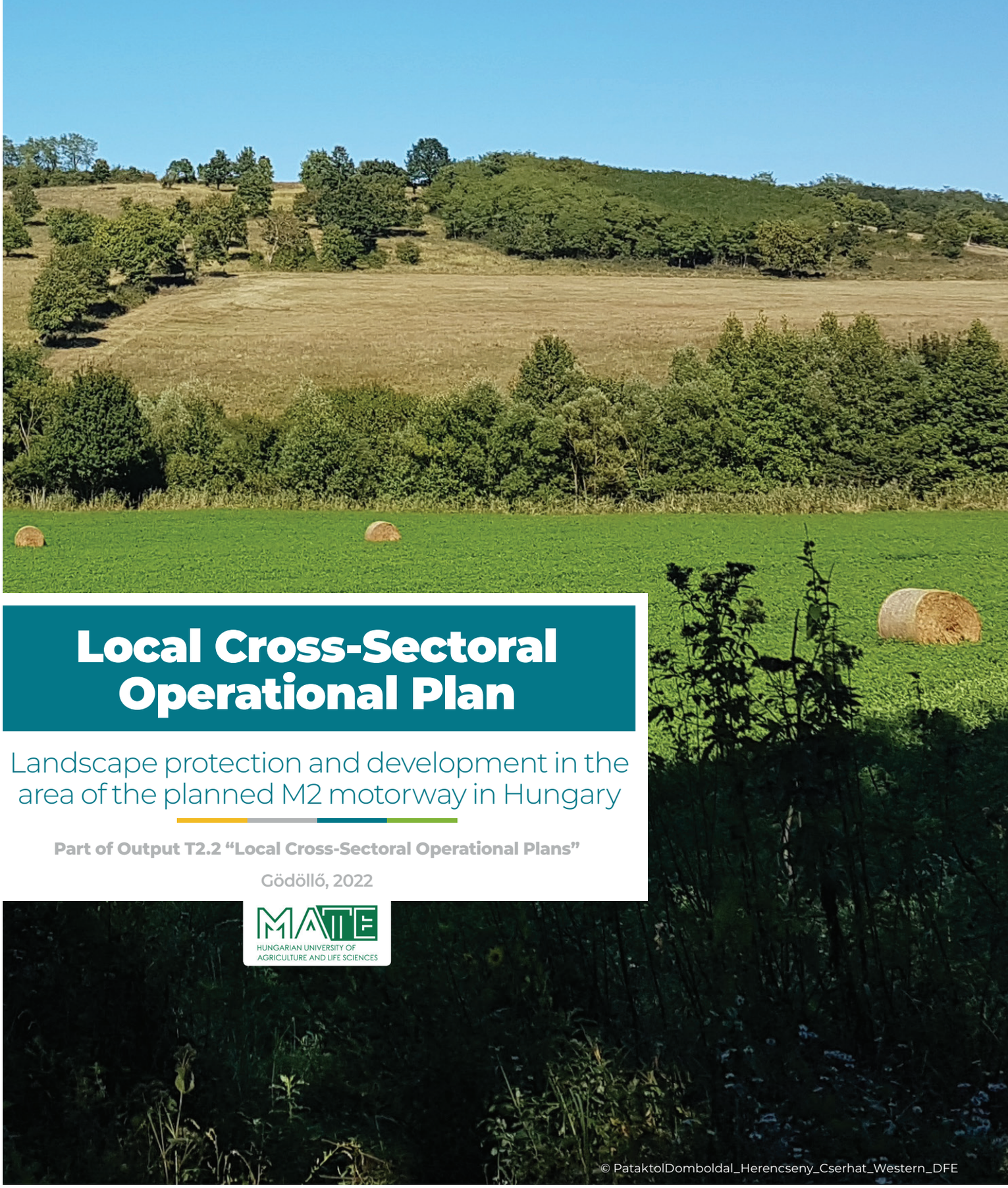

Local Cross-Sectoral Operational Plan

Landscape protection and development in the area of the planned M2 motorway in Hungary

Part of Output T2.2 "Local Cross-Sectoral Operational Plans"

Gödöllő, 2022

MATE
HUNGARIAN UNIVERSITY OF AGRICULTURE AND LIFE SCIENCES

Interreg
EUROPEAN UNION
Danube Transnational Programme
SaveGREEN

Project co-funded by European Union funds (ERDF)
www.interreg-danube.eu/SaveGREEN

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SaveGREEN “Safeguarding the functionality of transnationally important ecological corridors in the Danube basin”

Danube Transnational Programme, DTP3-314-2.3

November 2022

About SaveGREEN

The SaveGREEN project, funded by the Interreg Danube Transnational Programme is focused on the identification, collection, and promotion of the best solutions for safeguarding ecological corridors in the Carpathians and further mountain ranges in the Danube region. Currently, ecological corridors in the region are under threat due to the lack of adequate planning of economic development initiatives. Therefore, basing its work on integrated planning, SaveGREEN will monitor the impact of mitigation measures in 8 pilot areas and derive proper recommendations for follow-up actions and policy design.

www.interreg-danube.eu/savegreen

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András Weiperth – Béla Urbányi – István Valánszki – László Kollányi

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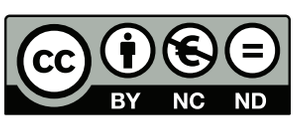

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Table of contents

Executive Summary

Within the frames of the SaveGreen project, an important objective was to elaborate a Cross-Sectoral Operational Program for the pilot areas. The goal of the "CSOP" was to identify major threats/pressure to connectivity and general objectives to address them, as well as relevant sectors and main stakeholders/actors focusing on the pilot site.

The Hungarian pilot site is a border region of the planned M2 motorway in North-Hungary. The aim of the planned M2 motorway is to increase border crossing opportunities in the Hont-Parassapuszta border area and to divert transit/cross-border traffic to the outskirts of the area settlements. Successful completion of the new motorway project will bring positive changes within cross-border cooperation (e.g. connecting the Nitra region with the Budapest agglomeration), support further development of the border regions and their economic potential and improve the quality of environment in the area between Vác and the border.

The heavy transit traffic causes environmental problems in the settlements that are already becoming unbearable. In order to ease these negative effects a motorway is planned in the area: M2. Our study is dealing from a complex, landscape level viewpoint of the study area. First, it gives an overview about the landscape conditions, then presents a general cross-sectoral analysis and exploration of land-use conflicts. The core of the study lies in the Logframe that contains objectives and actions to ease and mitigate the negative effects caused by the existing and planned infrastructure.

We elaborated a detailed **landscape assessment** within the frames of the CSOP. The planned M2 motorway will lead through a diverse, transition landscape of the Nógrád basin and on the peripheries of the Börzsöny Mountain and the crosses of the Ipoly valley, the landscape is crossed by several watercourses representing the most important ecological corridors connecting the core areas. The most dominant feature of the hydrography of the area is the Ipoly River, and the most important streams in the area are Csitár-stream, Hévíz-stream, Vargatói-stream, Fekete-stream, Derék-stream, Haraszti-ditch, Nagyoroszi-stream and Bernecei-stream. Of these, the Csitár stream, the Hévíz stream, the Fekete stream and the Derék stream and its tributaries flow directly into the Ipoly. Some of the watercourses originate from springs on the Börzsöny side in the Hont area and flow northwards into the Ipoly River, while others originate in the Nagyoroszi area and flow northwards towards Drégelypalánk and eastwards and north-eastwards towards Patak and Ipolyvece.

One of the core parts of the CSOP is the **Logframe** which gives an overview of the major conflicts and objectives related to the barrier effect of the new and existing infrastructure lines, including the changes in land management. The Logframe provides the country specific suggestions for the mitigation of negative effects. The most important measures concern the **new infrastructure lines**, among others:

- During route selection, ecological aspects should be considered, but this is often decided before ecologists/biologists have examined a trail in detail
- Avoid sensitive areas
- Gather data on relevant species using camera traps, tracking and telemetry. For watercourses, continuous sampling is required.
- SEA and EIA legislation should be complemented by provisions for specific roads; for example, the direct and indirect impact area of different roads.

- Specific, well-measured indicators such as the fragmentation analysis (e.g. minimum net size) or biological activation value calculations should be incorporated into the SEA process and spatial planning.

- A minimum percentage of the entry-level costs of a given project should be stipulated in legislation that must be spent on the ecological protection facilities (like under- and overpasses, fences) of the road, including the provision of area required for planting and implementing these facilities. In addition, a minimum size of an area intended for planting also requires further specification within the legislation, because planting can influence the effectiveness of ecoducts, among others. (The exact size should depend on the road category.)

- Set up a systematic monitoring plan of new linear infrastructure (before baseline, during the construction and after the construction is finished).

- The term of 'ecological corridor' or 'ecological connectivity' should be nominated in Gov. Decree 314/2005 (XII.25.), requiring that the impact of the railway/ road project to ecological corridors should be evaluated in EIAs.

- Review of national and international practice and adaptation to domestic conditions.

- Advocacy for development of a new small infrastructure project to create a defragmentation facility (overpass).

Most important general objectives **for the existing infrastructure lines**, among others:

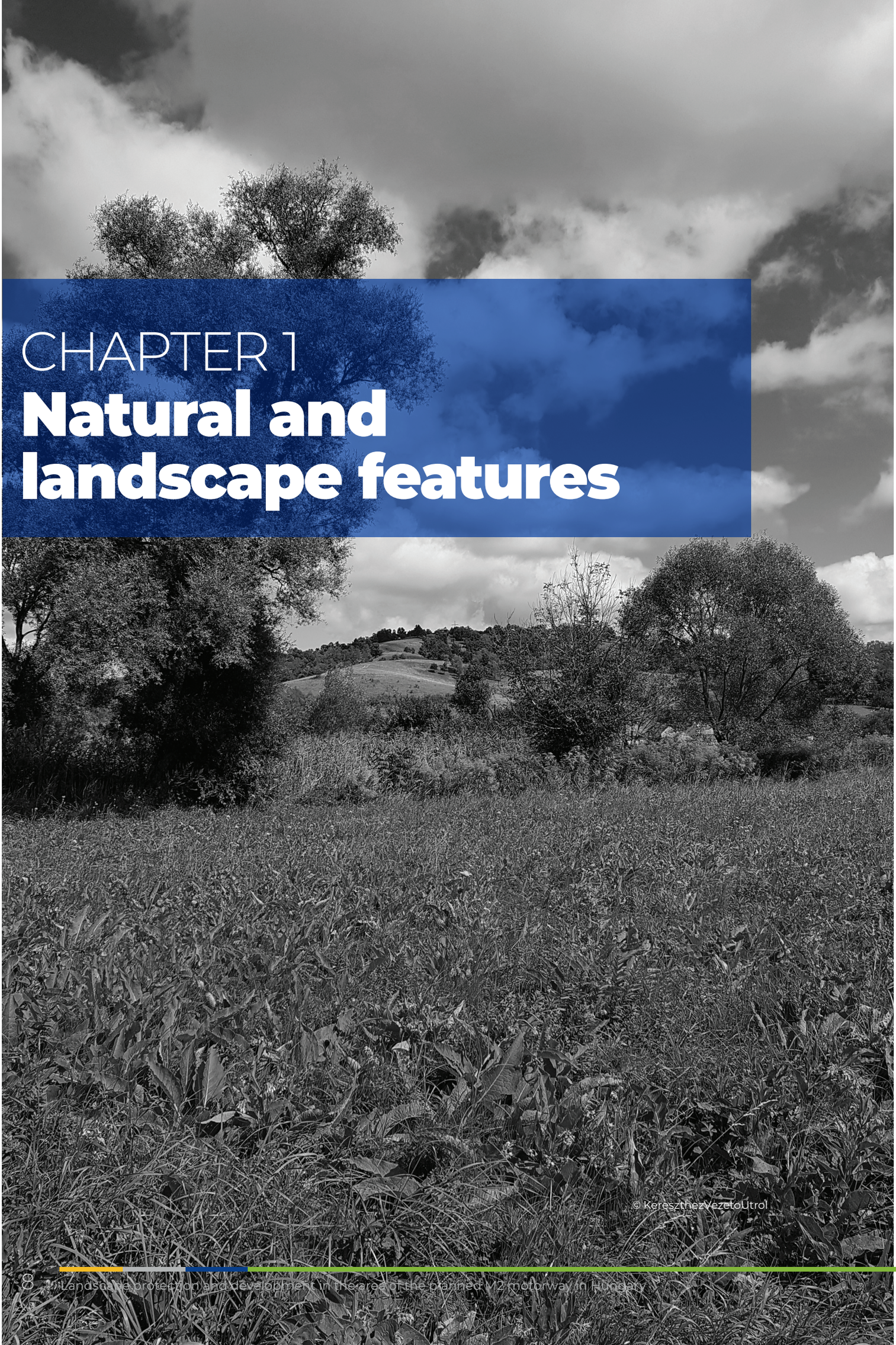
- Safeguard the permeability of existing transport infrastructure (including the enhancement of permeability of existing features, when possible)

- Safeguard the transversal permeability of riverbanks (including the enhancement of permeability of existing features, when possible)

- Safeguard the longitudinal permeability of rivers (including the enhancement of permeability of existing features, when possible)

In the **Descriptive part** we gave a focused assessment on watercourses, which serve as ecological corridors and the planned motorway is going across them. In the following we highlighted the critical sections. The most important critical sections of the planned M2 are the crossing zones of the above mentioned watercourses. Later we gave recommendations for mitigating the barrier effect of the planned motorway, and on a higher scale we formed proposals to improve the landscape connectivity and general ecological conditions.

CHAPTER 1
Natural and landscape features



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Landscape characterization is the first main chapter of the assessment, which includes a brief description and delineation of the planning area and exploration of the larger-scale landscape context. It is based on a study of natural features, including climate, topography and geomorphology, combined with an examination of exposure, slope categories and water regime. These factors influence the potential for agriculture and afforestation. The local climate and topography determine the vegetation. It is also important to mention the geological, geomorphological and soil conditions, which also influence the landscape vegetation and cultivation effectiveness. A particular focus is on the landscape structure and the different land uses (forestry, agriculture, arable land). The condition of green infrastructure elements, transport and accessibility are also examined.

1.1 Climate

The area climate is characterised by moderately cool and dry weather. The number of sunshine hours per year is 1,870 and the average annual temperature is 9-9.8°C. Rainfall is around 600-620 mm. The prevailing wind direction is westerly, with easterly and north-easterly winds also prevailing. Wind speed is 2 m/s on average. The climatic conditions are suitable for arable crops and less heat-tolerant fruit crops (Dövényi, 2010).

1.2 Topography, geomorphology

The area is typically flat, with an altitude of between 110 and 200 m above sea level. In

addition, Hont, Nagyoroszi and Drégelypalánk also have a hilly character (200-500 m), with Börzsöny also appearing as a dominant landscape feature. The lowest area is the valley of the River Ipoly, while the highest point of the Börzsöny-Lab area within the planning boundary is in Nagyoroszi, which reaches an altitude of 620 m above sea level. The topography map of the planning area is based on SRTM satellite imagery. Using a GIS program, contour lines were drawn every 10 m and the image was divided into five height categories and assigned a colouring.

Based on the topography data, we examined the slope categories that appear in the area (slope category map), and classified them into 5 groups from the viewpoint of agricultural cultivation: 0-5% flat, 5-12% gently sloping, 12-17% sloping, 17-25% gently steep, and areas with slopes ranging from 25% upwards, the latter being at risk of erosion and deflation. In the mountain ranges associated with the Börzsöny, areas covered by power are characterised by steeper slopes, while in the valley of the Ipoly River mostly flat areas predominate.

The exposure map has been broken down by cardinal points and shows the diversity of the area, but with a strong predominance of north, north-east, south-east and east. These areas are dominated by arable land, orchards and small forest patches. The area is heavily influenced by the mountain ranges of Börzsöny.

The soil types of the area vary along the three typical topographical features of the area (a soil-types map). No data are available on the soil types of the forested areas with higher mountain character on the foothills of the Börzsöny. The lower elevations, on the hills to the south, are characterised by clayey brown forest soils and, in the northern areas, by Ramann brown forest soils. In the flat areas, humic sandy soils are found, typically in the areas south of the Ipolyvecke and along the Ipoly, with even flatter areas of humic decomposition soils.

Data from the Institute of Soil Science and Agrochemistry of the Hungarian Academy of Sciences were used for the agricultural evaluation of the soils in the study area. The evaluation was developed along criteria such as soil type, topography, erosion, deflation and inland water vulnerability, etc. The soil values are distributed on a scale of 1 to 9. The most valuable soils from an agricultural viewpoint were assigned a value of 9. These are mostly located in the flatter areas along the Patak-Drégelypalánk-Hont axis. (Soil assessment plan for agriculture).

1.3 Hydrography

The most dominant feature of the area hydrography (Figure 1) is the Ipoly River, on the left bank of which the six settlements under study are located and only 4 settlements are directly affected (Patak, Ipolyvece, Drégelypalánk, and Hont). An important water resource is the coastal filtered groundwater along the Ipoly (Dövényi, 2010). The most important streams in the area are Csitár-patak, Hévíz-patak, Vargatói-patak, Fekete-patak, Derék-patak, Haraszti-árok, Nagyoroszi-patak and Bernecei-patak. Of these, the Csitár stream, the Hévíz stream, the Fekete stream and the Derék stream and its tributaries flow directly into the Ipoly. Some of the watercourses originate from springs on the Börzsöny side in the Hont area and flow northwards into the Ipoly River, while others originate in the Nagyoroszi area and flow northwards towards Drégelypalánk and eastwards and north-eastwards towards Patak and Ipolyvece. The watercourses of the study area and their immediate sensitive buffer areas are to be digitised. Four other major standing water bodies can be found in the area. In Honton there is a reservoir, Álmos Fishing Pond in Nagyoroszi, a reservoir along the Nagyoroszi stream near Patak and the Érsekvadkerti Derék-creek reservoir east of Horpács.

