PROTECTIVE BELTS FOR POWER LINES AND THEIR POTENTIAL IN LANDSCAPE CARE

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Abstract
Power line protection strips represent very important linear elements in the landscape. Until now, these objects have served primarily power line operators as technological objects in the construction and care of power lines. Since 2024, GasNet has been actively interested in the potential of using protection strips, especially for environmental protection and recreation of citizens from adjacent municipalities. In cooperation with Mendel University in Brno, a concept of optimized use of power line protection strips is being developed, aimed primarily at strengthening their eco-stabilization, anti-erosion, hydric and recreational functions. The topic is also carbon sequestration in the vegetation of the strips, as well as their importance for wild and farm animal species. The article presents the results of the first proposals for solutions for linear communities of power line protection strips, which should ensure the above functions.

Key words: landscapes green belts, ecosystem functions of landscape green belts, ecosystem functions of landscape green belts

Introduction

With the rapid development of industry and ongoing urban sprawl, the density of technical infrastructure that is proposed or under construction is increasing year by year, leading through and connecting different regions of a country. The existence of a large net of pipelines and powerlines has a clear influence on land-use planning, especially in the inhabited zones (Ramírez-Camacho et al., 2017). The aforementioned pipe and powerlines are usually protected via a strip of land called the safety or protection zone. The width of these zones depends on the importance and potential risk associated with the damage to the line. We believe that not only do these strips of land pose a challenge to land-use planning, they also bring along very interesting opportunities as well.
Since 2024, GasNet, Ltd., the largest Czech distributor of Natural Gas has been actively interested in the potential of using the protection zones along their pipelines, especially for environmental protection and recreation of citizens from adjacent municipalities. In cooperation with Mendel University in Brno, a concept of optimized use of these strips/belts is being developed, aimed primarily at strengthening their eco-stabilization, anti-erosion, hydric and recreational functions.
The basic prerequisite for understanding the potential for ecosystem services delivery of pipeline protection zones is knowledge of the ecology of restoration of disturbed habitats since after the construction of a pipeline, the area is heavily affected by the construction and preexisting habitats are negatively impacted (Brus et al., 2020). Coincidentally, the UN General Assembly has declared the period 2021-2030 as the Decade of Ecosystem Restoration, aiming at massive restoration of degraded and destroyed ecosystems.
There are a number of methods for assessing the environmental impact and associated risks of both pipeline construction and operation. However, there are very few studies dealing directly with the impact of pipelines on the surrounding vegetation and the protection or safety zone as such. For example, Sklavounos and Rigas (2006) evaluate pipelines in terms of safety, or the potential for fire, explosion, etc., with respect to the built-up area, pipeline size, operating pressure, gas composition (liquid petroleum gas LPG or compressed natural gas CNG) or the effect of current weather. A study by Hagen et al. (2022) looked at vegetation development in the buffer zones of power grids in Norway, or what active measures can contribute to reducing impacts on biodiversity and carbon storage. One relatively concrete approach is offered, for example, by the work of Kwast-Kotlarek et al. (2019), where the impact is primarily determined by the type of landscape where the pipeline is located. They divide landscape into four basic types according to the predominant management. These are rural development areas, agricultural areas with arable land, forested areas and barren land. Out of these four types, only the environmental components of forest land can be considered directly negatively impacted.
In this article, we follow up on the mentioned research where we focused solely on pipelines operated by the GasNET Company. We used their specific protection and safety zones as obtained from their internal regulations. We tried to describe the potential of these corridors in landscape for the

provisioning of multiple ecosystem services and also of offer an initial look at how these areas can be managed to support them.

Material and methods

For the purpose of this article, we used a specific experimental site where GasNet plans to build a new pipeline with approximate length around 10 km (ROZ VTL DN 500, Zdounky-Lubná PP gas pipeline). This is a specific type of high-pressure gas pipeline with a protection zone of 2 m on both sides, followed by a safety zone of 13 m on both sides. In total, this meant a 15 m wide strip on both sides of the pipeline axis. It is one of the most common pipeline types, so it makes for a good reference. The two buffer zones were grouped together under the title 'buffer zone'. Based on the research team's own expertise combined with the above mentioned literature sources, the management and operation of the protection and safety zones of pipelines was addressed in several successive steps:

1. Identification of the basic landscape type

In this step, division of the landscape into functional types was made, which fundamentally defines the potential of the sites, how and in what ways the implementation of the buffer zone can contribute to the fulfilment of the ecosystem functions of the landscape. Existing landuse, erosion threats and conditional opportunities were identified as basic criteria. Landuse was defined by the cadastral registry and the associated legal protection of the land bank. The threat of erosion was taken from a public agronomy server (ww.lpis.cz) server in the case of arable land and in other cases slope gradient above 5% was deemed indicative of possible erosion threat (according to the runoff coefficients provided by Czech National Standards). Conditional opportunities were defined in the proximity of water bodies, streams and floodplains as well in the proximity to settlements. The combination of these three criteria would define the landscape type and specific parts of the pipeline route stationing would be attribute to one of them.

