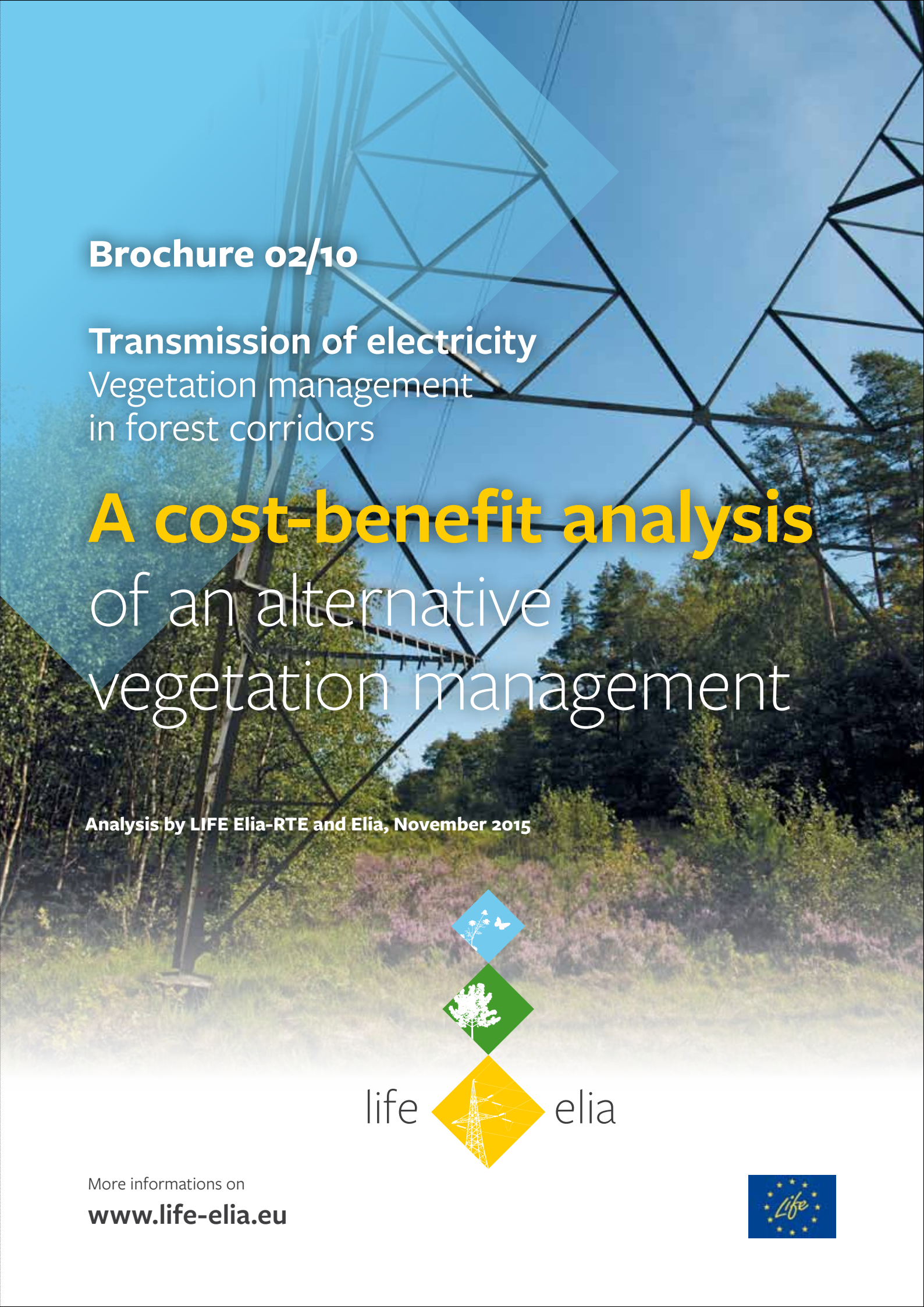

Brochure 02/10

Transmission of electricity
Vegetation management
in forest corridors

A cost-benefit analysis of an alternative vegetation management

Analysis by LIFE Elia-RTE and Elia, November 2015

life elia

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

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

EC Reference
LIFE10 NAT/BE/709

General Coordination
Gérard Jadoul
gerard.jadoul@gmail.com

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Summary

The second chapter of this document describes the framework in which this document has been created.

The third chapter summarises the LIFE Elia project, the aim of this document and the data used for the comparison.

The fourth chapter brings together the data that will be processed in order to compare the two approaches. The financial data on Elia's "traditional" management of the vegetation are calculated, as well as those from the LIFE Elia project.

The fifth chapter enables to put the Elia and LIFE Elia data into perspective and to compare them by basing them on an annual management cost per hectare. The other impacts of each management method are also mentioned.

The sixth chapter draws conclusions from this cost-benefit analysis and discusses the possible future developments.

2

Scope and Diffusion

2.1. Scope

This document was created by the LIFE Elia team and Elia between November 2014 and March 2015. A specific working group made up of LIFE Elia team and Elia members from Environment, Maintenance and Budget/Finance Departments was established in September 2014 to oversee the creation of the document.

2.2. Diffusion

This cost-benefit analysis is expected by numerous actors in the field of electricity transmission and maintenance of forest corridors in Belgium and Europe.

It will be supplied to the project partners, the other transmission system operators (TSO), the European Commission and more widely to our international partners (ENTSO-E, CIGRE, RGI) and also to other interested partners as required.

