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Renewables Grid Initiative

GREEN ELECTRICITY CORRIDORS IN EUROPE

Integrated Vegetation Management (IVM): Status, roadblocks and ways forward

Briefing Paper – November 2019

Ecofirst

Renewables Grid Initiative

Imprint

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About RGI:

The Renewables Grid Initiative is a unique collaboration of environmental NGOs and Transmission System Operators from across Europe. We promote transparent, environmentally sensitive grid development to enable the further steady growth of renewable energy and the energy transition.

More information:

www.renewables-grid.eu

About Ecofirst:

Ecofirst is a consultancy born out of the highly respected LIFE Elia-RTE project. They use their expertise to develop and deploy integrated vegetation management strategies in collaboration with Transmission System Operators (TSOs) across Europe.

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Abstract

With proper management, the land under powerlines can enable and support greater biodiversity. Such management, known as **Integrated Vegetation Management (IVM)**, can be used to create **green corridors** which are a type of **green infrastructure**. These are strategically-planned networks of natural and semi-natural areas designed and managed to improve biodiversity, protect vulnerable species and provide a wide range of ecosystem services. IVM can benefit multiple habitats and species by increasing plant diversity, which acts as important habitat for multiple bird, pollinator and small mammal species (among others). Although many **Transmission System Operators (TSOs)** have some form of IVM policy in place, there is still great potential to develop land in power line corridors for the benefit of nature. To understand why TSOs can find it difficult to implement IVM, the consultancy **Ecofirst and the Renewables Grid Initiative (RGI)** conducted a benchmarking exercise to understand what the common **roadblocks** are, what **tools** would be needed to overcome them and to propose some ways in which IVM policies can be **better developed and implemented**. The exercise found that the **main roadblocks were human rather than technical**. Building sustainable partnerships with landowners, convincing those within the TSO itself as well as making a business case for IVM were all recurrent challenges. From the research and further discussions, four main future priorities became clear:

- **Build mapping tools**
- **Test and share new governance approaches**
- **Prove cost efficiency through costs benefit analysis**
- **Expand the scientific knowledge base.**

Both RGI and Ecofirst are committed to expanding the positive impact of IVM and are looking to assist in the development of further projects across Europe. Our hope is to test new methods and technologies and help to spread knowledge and the lessons learnt to TSOs, NGOs and other stakeholders.

Picture of flowering meadow created through IVM, ©Ecofirst

1. Background

Integrated Vegetation Management (IVM) is a practice to proactively manage land underneath high voltage power lines. The purpose of this is to enhance the land's ecological value and regional habitat connectivity, to bring down maintenance costs and to build relationships with landowners. Developing the environmental value of power line corridors in this way has also helped develop the concept of **Green Infrastructure**, which can also be applied to other linear infrastructure such as pipelines, motorways, railways, channels and rivers.

Traditionally, **Transmission System Operators (TSOs)** have used vegetation slashing as the main way to remove trees that naturally re-grow in power line corridors. Although immediately effective, the slashing of vegetation is neither sustainable from an operational nor an ecological perspective. Vegetation slashing leaves a layer of organic matter that decomposes into an excellent humus, allowing seeds from the neighbouring trees to grow quickly on the bare ground.

In an effort to move away from this traditional vegetation management, between 2011 and 2017, as part of a LIFE+ Biodiversity project, the TSOs RTE (France) and Elia (Belgium) tested a range of new IVM methods and natural habitat restoration practices at selected sites in Belgium and France (www.life-elia.eu). The project was seen as pioneering in its approach, especially with its emphasis on building local partnerships with landowners and comparing the cost effectiveness with traditional vegetation management, as well as the quality of the outreach activities, which spread knowledge of this practice to other TSOs.

Although the interventions piloted in this project were a success, during the project it was found that European TSOs are experiencing a number of roadblocks which hinder the roll out of a comprehensive IVM strategy across their networks. **Ecofirst** and **the Renewables Grid Initiative (RGI)** conducted a benchmarking exercise in order to understand what the common and diverging roadblocks are relating to IVM, what practical tools would be needed to better mainstream the practices and to propose some other ways in which IVM policies can be better developed and implemented.

