus germanica*). The same applies to the common juniper (*Juniperus communis*).

In some regions, these species have virtually disappeared from the forest populations, the consequence of management too oriented toward production of wood alone. These small species have given way in many locations to production species like the beech or spruce in Belgium.

These orchards are called “conservatory”, as they thus contribute to safeguarding these rare species by ensuring that their genetic heritage is preserved.

Orchards of wild Apple trees planted in row, every 5 metres, under HV lines

The interest of restoring natural habitats

The key idea behind the establishment of conservatory orchards in forest corridors with high-voltage lines is that they very strongly reduce the possibility of growth of problematic tree species.

The establishment of conservatory orchards is of interest:

for a genetic reservoir

These orchards will re-energise the populations of wild fruit trees, but also facilitate harvests of fruit (and thus of seeds) for future programmes of redeployment of the species conducted by those involved in forest protection (administrations, research centres, associations, public initiatives, etc.) or nursery owners.

for specialised production of wood

In the long term, if they are well looked after, the trunks of fruit trees can provide the wood industry with small high-quality logs sought after especially in cabinetmaking.

for increased biodiversity

The flowers and fruits of the species in these orchards will be especially attractive to pollinating insects, birds, small mammals, and large and small wild fauna.

for improving the hosting capacity of the forests

The production of fleshy fruits will not fail to attract large and small wild fauna. Boars and deer are very fond of them, which argues for establishment of these orchards in hunting grounds. Wild apples resist the cold longer and remain available a long time for the animals, which will benefit from their presence during long winters.

for a positive impact on the landscape

These orchards provide a special touch to the ambiance and the forest landscapes because of their form, their abundant blossoming, the fruit and the fauna they attract. They emphasise the corridors depending on the seasons and will play an important role as a focal point in the landscape.

All information on conservatory orchards is available at http://www.life-elia.eu/en/Brochure-n-4-Forest-edges-and-orchards.

4.5.2. Fighting invasive plants

The presence of corridors and so of open environments in a forest area is advantageous for biodiversity. However, these stretches can become vectors for the spread of invasive plant species. Propagation of these species is often accidental (via fragments released during crushing or in clandestine disposal of garden waste). It can be reduced, in particular by raising awareness of the public and of managers, but also by promoting proper techniques for prevention and management.

Although there are also numerous invasive animal species, we will only deal with plant species here, as it is mainly on these that management of the corridors can have an impact.

The European Commission has also studied the issue of invasive species and has drawn up a list of species that cannot be sold anymore. It has drafted a regulation on prevention and management of introduction and propagation of invasive exotic species in Europe.

Raising awareness and prevention

Management of invasive plants necessarily involves raising the awareness of, and training, personnel, both those within the TSO and those of subcontractors involved in maintenance of the vegetation in the safety corridors.

The main ways that invasive plants enter include accidental imports of plant fragments via worksite machinery and clandestine disposal of vegetation (pruning waste, clippings, etc.). In fact, management machinery (grinder, for example) of course goes from one site to another and fragments of species such as Japanese knotweed may thus be transported and dispersed. This being the case, it is essential to delineate the infested areas to exclude them from the worksites and so avoid accidental dispersion.

Along the same lines, if earth must be moved, it must be absolutely ensured that it does not contain invasive species. If so (and in particular in the case of Japanese knotweed), this earth is unsuitable for use and must be put in landfills.

For any worksite aiming to manage an invasive plant, or a worksite on a site where an invasive plant is present, the specifications must include technical notifications that are as precise as possible to ensure adequate management or implementation of measures to avoid dispersion.

Actions on site to counter the spreading of invasive species

Hand removal of an invasive specie: *Prunus serotina*

Actions to fight against invasive species include grazing, manual removing, covering with plastic cover sheet, or surrounding plantings with fast-growing species. All information are available at http://www.life-elia.eu/en/Brochure-n-5-Ponds-and-invasive-species.

4.5.3. Digging ponds

Pond dug in the best way to favour biodiversity: orientated to the south, with mild slopes along the banks and in a bean-shape

The ponds dug in the LIFE project are semi-natural; that is, they are manmade, but every effort is made to give them the same characteristics as natural ponds (no sheeting in the pond bed, irregular contours of the banks, no species introduced, etc.).

In general, as long as water accumulates there rapidly, ponds are very quickly colonised by fauna. Among the first colonisers, aquatic bugs and beetles, newts and dragonflies often appear. The latter are in fact capable of covering large distances rapidly and so can quickly discover a new pond. Amphibians make their appearance there shortly thereafter. These animals are the prey of certain birds, so an entire food chain benefits from this. From the point of view of vegetation, algae, aquatic plants and shore plants will progressively establish themselves.

A good location makes the pond to fill quickly with water

For the TSO, these ponds are sometimes an answer to problems of stagnant water in the vicinity of pylons or on the route of the patrollers. They allow water to be concentrated in one place and consequently help drain these too-wet areas.

On good locations

When a semi-natural pond is to be dug, the decisive criterion in the choice of location is the possibility of a natural and regular water supply. This criterion is generally met in two particular cases:

→ either the terrain is marshy, muddy or peaty by nature and it is mainly the water table that will supply the pond,

→ or it is dug along the natural runoff path of rainwater that will thus constitute the water supply (this does not involve diverting streams, which requires authorisation in addition to that for digging). In this case in particular, the soil must have good water retention.

From the point of view of the work of network maintenance teams of Elia, no pond has been dug in the less than 20 m away from the pylons. But this distance is left to the judgement of the TSOs. Maintenance and monitoring vehicles must keep an easy access to the pylons.

Technical specifications of ponds

To maximize the positive impacts for biodiversity, ponds should be dug according to some important criteria:

- → size
- → depth
- → shape
- → orientation
- → slope of the banks

All information are available at http://www.life-elia.eu/en/Brochure-n-5-Ponds-and-invasive-species.

5 Working methodology

The LIFE Elia-RTE project has developed a working methodology that was applied on all areas where alternative vegetation management methods have been implemented. Composed of 6 steps, this methodology is combining all aspects linked with vegetation management on a land which is not owned by the TSO like technical requirements for electrical safety (distance to the cables), local potential for biodiversity, interests of local stakeholders (owners and managers) and tools to design actions and to register management plans

These 6 steps are:

- Initial mapping
- Proposition of actions on site
- Negotiating with local stakeholders
- Agreements with landowners and land managers
- Specifications, call for bids, on site works and control
- Management plans

Furthermore, the LIFE Elia-RTE project has also developed two actions which accompany this methodology:

- Measurement of indicators: Biological and Economical
- Communication on the actions and training sessions for TSO vegetation maintenance staffs

5.1. Step 1: initial mapping

This first step of Initial mapping is the starting point of the whole methodology and is crucial for all the next steps. It provides a fully integrated overview of the electrical network by making available a large amount of information linked with forest corridors under the HV lines. These informations can evolve all along the process through day-to-day updates. Eventually, it will also allow fast reporting.

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

5.1.1. Indoor layers upload

Mapping is first prepared indoor on a Geographic Information System (GIS) on which a mapping project is set up. This project organizes all needed layers that might be of some use for the work, defines styles and links (between layers and/or tables). These resources are locally present on drives or available on-line through Public services:

- HV lines network (with TSO classification features)
- Maps from the Geographical National Institute
- Landowner register
- Aerial photos (digital orthophotomaps)
- Protected areas (Natura 2000 sites, Nature reserves, National parks...)
- Any existing data on natural habitats and species

A simplified project is subsequently uploaded on a field tablet.

5.1.2. Indoor form set up

A pre-set form is established indoor so that it can facilitate the work on the field. The form will help to process all the data collected on the field. Each features have to be thought carefully, and should give open answers or answers from a list of possible answers.

This form will encompass the following data:

- Type of vegetation
- Height of vegetation
- Slope and solar exposition of the corridor
- Type of possible restoration actions
- Accessibility of the HV line sections
- Presence of natural habitats (if possible with EUNIS code[2]) or rare species
- Presence of human facilities (such as hunting huts for example)
- Any other comment that would give information on the way the corridor is managed or on the landowner interests

5.1.3. Field survey

The field survey helps to gather a wide range of fine-tuned information. The procedure is the following one: the worker in charge of the mapping walks along the corridor and integrates data in the pre-set form.

An expert judgement is here needed to foresee what are the vegetation management alternative methods that could be implemented.

Georeferenced pictures must be taken during the survey. They will facilitate the work indoors after the mapping. An example of a library collected during the survey can be seen at https://lifeelia.github.io/Chapeau_Web_Nassogne-Tenneville_FullScreen_En.html.

All information on Vegetation mapping is available at http://www.life-elia.eu/en/Brochure-n-1-Vegetation-mapping.

5.2. Step 2: proposition of actions on site

During the mapping, information on objects can also be added in the GIS of the tablet, such as:

Linear objects:

- Existing fence, track, ditch, hedgerow
- Forests bordering the HT line
  - level of risk: no risk to the line, existing risk, future risk (with evaluation of forest growth), risk requiring priority management
  - type of species in the neighbouring forest
  - current height of forest
  - distance of forest edge to the central axis of the line
- Possible actions for nature
  - plantation lines of forest edges

2 EUNIS [European Nature Information System] code: a classification system for European natural habitats

Points:

- Potential for digging a pond
  - potential site
  - estimation of the potential size (in m²)
  - technique: digging, blocking up drains
  - identification number for permit
  - distance to the nearest pylon
- Invasive plants
  - Latin name of species
  - number of plants or area of the species

Polygons:

- Presence of natural habitats: peat bogs, heathland, meadows
- Potential of the restoration actions
- Human activities habitats: intensive pastureland, meadow mown by hunter

As the mapping is completed, possible alternative vegetation management methods can be listed out. A map is then created to give a visual aspect of the polygon dedicated to each action. A simplified version of this interactive map is available on the LIFE Elia-RTE website at http://www.life-elia.eu/en/Couvin, for the site of Couvin.