List of acronyms

AEM Agro-environmental measure, **LIFE** L'Instrument Financier pour l'Environnement (Financial instrument for the environment), **TSO** Transmission System Operator, **WACC** Weighted Average Cost of Capital

Introduction

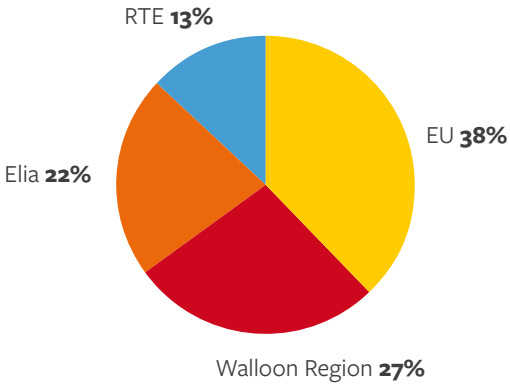
3.1. LIFE Elia-RTE

The main objective of the LIFE Elia-RTE project is to transform the routes through forests taken by high-voltage lines in Belgium and France into ecological corridors.

The 7 actions[1] carried out as part of the project aim to combine electricity security with biodiversity. The innovative vegetation management practices carried out by the project involve local partners and are raising the awareness of stakeholders in terms of taking biodiversity into account.

With total funding of €3 000 000, the project is co-financed by the European Commission (38%), the Walloon Regional government (27%), Elia[2] (22%) and RTE[3] (13%).

The project is led by a team of 7; it began in September 2011 and will end in December 2017.



3.2. Aim of the document

As part of the project, the European Commission is willing to get an evaluation both of the biological and economic impacts[4] of the alternative vegetation management practices implemented in the LIFE Elia-RTE project.

The aim of this document is to assess the economic impacts of the actions taken in the LIFE project by comparing them with the traditional vegetation management currently implemented by Elia in Belgium.

This analysis will also be a method of decision-making for the future management of the entire network located in forests in Belgium and for other operators. The sites located in France, where the project works in close collaboration with RTE, are not included in this analysis.

3.3. 3 possible levels of analysis

In order to compare both management methods, "traditional" and "LIFE Elia alternative", it would be most appropriate if we take into account all the costs and impacts which they generate for the Transmission System Operator.

There are 3 levels that can be analysed in this context:

- **Level 1: costs of external assistance:** the amounts required to carry out traditional vegetation management, or those from installation and management actions of the LIFE Elia. All these tasks carried out by subcontractors (rotary milling or pruning for Elia, various restoration actions for LIFE Elia (see chapter 5));

1 The planting or restoration of structured forest edges, the planting of orchards for genetical conservation purposes, the restoration of natural habitats, the creation of natural ponds, combating invasive species, intalling pasture and grazing areas and sowing flower meadows.

2 Transmission System operator in Belgium

3 Transmission System operator in France

4 One of the actions of the project consists of carrying out annual identifications and counts of the following on the sections of electrical corridors worked by LIFE: dragonflies, butterflies, birds, amphibians, bats and plants.

- **Level 2: staff:** staff time needed, both at Elia and on the LIFE Elia team, to introduce the actions and carry them out (patrols, mapping, contact with the managers/owners, creation of specifications, tenders, monitoring, approval of sites, etc.). This cost is in addition to external assistance;
- **Level 3: other impacts:** impacts on the company's image, facilitation of the relationship with governments, facilitation in order to obtain permits, landscape improvement, reducing risks of blackouts, ecological services provided by the natural environment, agreements with nature protection associations, etc.

Although level 1, **external assistance**, can be estimated precisely using invoices for carrying out the works, level 2 costs, staff is much less obvious to evaluate precisely. This needs records of working hours, broken down rigorously into different tasks. Estimating precisely the number of hours put into a project for one area is not easy, considering that, in a traditional use of time, these hours are distributed by an operator carrying out different tasks on several sites concurrently.

Level 3, **other impacts**, is very difficult to estimate and requires complex evaluation techniques which are difficult to apply as part of this analysis (see chapter 6). Nevertheless, it would be very interesting to try to evaluate these impacts through an external analysis carried out by experts in this field. Paradoxically, it is this level, as well as level 1, which should be of most interest to the TSO ! For information's sake, several TSOs[5] have decided that, even if the cost of external assistance were the same for traditional management and management that favours biodiversity, they would opt for innovative management, given the obvious benefit in terms of other impacts.

5 RTE (France), REE (Spain), APG (Austria)

Data for comparison

4.1. Unit of comparison: € per ha of corridor per year

The most appropriate unit of cost comparison is the amount in **€ per ha of forest corridor per year (€/ha/year)**. The costs are stated excluding VAT.

4.2. Traditional management data - Elia

4.2.1. Nature of works carried out

The costs of traditional vegetation management by Elia in the forest corridors are generated by:

- Rotary milling the vegetation in the corridor
- Manual felling of vegetation in the corridor
- Pollarding trees
- Pruning of lateral branches

Rotary milling consists of grinding thick vegetation (a mass of young, tightly-packed trees). This operation is carried out by a powerful tractor equipped with a device to shred/chip the vegetation before it becomes too high (see illustration). This operation is carried out in the electrical corridors located in forests. The frequency of the operation is set by the lineman responsible for the line. Apart from the fact that the soil is enriched by organic matter residues, the inconvenient of this method is that the soil is laid bare, which allows seeds from neighbouring trees to germinate. As a result, these seedlings then have to be cut down again after some years. Furthermore, since the operation only affects the upper part of the plant, numerous very vigorous stump sprouts are produced by the plant. The system is therefore a sort of vicious circle.

Manual felling is carried out in order to manage corridors where machines used for rotary milling cannot go, mainly due to the terrain (steep slope or very rugged terrain) or the nature of the soil (rocky outcrops). The felling is done by men using chainsaws in difficult conditions, which explains its high costs (see below).

Pollarding consists in cutting down the upper part of the tree (1/5 to 1/3 of its total height) and is done to trees the height of which poses a risk with regard to conductors. This situation may occur in an urban and suburban context where the riparian owner is opposed to rotary milling/felling trees but also in a forest context where the owner or manager is opposed to an adequate widening of the security corridor[6].

Pruning lateral branches are done on trees located on the edges of corridors where the trees' lateral branches pose a risk to the conductors. This situation often occurs where the electrical corridor is bordered by adjoining landowners' gardens. These pruning works are costly and carried out mainly in urban and suburban areas but also in a forest context where the owner or manager is opposed to an adequate widening of the safety corridor.