2. What is Integrated Vegetation Management (IVM)?

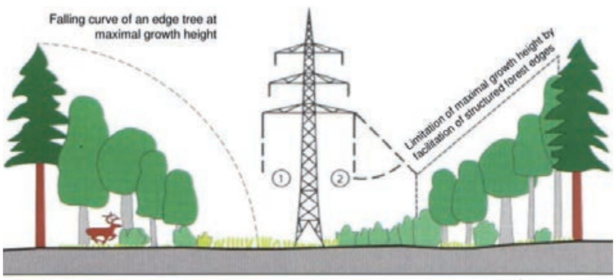
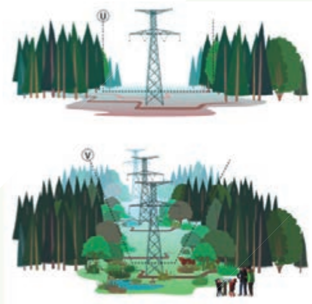


Figure 1: "Ecological Management of the Overhead Lines (EcoMOL)" ©50Hertz Transmission GmbH, Berlin, Germany (Krause et al. 2010)

Power line corridors have to be managed in order to prevent trees growing too close to the lines, making contact, causing faults and potentially starting wildfires.

A traditional vegetation management strategy needs to be efficient, in that it should require the least time and financial investment to achieve the best control of tree regrowth. Depending on the biogeographical region, the habitat type, the richness of the soil and the accessibility of the site, a vegetation management strategy can be designed in different ways.

Traditional vegetation management strategies have relied on three main interventions: rotary slashing of the vegetation on the ground, slashing of the aerial part of trees and the use of herbicides (less common in Europe). IVM on the other hand looks to avoid such approaches and instead plan and implement site specific interventions that are appropriate for the local context. These IVM interventions have to be designed in a scientifically robust way that will improve local biodiversity or provide habitat for a specific species. The main types of IVM interventions are shown below.

Selective tree cutting to create forest edges: The approach looks to create natural progressive structures to create habitat interfaces with the forest (ecotones) that are valuable for many species (especially reptiles, small mammals, invertebrates and plants). These approaches aim to restore ecologically functional edges (the “V-shape” corridor) by applying selective cutting of trees species to ensure their stability in the long-term. This is opposed to traditional VM techniques which maintain a “U-shaped” forest corridor.	 *Figure 2: VM comparison diagram, LIFE Elia-RTE, ©Elia*
Restoring natural and semi natural grasslands: Grasslands are important as they often contain a high diversity of native species. These habitats can be restored under the lines by changing the management of the land to include grazing (cows, horses or sheep) or by mowing and sowing mixes of locally harvested seeds on bare ground to create flowering meadows.	 *Figure 3: Sowing of meadows, ©Ecofirst*
Restoring heathland and peatbogs: Peatbogs and heathlands contain flora which support a number of specialised animal species. These habitats can be maintained and their quality improved with proper management. The restoration of these habitats usually takes the form of soil scraping and hydrological interventions (such as intentional waterlogging).	 *Figure 4: Soil scraping to restore heathland, ©Ecofirst*
Digging new ponds: Small ponds can be dug in clusters in the corridor to create habitats for many aquatic species (e.g. dragonflies and newts) and other species feeding in/close to water. Figure 5 shows an ecological compensation scheme in Switzerland where ponds were constructed in the corridor.	 *Figure 5: Ponds and other upgrading measures of biotopes, ©Swissgrid, 2018*

Controlling invasive plants: Invasive plant species can totally colonise power line corridors. IVM can introduce management plans to remove such invasive species and prevent their regrowth, i.e. by maintaining an herbaceous habitat after removal that blocks colonisation by invasive species. Fig 6 shows the distribution of Japanese knotweed, a species that can be eliminated from power line corridors.