Even though there is a constant care about the work of the TSO, this map is screened by the TSO maintenance team to check if it can be combined with patrollers' work.

5.3. Step 3: negotiating with local stakeholders

The negotiation can sometimes be the most time and energy consuming step of the methodology. It can be very efficient when speaking with one large landowner who is convinced by the project, but it can be very slow when speaking to a large number of small landowners.

5.3.1. Identifying the landowners and land managers

It is first necessary to identify who are the landowners concerned by the forest corridors. Usually this is already known from step 1. The best tool to use is the national or regional land register, which can be obtained either for free or for a certain price depending on the country. Contacts can be made by mail or by phone call if the landowner is easily reachable, like a Municipality for example. If the corridor is located in a public forest, then the land manager has to be involved in the discussions as well. Often it is the national or regional Forest Administration.

5.3.2. Meeting the landowners/land managers and understanding their interests

Meeting with TSO, landowners and land managers to propose alternative vegetation management actions

During the meeting, experts are first explaining the objectives of an alternative vegetation management method. It is the right moment to detect what are the main interests for the landowner.

Here is a set of arguments which are likely to interest different types of landowners/land managers:

Wood production

- Protect the forest from winds and storms by establishing a structured forest edge that will decrease wind speed

- Increase the economical value of trees on the border of the forest by avoiding the development of lateral branches, by establishing a forest structured edge
- Integrate the electrical corridor into a sustainable forest certification programme (PEFC or FSC) which precisely recommend open areas or edges
- Contribute to the diversification of wood species within the forest
- Produce firewood that could be harvest by the owner
- Produce small trunks from rare species (apple or peer fruit trees for example)
- Preserve soil quality by avoiding the recurrent passages of heavy machines on a classical vegetation management method

Hunting

- Increase the food available for the game trough grasslands or young trees from edges
- Offer shelter in structured forest edges
- Providing low-height vegetation firing lines with grasslands under HV lines

Biodiversity/landscapes/ecosystem and social services

- Comply with existing regulations aiming at nature conservation such as Natura 2000 network, Green Infrastructures, Biodiversity national or regional laws...
- Reduce visual impact of an electrical corridor in wooded areas
- Contribute to public awareness on nature conservation issues through didactic panels installed on site along trailing paths, leaflets, school visits...
- Offer new grasslands to local farmers
- Increase the ecosystem services provided by natural habitats in forests

Often, the actions proposed can be changed or adapted to fit in landowners' interests. It is of upmost importance to gain trust and confidence from landowners right from the start of the talks.

5.3.3. Long-term management

When discussing with local stakeholders, long-term management is an issue that needs to be addressed early in the talks. Indeed, local partners should not feel trapped in a situation in which they have to guarantee themselves the management after the restoration actions. It has to be avoided by explaining that the long-term management is going to be achieved by the TSO or subcontractors, as it was before the restoration action.

Sometimes, the local partner wants to manage himself the vegetation in the alternative method. The TSO should consider positively this will since it will involve the partner and it will also be a good way to be in contact with him. But it should bear in mind that this intention might be stopped: lack of time, interest or energy being the most frequent reasons. The TSO should not consider it as a failure, but has to value each year during which the partner has been involved and listen in his desire to manage vegetation.

All information on negotiation and agreements can be found at http://www.life-elia.eu/en/Brochure-n-9-Negotiating-and-agreements.

5.4. Step 4: agreements with landowners and land managers

Once everybody agrees on the actions to carry out, there are different ways to conclude the agreement. Even if we could hope for the perfect tool, we should admit that there is no "perfect" or standard solution in terms of contract with landowners or land managers.

5.4.1. A moral commitment rather than a strict legal contract

The contract that will bond the TSO and the landowner should be seen as a moral commitment rather than as a legal contract that could help the TSO win if going to court. Indeed, if the contract is too strict, landowners and land managers will be reluctant to sign it and prefers the TSO goes on itself managing the vegetation.

Even if sometimes projects with local stakeholders may abort due to many reasons, it is better to build the trust and confidence with landowners/land managers. It will help to establish a long-term relation.

Nevertheless, formal contracts can also be signed with municipalities, hunters or farmers for example.

5.4.2. Different types of agreements

Agreement with landowners/land managers can take different shapes:

With a public landowner

- → decisions on actions to carry out and the way they will be managed must be concluded in a Municipal deliberation, which is document that contains all the decision taken by the Municipal Committee.
- → some types of details can also be added to the Hunting lease rules. They will impose the hunter to take care of some vegetation management in his own (and game) interest.

With a private owner: a contract can be established between the TSO and the landowner. It will contain all information about the actions, the way the management will be led in the long-term and other details. This contract should not contain too many obligations for the landowner, otherwise he might not sign it to avoid any problems.

Signature of agreements with the TSO, a local farmer and the landowner

With a famer/land manager: a contract can be established between the TSO, the landowner and the land manager. This land manager can be a farmer or any other person or group who is taking care of the vegetation management. If the farmer receives European or local subsidies for management the land, he will have to comply with the contract and with the subsidies regulation in order not to pay fines. That might be the most powerful tool to comply with the contract.

In all cases, it should be mentioned in all type of agreements that in case of threat on the security of the electric line, the TSO, being responsible of the network, will always have the right to take action on vegetation.

All information on negotiation and agreements can be found at http://www.life-elia.eu/en/Brochure-n-9-Negotiating-and-agreements.

5.5. Step 5: specifications, call for bids, on site works and control

Once everybody has signed the agreement/contract, the working phase can begin.

5.5.1. Specifications

First of all, specifications have to be written down. For every action, specifications have to detail:

- Description of the actions to carry out
- Location and access to the site (maps)
- Specific constraints related to HV lines
- Specific constraints related to nature conservation
- Schedule

5.5.2. Call for bids

Specifications have to be sent to several subcontractors in order to receive several offers that will be compared. The chosen subcontractors must be specialised for the type of actions they can carry out. If possible, they should have their headquarters as close as possible to the sites to avoid long-distance travel.

Some usual subcontractors are clearly not fitting the new type of expected work. If specific knowledge is needed, the subcontractors have to organise the work in order to have a team leader who can guide the workers.

Of all the offers which will be received, it is important to consider both the cost of the work but also the techniques and know-how that will be used. In the framework of the LIFE Elia-RTE project, bids were always selected with the approval of the Elia, the Belgian TSO.

5.5.3. Work on site

Workers planting forest edges in the electrical corridor

Briefing on site on the work that should be achieved contributes to better results

Works on site have to be carried out at an appropriate period. The following periods should be preserved from works: mating season, hunting days, soil sensitive period (during humid conditions).

It should be borne in mind that the presence of an expert is essential on the first day of work. Even if everything is precisely explained in the specifications, the operator will always appreciate additional on site information. If the work should last more than a day, the expert should consider passing by the site on regular basis during the operations.

At the end of the mission, the expert should control and validate the work. This validation has to be given before the payment of the bill.

5.6. Step 6: management plans

After the works, the management plans have to be drafted. Even though they were supposed to be decided before the launch of the works, some details might be added after the work, depending on the results obtained on site.

5.6.1. Guidelines for the long-term management

Management plans should contain the following information:

- General data
  - Name of the landowner
  - Name of the land manager
- Type of vegetation management
  - Description of the existing vegetation and the restored vegetation
  - Restoration actions
  - Specific points to monitor
  - Actions on vegetation to carry out
- Calendar
  - Schedule of the actions

It has to be understood that this management plan, as any other planning tool, gives the best possible estimation of how and when the actions of vegetation management should be carried out. Plants and trees being living organisms, they can evolve in different ways according to weather conditions or other unpredictable factors.

The expert in charge of the long-term management will have an important task to monitor the evolution of vegetation, and order works when it is necessary. Therefore, some flexibility should be tolerated regarding the management plan. This flexibility will improve the impact for nature and often decrease vegetation management costs since management actions will be performed at the right moment.

5.7. Biological and economical indicators

For any TSO taking the path of alternative vegetation management methods, feedbacks on the actions implemented will be very important. Biological and economical indicators will provide interesting feedbacks on the impact of these methods.

5.7.1. Biological indicators

To assess the impact of the alternative methods, TSO should measure the evolution of biological indicators. Indicators chosen in the framework of the LIFE Elia-RTE project were:

- Birds
- Plants
- Butterflies
- Dragonflies
- Amphibians
- Reptiles
- Bats

These indicators will be looked at in terms of quantity of species and number of individuals. A special focus will also be brought on “red list” species[3].

3 Red list” species are threatened species within a given territory. This list is usually drafted nationally by the competent Administration

Butterflies is an important group to monitor

For each site, depending on the actions carried out, a set of indicators was selected. For each type of indicator, a frequency of inventories needs to be decided, as well as the best moment in the year to carry them out.

A strict protocol should be written before starting the inventories. All experts who will perform the inventories way over the years should repeat this protocol. It will guarantee that the data collected will be comparable throughout years.

An important step is the first inventory, called the "To" (T-zero). This "To" has to be carried out before the restoration actions. It is the initial description to which the data collected will be compared later, giving a trend of the evolution of the species populations.

Monitoring dragonflies 2 times a year around a pond under HV lines

Results obtained can be used in potential collaboration with scientific organisation, or communicated to show the positive impact of these alternative methods on biodiversity.

To have a better idea of what can be the outcomes, here is the LIFE Elia-RTE webpage dedicated to the results of biological inventories led during the project: http://www.life-elia.eu/en/Biological-indicators.

All information on biological indicators methodology can be browsed at http://www.life-elia.eu/en/Brochure-n-7-Biological-indicators.

5.7.2. Economical indicators

In a global context of cost reduction, there are no TSO ready to spend money on alternative methods without having a clear vision on long-term impact on budget. A cost-benefit analysis has been carried out in the LIFE Elia-RTE project. Unit of comparison selected was the €/ha/year. It was an important piece of work in order to assess the economical impact, comparing on one side the traditional management costs and on the other side the alternative method. The following table gives an overview on the results obtained.