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6 Often to prevent the forest from "growing back"

4.2.2. Estimating management costs

In forested areas, the major part of the works carried out is the rotary milling of forest corridors. Since they aim at the same objective, this task is comparable to the LIFE actions in forest corridors.

The cost of rotary milling are estimated at **€1 500/ha**. This operation is carried out on average every **3 years**, thus at an **average cost of €500/ha/year**. We shall use these figures as the basis for this comparison between the costs of traditional management and LIFE-type management.

The disadvantage of this approach is that it does not take into account the felling and pollarding work in forests, which is rare but very costly. The comparison of costs will thus be based on a "safe" figure for Elia.

For **manual felling**, where the terrain conditions (steep slope or presence of rocks) do not permit mechanical rotary milling, the average cost is **€14 285/ha** and the operation is carried out every **5 years**, therefore at an **average cost of €2 857/ha/year**.

Average costs for prunning/pollarding are estimated at €4 000 for 100 m long of forest corridor.

4.3. Alternative management data - LIFE Elia

4.3.1. Working assumptions and obtaining data

Two main assumptions are considered to calculate the costs of alternative vegetation management tested by LIFE Elia:

- The forest corridors are "secure": i.e. they are 50 m wide;
- As far as possible, depending on the height of the vegetation, the ecological restoration actions of LIFE Elia are carried out directly after traditional maintenance using rotary milling with a view to "preparing" the soil. This maintenance operation is not included in the break-even point calculation.

To obtain the LIFE Elia data, the team used:

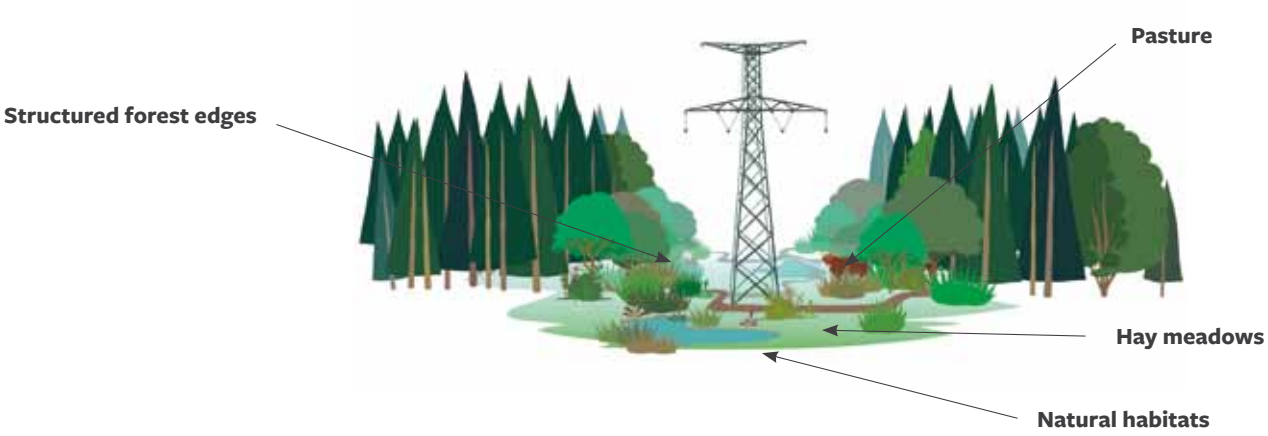
- All the invoices received since the start of the project and
- The geographic information system (GIS) to determine surfaces

This enables each of these invoices to be attributed to works carried out at very precise locations.

The figures used are safe figures which take into account all the interventions to be carried out in the future management of these sites (After-LIFE) and do not take into account the numerous cases where the management of the facilities will be carried out by the local partners (forest administration for the maintenance of the edges in public forests, agricultural operators for the repair of any damage to fences, etc.).

Some of our 7 ecological restoration actions are relatively similar in terms of the management of the forest corridors and the economic impact on the TSO, so we have classified them in 4 groups:

- Group 1 "Structured edges": plantation and restoration of forest edges and orchards
- Group 2 "Open land management": bovine, equine or ovine pasture, mowing and sowing of flower meadows
- Group 3 "Natural habitats ": restauration of moors, peatlands, lowland hay meadows
- Group 4 "Ponds and invasive species": digging ponds and fighting against invasive species



Group 4 is not included in this analysis.

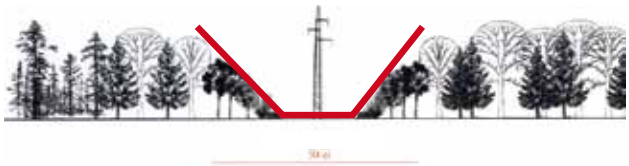
Technical aspects linked to LIFE Elia actions are detailed in other brochures.

4.3.2. Plantation and restauration of structured edges

The "edges" action is described in detail on the LIFE Elia website.

It must be specified that the edges action is traditionally carried out along the edges of the safety corridors and must be complemented by another action that aims to maintain the open environment in the central corridor because Elia requested an access for vehicules under the conductors. Depending on location, topography and the height of the cables, "edges"-type management can be used under the lines where the terrain is not suitable for an open area management (slope too steep , rockiness, surface area too small).

Before



After

Where a terrain situation is suited to the "Structured edges" action, two choices are possible:

- **Restoration:** preferred action from the budget perspective, consisting of only felling trees which will end up growing tall enough to pose problems for the safety of the conductors (birch, poplar, beech, ash, oak, spruce, etc.).
- **Plantation:** action involving planting species which are naturally bushy, low, interesting for biodiversity (flower and berry species, etc.). Action required in the areas where neighbouring forests (often monospecific) are impoverished or lacking in interesting vegetation and where the natural growth of indigenous shrubs is unlikely.

Central corridor, without plantation, has a minimim width of 10 meters and has to be managed either by rotary milling of mowing.