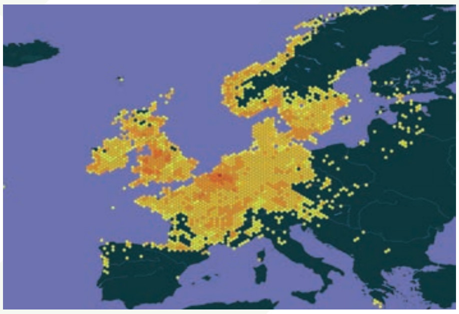


Figure 6: Presence of invasive Japanese knotweed in Europe, GBIF Secretariat, GBIF Backbone Taxonomy, accessed 14 November 2019

Although power line corridors have been criticised for fragmenting the landscape, creating risks to birds and for facilitating the intrusion of invasive species, ecologists have also emphasised their potential to create a mosaic of different succession stages that can be of great benefit to local biodiversity. They can also provide important ecosystem services.

3. How can IVM benefit nature?

Integrated Vegetation Management (IVM) has shown to benefit a number of different habitats and species.

Plants

Power line corridors, especially those within forests, produce clearings where new plants can grow. When managed with IVM and where vegetation slashing is avoided, the diversity and richness of plant species can be significantly higher than within a forest (where new growth is limited) or in a mowed or herbicide-treated area (where new growth is prevented). Areas with increased plant diversity can be especially valuable in monoculture pine forests, where biodiversity can be low. In one study, the number of plant species recorded in a power line corridor was more than twice the number found in the surrounding woodland. Such diversity creates “edge effects” which are important to support a variety of animal species.

Birds

Bird habitats vary between different corridors depending on the land use patterns that surround them. Some shrubland bird species (such as field sparrows and prairie warblers) have been shown to be more abundant on narrower corridors or at sites with particular types of vegetation. This indicates that vegetation management could be used to promote vegetation which favours species of high conservation priority. Also, it was found that several species were more abundant in corridors traversing unfragmented forests than those near residential areas or farmland, indicating that corridors in heavily forested regions may provide better habitat for some species.

Pollinators

There is a growing scientific literature demonstrating that IVM can create higher quality habitat for native bee species and butterflies. This is dependent on the presence of certain host plant species which can improve both pollinator abundance and diversity. With regards to bees, power line corridors have been shown to have richer communities which host more rare species across a wider area than in grassy fields. However, the surrounding, non-grassland landscape likely has a strong influence on the bee species collected at the grassland sites, as some bees may be foraging in the grasslands but nesting elsewhere. For example, improving habitat for native bees can be done through the sowing and management of flowering meadows. It is hoped that such approaches will help ameliorate the loss of pollination services caused by the collapse of wild and managed honeybee populations. A study in the USA suggests that power line corridors have the potential to provide five million acres of bee-friendly habitat in the US if utilities generally adopt appropriate IVM management practices.

Small mammals

The different successional stages created by power line corridors have the potential to enhance habitat availability for many small mammals. One study investigated the effects of traditional vegetation management on the timing of small mammal recolonisation, the vegetation characteristics that drive small mammal responses and the point where corridor resources are again sufficient to provide functional habitat for native species. It was found that native small mammal species recolonised the corridor after 1.5-3.5 years after traditional vegetation management. The corridor went on to support a breeding population of small mammals, 2.5 years post-management. It was suggested that cover and shelter use by the animals was more important in determining how small mammals use the corridor than which plant species are present. However, it is clear that the intensity of traditional vegetation management needs to be reduced and an IVM approach taken if power line corridors are to continuously provide habitat for native small mammal species.

4. Research results: IVM status, roadblocks and ways forward

In order to better understand why TSOs can find it challenging to roll out a full IVM strategy, Ecofirst conducted interviews with nine different TSOs. Questions asked included their current and planned IVM strategies, the roadblocks in implementing them and what they thought would be needed to further develop IVM in their countries. During the discussions, a pre-prepared questionnaire was filled. If needed, additional data were provided by email after the interview.

› To what extent is IVM implemented in your country?

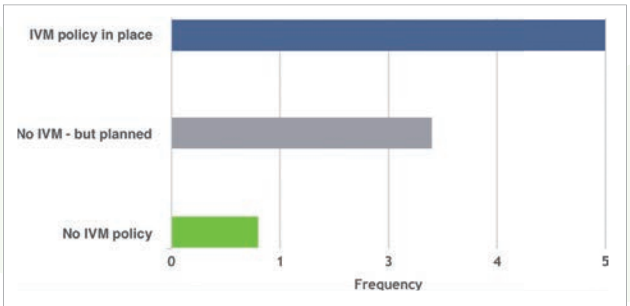


Figure 7: To what extent is IVM implemented in your country?

