COPEL
Pura Energia

# *Comparison of impacts and externalities between the use of integrated vegetation management in electrical systems and the use of mower on a distribution line in Parana*

## EXECUTIVE SUMMARY

The *Companhia Paranaense de Energia* (Copel) operates in the areas of generation, transmission, power distribution and telecommunications. In order to maintain the safety and quality of the energy supply, the concessionaires periodically carry out the maintenance of the passage lines and energy distribution networks in rural areas by means of manual or mechanized mowing, generally with the complete removal of vegetation.

In substitution of the mower, the electric sector has been discussing the use of Integrated Vegetation Management (IVM): a set of practices aiming the establishment, in the long term, of a community of plants whose growth characteristics do not interfere in the operational performance of the electrical facilities or that require the minimum of interventions, besides providing protection for the soil, shelter and feeding for the fauna, among other benefits.

The objective of this case study was to know the impacts and externalities of the use of integrated vegetation management in electrical systems in comparison to manual or mechanized mowing. In order to do so, the study evaluated which ecosystem services provided by the native vegetation can be maintained with the integrated management of vegetation in electrical systems. After identification, the evaluation of ecosystem services for global climate regulation and regulation of soil erosion was conducted.

As an example for this case, the high-voltage distribution line LDAT 138 kV Telêmaco Borba - Tibagi was considered, in a region of occurrence of the Mixed Ombrophilous Forest and Estepe (native Fields). The route has an approximate length of 28 kilometers and a passing bandwidth of 19 meters, in the municipalities of Telêmaco Borba and Tibagi, in the state of Paraná.

For global climate regulation, a negative externality of R$ 3.25 million was estimated in the mower scenario. In the scenario of implementation of the IVM, the negative externality decreases to R$ 1.22 million. Regarding the $CO_2$ emissions balance, the area in question resulted in a balance of - 26,726.21 $tCO_2e$, while in the IVM the balance was - 10,029.29 $tCO_2e$. Although the IVM also presents a negative externality for this ecosystem service, it is still more advantageous than traditional mowing, in addition to having a more favorable emissions balance. In addition, in the IVM, the interventions when more soft and spaced will allow greater land conservation both in physical-chemical properties and in its organic carbon stock. Regarding the regulation of soil erosion, the erosion rate in the mowing scenario was 310.51 tons per hectare per year, while in the IVM scenario it was 149.05 tons per hectare per year. Due to data restrictions, it was not possible to estimate the valuation, however, the erosion rate of IVM confirms the benefits of this alternative since the herbaceous-shrub cover will provide protection to the soil against erosion.

Approximately 25% of the traced on the studied distribution line is located in agricultural areas, and studies in the same region for other business indicate the occurrence of 35 species of native bees, in addition to other pollinators. This indicates that there is a great potential for pollination regulation with positive externality, but it was not possible at this moment to conduct the valuation study, due to data unavailability. In the future, it is recommended to conduct field research to better understand the relationship between increased supply of wild pollination for crops close to the Company's facilities and to understand how rural owners could benefit from this. In addition to the ecosystem services reported above, integrated vegetation management can also contribute to wildlife habitat, forest fire prevention, and the provision of medicinal and non-wood products. Thus, it can be confirmed that the integrated vegetation management maintains in part the environmental benefits that the native vegetation provides, unlike the mowing, that would practically cancel them.

Due to restrictions found for a complete valuation, because the lack of data, this theme was included in a proposal for a research and development project on integrated vegetation management that is in elaboration. The ecosystem services approachwill help in the communication with the interested parties, mainly as an argument with the environmental agencies for application of the methodology of integrated vegetation management in electrical systems in a larger scale.

## Reporting of dependencies, impacts and externalities

**Responsable for completing: Luciana Leal and Vanessa Barreto da Silva**

## Project drivers

**Goals:** Assess risks and opportunities; Compare options; Communicate internally or externally; Understand the business relationship with ecosystem services.

**Description:** Currently, the maintenance of safety ranges of networks and power distribution lines is performed by manual or mechanized mowing. With these techniques, there is habitat fragmentation, soil erosion and favoring invasive alien species. As a substitute for this process, the electric sector has been discussing the use of Integrated Vegetation Management (IVM) in Electrical Systems, with control only of species whose growth habits and size offer risks to the operational safety of the distribution lines and networks, most shrub plants and herbaceous cover.

With the characterization and quantification of related ecosystem services, it is possible to know the impacts and the externalities obtained with the implementation of this practice.

## Project scope

**Object of the project analysis:** Project.

**Description:** Assessment of ecosystem services for global climate regulation and regulation of soil erosion, aiming to know the externalities of the use of integrated vegetation management in electric systems in comparison to traditional or mechanized mowing. Although the ecosystem service of pollination regulation was initially considered in the analysis, it was not possible to quantify and evaluate it because of data unavailability.