The items to be specified, the unit costs of intervention per ha of corridor and the frequency of intervention for this action are:

Restored forest edges

Restoration	Costs (€/ha)	Costs (€/ha of corridor)	Frequency
Selective fellings (heavy)	1,155	924	1/5 years for the first 15 years
Maintenance/Management			
Selective fellings (light)	400	320	1/15 years after 15 years
Mulching of safety central corridor (10m)	1,500	300	every 3 years

Planted forest edges

Plantation	Costs (€/ha)	Costs (€/ha of corridor)	Frequency
Price of plants and, labour costs	1,949	1,170	once
Fencing against game (2m high)	3,794	3,794	once (in 10% of total situations)
Maintenance/Management			
Plantation cleaning	360	216	1/year for the first 2 years
Selective fellings (light)	400	320	1/15 years after 15 years
Mulching of safety central corridor (10m)	1,500	300	every 3 years

Explanation of actions

- The initial **selective felling of problematic species**: this action is called "selective" because it does not affect the bushy species which are not in themselves a problem for the electric security. This intervention is the first restoration action that can be done in a forest edge where interesting species are already present. One of the variations of the felling is ring-barking (if the tree does not pose any safety problem). This technique consists of removing a band of bark about 10 to 20 cm in width. The sap can then no longer circulate and the tree gradually dies but remains upright (the technique creates less visual impact, avoids the earth being covered by the felled tree, prevents stump suckers and offers perches to birds).
- The **selective control of problematic species** is identical to the above action but the intervention will be less heavy since the edge will already be well-established, i.e. the selected species will increasingly "shadow" the species that are causing a problem.

30/3/2012

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- Elia is requesting that, as far as possible, a **central herbaceous corridor**[7] is maintained, in order to enable emergency access. This corridor must be a minimum of 10 m wide and have a minimum width of at least the distance between the conductors furthest apart on the same pylon (up to 20 m for a 380kV line). In addition, it must enable two lorries to pass each other or a crane to manoeuvre around the pylons. This central corridor may be subject to a "mowing" agreement, i.e. a local actor mows the central corridor at no cost to Elia. In the absence of an agreement, it must be rotary milled as it was done before.

7 Without doubt some thought must be given to this topic. For many other GRTs, such as 50 Hertz, APG, ELES or even MAVIR, the most important thing is to have access to the pylons. The central corridor for the 220 and 380 kV line is covered in these cases by bushy vegetation but this poses no problem for the GRT.

- Given the density of game in some forested areas in the Walloon Region, the installation of **protective fences** (two-meter high Ursus fences) is necessary to guarantee the success of the plantations.

- **Initial thinning** of plantations is carried out in the two years following the year of planting and consists of felling species which might shadow the plantations (e.g. brambles, ferns). This operation must only be carried out on sites which have a high vegetation dynamic, i.e. around 15% of LIFE Elia sites.

Explanation of costs

- **Plant and workforce:** weighted average cost of works already done within the LIFE Elia project
- **Fences:** weighted average cost of works already done within the LIFE Elia project
- **Selective felling of problem species:** figures obtained from works carried out in Couvin and Ramioul sites. In many cases, these costs could be zero for Elia since, in public forests, the DNF takes care of this operation and in other cases the trees to be felled may be felled for firewood by local actors. This felling takes place before the trees become dangerous to the lines.
- **Initial thinning:** operation carried out by a worker paid €30/hr for an eight-hour day, with the estimate that it takes 1.5 days to cover 1 ha of forest corridor made up of 5 rows of plantation either side of the axis of the high-tension line.
- **Rotary milling of the central corridor:** rotary milling costs on average €1 500/ha. For 1 ha of forest corridor under consideration (50 m wide), rotary milling must only be done on a central strip 10 m wide, i.e. 1/5 of the total corridor width. This brings the cost to €300/ha of forest corridor every 3 years. In many cases, maintenance of this central corridor is carried out by hunters or, less often, by a farmer and, therefore, at no cost to Elia.

4.3.3. Open land management: Pasturing

The "Pasturing" action is described in detail on the LIFE Elia website.

In most cases, the pasturing used is bovine (cows) or equine (horses). On steep slopes or rocky environments, ovine pasturing (sheep) is more suitable, since sheep are better suited to these environments. Fences for horses and cows are composed of multiple raws of barbed wires. Fences for sheep can be fixed (this is costly, since they must be fine-mesh Ursus fencing and are often put up on difficult soil) or mobile. Compared to barbed-wire fencing, the type of fence used for sheep prevents a range of species (especially wild boar) from getting around freely and thus fragments the land. This often means that the hunting stakeholders are very reluctant to accept this kind of fence in forests. The idea of caprine pasturing (goats) was abandoned due to the difficulty of containing the goats in a pen.

Pasturing is an even more interesting option where there are double electrical corridors, since the area that must be enclosed will need a propotionnaly smaller perimeter of fencing[8].

The items to be specified, the unit costs of intervention per ha of corridor and the frequency of intervention for this action are:

Pasturage

Initial works	Costs (€/ha)	Frequency
Fencing for cows or horses	2,241	once
Fencing for sheep	5,872	once
Maintenance/Management		
Repairing of fences	160	once/5 years
Renewal of fences for cows or horses	2,241	once/15 years
Renewal of fences for sheep	5,872	once/15 years

Explanation of actions

- The **fences** to be installed differ according to the kind of animal they must enclose. Ovine (sheep) fences must have finer and more solid mesh (Ursus fencing), and are often installed on more difficult soil, which explains their higher cost. Bovine fences are simply created using 4 rows of barbed wire. The fences have a guaranteed average lifetime of 15 years and must then be, if needed, completely refurbished. The fences must also be able to be repaired promptly if damaged by fallen trees or branches.
- The **management** of the pasture is generally done by a farmer who has an interest in it for the following reasons: new agricultural areas for his livestock in a wider context of high land pressure, possibility of declaring the area under the Common Agricultural Policy and thus receiving agricultural subsidies, proximity of agricultural operations, diversification of activities, etc. In many cases, the agricultural operator receives an agricultural subsidy[9] paid by Europe and the Walloon Region for a more ecological management of the land. In some cases (isolates area, difficult to access, very low productivity and ineligible for agricultural subsidies), no farmers are interested in the pasturing area. In this case, we need to consider paying the farmer to have an interest in the area (an amount equating to the "biodiversity" agricultural subsidies that would anyway remain below the rotary milling costs), but this option has not been taken into account in this analysis.