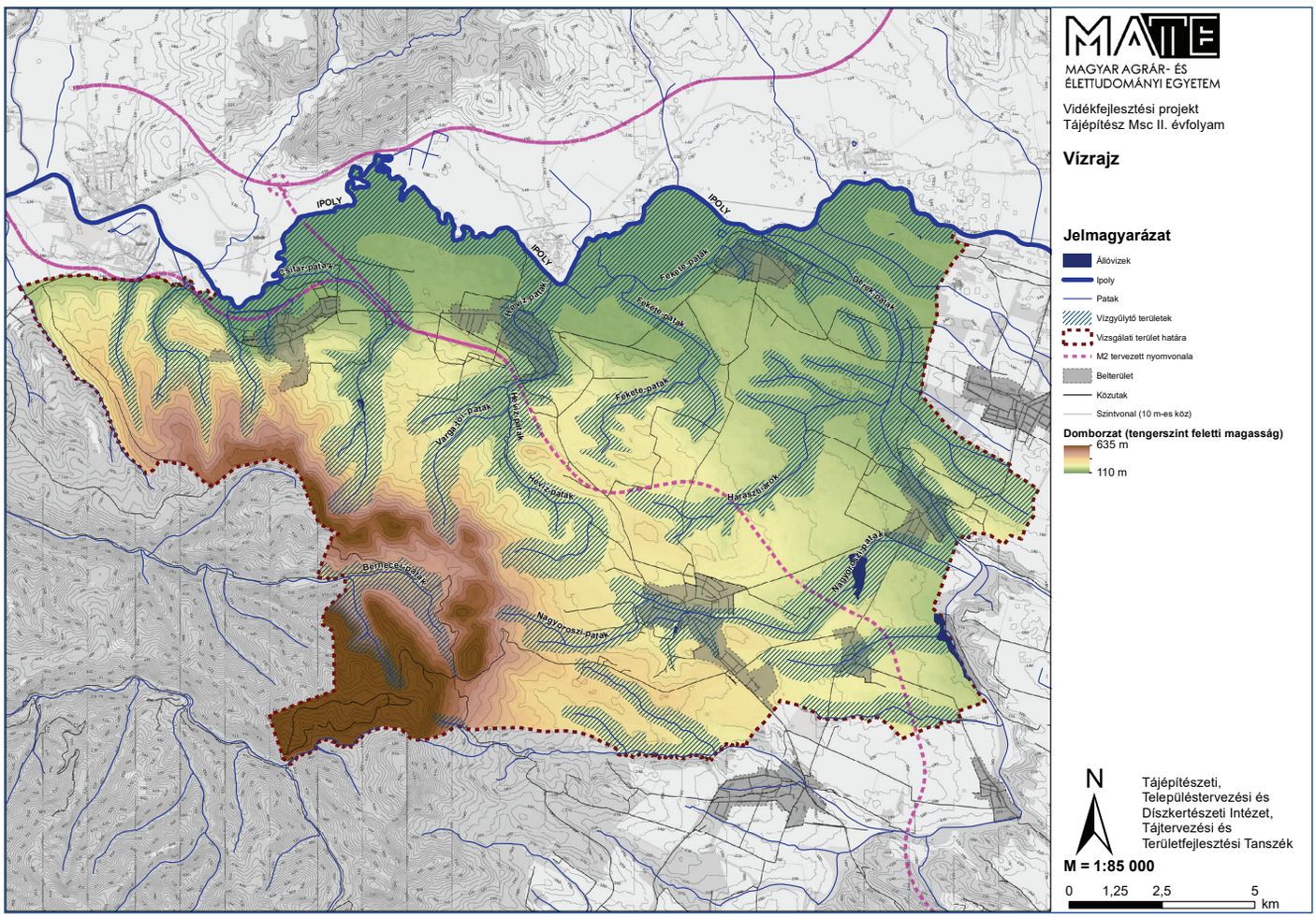


Figure 1 Geography and watercourses of the study area © MATE

1.4 Transport

The most important road in the study area is the main road No. 2, a road of national importance and a major trunk road, 78 km long, connecting Budapest with Parassapusta. It is part of the E77 European highway from Budapest to the border. The main road passes through Hont, Drégelypalánk and Nagyoroszi. It carries a very significant volume of freight traffic, which results in numerous conflicts.

Only three of the six municipalities are connected to the railway network. In the area, the train No 75 Vác-Balassagyarmat runs 8 times a day. There are bus stops in all the municipalities, 39 in total. Local public transport in the municipalities is provided by interurban bus services on the main roads. Buses run 8 times a day in Nagyoroszi, 5 times a day in Patak, 3 times a day in Horpács, and 2 times a day in Drégelypalánk, Ipolyvece and Hont.

There are no cycle paths in the municipality of Nagyoroszi, only a forest road designated for cycling. In Hont there are two types of infrastructure suitable for cycling; a cycle path in the municipal fabric and a cycle path between Drégelypalánk and Hont and between Hont and the border. There is no cycling infrastructure in Ipolyvece, Patak and Horpács.

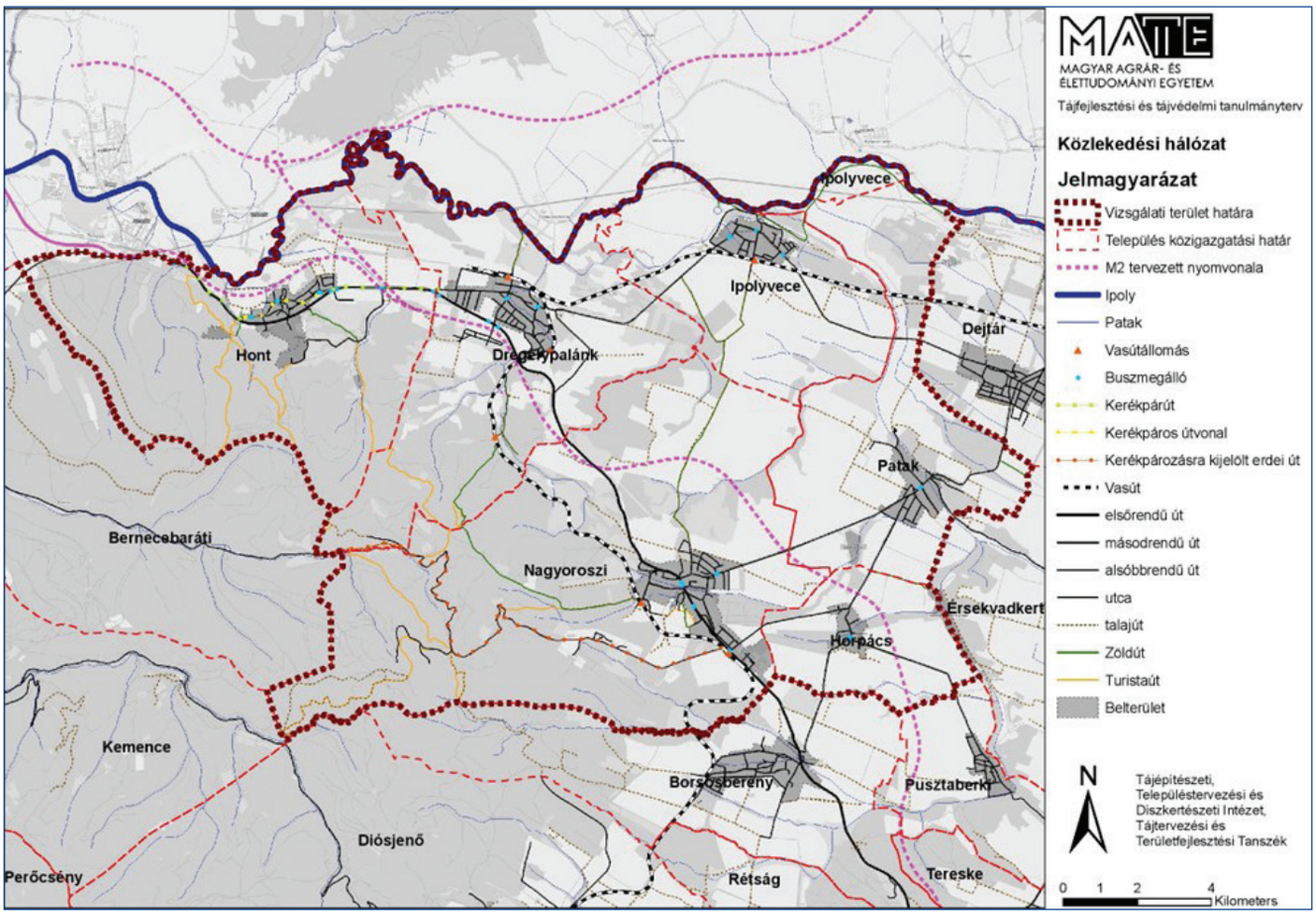


Figure 2 Transportation network in the pilot area

The “Örökségünk” (Heritage Route) greenway system covers all six settlements. The greenway runs along the main axis of all settlements and branches off in several directions. Each locality is connected to its neighbouring settlement. Patak and Ipolyvece are not connected by greenway.

There are several hiking trails in the area. The Pilgrim’s Route of Central Europe, the Route of Mary, passes through the area. It runs between the villages of Nagyoroszi and Szügy, with a further section between Parassapuszta, Csitári chapel and Drégelyvár. The “Gyöngyök útja”, which runs between Budapest - Mátraverebély - Szentkút, passes through Nagyoroszi and Horpács. Several hiking trails are crossing, connecting the settlements especially in the Börzsöny Mountains.

1.5 Green infrastructure elements

“Green Infrastructure is a strategically planned and maintained network of natural areas, cultivated areas and other open spaces, the elements of which preserve ecosystem values and functions and, thus, the associated benefits to society.” The three main categories are urban, semi-natural and managed (INT-01).

A large proportion of the green infrastructure elements in the area are made up of forests in the open countryside, which are concentrated in the western half of the area, in the Börzsöny. The second most populous green infrastructure element is grassland, most of which is located

along the Ipoly River. Parts of the grassland in this area also count as wetlands. The next category is scrub, which may be areas of land that have been cleared from continuous forest cover, or agriculturally abandoned ploughland, or possibly abandoned strips. Blue infrastructure elements include standing water, which is not very common in the area. They are mainly created by damming watercourses. Linear elements include tree lines, which are represented along major roads, and watercourses, in which they amply interlink the landscape.

The national ESZIR forest database was used to assess the state of naturalness of the forests (Map of Forests Naturalness). It can be said that for the most part, natural forests are found in the area. 33.7% of the forests in the area are natural forests, which are located in the south-western part of the territory of Nagyoroszi. 30.7% of the forests in the area are derived forests, mainly located in the western part of the municipality of Hont. 23.8% of the forests are cultivated forests, which are predominantly found in the municipalities of Nagyoroszi, Drégelypalánk and Hont. The largest area of plantation forest is found in the municipality of Patak, accounting for 0.04% of the total forest area. 0.03% of the area is transitional forest. For 0.04% of the forests there is no data regarding their natural state. There are no natural forests in the six municipalities surveyed.

1.6 Status of green infrastructure elements (naturalness, value, biomass NDVI index, forest naturalness)

The value of the green infrastructure elements was assessed on a scale of 1 to 5 (Green Infrastructure Current State Plan Sheet). The scores used for the assessment were composed of several components and were used as the basis for the figures. Naturalness is a dominant element; areas that are natural were given a score of 4 or 5. Less natural areas received a score of 3, while areas that were not or barely natural received scores of 1 and 2. In this figure, the condition, value and multifunctionality of the areas were included, so that the values previously established were shifted in some direction (Green Infrastructure Condition, Naturalness, Multifunctionality maps). An area in good condition, natural, valuable and well-connected was given a value of 5, while the opposite was given a value of 1.

- Very few areas are in category 1; they are generally isolated, surrounded by ploughland and weedy areas. These areas can be observed on the eastern side of the planning area, between Patak and Ipolyvece.

- Category 2 contains elements of better condition, generally subject to heavy encroachment (e.g. plantation forest), but it also includes areas of poor naturalness and feeble condition. These areas are located at the foot of the forest patch on the western side and wedged between areas of agricultural land.

- Category 3 includes areas that are more natural than the previous category, but which are not in good condition and therefore not of high value. These areas alternate with category 2.

- Category 4 includes semi-natural areas, mostly of high value, which are not in the highest condition. These sites are mostly in or strongly linked to category 5.

- The areas in category 5 on the western side are mainly the Börzsöny forest areas and the areas along the Ipoly River. In addition, valuable links between important ecological corridors and natural areas are also included in this category.

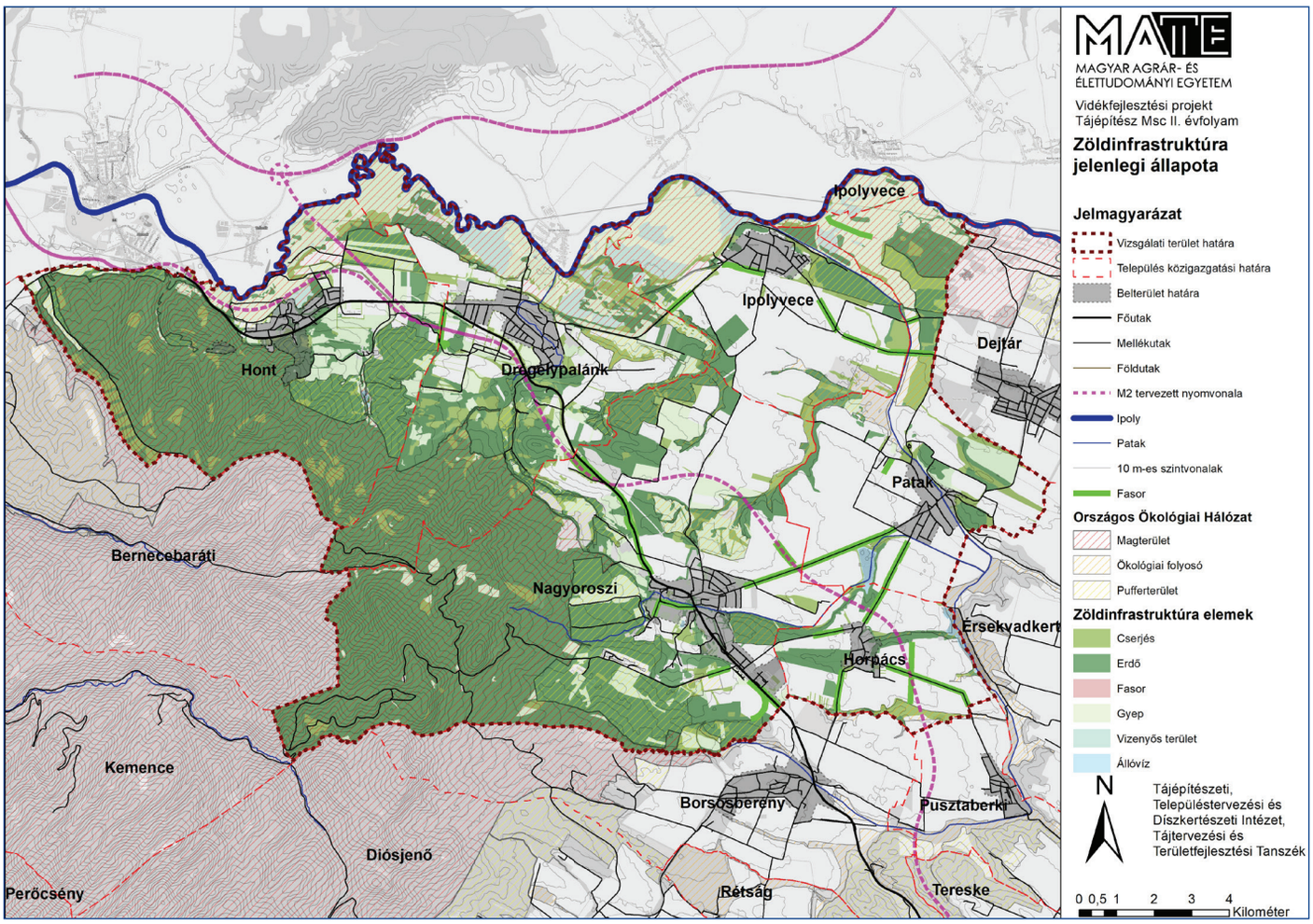


Figure 3 Protection of green infrastructure elements ©MATE

"The Normalized Difference Vegetation Index (NDVI-2020.09.) is the most widely used satellite vegetation index, which is related to the "greenness" of the surface, its photosynthetic activity" (INT-02). NDVI analysis was performed using Landsat space imagery showing data of September 2020. NDVI is a dimensionless metric and can vary between -1 and +1. It expresses the vegetation activity of a given area, i.e. the amount of chlorophyll. This index can be used to measure the biomass of an area. A green-yellow-red colour palette has been used to distinguish between areas of different green intensity. In the study area, the value varies between -0.04 and 0.54. The highest values are found in forest areas, woodland strips and some areas along the Ipi River. The lowest value was obtained for harvested arable land. Built-up urban areas also scored low. As a result of the analysis, marked in yellow forest area patches are clearly visible, indicating that the forest has been felled. In these areas, the regeneration is still less developed and, therefore, scores lower. The highest scores were obtained in patches with old stands of trees. In the field areas, the various stands of woody grassland, such as strips of woodland protecting fields and stream tracks, are clearly visible. These areas are of higher value than the surrounding farmland. Lower values are also observed along the existing Highway 2. The planned M2 motorway will pass through a number of areas of high value according to the NDVI index, but will also pass through intensive agricultural fields in many places.

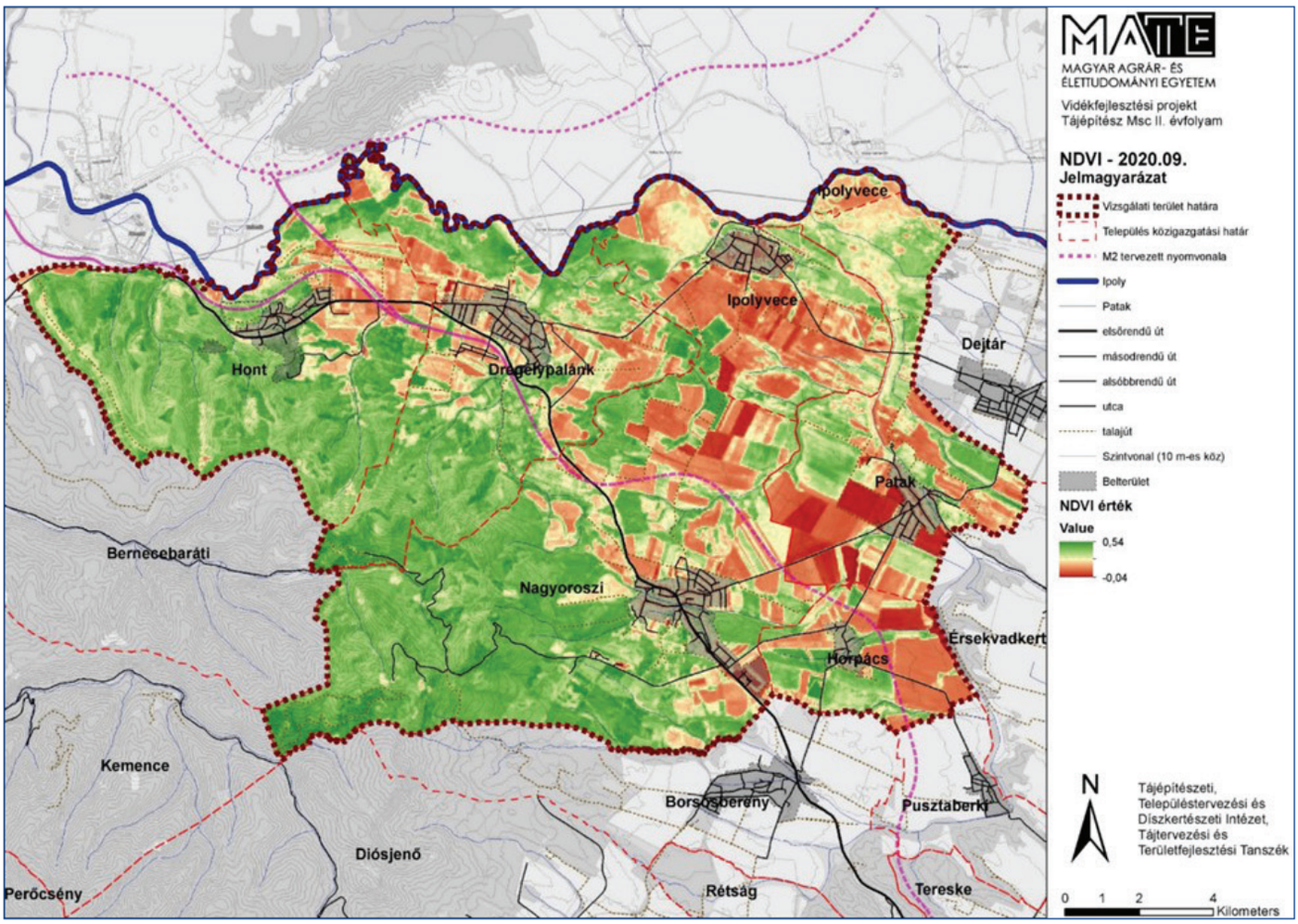


Figure 4 NDVI index ©MATE

1.7 Connectivity of green infrastructure

Large areas of contiguous green space are located in the western part of the region - in the Börzsöny – and in the northern part – along the Ipoly River (Figure 5). The former is dominated by forests, the latter by grassland. The fragmentation of the different elements is mostly caused by roads and large agricultural areas. This is typical of the eastern part of the area, where the topography becomes flat, providing opportunities for arable farming. The linear green infrastructure elements are intended to connect these fragmented areas. These may be tree-lines, strips of woodland or shrubland that protect fields and watercourses. The map shows that linear elements are missing in many places, thus breaking the link between the elements. This is most noticeable along the main road 2. There will also be missing links along the proposed M2 road due to its fragmentation effect, and these points are highlighted on the map. The points are mostly fragmented natural areas that will not remain connected due to the road.