IVM is not a new concept, many Transmission System Operators (TSO) have implemented some limited IVM approaches that encourage opportunities for natural resource conservation and habitat enhancement. Most TSOs asked had some form of IVM policy or intended to put one in place. This mostly took the form of selective cutting to create forest edges. Only one TSO answered that they have no policy and have none planned. A small minority of TSOs appears to have deployed IVM on a relatively large scale. This demonstrates that a systematic implementation across the whole territory is feasible. TSOs who have not yet implemented IVM said that they were lacking a long-term strategy for investment in new vegetation management approaches.

› What motivated you to implement an IVM policy?

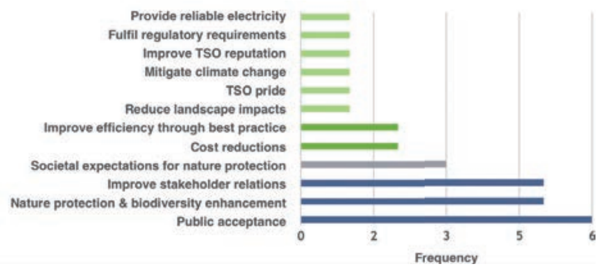


Figure 8: What motivated you to implement an IVM policy?

The main motivation for TSOs to implement IVM comes from the will to improve public acceptance and relations between the company and stakeholders. TSOs have to demonstrate that they are a proactive positive force in order to meet the environmental expectations of citizens. If TSOs are to upgrade and expand their networks in order to bring more renewables onto the system, the acceptance of stakeholders such as administrations, forest agencies, NGOs or citizens associations is vital.

The second most common answer given was the desire to protect rare species and enhance biodiversity. Many of the people interviewed are responsible for environmental issues within the TSOs. These individuals are often professionals in the fields of forestry, biology or a scientific discipline linked to the environment. Taking steps forward to implement IVM in favour of rare animal and vegetal species is part of their “core mission” and mandate within the company. Showing the quantified impact of IVM on biodiversity can be a real asset for nature as well as for the company as a whole when discussing their impact with other stakeholders.

Perhaps more surprisingly, saving costs was not listed as the top motivation to implement IVM by the TSOs asked. However, the LIFE Elia-RTE project demonstrated that it is at least an important condition: TSOs will not implement IVM on a large scale if management costs are much higher than conventional VM. It could therefore be considered more a condition for implementing IVM (or not) rather than a motivation to do it.

› What are the most important/useful tools to implement IVM?

Figure 9: What are the most important/useful tools to implement IVM?

With regards to the tools needed to assist in an IVM roll out, the priority expressed by participants was the ability to properly identify, map and prioritise potential sites that could be appropriate for IVM interventions. The ability to handle the complexity of the data coming from those who work in the field is crucial in order to successfully plan and manage an IVM strategy. Integrating all parameters (field characteristics, natural habitats, species populations, protection status and planning) to organise an efficient IVM is a challenge shared by most of the TSOs.

What restricts you from doing more IVM?

Figure 10: What restricts you from doing more IVM?

The answers given in the interviews showed that the biggest roadblocks to implementing IVM are human and not technical. When changing an established process (in this case traditional VM), companies will face various reactions from stakeholders, ranging from total rejection to embracing it. Moving from VM to IVM implies changes in the ways people work. These changes are not always easily accepted.

Sometimes, even when well-explained evidence can be brought into the discussions (with an understanding that IVM may not be applicable everywhere on the network), IVM implementers can face what appears to be irrational opposition from some groups. Engaging and convincing landowners and finding win-win solutions to involve them in the management of the land takes a huge amount of time and energy. Another consideration is that it is sometimes difficult to identify and map who is the owner of the land and get a response from them.

Reluctance to change can also be observed within a TSO itself. The cost of IVM and shifting roles and responsibilities can make some parts of a TSO slow to see the benefits of IVM. Progress is often dependant on the open-mindedness of senior management as well as the asset management and finance departments, which will ultimately push forward the implementation of IVM and place it higher up on the company's agenda.