2. Identification of the priority purpose of the buffer zone

According to the landscape type, the priority (desired) use of the buffer zone would be identified. For the priority use, examples of optimal management measures and restoration strategies would be outlined.

3. Technical drawing of ideal target conditions of the buffer zone

We defined five possible habitat types consisting of forest stand, shrub communities, open grassland, aquatic ecosystems and roadside habitat. A reasonable spatial representation of these habitat types served as a basis for the definition of ideal target conditions for any landuse type. These technical drawings are not shown here, because they would take up to much space but are available by the authors.

Results

Based on the study area, we defined four different priority purposes for six landscape types identified in step 1 (Tab. 1).

Tab. 1:. Landscape types and priority purposes of the buffer zone

Landscape type	Priority purposes	Recommended measures
Floodplain forest	Water retention and water quality	Wetland features, water pools, grassland establishment
Arable land on slopes	Anti-erosion and water retention	Grassland establishment, creation of swales and infiltration strips
Forest land on slopes	Anti-erosion and water retention	Natural tree species composition, less clear-cuts, coppicing
Arable land on the flat	Biodiversity support	Grassland establishment, fruit trees, bee supporting species
Forest land on the flat	Biodiversity support	Natural tree species composition, bee supporting species
Proximity to settlements	Landscape connectivity	Footpath network, recreation and education, fruit trees

For each buffer zone priority purpose, a technical drawing of ideal target conditions has been prepared. Sample cross-sections were prepared for 50 m long sections. In these sections, a safety zone of 2 m on each side of the pipeline is respected, where no proposed measures are located. In addition, a 3 m wide service road is standardly created during installation of the pipeline. It is therefore proposed to retain it in the form of a footpath to support both the connectivity of the landscape as well as to ensure good accessibility for maintenance and repairs. Following the area of effect of single

trees and shrubs according to Standards of the Czech Agency of Landscape Protection, a reasonable spatial distribution of habitat types was developed (Tab.2).

Tab. 2: Recommended spatial area of habitat types in buffer zones for different Landscape Types

Percentage of total area according to Landscape type (%)	Forest stand	Shrub communities	Open grassland	Aquatic ecosystems	Roadside habitat
Floodplain forest	34	8	10	37	12
Arable land on slopes	58	6	24	0	12
Forest land on slopes	76	8	4	0	12
Arable land on the flat	50	6	32	0	12
Forest land on the flat	76	8	4	0	12
Proximity to settlements	59	9	20	0	12

Discussion

In this article, we showed that the protection buffer zones along pipelines not only pose a challenge towards future urban and landscape planning but there is also a great opportunity associated with their specific maintenance which should be very high on the interest mainly of landscape protection and recreation. Basically, there is a potential to support green linear infrastructure in the landscape (Raiter et al., 2018) at a minimal opportunity cost since these strips of land have to be specifically managed anyway.

Here we specifically worked with underground pipelines leading Natural Gas, but the same opportunities and approaches can be easily replicated for other forms of safety and protection zones be it surface pipelines or powerlines. In this sense, our testing locality shows promise for similar attempts in the future and is a good starting point. We believe that cooperation between the operators of these safety/protection buffer zones of linear engineering infrastructure and land managers as well as landscape protection is key for future sustainable landscape planning. In the ongoing climate change, these strips of land could also play a significant role in supporting landscape adaptability and resilience (Kupec et al., 2021).

Conclusion

The buffer zones along lines of technical network infrastructure offer an interesting opportunity for landscape protection and recreation potential. They represent very important linear elements in the landscape. Since 2024, GasNet has been actively interested in the potential of using the buffer zones along their pipelines, especially for environmental protection and recreation to minimize their negative environmental impact. In cooperation with Mendel University in Brno, a concept of optimized restoration and maintenance of these areas is being developed. We believe that cooperation between the operators of these safety/protection buffer zones of linear engineering infrastructures and land managers as well as landscape protection is key for future sustainable landscape planning.

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Souhrn
Zajímavou příležitost pro ochranu krajiny a rekreační potenciál nabízejí ochranná pásma podél vedení technické infrastruktury. Představují velmi důležité liniové prvky v krajině. Společnost GasNet se od roku 2024 aktivně zajímá o potenciál využití ochranných pásem podél svých plynovodů, zejména pro ochranu přírody a rekreaci, aby minimalizovala jejich negativní dopad na životní prostředí. Ve spolupráci s Mendelovou univerzitou v Brně se připravuje koncepce optimalizované obnovy a údržby těchto území. Domníváme se, že spolupráce mezi provozovateli těchto ochranných pásem liniových inženýrských sítí, správci pozemků i ochranou přírody je pro budoucí udržitelné plánování krajiny klíčová.

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