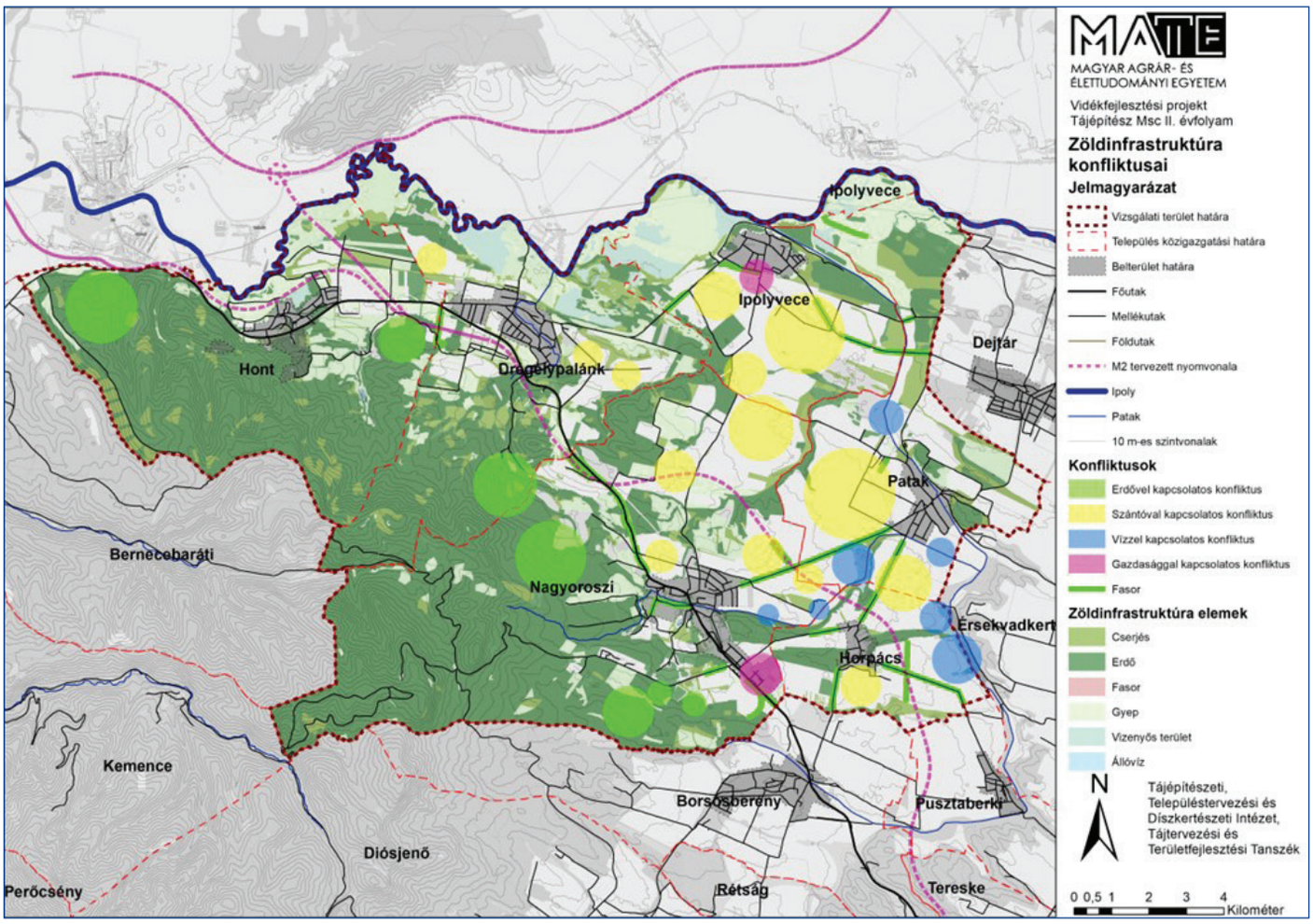


Figure 5 Connectivity of green infrastructure elements in the pilot area ©MATE

1.8 Protection of green infrastructure elements

In Europe, both the destruction and fragmentation of natural habitats are very serious problems. In general, the most important valuable natural areas are already protected, but there is a need to ensure the movement of species between areas, which is necessary for their long-term survival. Green infrastructure provides connectivity between existing natural areas, enhances the ecological value of landscapes, and contributes to healthy ecosystems. The proportion of protected areas in the region is very high (Landscape Ecological Analysis map). (INT-03)

Nationally and internationally protected areas

The area includes National Park, Natura 2000 site, Ramsar sites and elements of the National Ecological Network. Natura 2000 and Ramsar sites are internationally protected nature conservation areas, while National Park and National Ecological Network sites are national nature conservation areas. Within this space, there are areas of the Danube-Ipoly National Park in the municipalities of Hont, Drégelypalánk, Nagyoroszi, and Ipolyvece. The size of the National Park in the area is 4,582 ha (37% of the study area).

The Ramsar site of the Ipoly Valley was listed in 2001, and the area itself comprises the Ipoly River and the surrounding riparian area. The important plant communities found here are alder marshes (Drypteridi - Alnetum), willow marsh (*Calamagrostio – Salicetum cinereae*) and water lily communities (*Namyphaeetum albo – luteae*), which provide a rich habitat for flora and fauna. Ramsar sites are located in the areas of Hont, Drégelypalánk and Ipolyvece, covering a total of 2,149 ha (17% of the study area) (INT-04)

Ex lege protected areas are also identified in the planning area (Natural heritage elements – ex lege conservation plan).

Natura 2000 network

Both types of Natura 2000 sites appear in the area, the Special Protection Areas for Birds/Birds Directive (SPAs) and the Special Protection Areas /Habitats Directive (SACs). Special Protection Areas (SPAs), 1,599 ha are located in area of "Ipoly Valley'' and 3,067 ha under the name of "Börzsöny and Visegrád Mountains" (SPA total: 4,666 ha, i.e. 38%) (INT-05). The Ipoly Valley (HUDI10008) has an altitude of 118-134 m above sea level. It is one of the last remaining rivers in its natural state, less affected by water management. It is one of the last remaining natural habitats of the river, with a high number of wet meadow species and a prominent population of Corn Crake (Crex crex) (INT-06).

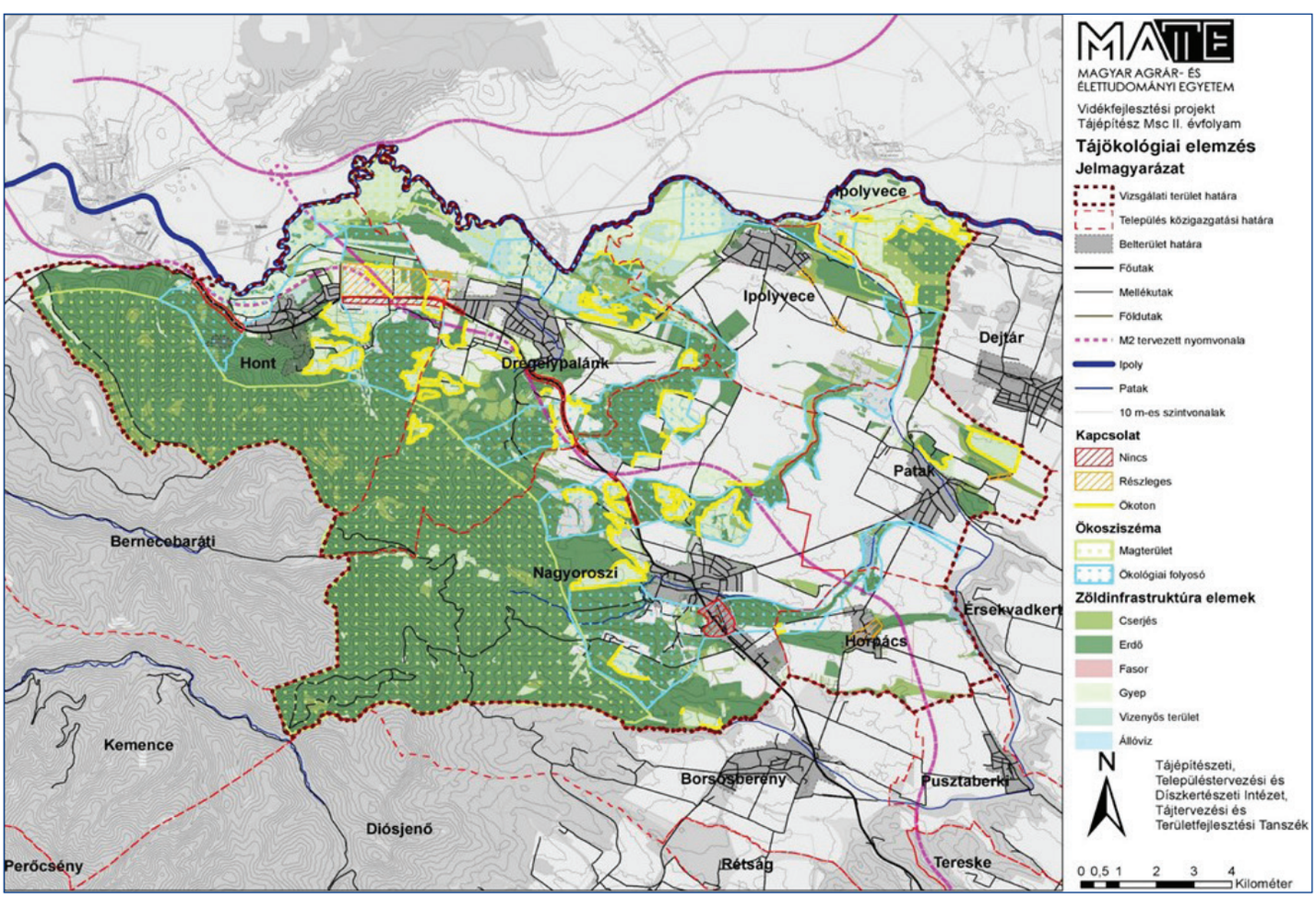


Figure 6 Protected areas in the study area ©MATE

Figure 7 Ex lege protected wetland in Ipolyvece ©MATE

The area of Börzsöny and Visegrád Mountains (HUDI10002), with altitudes ranging from 102 to 939 metres above sea level, is important for forest bird species. The protected areas of 3,510 hectares are designated as “Börzsöny” and 1,323 hectares as “Ipoly Valley” (total SAC: 4,833 ha, i.e. 39%). Both types of Natura 2000 sites are located in Nagyoroszi, Hont, Drégelypalánk and Ipolyvece (INT-07).

The habitat types occurring in the area are calcareous beech (Luzulo-Fagetum), submontane and montane beech (Asperulo-Fagetum) and Pannonian pine-oak. Important plant species are the red snake-grass (*Echium russicum*) and the maidenhair (*Pulsatilla grandis*).

Ipoly valley (HUDI20026) Natura 2000 areas are characterised by habitat types of floodplain marshes, Pannonian sand grasslands, alder and ash groves, riparian forests and marsh woodlands.

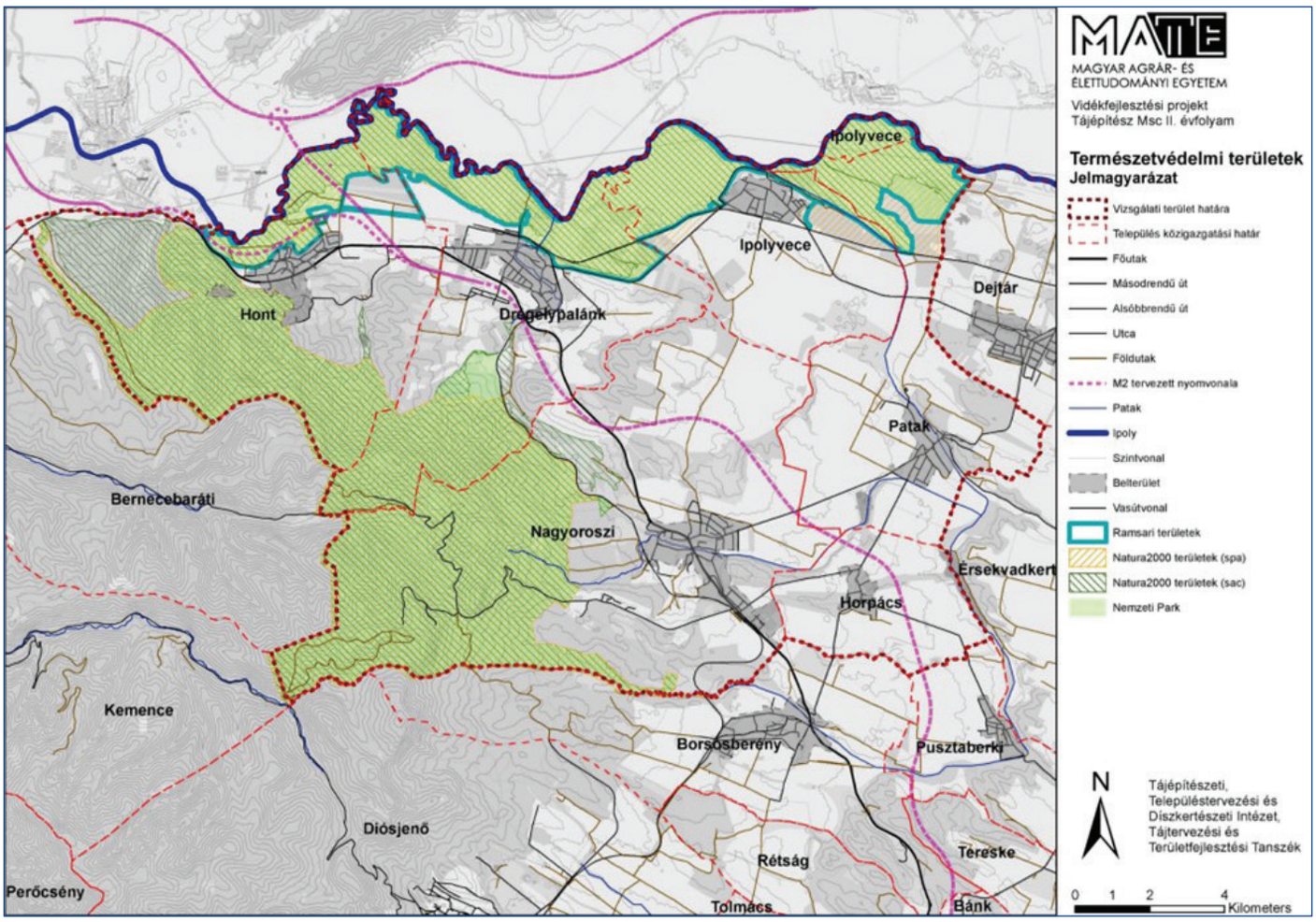


Figure 8 Protected areas in the study area, ©, MATE

National Ecological Network

Among the elements of the national ecological network, the Börzsöny and the Ipoly rivers are identified as core areas, the surrounding buffer areas and the ecological corridors connecting core areas. The ecological corridors are almost always located along watercourses (INT-08).

The core and buffer areas are present in Hont, Nagyoroszi, Drégelypalánk and Ipolyvece, of which the core area covers 4,830 ha (36% of the study area) and the buffer area 1,196 ha (9.7% of the study area). The ecological corridor covers 1,785 hectares (15% of the study area) and is located in Nagyoroszi, Horpács, Patak and Ipolyvece. The total size of the ecological network in the study area is 7,361 ha, which represents 60% coverage. There is a lot of overlap between protected areas, but it can still be said that more than half of the area is covered by protected areas, which is an outstanding proportion at national level.