	Comparison traditional management/LIFE method		With WACC = 5%
Actions	**Return on investment**	**After 30 years**	**After 30 years**
Planted edges	9 years	1.9 times cheaper	1.4 times cheaper
Restored edges	3 years	2.1 times cheaper	1.8 times cheaper
Pasturage	6 years	2 times cheaper	1.8 times cheaper
Pasturage in hard conditions	5 years	4.7 times cheaper	3.9 times cheaper
Mowing	6 years	4.9 times cheaper	2.5 times cheaper
Natural habitats (heathlands)	3 years	5.3 times cheaper	3.9 times cheaper
Natural habitats (peatlands)	9 years	3 times cheaper	1.8 times cheaper

In the LIFE Elia-RTE project, given a worst-case scenario and a Weighted Average Cost of Capital[4] of 5 %, all actions turned up to be cheaper (from a factor 1.2 to 3,9) than traditional methods on a 30-year scale. In all the cases, an initial investment has to be spent on year 1, but in the following years management costs are less important than in the traditional periodical mulching. All these results are online at http://www.life-elia.eu/en/Brochure-n-2-Cost-benefit-analysis-118.

These indicators are an excellent feedback on the potential savings obtained from these vegetation management alternative methods. Eventually, it will provide the TSO useful data to be considered in decision-making processes:

1. Cost of initial investment for each action
2. Number of years before reaching Return On Investment
3. Potential long-term savings

It is important to lead the cost-benefit analysis on a worst-case scenario so that all expenses will be planned.

Another major point that should be investigated more deeply is the indirect benefits.

The following table gives an overview of these benefits, by comparing them to the traditional vegetation management.

Other impacts	Traditional management	LIFE Elia-RTE management
Institutional, administrative and strategic aspects		
Facilitation in obtaining permits	none	Positive argument if presented upstream of new project, since Elia is seen as a partner in promoting biodiversity and not an organisation that destroys biodiversity
Relationships with institutions (Local authorities and governments)	"Passive" contact with forest authorities	"active" contact with forest authorities, co-construction of management methods that enable several objectives to be achieved, building of relationships of trust
Design and creation of overhead lines	Rejection	Improved due to biodiversity areas and at the same time potentially positive impacts on the demands for the network to be buried. Reduction of political pressure to put the lines underground
Europe		
Positioning in Europe	none	Positions TSO among the pioneer companies of these new methods
European legislation	none	Application of legislation on biodiversity and anticipation of the same on invasive species. LIFE Elia is quoted in the "Guidance document on energy transmission infrastructure and Natura2000 and EU protected species".

4 The **weighted average cost of capital (WACC)** is the rate that a company is expected to pay on average to all its security holders to finance its assets. The WACC is commonly referred to as the firm's cost of capital. Importantly, it is dictated by the external market and not by management. The WACC represents the minimum return that a company must earn on an existing asset base to satisfy its creditors, owners, and other providers of capital, or they will invest elsewhere

Other impacts	Traditional management	LIFE Elia-RTE management
Landscape and Nature		
Landscape	Brutal interventions that are highly visible	Smooth integration of lines, colourful blooms, more acceptance by adjoining landowners
Biodiversity	Negative impact in terms of destruction of plants, disturbance of species and soil degradation	Biodiversity promoted, networking challenge, creation of genetic pools of disappearing plant species (orchards)
Social acceptability and communication		
Shared values	none	Creation of benefits and financial resources for other actors
Internal Elia communication	none	Motivation to work for a company committed to nature conservation
External Elia communication	none	Many possible opportunities (articles, videos, brochures, etc.) to communicate to the general public, environmental associations, local authorities, governments, etc.
Local embedding		
Integration of local actors	Subcontractors covering wide areas, externalisation of management	Local entrepreneurs, farmers, hunters, environmentalists. Stronger local embedding, local population
Production of new values		
Bordering forests	Exposure to wind and sensitivity of forests to storms	Forest protection through structured edges which creates better resistance to storms
Added agricultural value	none	Hay production, pasturing areas (meat production), redeployment of endangered local breeds, beehives (honey production).
Added value for ecology and game	Maintenance of open areas for game	Restoration/creation of ecological habitats and feeding grounds for game
Added value of forests	none	Better quality for trees in the edge, possible production of firewood, small logs from fruit trees
Practical improvements		
Formalisation of boundaries	Administrative agreements (sometimes put into question during sales and inheritances)	Fixed arrangements enabling the width of areas to be restricted sometimes without financial damage
Institutional, administrative and strategic aspects		
Facilitation in obtaining permits	none	Positive argument if presented upstream of new project, since Elia is seen as a partner in promoting biodiversity and not an organisation that destroys biodiversity
Relationships with institutions (Local authorities and governments)	“Passive” contact with forest authorities	“active” contact with forest authorities, co-construction of management methods that enable several objectives to be achieved, building of relationships of trust

Other impacts	Traditional management	LIFE Elia-RTE management
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Europe		
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European legislation	none	Application of legislation on biodiversity and anticipation of the same on invasive species. LIFE Elia is quoted in the "Guidance document on energy transmission infrastructure and Natura2000 and EU protected species".

If everybody agree that these indirect impacts have a value, it is very hard to quantify it precisely. This valuation of impacts that has no intrinsic price is a part of the concept of ecosystem service https://en.wikipedia.org/wiki/Ecosystem_services). Measuring the value of ecosystem service is a process that is based on hypothesis of monetization of each sector separately.

5.8. Communication and trainings

It is important to *"do what you say"* in order to gain confidence from the local partners, and to *"say what you do"* to broadcast the positive dynamic established locally.

At first, communication should start with small events or news on a local level. Then, communication could progressively evolve to a wider audience, by reaching regional or national medias such as newspaper, TV and radio.

One of the important point of communication is that it can raise the interest of people even if the TSO cannot reach them at first. Which means that a part of these interested people will come to the TSO to be integrated in nature-oriented projects. With these landowners or land managers, the negotiation phase will be easier since they are already motivated by the concept or alternative vegetation management methods.

5.8.1. On site communication tools

Leaflets explaining the main challenges of vegetation management and how the TSO has implemented actions for nature.

Wherever a managed site is crossed by a hiking trail, it is possible to raise awareness on biodiversity and to show what the TSO has been implementing. It is important to relate with species and natural habitats that are targeted by the actions.

Two communication tools can be installed on site:

- Didactic panels explaining the actions
- Viewpoints to observe wild fauna in the corridor

Leaflets can be drafted on the site particularities and be available in Municipalities and in Tourism Offices.

5.8.2. Organisation of conferences and events

Conferences and events can be organised to gather people and to explain what are the actions carried out on site. It is a good way to create enthusiasm at local level. Any occasion where people can meet and exchange is positive to create bounds and relations. As an example, visits were organised every year within the Nature Festival in France, allowing RTE and local partners to meet and discuss on local actions.

Event organised for the unveiling of a viewpoint built under HV lines to observe wild fauna. Walloon Minister of Nature Conservation, official from the European Commission, official from Elia, and the Mayor of the Municipality. A good way to strengthen relations with local stakeholders.

Plantation of edges with children from a local school.

5.8.3. Publication of articles, videos and pictures

To reach a large number of people, articles can be written in specialised review. Periodical of main Federations (forest owners, landowners, hunters or farmers federations, nature reserve, NGO...) should be solicited to publish an article on alternative methods and their advantage so that it could interest potential partners on site.

When organising events, it will be interesting to invite local officials and the press to have a bigger echo.

All these efforts will contribute to the renown of a project, and will facilitate further contact made by the operational teams with all stakeholders on site. So actions on site are providing materials to communication and communication effort will help the deployment of actions on site.

5.8.4. Trainings for TSO staff

Trainings session have also been organised for Maintenance Department employees. They were held indoors and on the field, and the objective was to explain how the alternative methods can be implemented, what are the benefits and how the long-term management should be organised.

Journalist interviewing TSO official to know more about the involvement of the TSO in Nature conservation.

Trainings on the field with TSO employees to show what are the problematic species and the ones that will not grow high

6 Deployment of the actions for a TSO

This chapter is a kind of digest from the LIFE Elia-RTE project's experience. During the 6,5 years, the team experienced different situations of important progress but also difficulties. It a sole reflect of the team's opinion.

When (somebody from) a TSO decides to initiate a shift in terms of vegetation management, it can take a while before things can really start. There are obstacles that might make it difficult to progress, and there are some bottlenecks that need to be addressed. This chapter is trying to summarize this process by showing what could be the choices and the further step to go.

It has to be underlined that alternative methods for vegetation management do not have to be applied everywhere.

6.1. In the company

6.1.1. Getting support within the company

Presenting a cost/benefit analysis

Conference for several Departments of a TSO

First of all, the drive of looking at vegetation management alternative methods has to come from someone, or a group of person. That person, or group, will probably have to undergo some resistance within the company. Most of the time, Communication, Environment and Public acceptance Departments will be ready to work in that direction due to their proximity to the expectations of civil society. But often, if the potential of such a shift is grabbed easily in Environment Departments, it might be more difficult to convince Maintenance Department or Finance Department.

The best asset of alternative methods is to prove that they can cost less money, as we've showed in the Cost Benefit Analysis. Then one could argue that other kind of benefits for the company (image, public acceptance...) are heavy as well. At the end of the discussion, it has to be understood that a shift in vegetation management has to be considered as one of the evolution to make sure the company meets expectations of society. It is an investment that could be compared with any innovation in terms of technology (type of pylons, type of substations...) or software (to run the network, to facilitate international exchanges...). A company supports these innovations because it is an upgrade in terms of quality for the company. Shifting vegetation management should really be evaluated the same way.

But one should be prepared to face these fears on alternative methods:

- It costs money at the initial investment
- It changes too much the company organization in all departments
- It will not be possible to find subcontractors able to provide an adequate service
- It will take too much time to implement
- It will be too costly to find experts to launch the project
- It will be difficult to develop the project because of the strict national regulation

Energy and conviction will be needed to overcome these resistances. Therefore, as presented below, it might be a good move to start by "small" or "easy" (large public forests for example) pilot sites rather than aiming to change everything at first.