In your opinion, what can be done to overcome these roadblocks?

The answers to this question could be grouped in to four main categories:

Develop technical and governance tools

Many TSOs have shown interest in getting external assistance to develop tools that facilitate the authorisation processes at different levels (local and regional) as well as speed up the administrative process with landowners. There is a real requirement to avoid delays in IVM implementation caused by long and complicated administrative procedures.

Governance was also brought up regarding the company itself. In order to convince the company to shift from VM to IVM, there is a need to improve company buy-in. Data on a positive cost-benefit analysis and the "on the ground" impact of IVM through robust biological indicators can be useful in building a strong and positive case internally. Convincing stakeholders, especially decisionmakers, is a crucial step and the environmental departments of the TSOs are looking for demonstrable methods and arguments that back their desire to implement IVM. Some participants expressed their desire to jointly develop biological indicators, mapping technology and approaches to site prioritisation than can be used across different biogeographical regions.

Sharing information and networking

Several participants expressed their interest in a networking platform with other TSOs in order to exchange on various topics to do with vegetation management. Such a platform could be used to discuss regulation, types of actions, the tools used or just to get inspiration. Some of the feedback received mentioned the work done during the LIFE Elia-RTE project as a good basis that could be continued over time.

Identifying external co-funding sources

All costs relating to VM have to be approved by the national regulatory authorities (NRAs) for energy. Initial investment costs needed to start IVM on the network are often hard to fit into the budgetary period. Although they might save costs in the long term, TSOs can often struggle to fund IVM investments. Several participants interviewed stressed the importance of identifying sources of external financial help (co-funding). Such co-funding (potentially coming from green investment banks) would provide part of the needed capital and could to some extent mitigate the financial constraints that the TSOs experience.

5. What are the next steps?

RGI and Ecofirst are committed to seeing IVM become more widespread, as it is good for the environment, good for people and can help improve acceptance of infrastructure needed for the transition to an energy system based on renewables. Through the research and conversations with TSOs, NGOs, landowners and other stakeholders, a number of future priorities for action became clear.

Build mapping tools

Specialised mapping tools able to identify sites appropriate for IVM interventions are needed. The basis for such tools is an efficient data collection process that allows the integration of important parameters (field characteristics, natural habitats, species populations, protection status and planning), to organise the data, and to display it in a way which allows holistic and efficient planning and implementation of IVM. The tools would need to be flexible to order to be applied across multiple geographies and to have been developed by an organisation with expertise in both GIS systems, environmental science and landowner negotiation.

Test and share new governance approaches

The main roadblock preventing a roll out of IVM in many countries is the amount of resources needed to negotiate and conclude agreements with landowners. The solutions to some of these issues have to be local, as local context is key. IVM also must remain flexible and site appropriate if it is to be effective. That being said, there are some governance approaches which are being tested and could be developed further.

Standardised contracts – contractual agreements with landowners and managers who commit to managing the land in an integrated way are key. Designing standardised contract templates which are legally robust and set clear roles and responsibilities for landowners, land managers, TSOs and others is therefore vital.

Building partnerships – partnerships with NGOs, forestry organisations and government departments are a good place to start as these groups may own large plots of land in forest corridors. Approaching these organisations as partners with an explanation of the mutual benefits of IVM is the first step. It also can be important when developing and planning the interventions, as local partners can provide local knowledge and contacts. An approach taken during the LIFE Elia-RTE projects was to first approach the senior management in these organisations or departments. This was done in order to have a "green light" from the top of the organisational hierarchy which would give regional managers the confidence to pursue IVM.

Leveraging co-funding – finding the initial investment needed for IVM on a large scale can be difficult. Public financing is available on the regional, national and European levels for projects which look to develop green infrastructures and test experimental approaches to support biodiversity. However, this type of funding may not be appropriate for a more systematic longer-term investment in IVM. More stable financing from development banks who are looking to invest into biodiversity also holds potential. Innovative sources of financing, as well as better understanding of how TSOs can include IVM in their regulator-approved costs should be explored.