Protected natural areas of local importance

Protected natural areas of local importance are located in two municipalities. In Horpács there is the Mikszáth Park and in Drégelypalák the Szondi tree line. The former was declared a protected area in 1972 because of the mansion and new castle next to the Mikszáth Kálmán Memorial House and its well-kept park. The latter is located between Drégelypalánk and Hont. The linden tree, which has been protected since 1977, is said to lead to Szondi's grave. (INT-09)

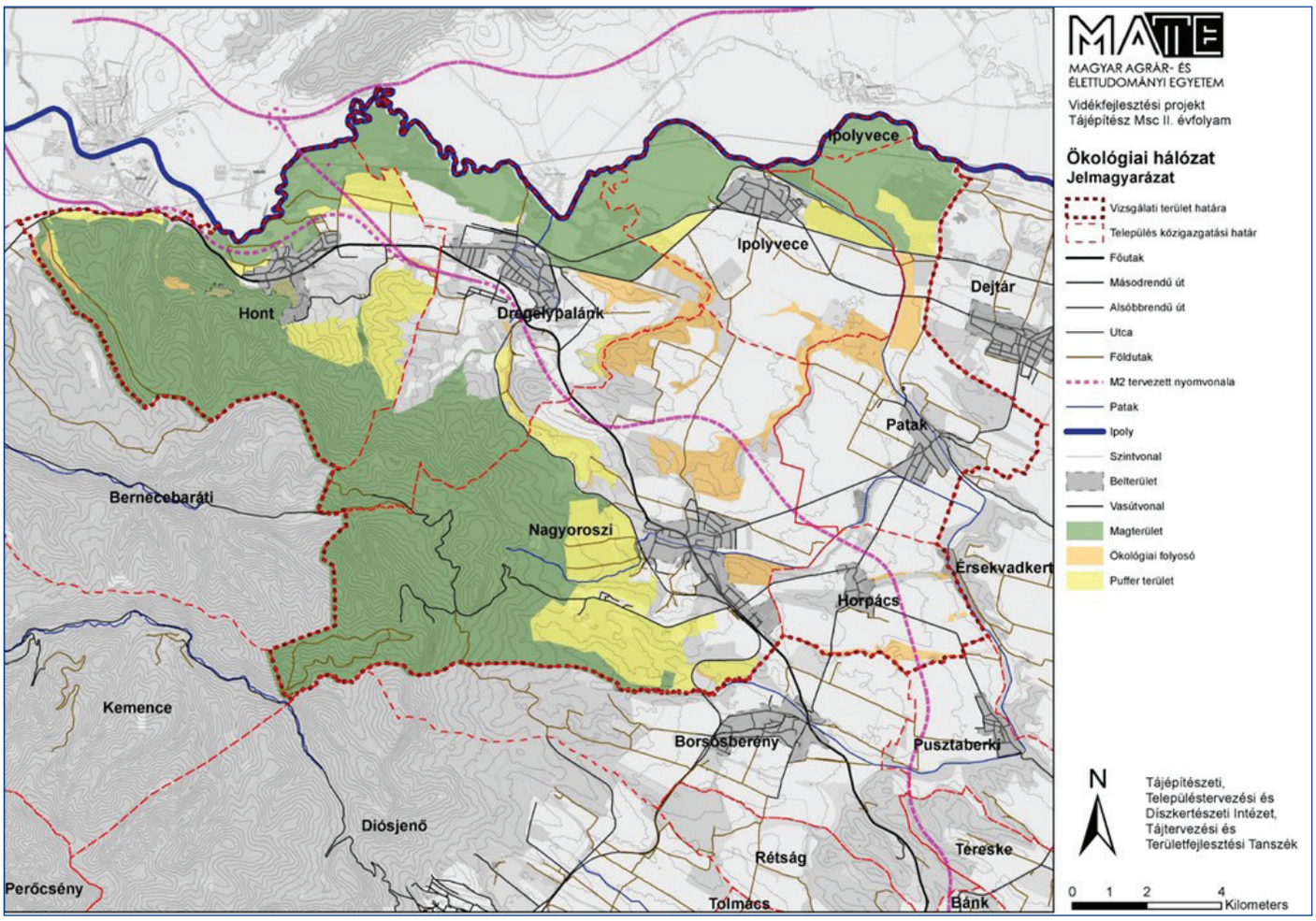


Figure 9 National Ecological Network: core area, buffer zone, ecological corridor ©MATE

1.9 Fauna

The region has a diverse landscape and habitats, which means that its fauna is also diverse. It can be divided into three major landscape types: the Börzsöny, the Ipoly Valley and the lowland agricultural landscape in-between. The Börzsöny has a high forest cover with forest species. Noteworthy are the lynx lynx (*Lynx Lynx*), the heraldic animal of the Danube-Ipoly National Park, and the stone crayfish (*Austropotamobius torrentium*), whose population is nowadays rare in small watercourses. The large populations of the white-backed woodpecker (*Dendrocopos leucotos*), the Imperial eagle (*Aquila heliaca*) and bats are significant.

Among the big game animals in the forest, besides stable populations of deer, golden eagle and roe deer, brown bear (*Ursus arctos*) and wolf (*Canis lupus*) have been described. Birds, fish and amphibian groups dominate the fauna along the Ipoly. Among fish, there are several protected and rare species. These include the pale-spotted ray (*Romanogobio albipinnatus*), the dwarf minnow (*Sabanejewia balcanica*), the european bitterling (*Rhodeus amarus*) and the German gudgeon (*Zingel streber*). All amphibian species found in Hungary, with a few exceptions, live in the area. 3,000 birds arrive at the Ipoly River during the migration season. Species of special conservation concern are the little lilac (*Anser erythropus*), the meadow pipit (*Tringa glaerola*), the

purple heron (*Ardea purpurea*), and the spotted water vole (*Porzana porzana*). The agricultural landscape provides important ecotone systems and habitats for many animal species. In addition to big game animals, these areas are home to rising numbers of reptiles and small mammals. These include the green lizard (*Lacerta viridis*), the sand lizard (*Lacerta agilis*) and various rodent species such as the common vole (*Microtus arvalis*). Predator species, such as the common buzzard (*Buteo buteo*), common kestrel and red-footed falcon (*Falco tinnunculus – Falco vespertinus*), and the imperial eagle (*Aquila heliaca*), are also present. Other species that feed here include pheasants, partridges and hares (INT-11).

1.10 Land use

The current land use map is based on ArcGIS Imagery satellite image, with 25 land use categories (Current Land Use Map): deciduous forest, tree group, plantation forest, coniferous forest, tree line, shelterbelt, field meadow, grassland, wooded pasture, shrub, grassland-scrub, wetland, water surface, orchard, vineyard, farm, industrial-farm-commercial, single-family house area, single-family house with garden, farmstead, holiday resort, cemetery, abandoned mining area, and castle ruin.

Deciduous forests are mainly found in the western, south-western and central areas,

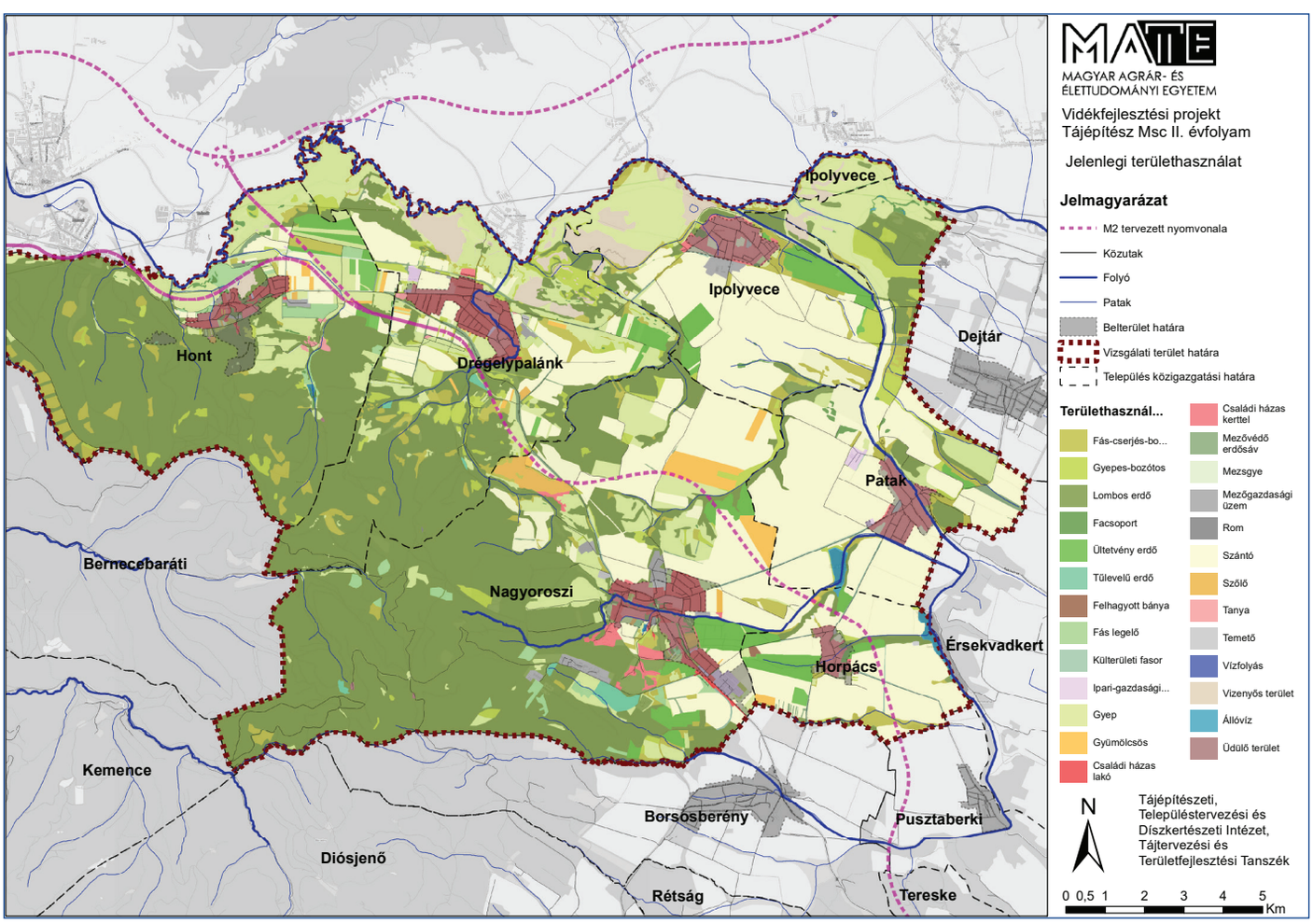


Figure 10 Current land use ©MATE

at the foot of the Börzsöny. The proportion of woodland is high in the area, 45.6%, more than double the national average (around 21%). Grasslands are mainly found along the Ipoly River and near the inland areas of Hont and Drégelypalánk. Their area share is 13.7%, which is also much higher than the national average (about 8%). Arable land is scattered in the areas of Hont and Drégelypalánk with small parcel sizes, and in addition, in the locations between Ipolyvece-Patak-Horpács and in the northern part of Nagyoroszi, it is spread over a larger area, often in the form of unbroken, continuous fields. Their area coverage is 24.8%, below the national average of about 46%. This shows that forests and grassland (natural habitats) are more important than arable land in the area, which is ecologically advantageous. Large areas of contiguous orchards can be found in the northern part of the village of Nagyoroszi. Grapes are generally found in small patches, but there is also a larger contiguous area along the northern border of Nagyoroszi, along the main road No. 2. Built-up areas (residential and industrial/economic combined) occupy 5.7% of the area. The relatively high proportion of scrub and heathland (7.9%) is explained by the large number of new growths resulting from forestry and the presence of mature woodland in abandoned fields and grassland.

Eight types of landscape character occur in the study area (Landscape character map). 35.8 % of the area belongs to the category of forested, homogeneous mid-mountain and mountain ridge landscapes, covering

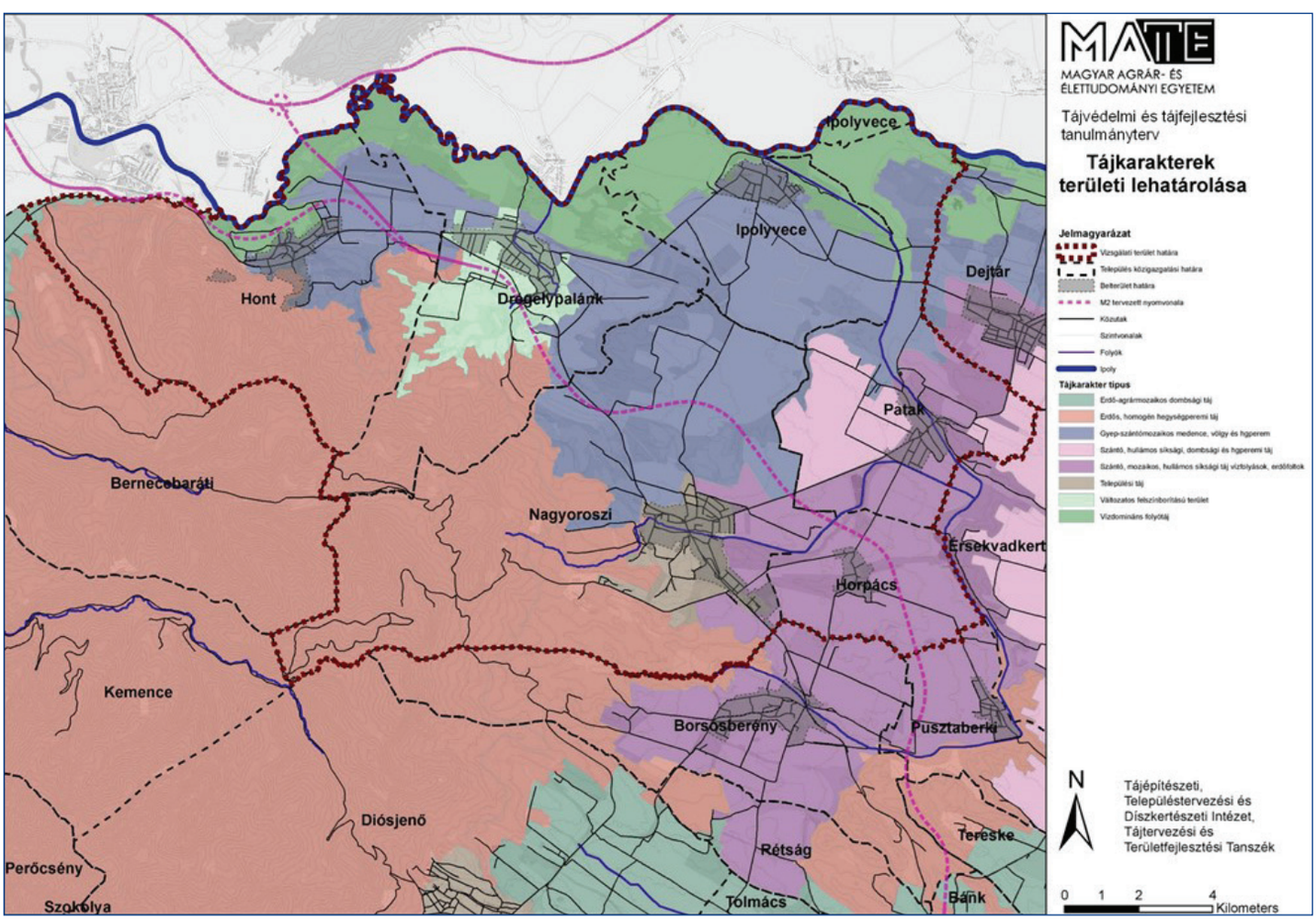


Figure 11 Landscape character units in the study area ©MATE

the foothills of the Börzsöny. 28.8 % of the area belongs to the category of grassland basin, valley and mountain ridge landscapes. These areas are located between settlements. Arable, mosaic-like, hilly landscape with watercourses and forest patches is found on 12.4% of the area in Patak, Horpács and Nagyoroszi. 11.4% of the area is dominated by rivers, located in the valley of the Ipoly River. Mountain ranges, hills, basins and valleys with varied topography only occur in 4.5% of the area. This type is located south-west of the settlement of Drégelypalánk. Arable homogeneous undulating plains cover 3.7% of the area, mainly in the municipality of Patak. The settlement landscape is hilly, mountain ridge and basin in the interior of Nagyoroszi with 2.8% coverage. Forest-agrarian mosaic hilly landscape totals for 0.2%. The area is divided into four small districts. The largest area falls within the Börzsöny foothills sub-region. 48.6% of the area is part of the Börzsöny Hills. It covers large parts of Hont, Drégelypalánk and Nagyoroszi. The Nógrád basin covers 28.9% of the area, which is made up of the settlements of Nagyoroszi, Patak and Horpács. The Central Ipoly Valley covers 22.3% of the area, with the municipalities of Patak, Ipolyvece and Drégelypalánk. The Central-Börzsöny area is less than 1%.

1.11 Agriculture

Agriculture includes areas related to crop and livestock production. Arable land accounts for