6.1.2. Defining a set of actions

Feasible actions of alternative methods for vegetation management should be exhaustively listed. If there are obvious solutions, like grazing or mowing, each TSO will find actions adapted to the biogeographic zone in with it operates the network. Vegetation management methods will be different if we are in mountains or in humid soils near the coast, in Scandinavia or in Mediterranean countries.

Then, it could be interesting to involve Maintenance team by explaining them the concept of alternative methods, and confront them with the exhaustive list. A top 10 or top 5 list could be created with the teams. It will have the interesting effect that on one side actions will be improved, and on the other side patrollers will feel involved in the process. One must avoid too harsh top down impositions, which risk to freeze vegetation managers motivation.

Training on site with Maintenance team

Trainings on site for long-term management of structured forest edges

6.1.3. Getting the right people on board: meetings, trainings and subcontractors

It will be important to find reliable partners to carry out these alternative methods. These partners have to be found inside the company, but also outside. The most important part of the job is to find experts who will develop the project. They can be found inside the company (vegetation management or consultation departments, but also outside the company in consultancy experts offices. This choice has to be made by TSOs to find the most suitable option. Human resources should be looked at closely. Organizing new methods to manage vegetation in the company requires energy and time. It would be a mistake to think that someone could accompany this shift on top of what are the daily missions of this person. It is often an aspect which is neglected but teams must not feel overloaded with the additional work that is required.

Once people who should work on projects are identified, it is important to organize trainings session so that maintenance people will be accompanied to better understand vegetation management alternative methods. These sessions can look at increasing the knowledge in various fields: vegetation ecology, recognition of species, trust in partnership and alternative methods.

Trainings on vegetal species identification

Concerning subcontractors who achieve on site works, one should bear in mind that the company has an impact on the market. It means that if a decision to manage vegetation differently is taken, then most of the subcontractors will adapt and evolve in their skills. The TSO should be able to raise awareness about new vegetation management methods and accompany subcontractors in a change of a part of their activities.

6.1.4. Investment or costs ?

This is a major issue. If the implementation of alternative methods is considered as additional costs to vegetation management budget, things will be very complicated for maintenance teams who are already doing their best to save costs.

The central question for the company is to determine if of all these actions have to be considered as Opex or Capex.

As presented in the cost/benefit analysis, initial investment needed to implement alternative actions are recovered after a few years. This initial cost of the work has to be clearly assessed as an investment or at least taken out from the classical vegetation management budget by the company. See booklet n°2 available on the website for more information.

This major initial investment can be an obstacle, but solutions for financing these actions are listed in chapter 8.

6.2. Working with partners

6.2.1. Finding the Federations to work with

Federations are regrouping locally, regionally or nationally people of similar interest. These are some Federations or administrations involved in forests and the surrounding open areas:

- Forest owners Federation
- Hunters Federation
- Nature conservation Federation
- Farmers Federation
- Forest subcontractors Federation
- Forestry administration

Field trip on vegetation management and HV lines for the Federation of private forest owners.

In order to establish contacts with these Federations, a list must be drafted and meetings could be organised to share ideas and vision on electrical corridors.

6.2.2. Signing national agreement

These Federations are of upmost importance. Binding with them will allow an easier deployment on local site afterwards, as these Federations have local or regional branches. Knowing that there is a national agreement with the TSO, local branches will be more keen to collaborate with the project.

Signature of agreements

An agreement can be signed between the TSO and those Federations. The content of this agreement will mainly summarize what the TSO can offer (a shared vision on the way vegetation should be managed) and what the TSO can expect (contribution to the work on site or to the finding of solutions when management methods should be found).

More information on partnerships and agreements developed in the LIFE Elia-RTE project are available in the booklet n°8 and booklet n°9 available on the website.

6.3. Actions deployment

6.3.1. The starting point

For a TSO interested to shift from a classical vegetation management to alternative methods, there must be a starting point. Being too ambitious right from the beginning might lead to a paralysis. Indeed, criteria to be taken into account the entire network are numerous and discussions can be very long.

Another strategy would be to test at small-scale these alternatives, on pilot sites to make it a showcase for further deployment. This would be a good way to gain confidence in the methodology (inside and outside the company), and to adapt it before further development. For the staff, it is also a good way to get familiar with these alternatives.

6.3.2. Choosing pilot sites

Choosing good pilot site locations is crucial to launch the process in the best conditions. These are several criteria which need to be looked at:

- **Landownership:** choosing public properties will make things easier. Having for example one Municipality to speak with will limit the time spent on the negotiation step. Furthermore, public properties are more likely to integrate large section of the HV network. An analysis of the maps of land register and the HV network will help to identify interesting spots. Another point is that a public authority is often open to any initiatives that will improve the integration of the HV lines in the landscape and involve citizens positively. Preliminary contact with a pre-selected Municipality should help to confirm this potential interest. Working on private land can be done in a pilot site if the landowner is known and is motivated by these alternative methods of vegetation management. The worst situation to start with would be a section of the network with a high number of “small” private owners. The time spent to identify, contact and negotiate will be high and the risk is to discourage the working team.
- **Local partners:** these partners will really contribute to deploy the actions for nature locally. As mentioned before, there are a lot of different potential partners to rely on. The experience of the LIFE Elia-RTE project shows that individuals are really important. Having an overview of the active Federations (National or regional nature parks, Hunters associations, Nature reserves...) will be useful when they will be overlaid with the land register layer in a GIS.

- **Potentialities:** if employees from the TSO can identify hotspots where vegetation management is not easy or extremely expensive, or where local partners are interested and involved in vegetation management, it will be also be a good point to be added in the decision making.
- **Location:** as the TSO organisation of the HV network is divided in regional/local centers, it is relevant to deploy pilot sites in these different administration sections of the TSO general organisation.

Mixing these 4 main aspects will help to choose the pilot sites. Depending on the information collected, choosing 2-3 pilot sites with a size of around 5 to 10 ha each is a good start.

6.3.3. Gathering data for feedbacks : economical et biological indicators

Economical and biological indicators are developed in the chapter 5.7. These indicators should be monitor on the two or three pilot sites, since they will provide important data for the company.

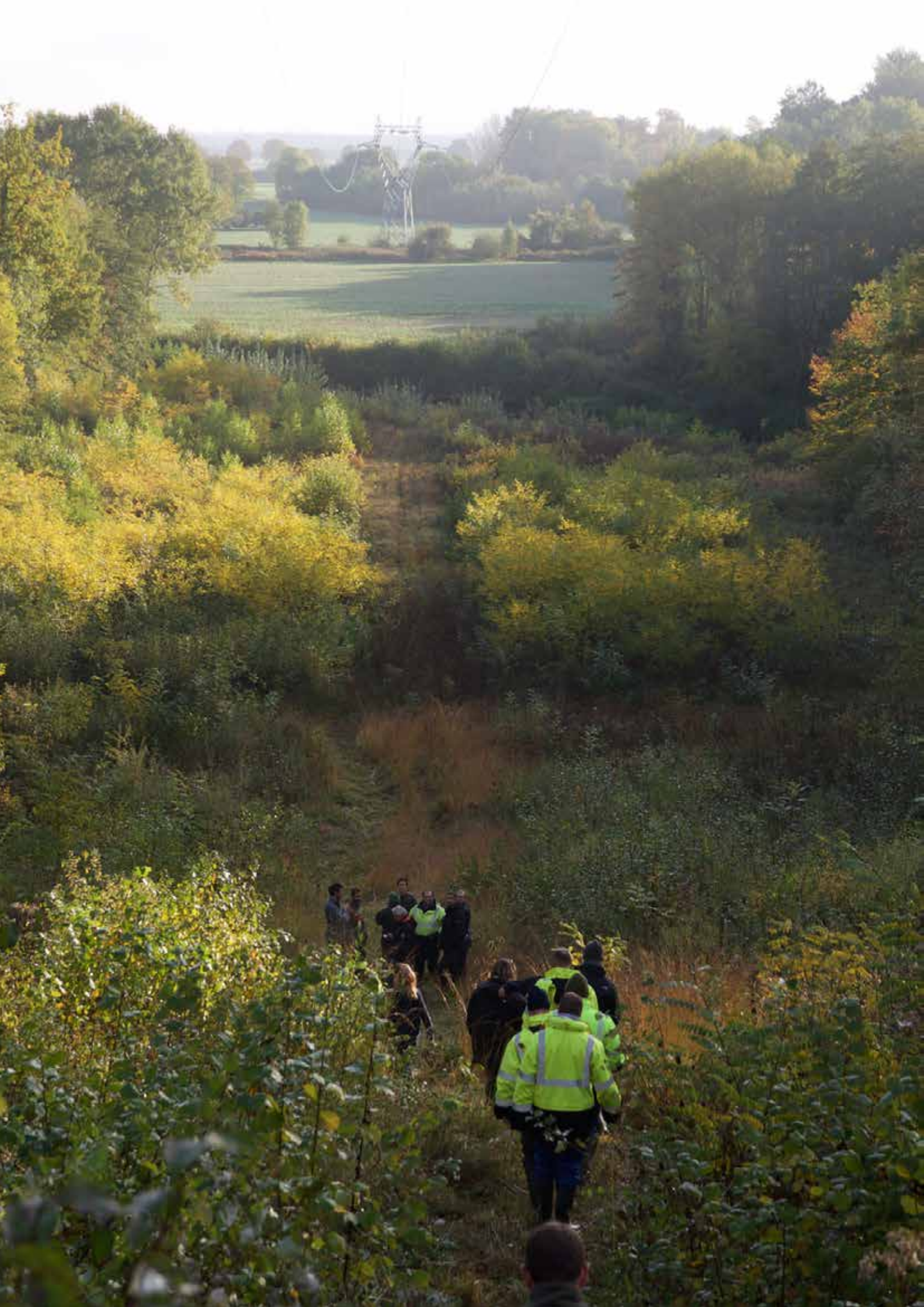
These indicators can be monitored by TSO staff for the economical level or by local experts for the biological one. They must be monitored before the start of the actions (the so-called T0) on site so that the TSO will have a clear idea of the initial situation.