8 For a corridor 50 m wide and 200 m long (1 ha of forest corridor), the length of fencing to install is 500 m. For a corridor of the same length but 100 m wide (2 ha of forest corridor), the length of fencing to install is "only" 600m.

9 Agricultural subsidy AEM 8: "High biological value"

Explanation of costs

- **Installation of fences:** the installation price of the fences includes materials (stakes, mesh, tensioners, access gates, etc.) and the workforce.
- **Possible repairs to fences:** Maintenance is included in the LIFE costs for safety purposes if a farmer requests assistance, but it is normally agreed that the farmer maintains the fences himself in the event of branch or tree falls.

4.3.4. Open land management: Mowing

The "mowing" action is described in detail on the LIFE Elia website.

This action requires a sufficiently large surface area in one piece in order to interest either a farmer in mowing and exporting or a hunter as a grassy feeding area. Where the mowing is done by a farmer, we will ensure that sufficiently wide areas are chosen, for example for double-lines corridors. The creation of edges is sometimes balanced out if this option is selected.

The items to be specified, the unit costs of intervention per ha of corridor and the frequency of intervention for this action are:

Mowing

Initial works	Costs (€/ha)	Frequency
Soil preparation for sowing	1,581	once
Seed harvest	1,332	once
Sowing	175	once
Maintenance/Management		
Mowing	-	once or twice/year

Explanation of actions

- **Working the soil to prepare for sowing:** after the rotary milling of the surface of the vegetation present (thickets, brambles, etc.), the soil often needs to be worked before sowing. This enables the root system of the vegetation to be removed, the soil to be broken up correctly, the topsoil to be levelled and loosened. Depending on the conditions, tilling, harrowing and/or ploughing may be required.
- The **harvesting of seeds** and their processing are carried out by a company specialised in this kind of work: Ecosem. The meadows on which the seed is harvested (source meadows) are chosen by the LIFE team on the basis of two main criteria:
  - They are close to the areas to sow
  - They have a great diversity of rare plants

  These "source" meadows are often the remnants of old meadows which have not been managed intensively (no fertiliser, chemical soil-corrective or ploughing).
- **Sowing** is carried out using the "broadcast" method, mostly from a seeder mounted behind a tractor equipped with a full roller but can also be done by hand on small areas.
- **Mowing** is carried out by a farmer using a tractor equipped with a mowing bar. The meadow is mowed at the best moment appropriate for biodiversity (after the reproductive cycles of insects, birds and mammals, after the plants have gone to seed, etc.).

Explanation of costs

- **Working the soil to prepare for sowing:** the situations encountered on the ground differ according to the work to be done to prepare the soil. If the soil is rocky or a plant has a large root system which involves working the soil at depth, the cost may be higher. The cost given in the table is the average for the situations encountered.
- **Harvesting seed:** done with Ecosem in partnership with the LIFE team in order to identify the meadows to harvest. One harvest produces a yield of several tens of kilos of seeds which can then be sown on several LIFE Elia meadows.
- **Sowing:** sowing is inexpensive and is either done by the LIFE Elia team or the contractor who works the soil (possibility of combining harrowing, ploughing and sowing in one sweep).
- **Mowing:** free for Elia, since it is done by a farmer. The farmer can apply for a subsidy for agri-environment measure 8 "high biological value", for which he may receive up to €450 ha per year, an amount which compensates him for the poor yield of the fodder harvested.

4.3.5. Natural habitats

The "natural habitats " action is described in detail on the LIFE Elia website.

This action is preferred where the initial mapping of the areas covered by LIFE show the presence or possible restoration of these natural habitats protected by the European Habitats Directive 92/43/EEC.

The items to be specified, the unit costs of intervention per ha of corridor and the frequency of intervention for this action are:

Explanation of actions

Natural habitats

Restoration - initial works	Costs (€/ha)	Frequency
Soil removal - heathland	1,331	once
Soil removal and waterlevel works - peatland	3,513	once
Maintenance/Management		
Selective fellings (light)	500	once/10 years

- **Soil removing** is an action which consists of removing the topsoil to a maximum depth of 10 cm. This action is used to restore moors and peatlands, natural habitats listed by Natura 2000 as protected habitats. This brings to the surface the seedbank which can then germinate.

- For peatlands, **water retention works** are sometimes necessary to restore an adequate level of water in the soil. These works consist of blocking a possible network of drains or building dykes to retain water.
- Selective **fellings of problematic species**: see structured edges. The moors and peatlands are "stable" natural habitats, we can clearly see that the growth of the trees posing a problem for the lines will be slower and this aspect remains more difficult to quantify.

Explanation of costs

- **Soil removing:** weighted average for works already done within the LIFE Elia project.
- **Soil removing and water retention works:** weighted average for works already done within the LIFE Elia project.
- **Selective felling of problem species:** prices from market price.

4.4. Lengths of the network

High-tension line lengths of the Elia network in Belgium and in the Walloon Region are given below:

Network lenghts

Grid	Lenght (km)	Source
HT network in Belgium	8,370	Elia F&F 2013
HT overhead network in Belgium	5,561	Elia F&F 2013
HT overhead network in Walloon Region	3,012	LIFE Elia F&F 2014**
HT overhead network in Walloon Region in forest areas	685	LIFE Elia F&F 2014**
HT covered by the LIFE Elia	221	LIFE Elia F&F 2014**
Forest corridors covered by LIFE Elia*	155	LIFE Elia F&F 2014**

* A corridor encompasses sometimes two HT lines ** Sources: intersect Elia Grid with IGN

The LIFE Elia is currently working on 221 km of the 685 km of lines in a forest environment.