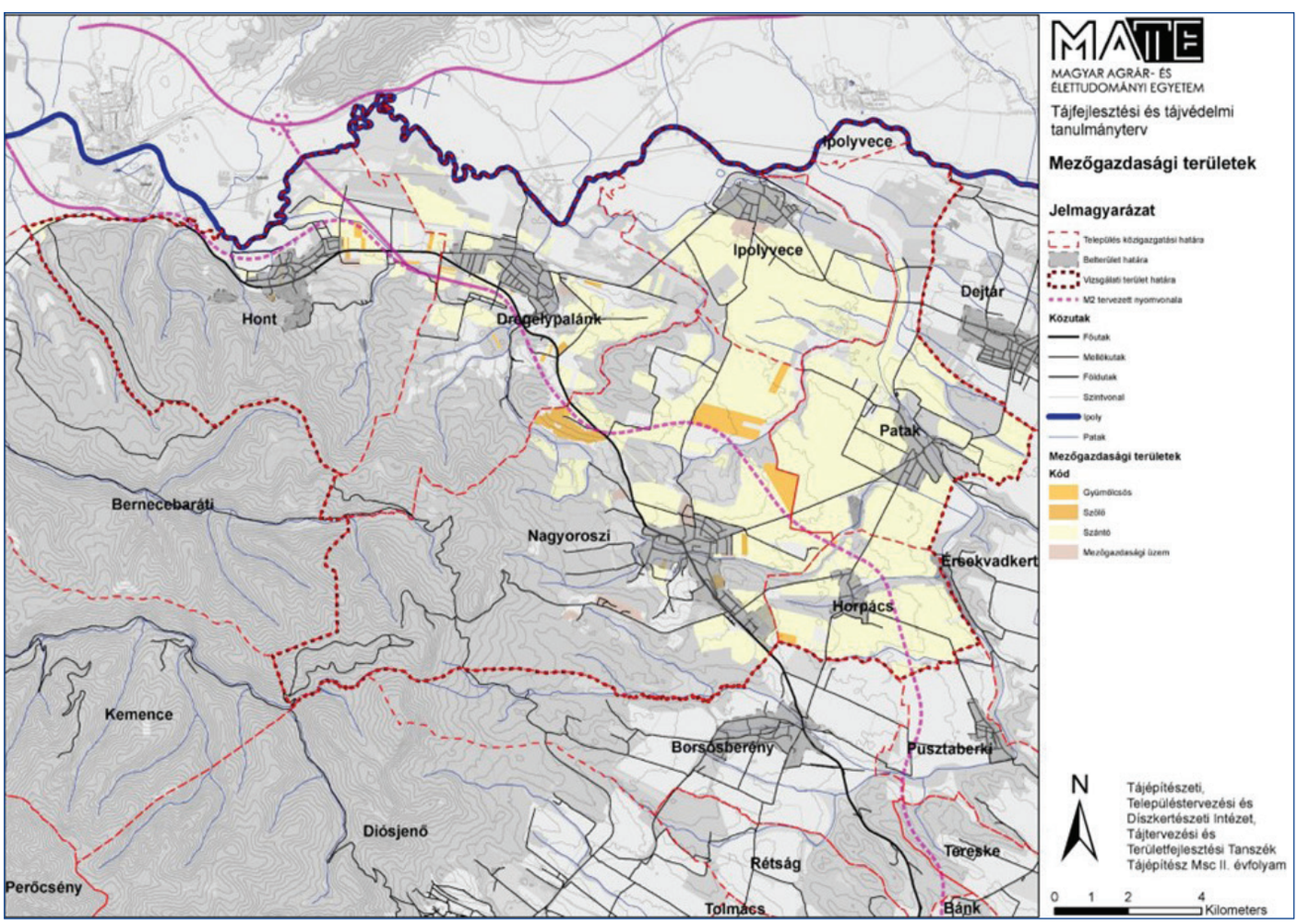


Figure 12 Agriculture: fruit gardens, vineyards, arable land ©MATE

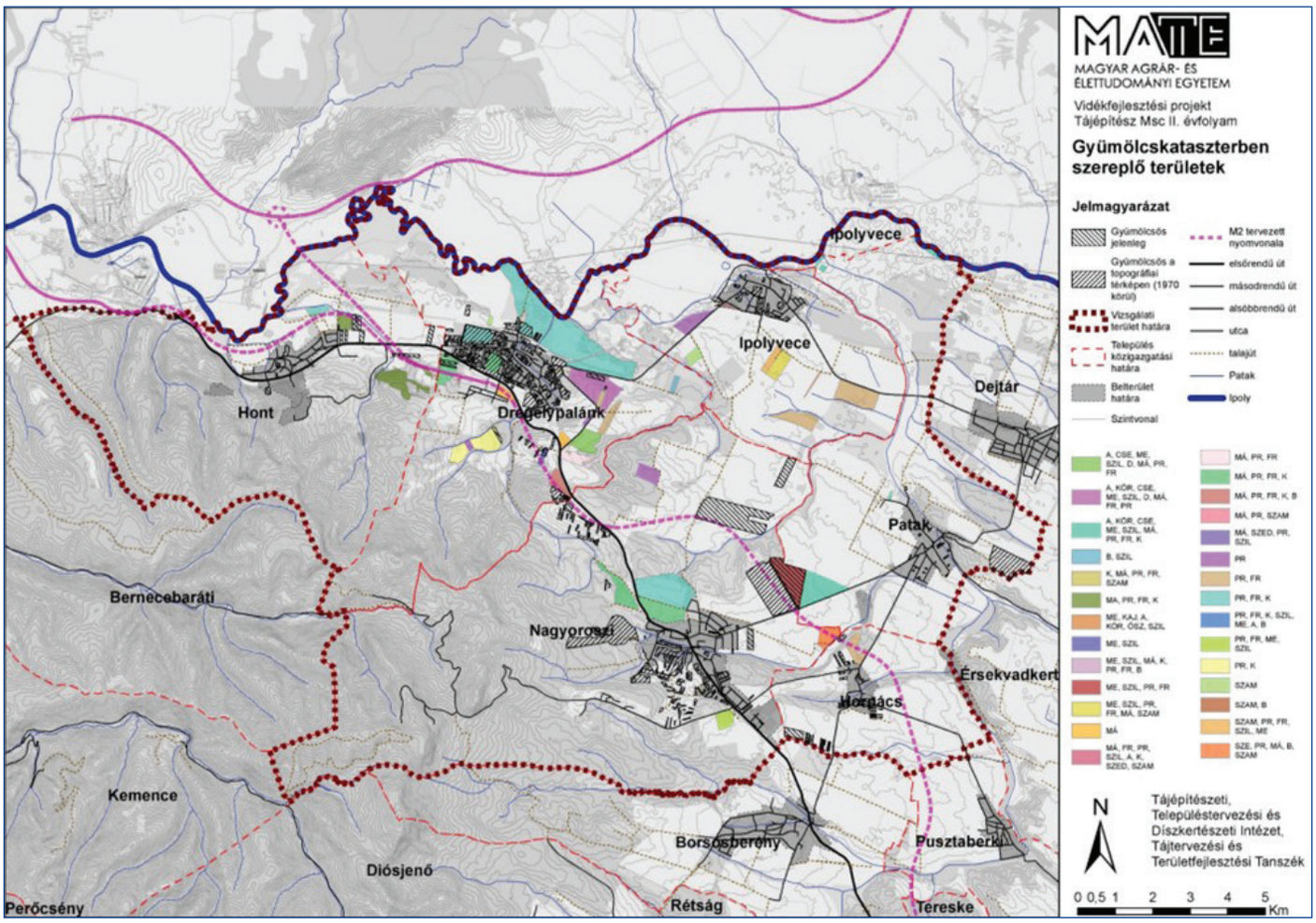


Figure 13 Fruit cadastre: fruit gardens from the official fruit tree inventory ©MATE

24.8% of the total, and is predominantly found in the central and eastern parts, predominantly in flat areas. The proportion of orchards is 0.1%, which is low from the viewpoint of the regional tradition of fruit-growing. Vineyards appear in small patches. Agricultural holdings are present in almost all the municipalities, with the exception of Patak and Horpács. (The areas suitable for fruit growing are shown in plot boundary colouring by fruit type in the Fruit Cadastre Areas Plan. These areas are mainly located in the area between Ipolyvece-Patak-Nagyoroszi-Drégelypalánk, but there are also small patches around the inner area of Drégelypalánk. The map also shows areas with oblique hatching that appear as orchards on the topographic map or in their present state. It can be seen that the areas currently used as orchards are not included in the cadastral map, but that the orchards on the topographic map overlap with the proposed areas in many places.

In general, the arable land is characterised by the presence of large monocultures of cropland. Another problem is a frequent absence of forest strips, which reduces ecological connectivity. These conflicts can be fully or partially reversed. It is of particular importance to reverse/mitigate these conflicts, as the construction of the new motorway (M2) will result in the loss of many additional habitats, which can only be compensated for off-site areas.

The main problem with grasslands is that they are no longer grazed or mowed when traditional land use ceases and are often cleared and then turned to ploughland. This conflict can be fully remedied by abandoning arable farming.

Some arable and grassland will be expropriated, resulting in the loss of many habitats. This process will cause irreversible damage to nature.

1.12 Forest management

The forest management of the municipalities is based on the NÉBIH Forest Plan. Most of the forest areas are state-owned, but there are also some privately owned forests. The share of the latter is high, especially in Horpács, Ipolyvece and Patak, while the forests of Börzsöny are almost entirely state-owned, due to the presence of the Danube-Ipoly National Park. There are no forests under common or mixed ownership.

The forest uses are predominantly cutting, with small patches of conversion and non-timber production, and no felling. According to the 2009 XXXVII. Act on Forests, Forest Protection and Forest Management, in the case of cutting, the end-uses in the forest follow each other in a regular cycle, while in the case of conversion or transition, the main professional objective is to change from cutting to “Forest wilderness” management or to maintain a more continuous forest cover than in cutting by increasing the structural diversity of small homogeneous stands of trees of nearly the same age. In the non-timber production mode, forest management does not involve stand management, and harvesting may be carried out for experimental, conservation, nature protection, public welfare, forest restoration or other public interest purposes (Table 1).

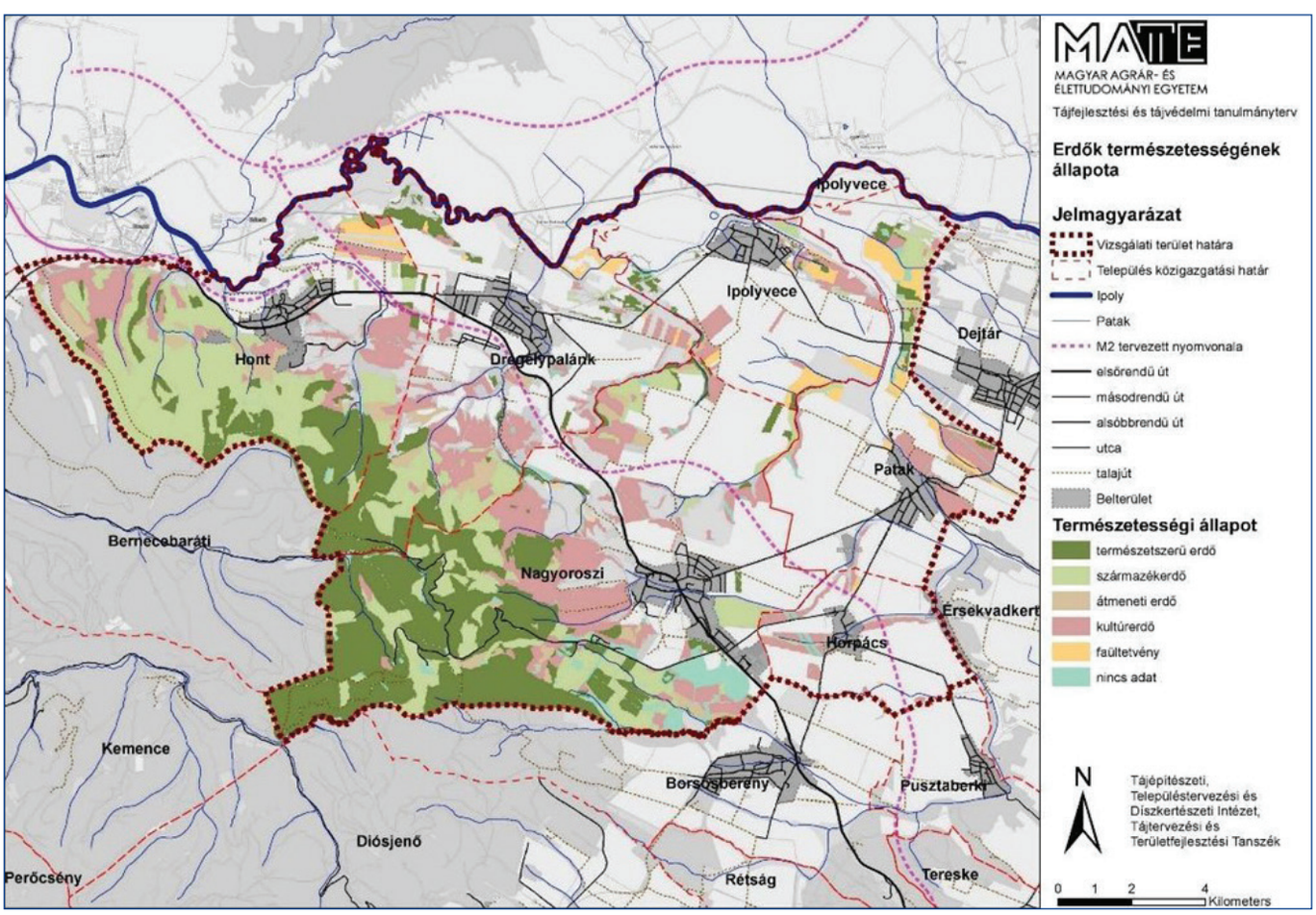


Figure 14 Naturalness of forests in the study area ©MATE

Table 1 Advantages, disadvantages and problems of clear-cutting forest-management

Benefits	Disadvantages	Problems
Easy to plan	Aggressive intervention, eliminating habitats	Vulnerable to biotic and abiotic stresses
Work and timber can be easily concentrated	Changes the micro-climate of the forest	Expensive renewal
It is not necessary to take care of the remaining stock (does not remain)	Reduces the protective effects of the forest	Lacks natural selection
Easy to mechanise	Weeding of the open space	-

The least significant of the land-use conflicts that threaten forests is the presence of acacia and aspen plantation forests, which are mainly found in the municipality of Nagyoroszi. A moderately significant problem is the emergence of agroforestry, which has resulted in a high incidence of invasive species. These two problems are fully reversible through landscape rehabilitation measures. The biggest problem that is expected to arise in the future is the loss of ecological connectivity in a one kilometre strip of forest along the route of the planned motorway and the potential for significant damage to this forest cover during construction.

Irreversible impacts are considered to be the removal of the alleys along the motorway corridor. These trees will be cut in the roadway and its immediate surroundings. In this way, seven tree alleys will be fragmented or disappear completely. Cutting of these trees will cause damage such as the lack of connectivity of green infrastructure elements, the loss of many habitats and the loss of the local urban character of the settlement.

1.13. Water management

The Third River Basin Management Plan of Hungary for the period 2022-2027 includes the Chapter on Significant Water Management Issues (SIGN3). This includes the sub-basin plan for the Ipoly River, prepared by KDVVIZIG. The document addresses, among other things, the status, sensitivity and aquifer conditions of the study area waters.

“The sub-unit (Ipoly) area is characterised by high and medium gradient, water bodies. Their condition is natural; the highly modified classification is due to the presence of reservoirs.” (INT-12) Reservoirs are found within the study area, for example on the Csitar stream in Hont. “In terms of the status of water bodies, the most dominant activities (main drivers) in the sub-unit are flood control development, industry and urban development.” (INT-12) The Ipoly River “is considered to be in a better condition than many other similar watercourses.” The most sensitive to human activity are the aquifers along the riverbank and the groundwater.

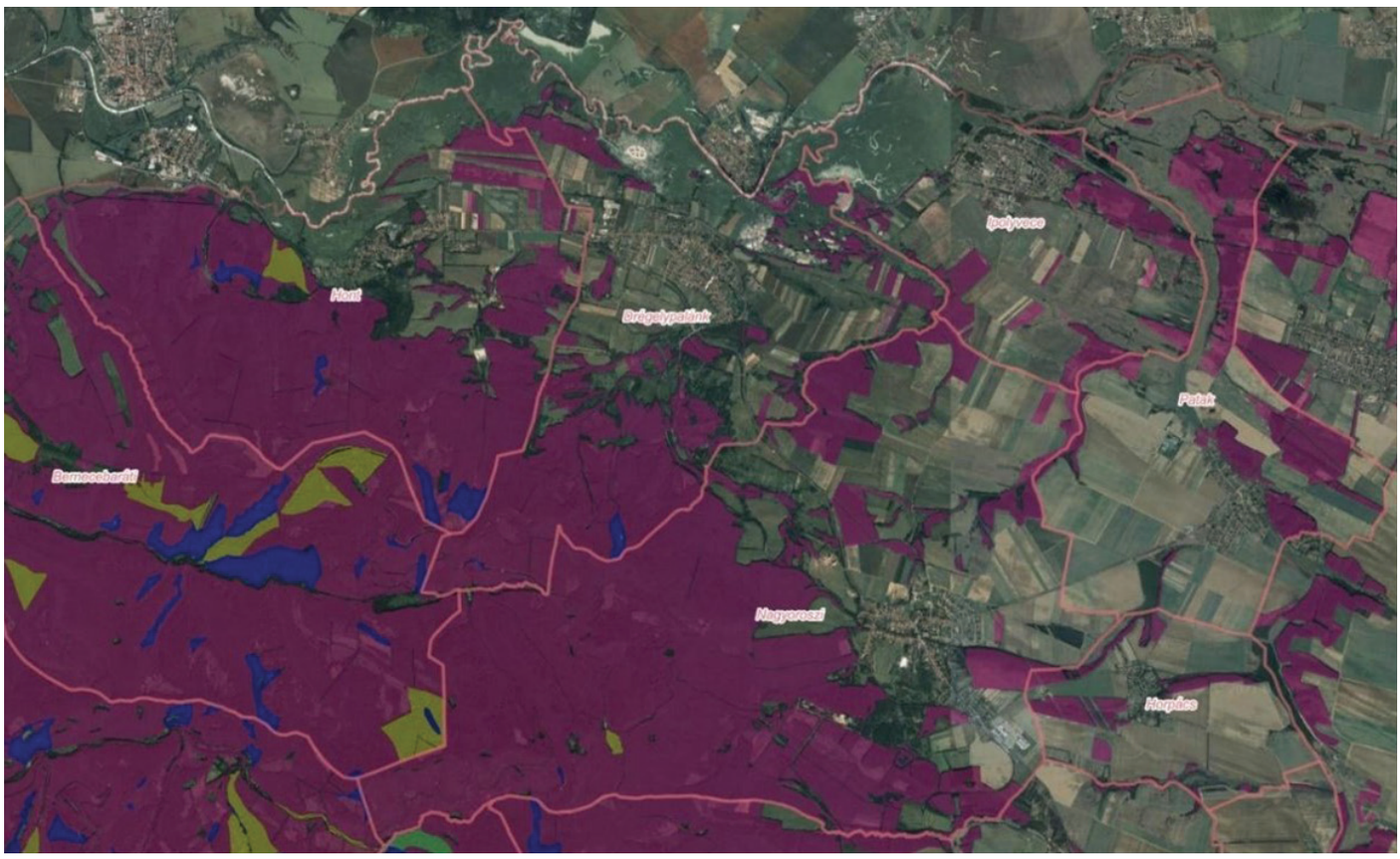


Figure 15 Forest of the study area, by type of use: cutting, non-timber production, conversion ©MATE

Surface water problems are most often caused by the proximity of arable land and the lack of a buffer/riparian zone. Most of the streams in the study area have no green edge; mostly these are ploughed right up to the banks of the watercourse, which creates many conflicts. The riparian vegetation is partially or completely absent. The stream especially at risk is the Nagyoroszi stream, which flows through the municipality of Nagyoroszi, as arable land on the left bank of the watercourse extends to its bed. The brook flows into a reservoir, on the banks of which there is a road.

The most extensive group of conflicts, with the most dangerous impacts, are the problems caused by the planned M2 motorway. The construction of the road will cause a number of irreversible impacts on the landscape. The planned road will cut through five streams in the study area alone, with an overpass over six others. The irreversible impact will be on the stream crossings where there won't be culvert under the road. These small watercourses will be blocked and then dried out. The impact on channelized streams will be moderate, as their environment is altered.

1.14 Hemeroby level (level of transformation)

The level of hemeroby indicates the degree of anthropogenic modification of the landscape. The assessment of the degree of human influence is based on the current land use map. The land use has been classified into 5 categories according to the extent to which it deviates from the natural or semi-natural state

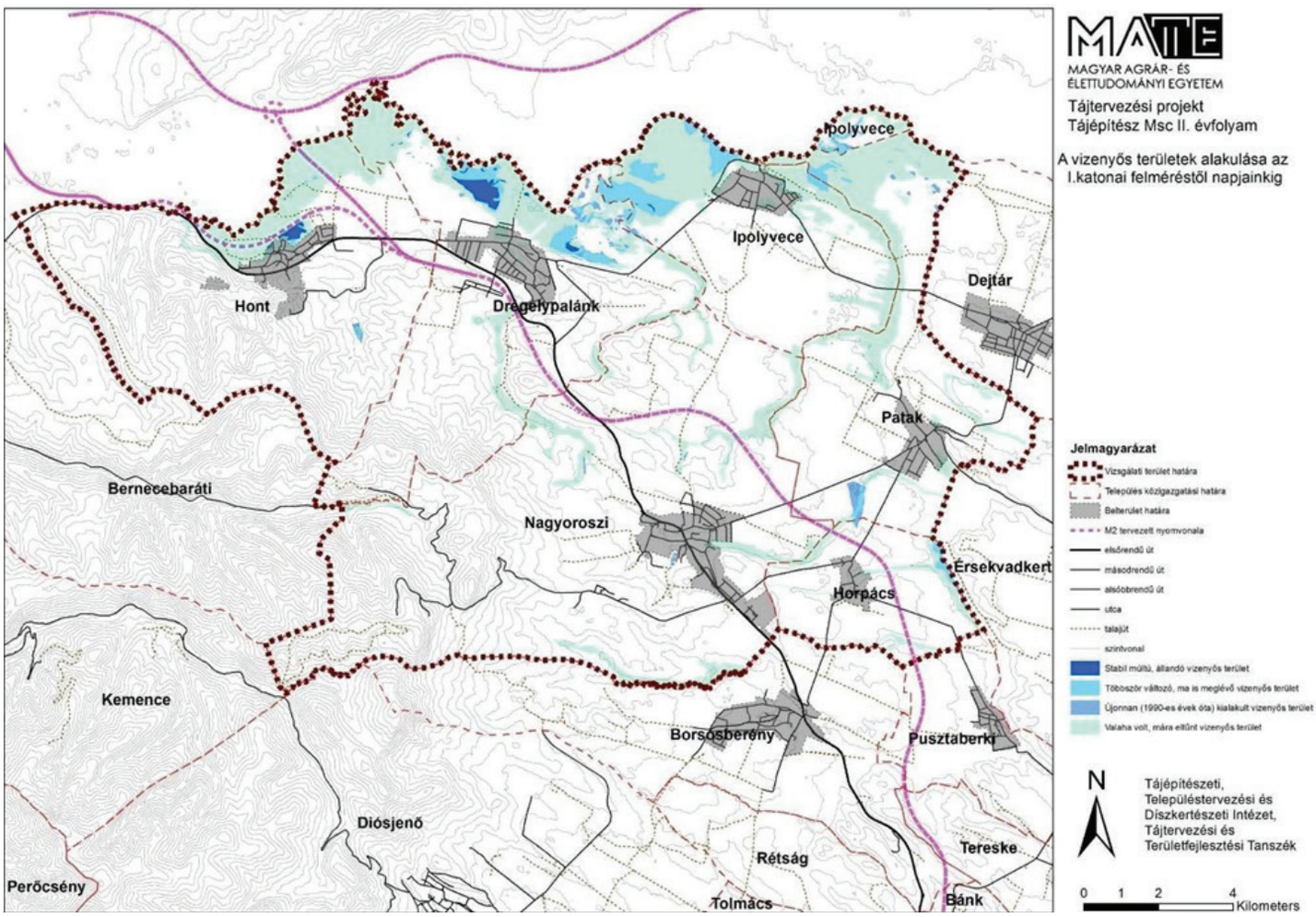


Figure 16 Stable (hasn't changed), changed, new wetlands and lost wetlands in the study area ©MATE

that could potentially occur in the area, and the map has been coloured accordingly.