6.3.4. Communication

As it is mentioned in chapter 5.8, communication actions will strengthen the deployment of the actions on site. Organising conferences and events around the actions on site will be a good way to build a profitable dynamic.

6.3.5. Replicating and up-scaling

Once conclusions will be drawn from the pilot sites experiences, the TSO will be able to adjust the methodology. Further on, on the basis of the lesson learned from the pilot site, it will be easier to draft a plan to up-scale the alternative methods of vegetation management to a larger area at national level.



7 Examples of vegetation management best practices from other TSO in Europe

Every TSO in Europe has to deal with vegetation management according to various aspects. Landownership, weather conditions and type of vegetation are among the most important factor that will affect the way vegetation is managed under HV lines. For each situation, TSO have found a way to combine these factors with the safety of the network.

In many countries, biodiversity has been taking an important part during the last years. Each TSO has to find the best way to enhance biodiversity under its network.

This chapter gathers experiences and cases of vegetation management best practices from TSO from 8 different countries: Finland, Italy, The Netherlands, Slovakia, Austria, Sweden, Switzerland and Portugal.

7.1. Example of best practices from Fingrid (Finland)

FINGRID

EIA as a step for biodiversity

For a long time now, Fingrid is taking care of integrating environmental issues in planning, constructing and managing phases of building/renovating new power lines. In the framework of the Environmental Impact Assessment, environmental data is collected and site-specific guidelines are available and used for the whole lifecycle of the power lines to retain the sites' values.

A set of 7 idea cards to inspire landowners to use the right-of-ways for humans and biodiversity

Land under transmission lines belongs to the landowners and Fingrid as a transmission system operator has a permanent, limited right of use to it. Since 2017, a campaign has been launched towards landowners underneath aerial powerlines. The idea is to value the right of way in electrical corridors as an asset for alternative maintenance, mainly biodiversity-friendly. A set of 7 actions has been promoted through the release of 7 idea cards related to: Grazers as landscape managers, Christmas tree cultivation, Diversity from wetlands, Saving the pollinators, Delicacies and beauty from cultivation, Aiming for game and Managing traditional environments. To ensure acceptance of these techniques within maintenance specialists, the environment specialists worked hand in hand with the maintenance staff to make sure the guidelines were safe and feasible.

These guiding idea documents, available at http://www.fingrid.fi/fi/verkkohankkeet/voimajohtoalueiden_hyodyntaminen/Sivut/default.aspx, have been promoted during Environmental Impact Assessments, in forestry and farming fair in the countryside.

Incentive measures for nature

Traditional rural biotopes are the most threatened habitats in Finland. Fingrid has implemented a funding tool for landowners who are ready to manage their land in favour of traditional landscape and nature values. The support contains two components: They can receive 300 €/ha, as a one shot, for applying vegetation management measures that are encompassed in a treatment plan made by landscape specialists and paid by Fingrid.

The plan is written by experts form the Pro Agria - Rural Advisory Services and is containing guidelines for the landowner to manage the vegetation of the transmission area. Experts are spread locally throughout the country and are providing advices to farmers and foresters. This partnership helps Fingrid to reach landowners.

Decaying dead trees

Another measure taken by Fingrid is to promote standing and laying deadwood, which are important for the biodiversity. When contacting the landowner for cuttings, Fingrid is promoting deadwood to the owners by focusing on the fact that trees targeted are the ones with less economical value.

Case: local project in Nokia

A "win-win" project has been launched in 2010 around the municipality of Nokia. The corridor under the powerline, around 700 meters long, is located on an island and therefore hard to reach, sheep are great allies to manage this area. The Municipality and the Church of Nokia (as the land owners) have offered the installation of fences and drinking places for sheep. Three times a week, people from the local football team are looking after the sheep. Fingrid is paying for the efforts of these people and for the renting of the sheep to the owner low price since the owner also benefits from the situation.

In terms of public acceptance, this example has proved to be very efficient since landowners around the lines are really enjoying this new landscape and the presence of sheep. For biodiversity, an increase in the number of plants and variety of species has already been recorded.

Many thanks to Tiina Seppänen and Satu Vuorikoski (Fingrid) for this contribution.

7.2. Example of best practices from Terna (Italy)

Measures for biodiversity protection

Within Terna's environmental policy in terms of biodiversity, mitigation and compensation measures are a key element in order to improve the integration of the national electricity grid infrastructure in the surrounding territory and to reduce eventual impacts.

In areas of high environmental value and landscape interest, Terna implements different kinds of actions with the aim of biodiversity protection:

- Naturalistic engineering techniques to mask substations and to stabilize slopes or scarps;
- Environmental recovery and habitat requalification;
- Restoration of vegetation after the demolition of overhead line.

In the following paragraphs you will find just a few examples which can briefly describe Terna's approach to protect biodiversity, its principles and methods.

Maleo and Chignolo Po Substations: masking actions

In Lombardy (North of Italy), after the realization of the new power line 380 kV between the substations of Chignolo Po and Maleo, Terna has realized two masking projects for both the substations.

The Maleo substation is located in the River Adda Regional Park, in a landscape characterized by vast cultivated areas, natural and semi-natural woods, poplar plantations and some residual wet zones. The Chignolo Po substation is located in a flat area surrounded by cultivated land where natural environments are scarce and fragmented: small woods along the river, river banks and some residual wet areas, survived to drainage measures.

The masking measures that Terna has realized are based on naturalistic engineering principles and foresee the use of local species in order to obtain the highest level of biodiversity, according to the security conditions for both the construction and operational phases of the electric infrastructure.

In this context, about six years after the realization, different actions applied in both the projects have allowed the growth of plants and the development of vegetation spots totally coherent with the potential natural vegetation of the area, improving the environmental quality in terms of flora and fauna.

Moreover in the case of Chignolo Po, where the substation is quite isolated from the natural areas of the surroundings, the new born vegetation areas with bushes and trees have created ecological conditions

which have favoured the colonization of a rich population of tree frogs (Hyla intermedia), amphibious animals very interesting from a naturalistic point of view and scarce in all the investigated surrounding territory.

380 kV power line between Calabria Region and Sicily Island: landing point of the submarine cable

The project of the 380 kV link between Sicily and Calabria (Italian peninsula) foresees the implementation of a complex landscape requalification and nature restoration in the interested coastal area.

The landing point of the submarine cable on the Calabrian side is close to the urban area of Favazzina, an old area with a great exploitation of the land for urbanization and intensive agriculture purposes.

Therefore in the area the distribution and coverage of the original vegetation is altered and corrupted, in the past the old typical landscape of the Viola Coast was made of stone walls and terraces for the traditional cultivation of vegetables, citrus and grapevine.

In this area Terna has studied a project of landscape and environment restoration aimed to integrate the elements of the agricultural tradition with the potential natural vegetation of the area. The project foresees the realization of a garden with a local citrus grove (typical lemon trees especially), requalification actions through the plantation of local species of the Mediterranean scrub and actions to recover the beach morphology and the potential vegetation typical of this part of the coast.

Many thanks to Valentino De Santis (Terna), Andrea Serrapica (Terna) and François Salomone (Agros Realizzazioni) for this contribution.

7.3. Example of best practices from TenneT (The Netherlands)

TenneT realises that her assets have an impact on the environment and for that reason takes her responsibility towards nature and landscape of which vegetation management is an important aspect. Combining the asset infrastructure with a positive contribution to nature is starting to being applied wherever it is possible.

The Commitment to Nature vision of TenneT underlines the approach towards nature and illustrates the responsibility to minimise environmental impact and protect and improve local nature. With assets throughout the Netherlands and Germany, in national and international waters, and often in areas of natural beauty, TenneT strives to balance business activities with the impact they have on biodiversity, ecosystems and the landscape.

Crucial in the roll-out of the vision is the cooperation with (local) stakeholders, from citizens, local governments to national NGOs. For that reason there are partnerships with Natuur& Milieu and Limburg Landschap in the Netherlands and RGI (including NaBu) in Germany.

Green Dean Infranatuur

TenneT is also taking part in the Green Deal Infranatuur (http://www.infranatuur.net), a platform where major linear infrastructures companies, Provinces, Environmental experts and NGO are gathering to connect initiatives that promotes biodiversity, with the theoretical aim to create a second ecological structure in the Netherlands.

Here are two examples of different projects that developed alternative vegetation management methods that can be found under the HV network in The Netherland. A lot of these projects can be found on this webpage: https://www.tennet.eu/nl/ons-hoogspanningsnet/groene-kaart/.

Grazing with sheep under HV lines in Rozephoeve

In the middle of the Rozephoeve property, in the municipalities of Oisterwijk and Oirschot, there was a military site until a few years ago. This site was purchased by the Rozephoeve estate, with the aim of bringing it back to its old form of management.

In 2015, some old military buildings were converted into sheepfold and fences were installed. With the collaboration of the Province of Brabant, sheep herds were back in the landscape. The owner of the area knocked at TenneT's door and submitted his plan, to use the sheep instead of the annual pruning. The plans were in line with TenneT's policy, which allowed him to count on a financial contribution. Two subsidies were obtained, so the estate was able to finance the plan of a total 100,000 €.

In 2017, the sheepfold was festively opened with a lunch that gathered many local stakeholders: the owner, the farmer and the Mayor of Oisterwijk.

A corridor for heathlands in Soestduinen

The design plan consisted of the conversion of approximately 22 hectares of nature, of which 8 hectares are of forest, to a small-scale heathland varying from 30-50m wide with screen vegetation and heather at the edges. At the height of the Paltzerweg, Provincial road N413 (Van Weerden Poelmanweg) and the bike path Heezerspoor Oostzijde, passages for fauna were realized.