In order to facilitate the work, these 221 km were chosen on stretches which were large properties in one piece (public forests, large private forests). Without having carried out a fine-grained analysis of the land cadastre, it is very difficult to decide on whether to parcel up the properties under the lines over the remaining 464 km or not.

Nevertheless, a significant portion of the remaining 464 km has the potential to be managed using the LIFE Elia management techniques. One solution to the problem of small properties is that, in order to limit the steps in the process, agreements have not been signed with the "small" landowners. LIFE Elia-type actions would in this case be the method chosen by Elia to ensure electrical safety in the forest corridors.

The line lengths and voltages are set out more precisely in the table below.

Voltage (kV)	Total lenght in Walloon Region (km)	% of total lenght	Forest corridors lenght (km)	% of lenght crossing forests (km)
30	22	1	8	1
70	1,531	51	331	48
110	1	0	0	0
150	732	24	136	20
220	299	10	104	15
380	418	14	104	15
	3,012	**100**	**685**	**100**

Comparison of the two management methods

5.1. Comparison of the costs of external assistance

The purpose of the cost-benefit analysis is to compare the costs incurred in vegetation management of both kinds: traditional management versus the LIFE Elia method.

The figures used to compare the two methods are derived from the previous chapter. It should be noted that these amounts do not include VAT.

Presentation of graphics

The various graphics used below express the evolution of **annual** costs related to vegetation management in **forest corridors** in **€/ha**[10].

LIFE prices – invoiced and conservative

The figures set out in the previous chapter are figures derived from sites managed by LIFE Elia. They do not include the economies of scale which would be possible if larger contracts were awarded. The desire to be integrated in the local economic context will no doubt enable even more economies.

Furthermore, in some cases, some of the actions accounted for under the LIFE method will be carried out by third parties at no cost to Elia. This will further reduce the actual cost of the LIFE method.

WACC and discount rate

WACC means Weighted Average Cost of Capital. This is an economic indicator representing the annual average rate of return expected by the shareholders and creditors on their investment. A company like Elia compares costs using this WACC.

This rate includes a) **actualizing** and b) **inflation** (at about 2%).

In order to reflect actual costs as of today (year 0), all the amounts have been **actualized** using the following formula:

$$\textbf{Capital cost} = \textit{sum of costs (year x)}/(1+WACC)^{(year\ x)}$$

The WACC used is a rate used among the GRTs, i.e. **5%.**

As is the practice of enterprises like Elia, the comparison of both methods is done using updated amounts, both for the traditional method of rotary milling and the LIFE methods.

5.1.1. Summary of the results of the comparison

The summary of the results of the comparison is below:

The “break-even point” column shows, for each action, after how many years the action becomes profitable, i.e. how long it takes for the costs to become lower than the costs of traditional management using rotary milling.

The “comparison” columns compare the relationship of the costs after 30 years for each LIFE action with the costs of traditional management, without and with a WACC of 5%.

All these figures are set out in more detail in this chapter.

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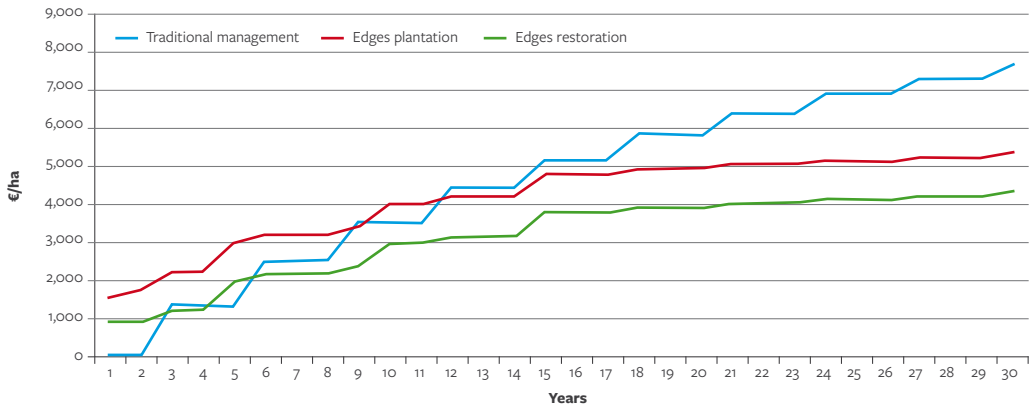
10 N.B. 1 ha of “standard” forest corridor is 50 m wide by 200m long

	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

5.1.2. Traditional management/structured edges

The costs of traditional management are specified in chapter 4.2 and the costs of LIFE management are specified in chapter 4.3.

Comparison traditional management/structured edges



Once calculated using updated figures, the results show that the **break-even point** of this action is reached after **6 years** for edges restoration and after **12 years** for edges planting.

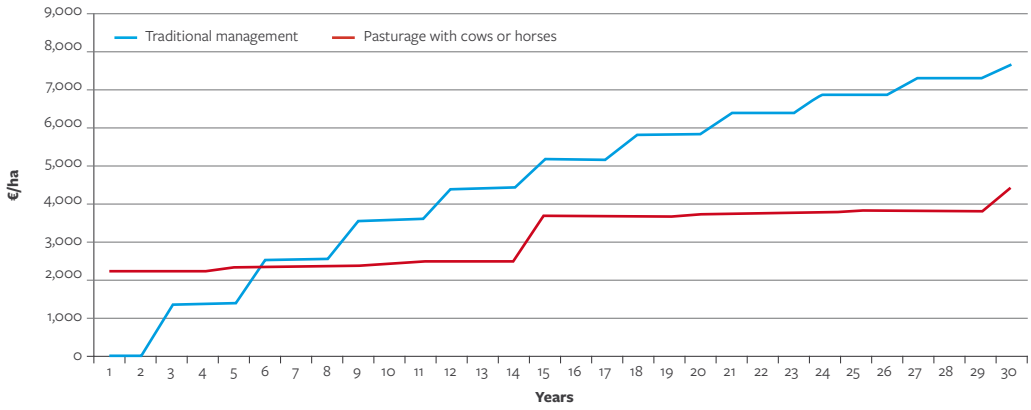
--> After 30 years, and based on updated figures, the action shows a cumulative cost **1.8 times lower** for restored edges and **1.4 times lower** for planted edges compared to the costs of traditional management using rotary milling (WACC = 5%).