- Category 1 (near-natural): deciduous forest, grassland, water surface, wetland
- Category 2: shrub, grassland-scrub, tree group, pine forest, wooded pasture,
- Category 3 (moderately modified): plantation forest, orchard, vineyard, shelterbelt, field meadow
- Category 4: farm, castle ruin, farmstead, recreation area
- Category 5 (heavily converted): abandoned mine, industrial-farm-commercial, detached house, detached house with garden, cemetery

It can be concluded that the Börzsöny area and the areas along the Ipoly River are the least modified, while the inner areas of the municipalities and their immediate surroundings are the most affected. The moderately modified areas are located in the eastern and south-eastern part, as this area is relatively flat, more suitable for arable farming and currently used for this activity.

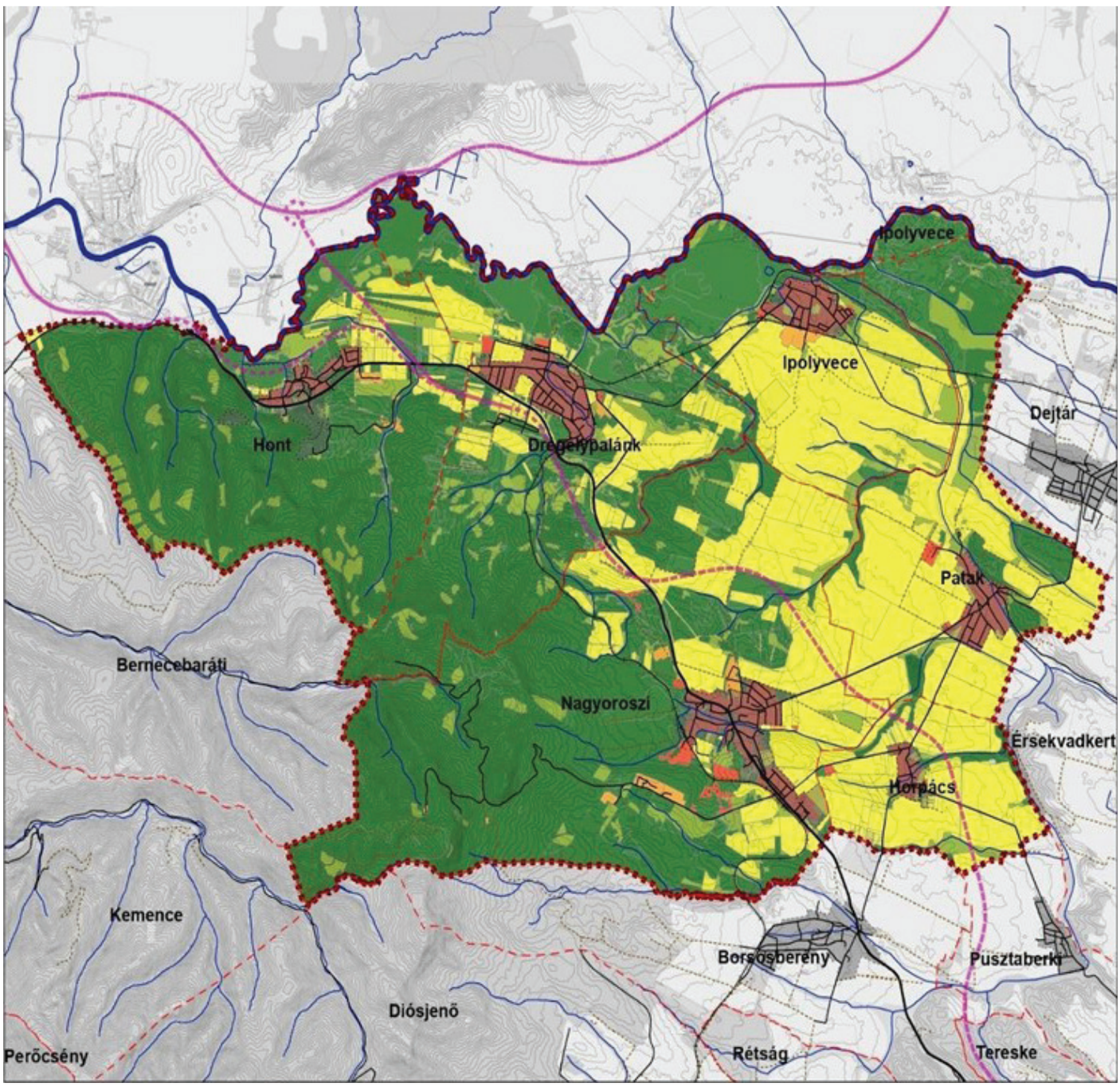
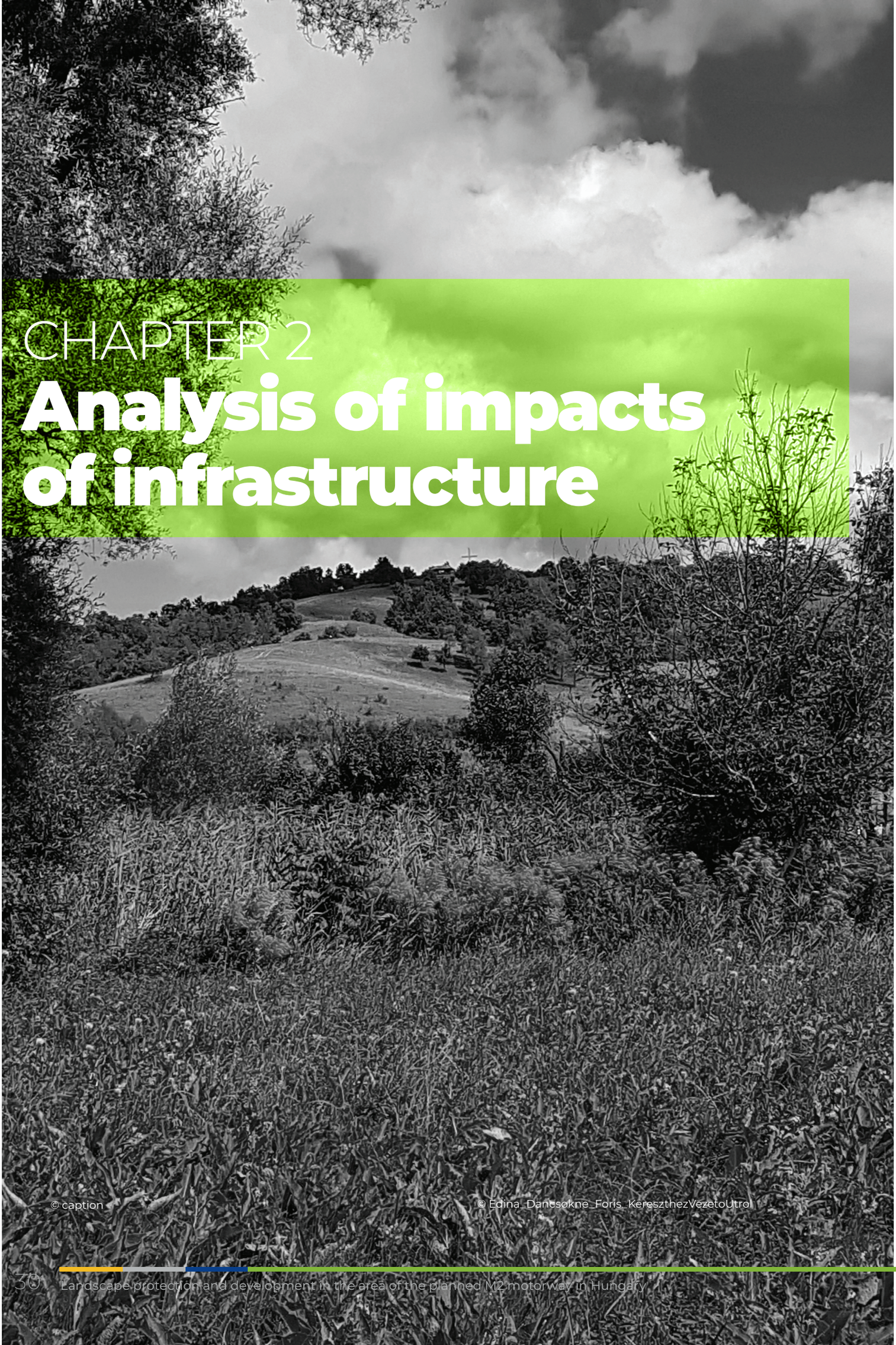


Figure 17 Hemeroby map, level of human influence (Green- natural) ©MATE



CHAPTER 2

Analysis of impacts of infrastructure

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Table 2 Logframe

THREAT/ PRESSURE	GENERAL OBJECTIVES	Problems
1. New Transport and other Linear Infrastructure (TLI*) projects may increase the barrier effect at landscape level.	1.1. Ensure adequate and relevant background data of new infrastructure projects for proper decision making.	Cross sectoral knowledge transfer on barrier effect of new linear infrastructure elements to strengthen the ecological aspects in decision making processes (especially in the choice of the new infrastructure corridor/line)
		Continuous data collection and monitoring is needed even before the investment starts.
	1.2. Support/participate in the SEA/EIA/AA processes and procedures with relevant data and examples of good-practice	SEA and EIA studies are based on general methodologies and guidelines. The legislation does not address the specific problems of the road. Lack of possibility to have defragmentation mitigation measures in SEA/EIA/AA outside infrastructure easement due to law.
		Lack of possibility to have defragmentation mitigation measures in SEA/EIA/AA outside infrastructure easement due to law especially concerning plantations related to ecological corridors.
	1.3. Support the design & technical details and constructive solutions with examples of good-practice	There is no up-to date publication that summarises best international and national practices in Hungarian language. (International example: https://handbookwildlifetraffic.info/1-introduction/cost-341/)
	1.4. Maximize the functionality of underpasses (all objects)	The functionality of underpasses is not known in early stages of preparation.

Measures	Actions
1.1.1. During route selection ecological considerations should be taken into account, but this is often decided by the time ecologists/biologists have examined a trail in detail	Avoid sensitive areas Stakeholders: NIF, NP Directorates, decision-makers, planners, environmental experts
1.1.2. Gather data on relevant species using camera traps, tracking and telemetry. For watercourses, continuous sampling is required.	Set up a systematic monitoring plan of new linear infrastructure (before baseline, during the construction and after the construction is finished). Stakeholders: NIF, NP Directorates, environmental experts
1.2.1. SEA and EIA legislation should be complemented by provisions for specific roads. For example, the direct and indirect impact area of different roads. Specific, well-measured indicators such as fragmentation analysis (e.g. minimum net size) or biological activation value calculations should be incorporated into the SEA process and spatial planning.	Cooperate with NIF and involve Chamber of Engineers to create new standardised methodologies and national standards specifically for new road constructions. Round table organization for stakeholders, to provide a common platform for a common initiative Stakeholders: NIF, NP Directorates, Chamber of Engineers, planners, NGOs, environmental experts
1.2.2. A minimum percentage of the entry cost of a given project which must be spent on the ecological protection facilities (like under- and overpasses, fences) of the road should be stipulated in legislation, including the provision of area required for planting and implementing the facilities. In addition, a minimum size of the area intended for planting is also proposed for further specification in the legislation, because planting can influence the effectiveness of ecoducts, among others. (The exact size should depend on road category.)	Stakeholders: NIF, NP Directorates, Chamber of Engineers, planners, NGOs, environmental experts
1.2.3. The term of 'ecological corridor' or 'ecological connectivity' should be nominated in Gov. Decree 314/2005 (XII.25.), requiring that the impact of the railway/road project to ecological corridors should be evaluated in EIAs.	Stakeholders: NIF, NP Directorates, Ministry of Agriculture and Ministry of Innovation and Technology
1.3.1. Review of national and international practice and adaptation to domestic conditions. Advocacy for development of new small infrastructure project to create defragmentation facility (overpass).	Cooperate with NIF to apply best techniques. Stakeholders: NIF, NP Directorates, Chamber of Engineers, planners, NGOs, environmental experts
1.3.2. Searching for funds for further financing the implement of research, database building, publication and exploitation of such a database.	Stakeholders: NIF, NP Directorates, planners, NGOs, road and environmental experts
1.4.1. Provide monitoring system regarding the functionality of underpasses	Cooperate with NIF and with National Park Directorates to ensure functionality of underpasses in the new local infrastructure projects. Stakeholders: NIF, NP Directorates, motorway management, environmental experts

THREAT/ PRESSURE	GENERAL OBJECTIVES	Problems
	1.5. Maximize the functionality of overpasses (all objects)	The functionality of overpasses is unknown in early stages of preparation.
	1.6. Assign a legal status and develop coherent regulations for all objects which are potential wildlife passages (especially for green infrastructure corridors).	Green infrastructure corridors are not legally protected unless they are part of a national ecological network.
	1.7. Increase the permeability of embankments (whenever & wherever fencing is not mandatory)	Roads on the embankment impede passage and reduce permeability.
2. Structural interventions on existing Transport and other Linear Infrastructure (TLI) (maintenance, upgrading without changing the category/ class of the infrastructure etc.) and on other linear features may increase the barrier effect at landscape level.	2.1. Safeguard the permeability of existing transport infrastructure (including enhanced permeability of existing features, when possible)	Pressure for narrower or unnecessarily wide green bridges.
	2.2. Safeguard the transversal permeability of river banks (including enhanced permeability of existing features, when possible)	Banks impermeable for some categories of species. For amphibians and reptiles, access from the Börzsöny to the Ipoly is blocked by the Route 2.

Measures	Actions
Cooperate with NIF and National Park Directorates to ensure the functionality of overpasses in the new local infrastructure projects.	Cooperate with NIF from early stages of specific road construction projects. Stakeholders: NIF, NP Directorates, Chamber of Engineers, planners, NGOs, environmental experts
Critical green infrastructure corridors linked to road development should be formally protected by law.	Preparation of policy act: preparation of recommendation, lobbying activities to each relevant ministries Stakeholders: Ministry of Agriculture, Ministry of Innovation and Technology
Systematic survey of the actual state of embankment, evaluation of its potential barrier effect with recommendation on mitigation measure(s)	For unfenced roads on embankments, permeability should be promoted by landscaping, planting vegetation, and taking into account visibility and traffic safety. Stakeholders: motorway management, NP Directorates
2.1.1. Respect expert recommendations and existing standards about the width of green bridges.	a, Create a national database of existing green bridges. b, Ensure the continuous monitoring underpasses and overpasses, identify underpasses that are used for migration, identify bio-corridor and preparation of the background map, as a base for a change in the spatial plans, identify critical points on corridors (bottlenecks), enforce the protection of bio-corridors in the zoning plans of the affected cities/ municipalities/regions. Stakeholders: NIF, motorway management, NP Directorates, NGOs, environmental experts
2.1.2.Research the reasons of the lack of respect of experts' recommendations about the width of green bridges	a, Making communication steps to reach decision makers/ fellow designers/other sectors representatives to build up the respect of experts' recommendations about the width of green bridges. b, Modification of the existing standard, if necessary. Stakeholders: NIF, NP Directorates, Chamber of Engineers, planners, NGOs, environmental experts, Ministry of Agriculture, Ministry of Innovation and Technology
2.2.1. Ensure the permeability of the banks of the Ipoly River.	The development of frog foraging and frog rescues required increased attention last year. Get support/funding to frog foraging and frog rescuing as far as effective permanent mitigation implemented. Stakeholders: motorway management, NIF, NP Directorates, NGOs

THREAT/ PRESSURE	GENERAL OBJECTIVES	Problems
	2.3. Safeguard the longitudinal permeability of rivers (including enhancedpermeability of existing features, when possible)	The crossdams limit the longitudinal permeability to the Ipoly River.
3. Linear transport infrastructures (including electric power lines) cause wildlife mortalities	3.1. Implement an adequate fencing system on motorways & high-speed railways, including escape gates	TBD
	3.2. Direct animals towards functional underpasses	No legal obligation for planting vegetation
		Guiding vegetation not planted in some cases when recommended.
	3.3. Warning drivers on road-kill /accident-prone areas	Frequent wildlife crossings including protected species occur.
	3.4. Warning train conductors on rail-kill / accident-prone areas	Not enough data available.
		Accidents involving large carnivores were documented.
	3.5. Prevent accidents caused by mammals being blocked in railway tunnels or on long bridges	TBD

Measures	Actions
2.3.1. Ensure the longitudinal permeability of the Ipoly River.	Establish and maintain an enhanced monitoring system. Ongoing liaison with the national park. Stakeholders: NIF, NP Directorates, motorway management, NGOs, environmental experts, Ministry of Agriculture, Ministry of Innovation and Technology Establish and maintain an enhanced monitoring system. Ongoing liaison with the national park. Stakeholders: NIF, NP Directorates, motorway management, NGOs, environmental experts, Ministry of Agriculture, Ministry of Innovation and Technology
2.3.2. Ensure the longitudinal permeability of the small river watercourses	Establish and maintain an enhanced monitoring system. Ongoing liaison with the national park. Stakeholders: NIF, NP Directorates, motorway management, NGOs, environmental experts, Ministry of Agriculture, Ministry of Innovation and Technology
3.2.1. Ensure obligation for vegetation planting in legal regulations	a, Ensure that a proper size of land is bought along roads for appropriate vegetation. b, Ensure proper maintenance. Stakeholders: NIF, motorway management
3.2.2. Ensure the guiding vegetation.	a. Facilitate discussion on systematic solution for guiding vegetation related to linear infrastructure. b. Ensure guideing vegetation is realized when migration studies recommend it. Stakeholders: NIF, motorway management, NP D.
3.3.1. Install a warning system in the area	a. Install warning signs for drivers. b. Install an intelligent warning system. c. Install reflex artworks. d. Follow best practices
3.4.1. Map the mortality on railways.	a. Review the existing sources of data about wildlife mortalities on railways. Stakeholders: MÁV
3.4.2. Install warning systems on railways.	a. Check the possibilities of installing warning signs along main railway corridors. Stakeholders: MÁV