**Geographic Area:** Telêmaco Borba and Tibagi, in the state of Paraná, Brazil.

**Step(s) of the value chain included:** Own operations.

**Type of approach:** Prospective.

**Time horizon:** Five years.

**Ecosystem Services:** Global Climate Regulation and Soil Erosion Regulation.

## Global climate regulation

**The role played by ecosystems in carbon and nitrogen biogeochemical cycles, thus influencing emissions of important greenhouse gases, such as $CO_2$, $CH_4$ and $N_2O$.**

**Method(s) used:** Replacement Cost Method (RCM).

**Results**

**Externality:** Scenario 1 (mower): - R$ 3,25 millions; Scenario 2 (IVM): - R$ 1,22 million

| Data used | Type of data |
|---|---|
| **Net emissions** | |
| **Actual emissions resulting from deforestation or environmental degradation, in $tCO_2e$:**<br>Balance - 26.726,21 (mowing)<br>Scenario 1 (mowing) = 27.828,21<br>Scenario 2 (IVM) = 11.131,28 | Primary |
| **Actual removals resulting from environmental recovery, $tCO_2e$:**<br>Balance - 10.029,29 (IVM)<br>Scenario 1 (mowing) = 1.102,00<br>Scenario 2 (IVM) = 1.102,00 | Primary |
| **Avoided deforestation** | |
| **Biome phytophysiognomy and land use:** Mixed Ombrophilous Montana Forest | Secondary |
| **Area of avoided deforestation, in hectares:** 53,2 | Primary |
| **Deforestation rate considered as base line:** 53,2% | Primary |
| **Deforestation rate with the project:** 40% | Primary |
| **Avoided emissions, in $tCO_2e$:** 16.696,92 | Primary |

**Further information**

**Exchange rate used to convert the Social Cost of Carbon (SCC), in Brazilian Reais:** 3,20.

**Assumptions adopted in the valuation estimates:** With IVM, it is estimated that about 60% of the vegetation is maintained, while in the mowing 100% of the vegetation cover would be removed.

**Adjustments or derivation applied to the methods and tools used:** N/A.

**Others:** N/A.

**Explanatory Notes:** The calculation tool considers tree vegetation for the emissions calculation. However, in the IVM, the vegetation maintained will be only shrub and it was not possible to calculate this differentiation or find references to a value closer to the real.

As the objective was to compare IVM to mowing, two calculations were made for global climate regulation - one for each scenario. Scenario 1 - mowing; Scenario 2 - IVM.

Due to the fact that the tool does not have the mowing vegetation category, it was considered Pasture - Other Biomes.

As avoided emission, the difference between the emissions of the mowing and the IVM was considered.

## Soil erosion regulation

**Role played by ecosystems in controlling soil erosion processes – natural processes, which can be accelerated or retarded depending on the type of use and the soil management practices adopted.**

**Method(s) Used:** Valuation was not performed (quantification only).

**Results**

**Dependency:** Not calculated | **Impact:** Not calculated | **Externality:** Not calculated

| Data used | Type of data |
|---|---|
| **Total area covered in erosion estimates:** 53,2 hectares. | |
| **Different soil uses:** Degraded grazing (mowing) x reclaimed pasture (IVM). | Primary |
| **Loss of soil nutrients (Method 1):** N/A. | |
| **Turbidity in the body of water (Method 2):** N/A. | |

**Further information**

**Results from physical metrics:** Scenario 1 (mowing) – 310,51 t/ha.year; Scenario 2 (IVM) – 149,05 t/ha.year.

**Assumptions adopted in the valuation estimates:** the mowing was considered as degraded pasture and the IVM, as pasture recovered.

**Adjustments or derivation applied to the methods and tools used:** N/A.

**Others:** N/A.

**Explanatory Notes:** For this analysis, an approximation was made with secondary data for ramp length and type of soil, due to the unavailability of stratified primary data for the entire length of the line.

As a data source for Rainfall erosivity factor, we considered the work "WALTRICK, P. C.; MACHADO, M. A. M.; DIECKOW, J.; OLIVEIRA, D. *Estimativa da erosividade de chuvas no estado do Paraná pelo método da pluviometria*: atualização com dados de 1986 a 2008. R. Bras. Ci. Solo, 39: 256-267, 2015."

We considered the restored pasture (IVM) as CPmin, and degraded pasture (mowing) as CPmax.

The valuation calculation was not performed, since we do not have reference data on the cost of land replacement in power lines, since it is a practice carried out on a timely basis (we have no recent historic of this cost).

## Analysis of the results

Even with the lack of data, it was possible to compare the two procedures and to realize differences that justify the use of integrated vegetation management instead of mowing.

The deployment of power distribution lines is expected to modify the environment. The IVM appears as a less aggressive alternative, since it maintains part of the vegetal cover, favoring the habitats for the fauna, the native species and preserving the soil. Both the business and the surrounding community will benefit.

In order for IVM to be a routine practice in the implementation and maintenance of electrical systems, it is necessary to consider it in environmental studies where consistent data can be obtained to justify its choice.

## Management of ecosystem services

**Use of ecosystem service valuation results:** Cost-benefit analysis; Social and environmental impact assessment; Reporting.

**Description:** The results show that the implantation of the integrated vegetation management at the analyzed area is more favorable than the manual or mechanized mowing, confirming what was already expected, based on the North American literature and experience.