Prove cost efficiency through Cost Benefit Analysis

The cost effectiveness of IVM is a precondition for its rollout across the network. Although this cost effectiveness was demonstrated in the LIFE Elia-RTE project, it has not been standard practice to perform a comparative cost benefit analysis of traditional VM vs. IVM. A multi-country comparative cost benefit analysis (CBA) that compares the long-term costs across different IVM intervention types would be an important step in understanding the conditions under which IVM is cost effective. The results of such an exercise would be vital to convince other TSO departments as well as regulators as to the financial value of IVM.

Expand the scientific knowledge base

IVM is only valuable for biodiversity and vulnerable species if it is shown to work. The effectiveness of different types of IVM intervention need to be measured through scientific study and carefully designed biological indicators which can quantify its impacts. The more standardised and comparable these study methodologies are, the more can be learnt. Special biological indicators that are relevant for biodiversity in power line corridors should be developed and tested across multiple sites. This would both demonstrate the value of existing IVM approaches and bring people together to promote scientific exchanges and provide more evidence of the effectiveness of IVM. Agora such as the IENE network of experts (http://www.iene.info/) should be promoted and new fora set up.

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Annex 1 – Questionnaire

› PART 0: Glossary and Scope

Forest corridor (Right-of-way): Section of the high-voltage network crossing forest areas. Vegetation Management (VM): all actions carried out by TSO to ensure network safety. Integrated Vegetation Management (IVM): actions carried out by TSO in order to combine network safety, biodiversity and local partnerships.

This questionnaire does not address the following topics:

- Birds protection actions on wires
- Substations
- Pylon's foot in agricultural areas
- Mitigation measures

› PART 1: Practical information

- Country:
- Name of the TSO:
- Department and Function:
- Postal address:
- Telephone and Email:

Network data

- Number of TSO in the country:
- Network length (aerial VS underground):
- Range of voltage lines:
- Percentage of network crossing forests:

› PART 2: Current practices for "traditional" VM in forest corridors

- What are the legal obligations in terms of VM?
- What are the usual VM techniques applied in forest corridors? Is it achieved by the company or subcontracted?
- Who is the regulatory authority?

› PART 3: Company policy towards IVM in forest corridor

- Do you already have an IVM strategy set up on your network? (Yes/No)
- If no, is there a plan within the company to implement a type of IVM?
- If yes, what are the main motivations?
- What are the biggest issues that makes IVM difficult to implement (bottlenecks)?

- Do you include effects on the nature protecting areas in VM planning ? (e.g. Natura 2000, Bird and Habitat Directives, water protection, RAMSAR sites) If yes, how, how do you prioritize the different levels of protection?

PART 4: Implementation of IVM to develop green corridors

PART 4A

- If yes to part 3, what are the concrete actions already implemented by your company?
- If yes, is it local projects or wide deployment?
- If yes, what type of actions?
- What is the extent of the actions of IVM implemented (ha, km of HV lines, types of habitats/species targeted)?

PART 4B

- In summary, what is the deployment methodology of these actions? (regions chosen, local partnerships, contracts with stakeholders, departments of TSO involved, use of consultants/subcontracting, regional centers etc.)
- Methodology of deployment is the following one/ departments involved:
- Did you develop specific tools in order to deploy IVM in forest corridors?

PART 4C

- How does the company finance the IVM actions?
- Do you have to report to the regulator to finance these actions?

PART 5: Biological monitoring, Cost-benefit analysis and communication

- Did you monitor a set of biological indicators before/after IVM implementation?
- Did you do a cost-benefit analysis comparing VM/IVM costs? If yes, what are the main results?
- Did you communicate on the main results obtained through a new IVM implementation?

PART 6: Feedback

- Does the IVM strategy deployed by your TSO:
    - promote changes within the company?
    - change your relations with stakeholders?
    - change your daily work ?
    - change the work of the maintenance teams (they are proud of the results; it gives more sense to their job)?

- What assistance would you need (financial, technical, science, governance) to develop/further develop your IVM strategy?

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RGI gratefully acknowledges funding from the European Commission's LIFE operating grant for NGOs. All opinions expressed in this publication are solely those of RGI.