THREAT/ PRESSURE	GENERAL OBJECTIVES	Problems
	3.6. Increase drivers/conductors visibility on roads/ railways	Not enough data available.
	3.7. Implement special measures to avoid birds mortalities (powerlines, noise barriers impact)	Not one single centralized database exists.
	3.8. Implement special measures to avoid bats mortalities (light impact)	Several sources of data should be unified.
	3.9. Implement special measures to avoid amphibians & reptiles mortalities	Further actions should be based on existing initiatives.
	3.10. Collect and process data to identify incidents/ accidents critical sectors on roads, motorways and railways	No accurate data about the effects of infrastructure on wildlife
	3.11. Create and/or train specialized teams to deal with wildlife-related incidents on motorways, railways, roads, including emergency interventions, i.e. Bears on the motorway/railway tunnels	No accurate data about the effects of infrastructure on wildlife
	3.12. Develop and use an integrated database as decision-support tool to address traffic incidents (for implementing / adjusting measures to prevent wildlife traffic-kills / damages / human casualties)	A central cross-border database of wildlife traffic incidents does not exist.
4. Changes in land-use may reduce landscape permeability	4.1. Inforce legislation preventing changes of land-use towards a less permeable categories (including compensatory measures targeting connectivity)	Numerous recreation areas contributed to the built up of biotopes of large carnivores in the region.
		Changes in land-use and agriculture led to large rural areas without sufficient cover for migrating animals.
	4.2. Facilitate/support changes of land-use toward more permeable categories through agricultural payments	Agricultural cultivation cause the loss of connectivity elements especially due to the lack of buffer zones along watercourses
5a. Changes in land management – fencing – may reduce landscape permeability	5a.1. Fencing regulations and promoting non-fenced areas	In individual cases, fencing can reduce the permeability in certain migration corridors.
	5a.2. Develop guidelines and impose fencing-related conditions linked with agriculture/forestry subsidies or specific programmes	TBD

Measures	Actions
3.6.1. Identify the spots of insufficient visibility.	a. Perform a mapping of traffic accidents caused by decreased visibility in the pilot area. Stakeholders: MÁV, NIF, motorway management
3.7.1. Evaluate the mortality of birds.	a. Consult experts, Hungarian Ornithological Association about existing data. b. Propose further actions based on existing data.
3.8.1. Evaluate the mortality of bats.	a. Consult experts about existing data.
3.9.1. Evaluate the mortality of amphibians and reptiles.	a. Consult the NCA, local NGOs and CSOP about existing data.
3.10.1. Collect and process data to identify incidents/ accidents critical sectors on roads, motorways and railways	Stakeholders: NIF, NP Directorates, motorway management, NGOs, environmental experts, Ministry of Agriculture, Ministry of Innovation and Technology
	Stakeholders: NIF, NP Directorates, motorway management, NGOs, environmental experts, Ministry of Agriculture, Ministry of Innovation and Technology
3.12.1. Gather available data on wildlife traffic mortalities.	a. Set up an official procedure for complex data collection. b. Share data records of critical locations to incorporate warnings into car navigation.
4.1.1. Monitoring of the growth of built up recreation areas.	Perform systematic monitoring of EIA procedures. Ensure that connectivity will be preserved.
4.1.2. Planting guiding vegetation taking into account the principle of networking.	Identify piees of land to plant more guiding vegetation.
4.2.1. Support the maintenance of ecological areas	Leaving at least 20-50 meters of uncultivated land along watercourses (providing buffer zones)
1. Reduce the use of fencing in agriculture	a. Educate farmers – excursions. b. Participate in the EIA processes.

THREAT/ PRESSURE	GENERAL OBJECTIVES	Problems
5b. Changes in land management – crop cultivation/ natural vegetation management – may reduce landscape permeability	5b.1. Prevent large-scale monocultures and/or facilitate & support mosaic cultivation	Intensification and concentration of agricultural production leads to large monocultural agricultural land
	5b.2. Support adequate management of natural features & marginal habitats	Low knowledge about the need of natural features contributing biodiversity
	5b.3. Support and promote development of good-practice examples of connectivity-sensible agriculture, water management and forestry practices	TBD
5c. Land management causing degradation of natural habitats may reduce landscape permeability	5c.1..Prevent/control spreading invasive plant & animal species and renaturation of invaded/ degraded land	The unmanaged construction land cause spreading of invasive species
	5c.2. Prevent/enforce legislation on fire	Not relevant
	5c.3. Prevent alteration of water bodies, restore hydric system and support renaturation of wetlands	TBD
5d. Land management through mineral extraction may reduce landscape permeability	5d.1. Develop coherent management plans and apply EIA/AA procedures in order to avoid-mitigate-compensate for impacts, and to renaturate the sites	Extraction sites may harm natural assets
6a. Other anthropogenic activities – game management – may reduce landscape permeability	6a.1. Develop coherent game management plans and apply the EIA/AA procedures in order to avoid-mitigate-compensate for impacts	TBD
	6a.2. Facilitate data-collection on key-species	TBD

Measures	Actions
5b.1. 1. Modification of agricultural subsidies in order to support mosaic cultivation	
5b.2.1. Awareness raising among farmers	Awareness raising among farmers
reduce the presence of invasive species after the construction phase, by clearing the work area as soon as possible (restoring the original land use or by grassing and regular mowing) or by aftercare (e.g. weed control mowing).	Stakeholders: motorway management
	In order to prevent the spread of invasive species, the new road will require the grassing of the gullies and unpaved ditches adjacent to the Natura 2000 site, and the maintenance of the gullies by mowing at least twice a year. Stakeholders: NP Directorates, motorway management,
	In the vicinity of wetlands – I the case of canals crossing the road or grassland temporarily submerged by rainfall in winter and spring - it is recommended to carry out the work between October and March to protect the amphibians and birds that may live there.
5d.1. 1. Any material extraction sites and landfills that may be developed should be sited in such a way that they do not directly or indirectly damage natural assets. In Natura 2000 areas, no extraction site, no depot, no staging and transport route, no staging area (assembly area) shall be designated except to the minimum extent necessary; nor shall any area be designated for the temporary storage of waste that may be left over during construction.	Stakeholders: Ministry of Innovation and Technology
	Stakeholders: NIF, NP Directorates, motorway management, game management associations

THREAT/ PRESSURE	GENERAL OBJECTIVES	Problems
	6a.3. Harmonise game management with Natura 2000 and connectivity-related objectives	Hunting activities sometimes take place in migration corridors which causes stress for migrating individuals and increases risk of poaching.
	6a.4. Implement poaching prevention and control	Poaching is a great source of mortality for large carnivores and other groups of species. Public opinion is related to the rate of poaching.
		Poaching is widespread in the concerned countries but persecution of criminals is lagging behind.
6b. Other anthropogenic activities – human-wildlife conflicts – may reduce landscape permeability	6b.1. Facilitate the implementation of legislation on damage compensations	Some farmers react slowly in the case of damage caused by large carnivores.
	6b.2. Facilitate the implementation of traditional shepherding	Traditional shepherding declined during the 20th century. The return of large carnivores caused significant damage due to abandonment of traditional methods of protection.
	6b.3. Facilitate the implementation of modern methods for prevention	A complicated bureaucratic process of getting money from European funds to finance preventive measures is for many farmers only manageable with the help of NGOs.
	6b.4. Facilitate increased subventions based on large carnivores conservation	TBD
	6b.5. Regulate other anthropogenic activities which could increase the level of conflicts (waste management, unsustainable development & tourism activities etc.)	Information about localities used as core habitat by protected species spreads on the internet and social media and causes increased disturbance.
		Certain bear individuals may approach settlements in search of food. These situations are usually caused by irresponsible human behaviour and can be prevented. Moreover, often lead to lowered acceptance and spread of myths.
	6b.6. Facilitate rapid intervention in special situations related to wild animals	

Measures	Actions
6a.3. 1. Cooperation with local hunting associations.	a. Establish a group or think tank to formulate best practices for regulating hunting in migration corridors and cooperate with hunting associations. Stakeholders: NP Directorates, motorway management, game management associations
6a.4.1. Work with the general public.	a. Perform terrain monitoring aimed at prevention of poaching. b. Educate the general public about the realities of large carnivores and problems of poaching. Stakeholder: game management
6a.4.2. Support the authorities in fight against poaching.	a. Coordinate the actions against poaching between nature conservation, police, border guard.
6b.1. 1. Inform and educate the farmers about damage procedures.	
6b.2. 1. Inform and educate the farmers about methods of traditional shepherding.	a. Inform farmers in specialized events.
6b.3. 1. Informing and support for the farmers in introducing modern methods of prevention.	a. Inform farmers in specialized events. b. Support farmers in applying for subsidies for preventive measures. c. Introduce state sponsored, easily administered subsidies for preventive measures.
6b.5.1. Limit publishing sensitive localities online.	a. Establish a systematic solution with large relevant servers such as mapy.cz. Stakeholders: NIF, NP Directorates, motorway management, NGOs, environmental experts, Ministry of Agriculture, Ministry of Innovation and Technology
6b.52. Avoid the risk of synanthropic bears.	a. Introduce and control bear-proof containers. b. Educate locals and visitors about behaviour in regions with the presence of bears.

THREAT/ PRESSURE	GENERAL OBJECTIVES	Problems
7. Lack of coherent monitoring at landscape level and adaptation of solutions	7.1. Facilitate implementation of an integrated monitoring programme – procedures, database, indicators, assessment	The monitoring required by migration studies does not always occur and data are not systematically collected. Central databases are missing.
		Migration objects on motorways are not properly maintained after the period of post-project monitoring.
		Monitoring of traffic accidents might provide data in spots that are not necessarily equal to critical spots of migration corridors.
		New threats to connectivity are constantly occurring. Monitoring of conceptions and projects considered for the SEA and EIA must be constantly performed to prevent the risks for connectivity process.
8. The support of stakeholders for a cross-sectoral & integrated approach at landscape level is reduced	8.1. Facilitate networking and develop a common platform and database	Lack of communication leads to certain problems in the present (e.g. confusion about legal protection of migration corridors).
	8.2. Facilitate information, awareness, education, communication	The problem of connectivity is still not well known among the general public.
	8.3. Support research and studies focused on connectivity; facilitate inter-sectoral capacity building and development of new professional opportunities (mainstream biodiversity to other sectors)	The measures to support landscape connectivity need more research.
	8.4. Facilitate the development of a regional identity and promote the area – nature, culture, services (connectivity as one of the themes)	
	8.5. Facilitate the development & alignment of local strategies into regional sectoral strategy (connectivity as one of the themes)	Strategic documents should guarantee a sufficient level of landscape connectivity. Some of them are vague and non-ambitious.
	8.6. Facilitate and support complementary initiatives (connectivity as one of the themes)	

Measures	Actions
7.1.1. Monitoring the effectiveness of existing migration objects and permeability in general.	a. Create and implement the Monitoring Plan. Stakeholders: NIF, motorway management, Ministry of Agriculture, Ministry of Innovation and Technology
7.1.2.Maintenance and service of migration objects after the monitoring period	Provide enough financial resource for the proper maintenance (including involving experts, if necessary)
7.1.3. Selection bias in monitoring.	a. Include appropriate actions in capacity building. b. Create and implement the Monitoring Plan.
7.1.4. Monitoring of SEA, EIA.	a. Constantly monitor conceptions and projects considered for the SEA and EIA. Create and implement the Monitoring Plan.
8.1.1. Create a platform for information and knowledge exchange for stakeholders.	Establish a local working group. Stakeholders: NIF, NP Directorates, motorway management, NGOs, local municipalities, farmers, Ministry of Agriculture, Ministry of Innovation and Technology
8.2.1. Increase the awareness of the general public.	a, Maintain species-oriented online communication on social media and include topics related to connectivity. b, Organize lectures, discussions and infodays for the general public. Stakeholders: NIF, NP Directorates, motorway management, NGOs, local municipalities, farmers, Ministry of Agriculture, Ministry of Innovation and Technology
8.3.1. Engage students and universities.	Initiate collaboration with universities to offer students connectivity-related topics for theses. Stakeholders: NIF, Universities, NGOs
	Stakeholders: NGOs, local municipalities, farmers, regional associations
8.5.1. Development plans containing general principles for protection of landscape connectivity.	a. Follow the existing SEA procedures, participate in commenting.

2.2 Descriptive part

The aim of the planned M2 motorway is to increase border crossing opportunities in Hont-Parassapuszta border area and to divert transit/cross-border traffic to the outskirts of the settlements in the area. The successful completion of the new motorway project will bring positive changes in cross-border cooperation (e.g. connecting the Nitra region with the Budapest agglomeration), support the further development of the economic potential of the border regions and improve the quality of the environment in the area between Vác and the border.

The construction of the new motorway will significantly reduce transit traffic among the settlements, which will improve the situation and quality of life of the inhabitants. The shift of transit traffic following the construction of the new motorway is expected to reduce, and in some cases even eliminate the environmental and nature conservation pressure tendencies and problems along the existing road network sections (e.g. amphibian and reptile run overs along the main road No. 2 between Hont and Parassapuszta).

The planned M2 motorway will lead through a diverse, transition landscape Nógrád basin and on the peripheries of the Börzsöny Mountain and cross the Ipoly valley. The landscape is crossed by several watercourses representing the most important ecological corridors connecting the core areas. The most dominant feature of the hydrography

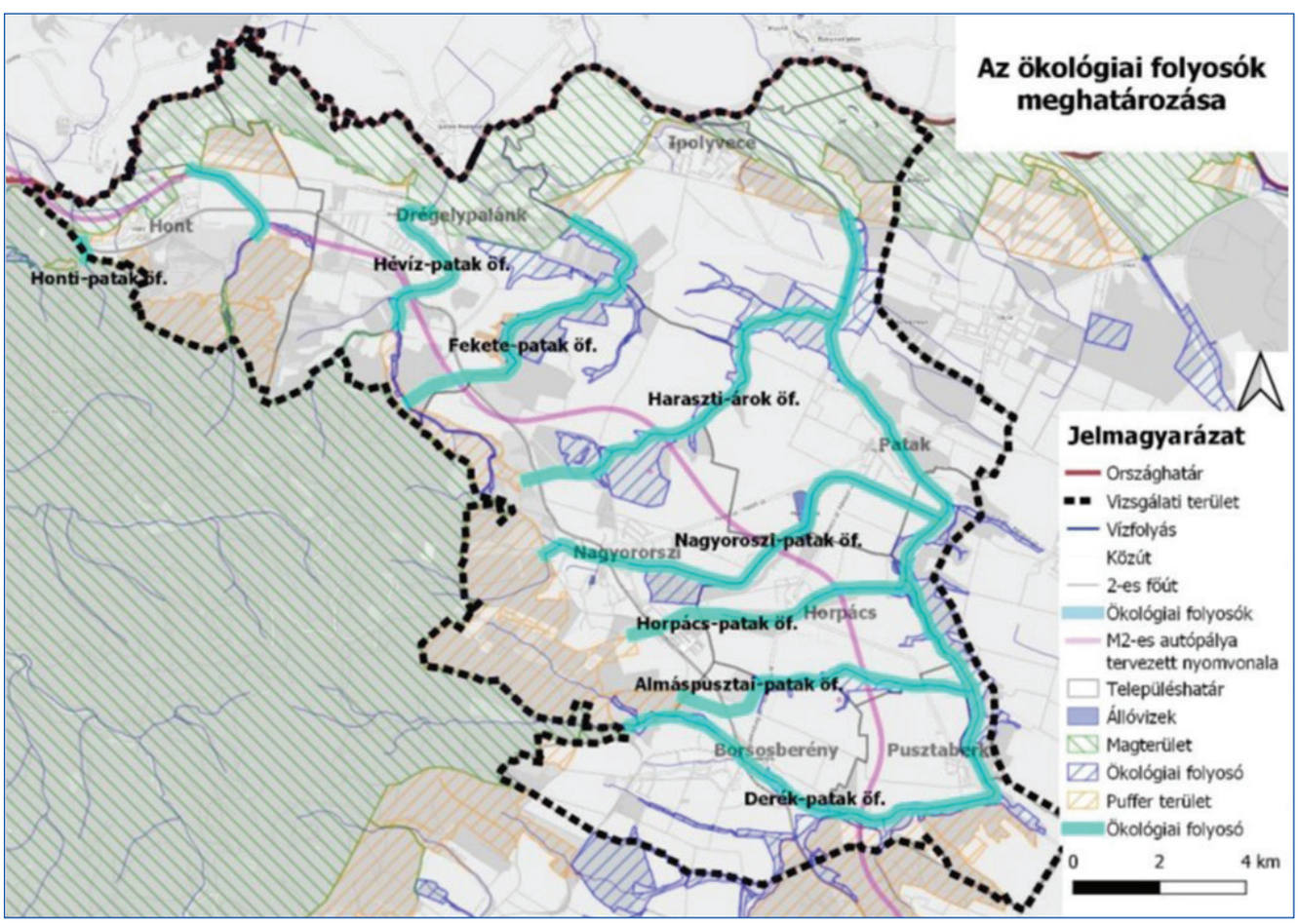


Figure 18 Blue infrastructure lines – watercourses crossing the planned M2 motorway, and ecological core areas of Börzsöny, Ipoly valley and ecological buffer zones and corridors (Zsombor Bányai, 2021)

of the area is the Ipoly River, and the most important streams in the area include the Csitár-stream, Hévíz-stream, Vargatói-stream, Fekete-stream, Derék-stream, Haraszti-ditch, Nagyoroszi-stream and Bernecei-stream. Of these, the Csitár stream, the Hévíz stream, the Fekete stream and the Derék stream and its tributaries flow directly into the Ipoly. Some of the watercourses originate from springs on the Börzsöny side in the Hont area and flow northwards into the Ipoly River, while others originate in the Nagyoroszi area and flow northwards towards Drégelypalánk and eastwards and north-eastwards towards Patak and Ipolyvece.

The most important critical sections of the planned M2 are the crossing zones of the above mentioned watercourses. The following text gives recommendations for mitigating the barrier effect of the planned motorway.

We created a new system for evaluating ecological corridors that can be used to determine their value and importance, and, where appropriate, the type and location of the wildlife mitigation measures.