The project makes an important contribution to the biodiversity of the Utrecht Heuvelrug by connecting high-quality heathland sites. The acreage of heather is thus increased, to the benefit of rare Utrecht species: the sand lizard and the Common Branded Skipper.

The project combines nature development with safety: instead of future clear-cut under the high-voltage stretch, high-quality nature is developed through the restoration of natural habitats. The project is a unique example of cooperation between private, social and public parties, whereby nature development is largely financed from the companies.

Many thanks to Margriet Rouhof (TenneT) for this contribution.

7.4. Example of best practices from VSD (Slovakia)

In Slovakia, VSD is active in a LIFE project: Project LIFE 15NAT/HU/000902

"Conservation of the eastern imperial eagle by decreasing human-caused mortality in the Pannonian Region"

Sub-action C.3.3 – Construction of game- and bird-friendly habitats under power lines in Kosicka kotlina, Slanske vrchy and Ondavska rovina SPA

What: Game-and bird-friendly habitats will be developed along power lines in Eastern Slovakia to support prey availability of target species and thereby, ultimately, viability of imperial eagle and saker falcon populations.

How: As a transmitter of electricity, VSD is obliged to observe all necessary security obligations. This involves maintaining of corridors with vegetation not exceeding 3 metres in the forests or grows within agricultural landscape. These corridors, according to land register, are usually classified as "other land" not intended for forest nor for agricultural production. Currently, they are often thickets with low biodiversity and with no value for raptors since they do not allow for breeding and hinder access to prey.

At the present project selected sections of such corridors will be restored to raptors friendly habitats with added values also for game and other species. Preliminary area of 20 ha was identified for restoration and an authorised company will be hired by 03/2017 to develop very detailed restoration plan. Plan will be completed by 12/2017 and implemented in the course of 2018 and 2019.

Where: In Kosicka kotlina, Slanske vrchy and Ondavska rovina SPAs in Slovakia

When: 01/01/2017 – 31/12/2019

Why: Land where power lines crosses forests or grows in agricultural landscape have high potential value for biodiversity. These areas can be converted to habitats that will support feeding opportunities for raptors, including imperial eagle and saker falcon and thus contribute to overall population viability. This is

very important in consideration that in intensively managed farmlands prey availability is decreasing. Moreover raptors are often seen by hunters as competitors for small game species. Habitats along the electric lines can support small game species and therefore be positively perceived by hunters. Thus can serve as excellent measure for decreasing conflict between this important stakeholders group and raptors. The present project aims to demonstrate feasibility of habitats restoration along electric lines.

Many thanks to Jozef Toth (VSD) for this contribution.

7.5. Example of best practices from APG (Austria)

The Austrian Power Grid AG (APG) is Austria's transmission system operator and responsible for the domestic transmission super grid. As a sustainably operating entity, APG has engaged in environmental

protection in all areas of line maintenance for 20 years. APG's grid encompasses approximately 3,600 km of power line corridors spread over 22,000 ha and including 950 km of lines running through forests. The forest area managed by the APG totals 6,650 ha while further 1,210 ha are subject to special habitat management.

The Philosophy of APG's Sustainable Line Management

In 2005, APG developed a comprehensive concept for the sustainable management of corridors under overhead power lines, which takes into account environmental and cultural factors and is based on the natural potential of the site and its surroundings. At the same time, ensuring occupational safety remains the top priority. The cornerstone of APG's approach is the ecological maintenance of the line corridors, which aims at reducing or completely avoiding impacts on the natural environment and the landscape. The measures make sure that rare and valuable animal and plant species are preserved and promoted. They are developed in cooperation with land owners and authorities, NGOs, research institutions etc. and implemented by the land owners and local service providers (farmers and foresters).

Catalogue of Measures

The basis of APG's sustainable line management has been the summarization of 42 groups of cultural landscapes into 12 route types and the subsequent deduction of ecological potentials as well as a general catalogue of measures for every route type. There are, for example, routes where forests, grasslands or farmlands predominate, routes in residential/industrial areas or routes above the tree line. As regards types of measures, there are those concerning dry grasslands, woodland edge management, logging trails, extensively used meadows, pylon base design, meadow restoration, nesting aids for birds and bats, management of alien plants, meadow maintenance, management in protected areas, spawning habitats, to name just a few.

Measures Database

All the measures are managed with the help of a database and the implementation is documented continuously. The information is presented in APG's internal geographical information system (EGIS) and available for every employee.

Basic Management of Routes in Forests

Depending on the age and stage of the forestland, the routes running through forests are managed according to the following criteria:

- Selective removal of fast-growing tree species
- Small-area utilization or removal of individual stems
- Establishment of layered and irregular woodland edges
- Promotion of slow-growing tree species and bush populations
- Establishment of glades as links between biotopes

Specific Habitat Management

There are habitats of outstanding ecological value along the transmission routes, situated in locations with an especially wet or dry soil water balance. In such cases, measures are customized according to conservation goals or to the special needs of the site. Depending on the development objective, the following tending strategies can be used:

- Preservation of dry grasslands by mowing or grazing
- Promotion of low-growing woody plants or removal of fast-growing trees
- Installation of nesting aids on pylons
- If necessary, management of alien plants

Selected Examples of Sustainable Line Management:

1. **Crossing the Riparian Forest in the Traun-Danube-Auen National and European Protected Area (Upper Austria)**

   This species-rich area, which is crossed by an APG power line, is home to a number of seldom and endangered plant species as well as a nesting area for the red-backed shrike and amphibians (e.g. the crested newt). The objective here is to preserve species-rich wetland meadows side by side with semi-dry grasslands and non-cultivated reed beds as well as permanent shrubs on a managed area of approx. 6 ha. The following tending measures have been implemented: mowing twice a year, consistent suppression of alien plants with appropriate mowing dates or also small-scale tending interventions, special maintenance measures for threatened species found on the Red List (e.g. orchids), preservation of species-rich edges by occasionally mowing or disrupting the topsoil in order to optimize the habitat for the red-backed shrike, seeding with wild plant seeds. Local farmers manage the meadows on a day-to-day basis while regional forestry companies cultivate the forests at the behest of APG. Experts accompany the implementation of measures and verify the efficacy of the measures.

Grassland and woodland edge management in the Traun-Danube floodplains (author: Britt Egger)

2. **Nesting Aids for the Saker Falcon (Lower Austria, Burgenland)**

   The saker falcon (*Falco cherrug*) is one of the most endangered bird species in Austria with its population declining rapidly also worldwide. In Austria, there are mostly not enough safe breeding grounds for the species. For this reason, the University of Veterinary Medicine, Vienna, started a species protection project in cooperation with APG and BirdLife Austria. The goal is to preserve

Nest box with a breeding pair of saker falcons
(author: Franz Josef Kovacs)

a vital, self-sustaining population of the saker falcon in Austria. The essential element of the current protection measures is the installation of artificial nest platforms and boxes on APG's pylons. Until now, 131 nesting aids have been mounted in eastern Austria. For the rare falcon species, these nesting aids on the approximately 50 m high transmission towers offer a safe alternative to natural breeding places. In 2016, 21 of the 35 breeding pairs laid their eggs in APG's nesting aids. The successful project is being continuously expanded not only for the saker falcon but also to include other bird species.

Many thanks to Sven Aberle, Patrizia Dreier and Britt Egger (APG) for this contribution.

7.6. Example of best practices from SVK (Sweden)

Svenska kraftnät is the Transmission System Operator in Sweden. The company manages 15000 km aired high voltage net. The power line corridor amounts to about 55 000 hectares. The power line crosses over many different habitats such as forest land, cropland, grassland, wetlands and so on.

Old farmland in Sweden means a mosaic landscape with small fields, meadows, pastures, verges between forested areas and open areas with low to mid-high vegetation. Older times techniques, with burning brush-wood-vegetation to develop fields for grazing and mowing, is today rarely seen. The changes in the landscape during the last century have resulted in a drastic reduction of meadows and pastures in Sweden. Many species, adapted to these continuously managed, open environments have declined. One of these alternative environments is the power line corridors. It resembles meadows and pastures since the vegetation in the power line corridor is mowed regularly.

Collaboration with others

Svenska kraftnät cooperates with many actors such as scientists and authorities. Collaboration with SLU (Swedish University of Agricultural sciences) has been about scientifically verifying the value of the power line's biodiversity values. The focus has been on vascular plants and butterflies with relations to grasslands. Both inventories and maintenance have been carried out. Scientific articles have been published in the subject area. Lydinge outside Uppsala is one area, where a lot of scientific studies have been made. The area is very diverse, with presence of grassland species related to meadows and pastures and presence of red-listed butterflies. Cooperation with county administrative boards consists mainly of issues relating to red-listed species, including green infrastructure and the development of maintenance plans.

Swedish power grid lines are also included in the national monitoring program of grasslands. 18 of 21 counties in Sweden also participate in the program.

About Siggefora

Siggefora is a distance 20 km in a power line located west of Uppsala. Siggefora became a Natura-2000 area in 2004, due to abundant occurrence of a red-listed butterfly, the Marsh Fritillary (*lat. Euphydryas aurinia, swe. Väddnätfjäril*).

Marsh Fritillary female

Marsh Fritillary male

Between 2011 and 2013, the powerline in the Natura-2000 area of Siggefora was reconstructed and colonies of the butterfly decreased during the reconstruction. Inventories in 2014 showed that the number of colonies was 50% lower than in 2003. In 2014 and 2015 we did several actions to create better habitats for the butterfly. Monitoring was done before, during and after the actions.

The results of monitoring show that the number of butterfly colonies 2016 has increased by more than 350% in three years. Compared to the start of the Natura 2000 area at 2003, habitats are now colonized by more than 50% more butterflies.

The conclusion of these very clear and good results is that our actions were well customized and efficient in this place. This has given us experience and confidence in how to act in the future in similar situations.