As indicated in the description of the actions in the previous chapter, in some cases the forest edge management will be done by third parties (Department of Nature and Forests, landowners, farmers) before the woodland becomes a risk to the line. In those cases, the management costs after LIFE Elia's planting/restoring the edges will be equal to zero.

5.1.3. Traditional management/Pasturing

The costs connected with traditional management are set out in chapter 4.2 and those connected with LIFE management are specified in chapter 4.3.

Comparison traditional management/Pasturing



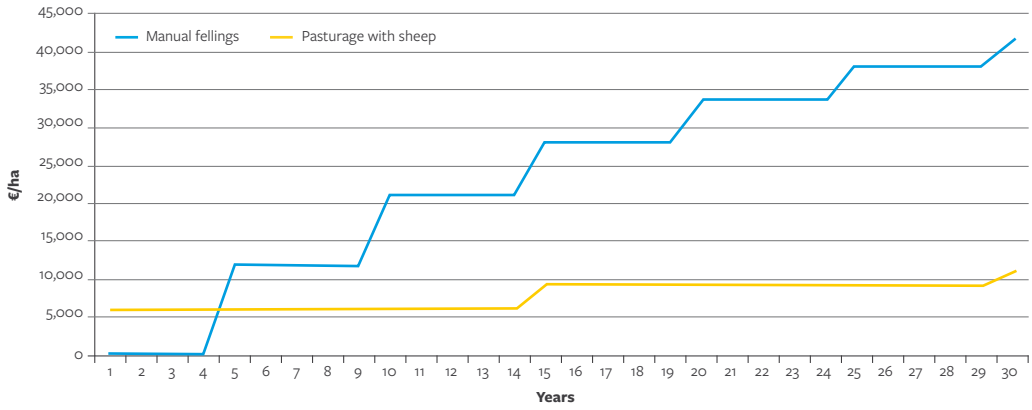
Once calculated using updated figures, the results show that the **break-even point** of this action is reached after **6 years**.

--> After 30 years, and based on updated figures, the action shows a cumulative cost **1.8 times** lower than the costs of traditional management using rotary milling (WACC = 5%).

This result is a worst-case scenario in a way that, even though they are guaranted 15 years, fences are lasting much more than 15 years.

Where felling has to be carried out manually, we have compared the costs with those connected with pasturing sheep.

Comparison traditional management/Pasturing in difficult conditions



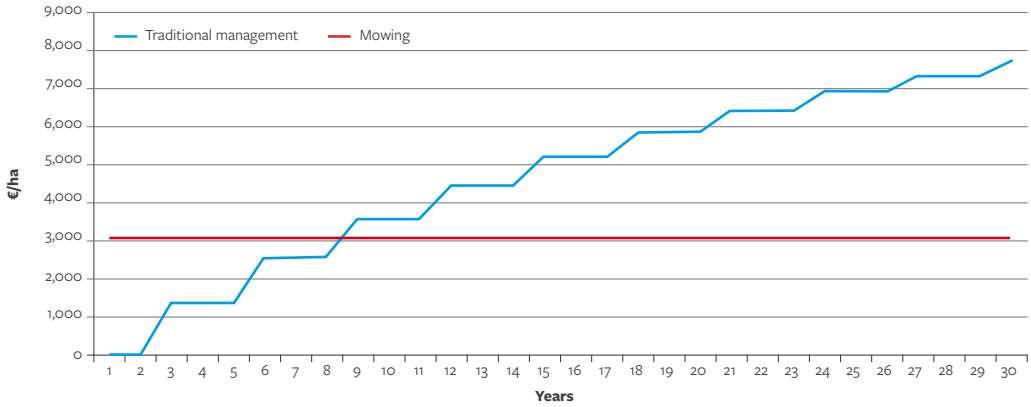
Once calculated using updated figures, the results show that the break-even point of this action is reached after **5 years**.

--> After 30 years, and based on updated figures, the action shows in both cases a cumulative cost **3.9 times lower** than the costs of traditional management using rotary milling, even given increasing costs (WACC = 5%).

5.1.4. Traditional management/Mowing

The costs connected with traditional management are set out in chapter 4.2 and those connected with LIFE management are specified in chapter 4.3.

Comparison traditional management/Mowing



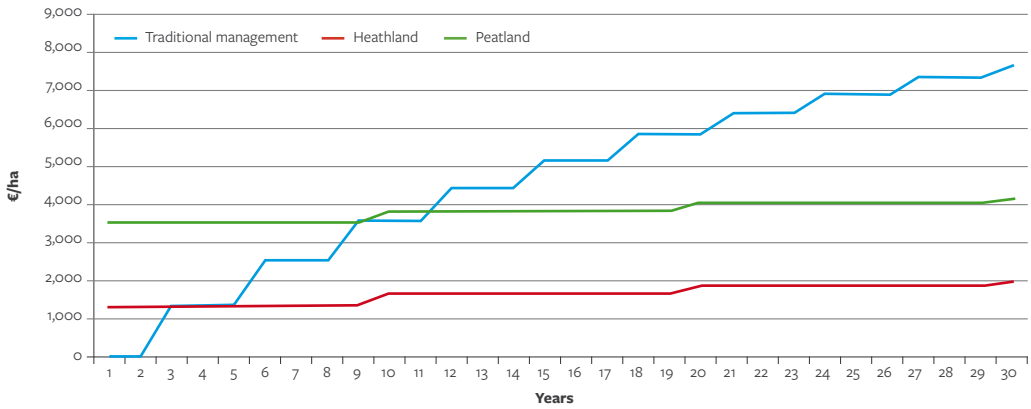
Once calculated using updated figures, the results show that the break-even point of this action is reached after **9 years**.

--> After 30 years, and based on updated figures, the action shows a cumulative **cost 2.5 times lower** than the costs of traditional management using rotary milling (WACC = 5%).

5.1.5. Traditional management/Natural habitats

The costs connected with traditional management are set out in chapter 4.2 and those connected with LIFE management are specified in chapter 4.3.

Comparison traditional management/Natural habitats



Once calculated using updated figures, the results show that the break-even point of this action is reached after **3 years** for heathlands and **12 years** for peatlands.

--> After 30 years, and based on updated figures, the action shows a cumulative cost **3.9 times lower for heathlands** and **1.8 times lower for peatlands** than the costs of traditional management using rotary milling.

In many cases, natural habitat management will be done by third parties (Department of Nature and Forests, landowners, farmers) before the woodland becomes a risk to the line. In those cases, the costs to LIFE Elia of natural habitat management will be zero.

5.2. Other impacts

The other impacts are all the aspects caused by the two types of management. These aspects must be taken into account in the comparison of the two modes of management but they are difficult to quantify.

The table below compares the two modes of management on various points:

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

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".

6. Conclusions and prospects

6.1. Conclusions

6.1.1. Financial comparison between traditional management and LIFE management

The comparison of costs shows that **the LIFE actions break even in 3 to 12 years**, depending on the actions. After 30 years, these actions will have become **1.4 to 3.9 times cheaper** for Elia than the traditional rotary milling carried out at present.

The figures presented by the LIFE team are deliberately very conservative. They consider that the TSO will systematically support the future maintenance costs, even though, in many cases, they may be carried out **by local actors** (management of edges by the forest authorities for public forests, mowing by hunters, maintenance of fences by the farmer, etc.). There is, therefore, a strong chance that, in many of these places, the costs of the LIFE Elia actions will be lower than those in this analysis and the actions will be even more profitable.

It appears that Elia would have a great opportunity to reduce maintenance costs. A projection of these short-term savings could be made by LIFE Elia in collaboration with Elia.

For example, if we consider the 424 km of forest corridors not included in LIFE Elia, for traditional management using rotary milling at €1 500/ha every 3 years, not including additional expenditure connected with pruning or pollarding, the amount expended will be €9 540 000 over the next 9 years. For the same 424 km, the costs of planting edges amount to €3 805/ha in all, which comes to a total of €8 066 600 – a saving of around €1 500 000. This saving increases to €5 200 000 over an 18-year period and €12 800 000 over a 27-year period. This does not include the areas which could be given over to pasture and hay meadows, where the savings are even greater.

6.1.2. Improvement of social acceptability

An improvement in the societal acceptability of the profession of TSO is one of the consequences of the actions of the LIFE Elia project and any LIFE-type management used in the future for the whole network. Due to a lack of tools and resources for this type of detailed analysis, figures for this component are absent from this document. Nevertheless, it is significant in the current societal context.

The analysis could be carried out in parallel and as a complement to this study by Elia and/or in collaboration with RTE, by their respective Corporate Social Responsibility departments.

The benefits of improving the societal image of the TSO vis à vis its partners (landowners, environmental associations, local actors, general public, etc.) will enable trust to be built between the stakeholders concerned.

6.1.3. Facilitation in obtaining permits

Taking biodiversity, which is at the heart of European preoccupations, into account well upstream of the projects to create/renovate lines is a great asset that facilitates obtaining permits or reducing processing times. Procedures can become more fluid as a result, among other things, of the quality of the relationships with institutions (local authorities and governments).

6.1.4. Overhead lines...a business strategy

In many places, the option of constructing new overhead lines or renovating old ones is becoming increasingly difficult, for landscape, social or environmental reasons. The solutions proposed by LIFE are likely to make construction/renovation possible again, since they take the above obstacles directly into account. The lifetime of an existing line can also be extended in this way.

6.1.5. Anticipation of European legislation

The problem of invasive plants is a concern that is being closely monitored by the European Commission. Future legislation to limit their spread is anticipated and will apply to various actors, including line operators. Electricity lines are areas conducive to the spread of these species, which "choke" indigenous vegetation. If we anticipate the measures to address this problem, we are in the vanguard of a more substantial effort if the situation is not taken under control now.

European legislation, by means of Natura 2000 and other Directives, emphasise the importance of conserving biodiversity. The LIFE Elia project integrates these changes by translating them into actions at the heart of the TSO.

6.2. Prospects

6.2.1. Prospects for the whole Elia network

The arrangements of forest corridors by LIFE require a **detailed knowledge of the contexts encountered**, both at the biological and human level (networks of knowledge of local actors such as local authorities, foresters, farmers and hunters). The ecological engineering required to implement the actions and monitor some of them cannot be ignored if Elia decides to apply the LIFE methods to its whole network. A **joint discussion by Elia/LIFE Elia team** to plan out the next 10 years would have the advantage of highlighting the experience acquired by the LIFE Elia team and Elia's expertise.

6.2.2. Towards greater freedom on the electricity pathway in forests

One of the steps which needs the most time for the actions to be put in place is certainly negotiation with landowners. Following the recognition by the Ministries of Energy and Nature of the work done by Elia to benefit the environment, it would be possible to explore ways of making it easier to change the type of management in forests. A possible kind of environmental right-of-way or flexible conservation status which would enable landowners to be strongly "convinced" would facilitate the work. This would enable the **landownership obstacle to be overcome where works are carried out in favour of biodiversity**.

6.2.3. A study expected by the TSO in Europe

This analysis is **expected by many TSO in Europe** because it will be the first of its kind in terms of its breadth and extensiveness.

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/