Diverse areas and adapted management in the powerline corridor

During an eight-year period of 2008-2016, we inventoried the powerline corridor in the whole transmission net in Sweden. The inventory used a manual to find divers grasslands. In total, approximately 950 biodiversity areas were identified spread over the whole transmission net. In 2017 we started a management program where the vegetation management actions are designed to develop biodiversity in certain areas.

For each area, there is an instruction, with a map and a description, about to guide our vegetation management consultants in their work. We have a close dialogue and educate our vegetation management consultants to make sure they know how to think and what to care for. It will take several years to manage all the 950 areas, since the special management program follows the cycle of the normal vegetation management.

By involving this special management in the normal vegetation management, we are aiming to fulfil our goals of long term and sustainable management.

Many thanks to Sara Widell (Svenska kraftnät) for this contribution.

7.7. Example of best practices from Swissgrid (Switzerland)

swissgrid

Legal framework building of new lines, renovation of existing lines

Swiss legislation stipulates a multiple-staged process for permitting a new line. A core object of this approval process is to assess and mitigate any negative impacts of the project on the environment and the protection of natural habitats.

Therefore, it is mandatory in the process of approval to apply an Environmental Impact Assessment. Where it is not possible to avoiding or restore negative impacts, compensation measures have to be taken. Those measurements have to be documented and submitted to the permitting agency.

Status quo of vegetation maintenance

An overall concept for vegetation management is still missing since Swissgrid became the owner of the transmission network in 2013 (380kV and 220kV network), either for power lines and for the switch gears.

For vegetation under and aside (that is in the corridor) of power lines, Swiss legal framework does not allow complete clearing of vegetation (clear cuts) in forested areas. Therefore, mulching is not a real option, but selective felling is the normally applied technique. In some cases, there are individual agreements with local farmers and forest authorities about the vegetation maintenance.

Right now, a working group is involved in deriving alternative, long-term strategies of vegetation management under power lines. Based on a strategy decision, a more detailed concept shall be developed.

Additionally, Swissgrid has hired foresters to strengthen internal knowledge and to simplify the process chain. With this action, the vegetation maintenance should improve significantly in terms of efficiency and workload.

Regarding vegetation management in substation, it is the intention of Swissgrid to prohibit the application of herbicides.

Current example of actions from (local) organizations under pylons:

In 2017, Swissgrid has been approached several times by local engineering offices and local foundations of nature protection concerning the construction of small structures (e.g., piles of wood and stones, little ponds for amphibians) as habitats for animals and plants under pylons. The area under pylons is normally only extensively managed and, therefore, predestined for such purposes.

Local example: digging ponds for amphibian

Two ponds were created under pylons. Actions are executed by www.naturschutzloesungen.ch.

Ponds are made out of sheet metal or plastic tubes, overall 40 cm height, size ca. 4 m². The tubes are dug in 20 cm deep, 20 cm are raised as an embankment around the pond and covered with coarse gravel. In addition, piles of stones and sticks are added at the edges.

Swissgrid is not involved regarding financial support, but is giving advice regarding the technical specifications and the safety standards among power lines. Furthermore, project leaders are provided with data (e.g., location of lines and pylons) and guided by Swissgrid technicians during the construction.

While a pilot project with ponds for amphibians has turned out successful, there are now plans by an engineering office to gain sponsors for additional 100 little ponds under powerlines for the region Swiss Plateau.

Many thanks to Hoang Hac Dinh van (Swissgrid) for this contribution.

7.8. Example of best practices from REN (Portugal)

Reforestation programme for the corridors of the power transmission networks.

In 2009, REN introduced a new strategy for managing transmission line service corridors – namely, converting buffer corridors by planting native species of trees that are compatible with the continued operation of the lines. This strategy has been extremely well received by landowners that have adopted such measures.

The National Defence System against Forest Fires has outlined a series of measures and institutional coordination actions for planning and intervention to protect forests from fires. One of these measures is that the electricity transmission line buffer corridors are required for forest fires prevention strategies, becoming a secondary network for fire prevention and combat.

For this it is necessary to proceed to vegetation management including bush and trees removing, along the electricity transmission line buffer corridors.

The conversion of the buffer corridor consists of a change in land use – for agriculture (vines, pasture, orchard), for example –or replacing existing trees with others that are capable of remaining within the minimum safety distances between them and the power lines.

These goals are to ensure: i) the compatibility of vegetation with the corridors; ii) the reduction of fire risk; iii) the enhancement of the landscape and promotion of native species (such as oak, strawberry tree, holly, cork oak, holm oak, and others); iv) stop the proliferation of areas of land with the same species of vegetation; v) increase the intervention cycles; vi) ensure a shared responsibility with landowners; vii) and cut maintenance costs.

What are the best tree species to plant?

The species REN proposes to the owners for reforestation depends predominantly on the season's climate and soil conditions, on the risk of fire and on their compatibility with the presence of the line (small size and slow growth):

- Carob Tree
- Holly tree
- Holm Oak
- English Oak
- Pyrenean Oak
- Portuguese Oak
- Sweet Chestnut
- Strawberry Tree
- Walnut Tree
- Olive Tree
- Stone Pine
- Willow
- Cork Oak

The conversion of our corridors with the selected trees meets the new legal requirements, without having an exponential increase in maintenance costs.

The conversion of the protection zone for a line consists of:

- the change of land use, e.g., for agriculture (vineyards, pastures, orchards), or
- the change of soil occupation, by replacing the existing forest species by species which make it possible to comply with the minimum safety distances.

Most native forest are compatible with the safe operation of REN's infrastructure, both technically and in terms of its legal responsibilities.

By promoting the conversion of the buffer corridor into forested areas, REN has joined forces with the non-governmental environmental organization QUERCUS (National Association for Nature Conservation) as it establishes a program for developing and encouraging native forests with high levels of biodiversity.

The Institute for Nature Conservation and Forestry and the Portuguese government are also partners in this protocol.

Between 2010 and 2017 we proceeded to the reforestation of 1,979 ha, equivalent to planting 864,711 native trees. It is estimated that more than 2,000 ha will have been converted by 2018, representing over 1,000,000 new planted trees.

Until 2017, the stone pine (*Pinus pinea*) has been the species most chosen by the landowners. This happens since it is the best known species among those we propose, and it allows multiple uses, of which the production of pinion is the most valued, combining a high economic value, as well as environmental protection and landscape.

One of the species that we predict will significantly increase the area is the strawberry tree (*Arbutus unedo*). Shrub is perfectly compatible with the presence of electricity transmission lines. It has great economic interest, namely through the use of its fruit, both in the production of "aguardente" (alcoholic beverage) of arbutus and in the agrifood industry. It is an emerging sector whose growth potential is high.

In order to encourage the plantation of strawberry tree we have a protocol with the CPM - Cooperativa Portuguesa do Medronho, CRL., which aims to promote this species with the landowners as well as the flow of this product through the various markets.

Results

With the implementation of this project we are creating a true multi-service network:

- electricity transmission network
- forest defense network against rural fires
- biodiversity network

This new approach is based on the three pillars of sustainability:

Environmental

- Biodiversity increase (afforestation with autochthonous forest);
- Forest Fire Protection, promoting increased resilience of territories to forest fires and improved combat opportunities.

Economic

- Reduction of maintenance costs;
- Profitability of the landowners, adding value to their properties

Social

- Increase in the number of companies and workers in the forestry sector affected to this activity;
- Job creation at local / regional level;
- Potentiation of sectors related to non-woody forest products.

In terms of public acceptance, this example has proved to be very efficient since landowners around the lines are really enjoying this new landscape and the presence of new species. For biodiversity, an increase in the number of plants and variety of species has already been recorded.

With this project, everybody wins: i) the landowners who receive an income from previously unused land; ii) QUERCUS and REN by encouraging practices that enhance biodiversity; iii) and consumers and society through service to the ecosystem, the protection of forest from fires, and, of course, the comfort of having energy brought directly to their homes.

Reforestation performed under the partnership REN | LIFE Elia-RTE.

Under the agreement between REN and LIFE-Elia, in Mach 2017 a pilot project was carried out, in which the 2,400 m² area was redeveloped, initially occupied with eucalyptus stands and now reforested with arbutus trees.

In order to compare the evolution of plant growth, the project area was subdivided into two plots:

- Parcel 1 (1,200 m²): in this plot, a weed-cleaning and a harrowing were carried out prior to planting, after which a manual plow (30x30cm) was laid for laying the plants, providing the existence of boilers for greater water retention.
- Parcel 2 (1,200 m²): in this plot only the manual pits were opened (30x30cm) for placement of the plants, providing the existence of boilers for greater water retention.

As part of this project, 160 plants were planted, with the placement of individual protectors.

One year after the implementation of the pilot project will be carried a comparison and evaluation of the different types of land preparation that were made at the time of planting, in order not only to evaluate the development of the plants, as well as to evaluate aspects related to biodiversity (plant and animal).

Many thanks to Pedro Marques, João Gaspar and Bruno Pocinho e Silva (REN) for this contribution.

8 Topics to be taken forward

8.1. Tools to finance projects

When looking at launching alternative vegetation management methods, TSO may find financial aspects as a main obstacle. Initial investments are considerable and they often cannot fit into Maintenance Department's budget.

Any innovation implemented in a company, such as software upgrades, staff trainings or data management, it has a cost. In order to undertake such kind of innovations, the company has to decide whether or not this innovation is worth the case. If the answer is yes, then the second step will be to find available budgets to implement it.

Therefore, it would be a mistake not to make the mind shift on the way alternative vegetation management methods have to be seen. It is not anymore a matter of additional annual costs, but rather an investment that will help reducing the costs while increasing public acceptability. By seeing things this way, Maintenance Departments are somehow relieved of the heavy burden of the entire financing of these actions. And further, this intention of doing something different with vegetation is shared at different level of the company, which helps making it acceptable for all the staff.

Nevertheless, there are some financing tools that might help TSO to spark the process:

→ **LIFE projects**

LIFE is the EU's financial instrument supporting environmental, nature conservation and climate action projects throughout the EU. Since 1992, LIFE has co-financed more than 4500 projects. For the 2014-2020 funding period, LIFE will contribute approximately €3.4 billion to the protection of the environment and climate (Source: http://ec.europa.eu/environment/life/).

LIFE Programme can fund projects that are supporting nature conservation actions. First step is to draft a proposal and to find budget within the Member States. Then the Commission, based on the quality and the solidity of the proposal, can decide to co-finance the project. A close follow-up is set so that projects stay well on tracks for the achievements of objectives on the whole project duration.

Any TSO could have a close look on the place where HV lines crosses protected areas (like Natura 2000), and see how the vegetation management of the network could evolve more closer to natural habitats concepts.

→ **NCFF**

The Natural Capital Financing Facility (NCFF) offers funding to projects that promote the conservation, restoration, management and enhancement of natural capital for biodiversity and adaptation benefits, including ecosystem-based solutions to challenges related to land, soil, forestry, agriculture, water and waste inside the EU.

The NCFF consists of a combination of the following two components:

- The **finance facility** can provide financing of a minimum amount of EUR 2 million and a maximum amount of EUR 15 million
- The **technical assistance facility** can provide each project with a grant of up to a maximum of EUR 1 million for project preparation, implementation and the monitoring of the outcomes

The NCFF combines EIB financing and the Commission's funding under the LIFE Programme, the EU's funding instrument for the environment and climate action. The facility is currently in a pilot phase and can sign projects until the end of 2019. The first loan was signed in April 2017. (Source: http://www.eib.org/products/blending/ncff/index.htm)

This tool may be of great importance of TSO since it can counterbalance the pricing period effect. During this period, a national regulation agency makes sure that management costs are not rising. By being lend money at advantageous rate, TSO can implement a change now and postpone financial impacts on the next pricing period.

- **Interreg**

  INTERREG IVC provides funding for interregional cooperation across Europe. It is implemented under the European Community's territorial co-operation objective and financed through the European Regional Development Fund (ERDF).

  The overall objective of the INTERREG IVC Programme is to improve the effectiveness of regional policies and instruments. A project builds on the exchange of experiences among partners who are ideally responsible for the development of their local and regional policies.

  The areas of support are innovation and the knowledge economy, environment and risk prevention. Thus, the programme aims to contribute to the economic modernisation and competitiveness of Europe. (Source: http://www.interreg4c.eu/programme/index.html)

  Of the main interest of this programme is that it is aiming at sharing cross-boarder experiences and know-how. HV networks form different countries are already linked in terms of physical connection and market exchanges, but it can also be a knowledge exchange with the Interreg programme.

- **National or Regional tools:**

  TSO must also look at financing possibilities that were not considered before. National or Regional authorities are often setting financial tools to promote biodiversity and nature conservation actions. Through call for proposals, they are selecting a range of projects to be funded. TSO should also browse these tools and see how the actions they want to implement can benefit any of these potential supports.

8.2. Temporary biodiversity concept: a need to be heard

Setting up the perfect conditions to host protected species and natural habitats under HV lines might have an unpleasant side effect for the TSO. Indeed, on places where nature has been restored, TSO have to be able to complete their mission of maintaining the lines or the pylons. They should not be impeded to do so, even though they can comply, if possible, to certain types of specifications to protect species or natural habitats.

If we take it form another angle, we could state that, in places where they have restored nature, TSO should be allowed to maintain the network. Otherwise, this main obstacle will not be a positive sign for TSO to start alternative vegetation management methods.

EU institutions are already tackling this *Temporary Nature* issue, but clearly it needs to be brought at the foreground to make sure that efforts done by TSO will not affect their usual business. Efforts should be pursued in this way.

8.3. Environmental right-of-way

An environmental right-of-way could improve the feasibility of best practice actions, since it could have an impact on:

- the regulation framework
- the ratio amount of landowners/surface of corridors

8.3.1. The regulation framework

Through national or regional regulation, TSO are given the right to maintain vegetation in forest corridors. Even though the HV lines are located on private properties, this right is given because electricity transmission is a mission of public utility. Often, regulation defines the way vegetation should be managed.

For the TSO, it gives a framework in which Maintenance team can work and cut vegetation if needed. But if other types of vegetation management are carried on, there might be some reluctance from Regulation Department because methods used are not fitting in the regulation.

8.3.2. The ratio amount of landowners/surface of corridors

Talks with a private landowner

Another important point lies in the fact that TSO do not own easement under HV lines. It means that actions of vegetation management are undertaken on public or private properties. Sometimes, one large landowner (public or private) owns a large section of the network. In this case, meetings and negotiations are pretty efficient because they are led with one or a few interlocutors. The situation is very different in the case of very small areas owned by a lot of owners. In this case, a lot of time is spent to negotiate with a large number or interlocutors for only small surfaces concerned on site.

8.3.3. Advantages of an Environmental right-of-way

A sort of environmental right-of-way should be studied so that it could provide a better regulation background for TSO. This environmental right-of-way would allow TSO to carry on alternative vegetation management methods without having to receive in each case the agreement of the owner, only if these methods are in favour of biodiversity.

Of course, this right-of-way should be defined with more precision. The installation of fences to organize pasturing should be still implemented with the agreement of the landowners, for it has an impact on the circulation on the property or on hunting activities. But when it comes to the plantation of forest edges, one could consider this action as a “soft-impact” alternative method and therefore it could be implemented without the agreement of the landowner. If the landowner expresses adverse feelings about the action, a contact with the specialist could help him to understand the objective of the action. Of course, it does not impede personal contact with large landowners when planning the actions under the HV lines.

8.4. A vegetation management working group

Brainstorming of representatives from 17 TSO in June 2015

As many TSO in Europe are tackling this issue of alternative vegetation management, it would be interesting to set up a working group focused on this subject. Exchanges of ideas, experiences, feedbacks and results would stimulate all the TSO involved and thus create a positive dynamic.

Like any other main subject on which TSO are exchanging (markets, technical development, codes, communication or public acceptance...), vegetation management could be a main subject of a working group. One or two people from each interested TSO could be involved and take part in the working group.

Field trip in Belgium on alternative vegetation management methods with TSO in June 2015

If the idea has been tested with ENTSO-E, the European body for TSO, it has still some way to go before seeing real outcomes.

8.5. Other actions to be led

Vegetation management methods of corridors under HV lines have been intensively investigated within the LIFE Elia-RTE project.

But other parts of the network also deserve a close attention.

8.5.1. Pylons

Stepping-stones bushes in agricultural area in Austria

Bushes for wildlife at pylon's foot

Boosting biodiversity under pylons located in agricultural areas is of great interest for wild fauna. In these areas, where crops are cultivated, bushy vegetation are shelters for small mammals and for birds. They can be considered as stepping-stones for the movement of these species by offering steps in the ecological network.

Vegetation at pylon's feet can be managed with a partnership with local hunters. Of course the farmer has to agree on these actions.

8.5.2. Substations

Vegetation management in substations can be another way to enhance biodiversity on the network. Specific soils, mainly small rocks to allow trucks to drive in every condition, installed in the substations are offering interesting areas for vegetation.

This subject is even more important with the possible ban of glyphosate's use. Alternative vegetation management methods can consist in grazing with sheep, mowing and sowing low-height plants adapted to the specific soils.

9 Conclusions and perspectives

Vegetation management has never been the core-business of Transmission System Operators. Operating the HV electricity network management requires a focus on the technical issues of HV lines, grid balance, electricity cross-boarders exchanges or network development projects. Nonetheless, biodiversity has been put at the top of the agenda of all companies in Europe. Mainly through the creation of the Natura 2000 network and the obligation to carry out Evaluation Impact Assessment, biodiversity has made its way into company's policies.

If nature conservation has become a baseline in European regulation, nature restoration can provide major boost to halt the loss of species and natural habitats. As an important feature of the landscape, Transmission System Operators have a great asset to offer to enhance biodiversity: its network. By adapting vegetation management methods, TSO can play a major role into the ecological network by connecting hotspots for biodiversity. These connection possibilities will counter one of the biggest threats for species that is the fragmentation of their habitats.

But TSOs are not owning the land under HV lines. Therefore, TSO have to deal with landowners and land managers to develop actions for nature. In this context, partnerships are valuable when carrying out actions for nature on a local scale. What may be considered as a loss of time may revealed itself as being a real gain in terms of efficiency and local acceptance. Long-term trustful relation with local stakeholders can eventually come out from these actions for nature.

For the company, the challenge is not easy to step up. A change in vegetation management methods implies a change of deeply rooted procedures and habits within the Maintenance Department. According to the experience of the 6,5 years of the LIFE Elia-RTE project, it is clearly worth the case for different reasons. Indeed, combining electrical safety with biodiversity has proven to contribute to: saving costs on vegetation management, increasing public acceptance of HV lines, improving the integration of HV lines in the landscape, bringing pride within the company employees and improving relations with local stakeholders.

If this contribution to nature conservation is praised by Regional, National and European institutions, obstacles needs to be addressed. As a consequence of efforts made by the TSO to enhance biodiversity under HV lines, rare natural habitats can be restored and species will be able to colonize the corridor. But these habitats or species should not be a brake for the TSO to accomplish maintenance operations such as pylons paintings or renewing of components. A significant move could also be operated in the regulation area to facilitate the implementation of biodiversity friendly actions on private and public land. A kind of environmental right-of-way, that should be detailed, could accelerate processes and make it easier for restoration actions.

A lot of know-how now exists on the vegetation management subject. It is for every TSO to seize opportunities and to develop these actions where it is possible, bearing in mind that actions for the LIFE Elia-RTE can be adapted and replicated to other type of situations.

Implementation areas

In Belgium (Walloon Region):

- 155 km of forest corridors

In France:

7 sites spread on different biogeographic zones

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

Follow the project on:

www.life-elia.eu/en/