Firstly, we identified the "target" animal groups and species occurring in the area, which is a total of 13 animal species. Then we defined their needs according to the six given criteria, such as their demand for vegetation or how well they tolerate disturbance. Following that, we examined the properties of ecological corridors. The following 6 aspects were identified: corridor length, width, vegetation, water presence, continuity, and surrounding land use or confusion. We compared these values with the needs of animals and examined how suitable a particular property of a corridor is for different animal species. Here we defined 4 values: S1, S2 S3, and S4; where S1 is the most suitable and S4

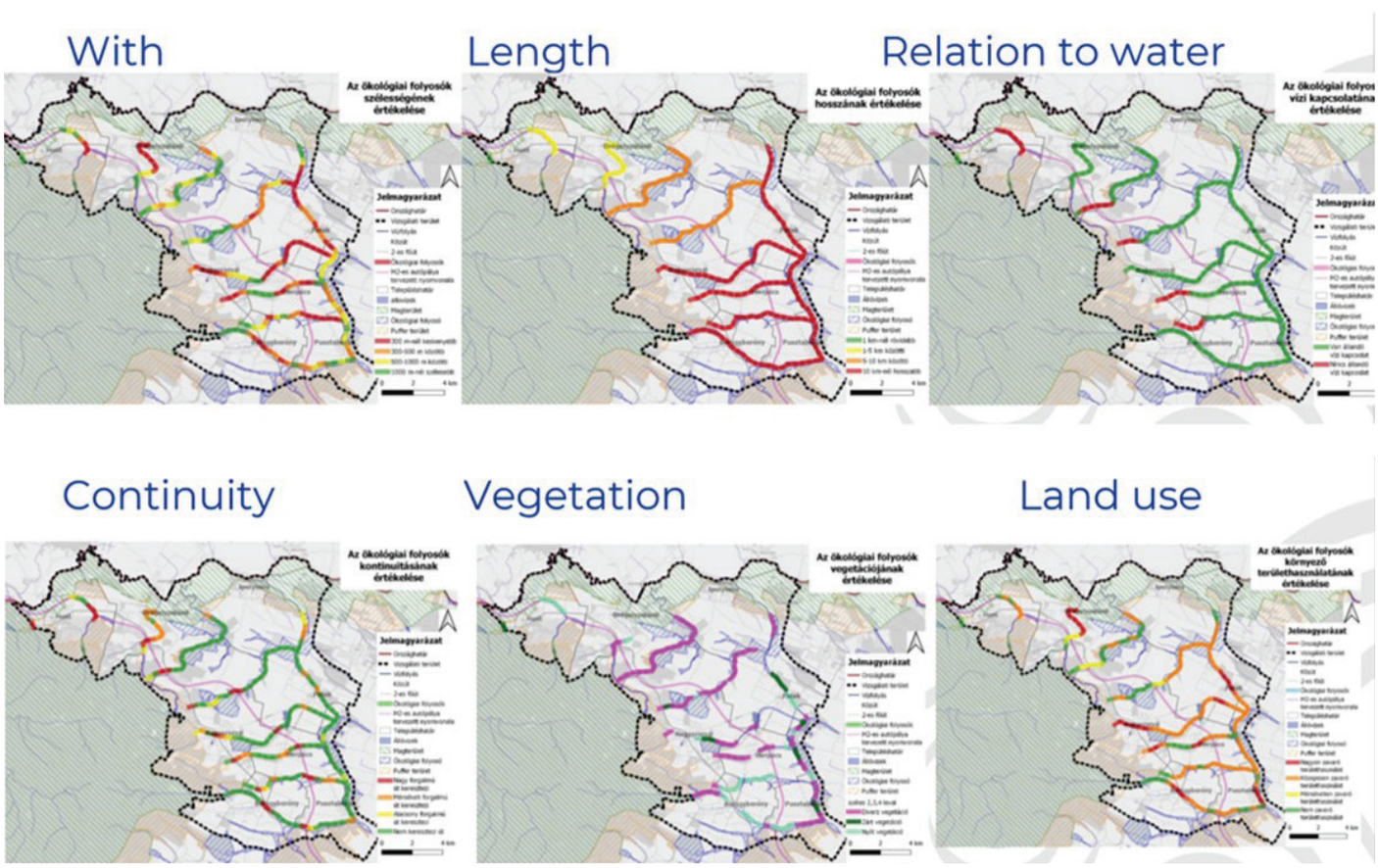


Figure 19 Evaluation of ecological corridors along the watercourses

is the most unsuitable. We averaged the values by animal species and illustrated the results in a summary table that shows which animal species are best suited to use the corridor. We aggregated the data using a GIS system to locate the ecological gateways along the route of the M2 highway. Finally, we identified suggestions for the type of gateway by comparing the characteristics of the ecological corridors and the needs of the animal species that define the area.

2.2.1 Description of the area No. 1: M2 segment near the Hont municipality, Ipoly valley

Threat 1: New Transport and other Linear Infrastructure (TLI*) projects may increase the barrier effect at landscape level.

Specific objectives:
1.1 Maximise the functionality of underpasses (all objects)

1.3 Assign legal status and develop coherent regulations for all objects which are potential wildlife passages

The area in question represents an important bio-corridor and core habitat. The planned section of the M2 motorway between Vác and the border between Rétság and the border may affect the Special Nature Conservation Area (KjTT-SCI) Ipoly Valley (HUDI20026) and the Special Birds Protection Area (KMT-SPA) Ipoly valley (HUDI10008). The effect zone of the proposed project (125-125 m from the axis) overlaps with the western edge of the two Natura 2000 sites on the outskirts of Hont, between sections 19+000-23+363 km of the Rétság-Border section.

Natura 2000 sites in the Hungarian region:

1. Birds protection Directive Site, Ipoly valley, (SPA) (HUDI10008),

The site is composed of various habitats: the most important parts are the unregulated

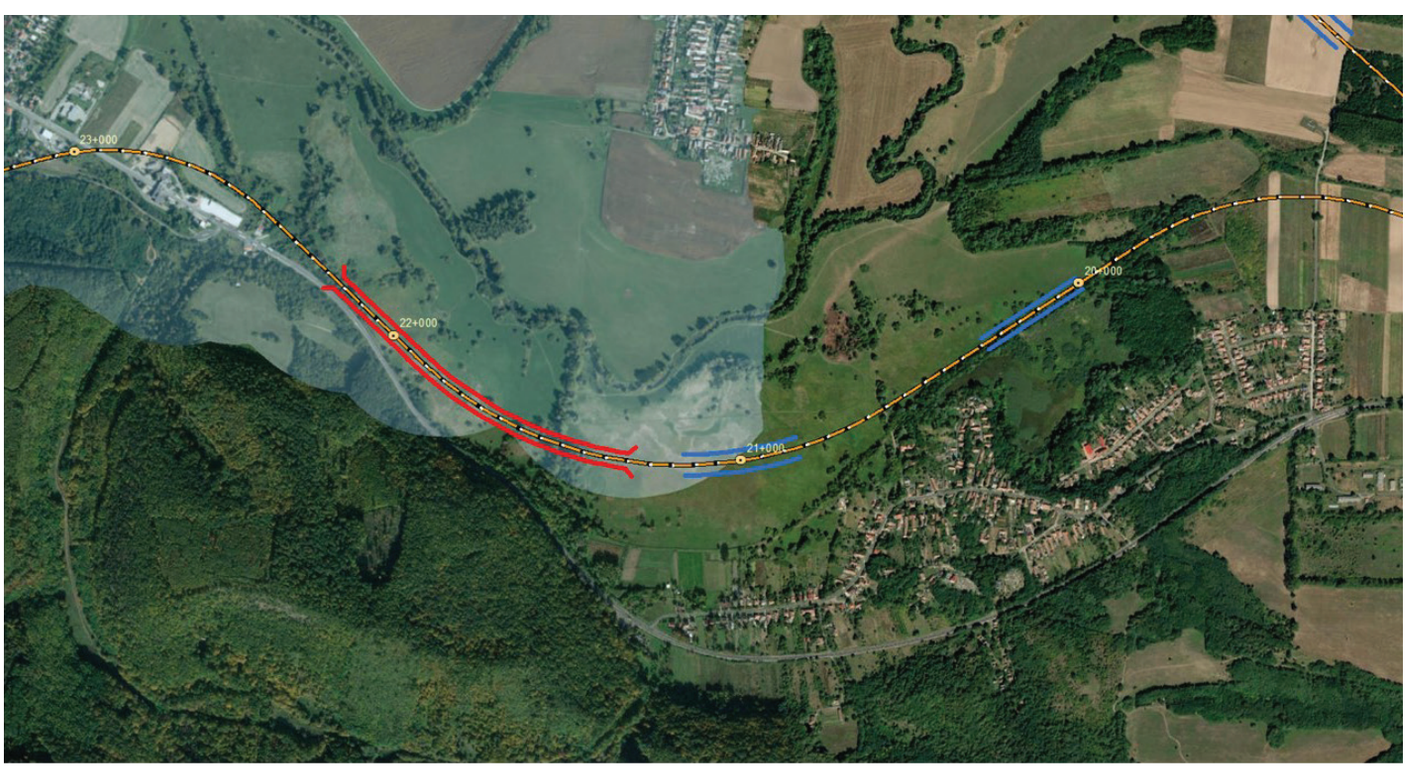


Figure 20 The planned M2 motorway line in Ipoly valley ©MATE

section of River Ipoly and the floodplain area with different riverside terrains and diverse birdlife. Species that prefer wet meadows are present in significant numbers in the area. The corncrake population (Crex crex) is of global importance, with similar numbers (20-40 pairs) on the Slovak side of the river (Heath & Tucker, 2000).

2. Habitats Directive Site, Ipoly valley (HUDI20026)

- Habitat types of Community importance:
  - 6440 *Cnidion dubii* river valley marshes,

- Habitat types of Special Community importance:
  - 6260 Pannonian sand grasslands,
  - 91E0 Mild alder (*Alnus glutinosa*) and tall ash (*Fraxinus excelsior*) woodland (*Alno-Padion, Alnion incanae, Salicion albae*)

The planned motorway in the affected Natura 2000 section (between Drégelypalánk-Hont and the border of Hungary) is typically designed with embankment heights between 0-3 m and 3-5 m. The planned embankment heights for each section are briefly summarised below:

19+000-19+560 km: embankment height between 0-3 m;

19+560-20+510: embankment height between 3 and 5 m;

20+510-21+300 km: embankment height between 0-3 m;

21+300-22+200: structure CÖ7;

22+200 km to 22+385 km: embankment height between 3-5 m;

22+385 -22+420 km: 0-3 m embankment height;

Figure21 The Ipoly River in this region represents the most natural riversection in Hungary ©MATE

22+420 - km 22+475: notch;

22+475 - 22+560 km: 0-3 m embankment height. (VIBROCOMP – BOKÚT-TERV KONZORCIUM, 2015)

The ex lege alder floodplain wetlands in the floodplain of the Ipoly River within the project area are ecologically important habitat patches. The proposed route directly crosses a patch of valuable ex lege alder marsh within the floodplain of the Ipoly River, which is protected by the Habitats Annex. To the north of the interior of Hont, it directly crosses a forest patch of 5,205 m^2 covering approximately 2,900 m^2 and a patch of 1,276 m^2 covering approximately 347 m^2. (VIBROCOMP – BOKÚT-TERV KONZORCIUM, 2015)

Mitigation of negative impacts:

- Habitats will be lost during the construction of the M2 motorway; to compensate for this, grassland and arable land within the planning area has been identified as suitable for conversion to valuable habitats.

- Along the Ipoly River, the complexity of the problem requires complex habitat rehabilitation. To preserve and maintain sensitive grassland and biodiverse habitat communities, a viaduct would be the most appropriate on the whole sensitive section, with the potential for a landscape bridge underneath.

- Construction will still cause major damage to the habitat, so ecologically the most optimal option would be to modify the track.

- Minimise disturbance under construction.

- Minimize barrier effect by underpasses of appropriate size, the plans foresee a structure CÖ2-CÖ7 and a potential CÖ8 (see details below). (VIBROCOMP – BOKÚT-TERV KONZORCIUM, 2015)

- In order to mitigate the expected land and habitat occupation along the section of the route crossing Natura 2000 sites, a reduced cross-section design is planned for the section between 19+750-22+250 km. The roadway embankment will be constructed at a gradient of 1:1.5, with the drainage ditch and the expropriation boundary line, if any, to be constructed at the base of the embankment, together with a maximum width of 2 m from the contour of the embankment. Considering the expected embankment heights of between 3 and 5 m on this stretch, the estimated occupation of the area could be up to the maximum width of 45.6 m. (VIBROCOMP – BOKÚT-TERV KONZORCIUM, 2015)

- In order to prevent the spread of invasive species, the new road will require grassing of gullies and unpaved ditches adjacent to the Natura 2000 site, and the follow-up maintenance of the gullies by mowing at least twice a year.

- Mobile fencing is required along the boundary of the expropriation area during construction works in sections of the trail affecting candidate habitats to protect the habitats.

- In the vicinity of wetland areas, such as crossing channels or temporarily flooded grassland due to wet winter and spring, it is recommended that works are carried out between October and March to protect amphibians and birds that may be present.

- To protect breeding birds, trees and shrubs should only be felled outside the growing season (30 September to 10 March).

- The plans foresee bird protection walls to be constructed at the crossing of the Ipoly valley to reduce and eliminate the risk of hit-and-run of bird species potentially occurring in the area in the following km section:

- 20+000-20+500 km No (bird protection wall on the right-hand side of the road as sectioned)

Table 3 Types and size of structures to mitigate barrier effect in the Ipoly valley

Number of structure	Location km section	Type	Length (m)
Cö2	19+850	medium mammal passage	2.2 x 2.2
Cö3	20+000	frog and small mammal passage	2.2 x 1.7
Cö4	20+125	frog and small mammal passage	2.2 x 1.7
Cö5	20+250	medium mammalian gateway	22 x 2.2
Cö6	20+500	frog and small mammal passage	2.,2 x 1.7
Cö7	21+300		
22+200	lifting on pillars (min. 4 m height) - viaduct	900	
Cö8	20+850 21+500	lifting on pillars (min. 2 m hight) - viaduct	300

(VIBROCOMP – BOKÚT-TERV KONZORCIUM, 2015)

- 20+800-21+800 km (bird protection wall on both sides of the road as sectioned)

For the minimum follow-up period of 3 years, monitoring is necessary to assess the effectiveness of the measures proposed to mitigate the threats to the species described above. If any of the structures lack the desired effect, future proposals should be made and implemented to either rebuild the structures or to find ways to eliminate the negative effects. The methodology for monitoring studies should be developed in the light of future requirements of the nature conservation authority and applied.

2.2.2 Description of the area No. 2: M2 segment near the Hont municipality, Csitári-stream

Threat/Pressure 1: New Transport and other Linear Infrastructure projects may increase the barrier effect at landscape level.

Specific objectives:
1.1 Maximise the functionality of underpasses (all objects)

1.3 Assign legal status and develop coherent regulations for all objects that form potential wildlife passages

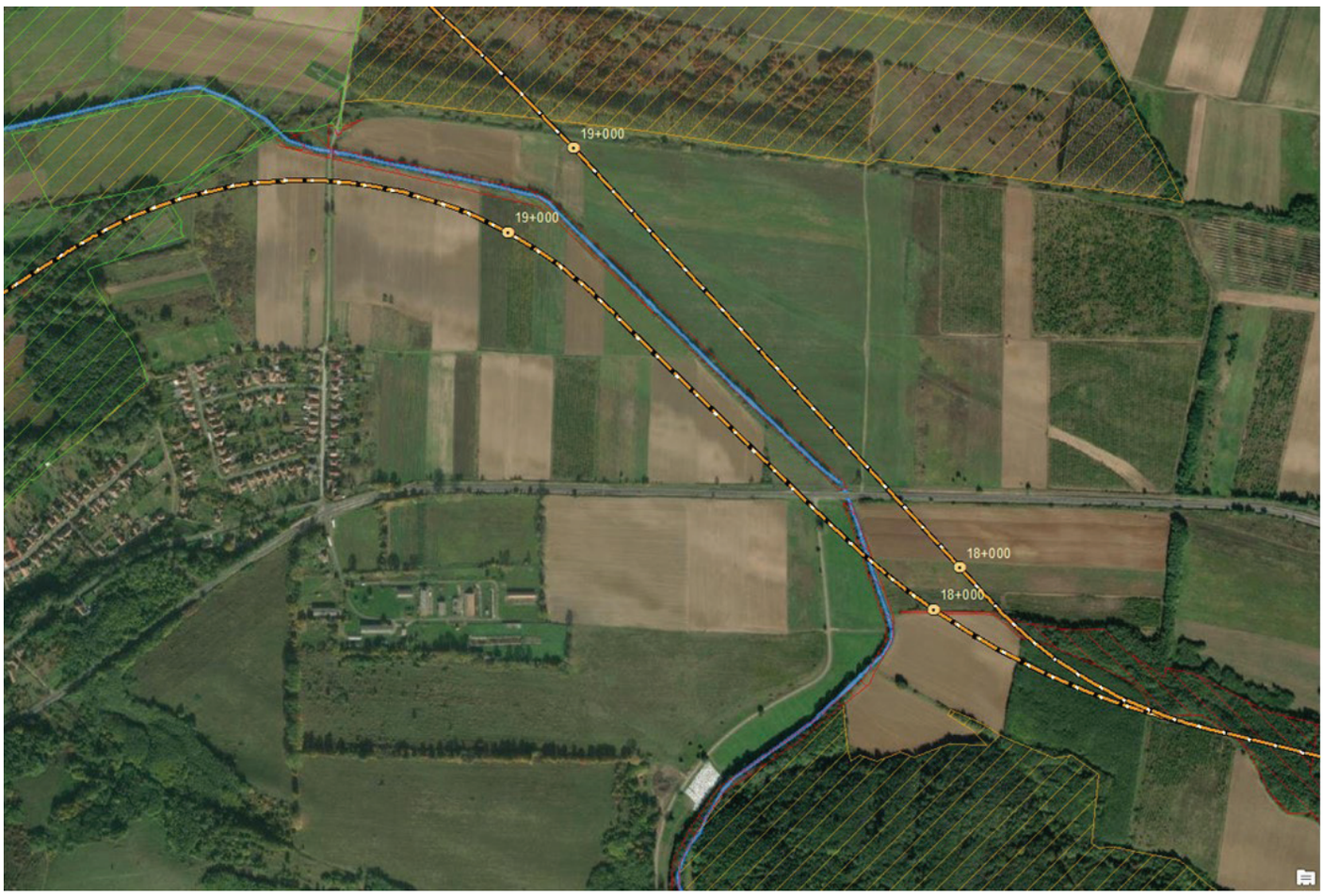


Figure 22 Csitári-stream ©MATE

The area in question represents an important bio-corridor. The characteristics of an ecological corridor:

The length of an ecological corridor is about 2,600 m. The Csitári stream is currently an intermittent watercourse. Only after heavy rainfall is there water found in the ditch.
The topography is flat. The average width of vegetation is well below 300 m; commonly about 100 m. It is rarely connected to a larger area of permanent vegetation. The vegetation is dominated by floodplain herbaceous vegetation with mosaic-like clearings. Its continuity is moderated by the main road No 2. The culvert located here cannot be categorised as an ecological gateway, and no evidence of its use was found during the surveys. Of the surrounding land uses, ploughland is the most prevalent. There are no settlements or roads in the vicinity due to the high proportion of arable land, which is defined as a disturbed and easily accessible corridor.

Suggested measures:
No passage for animals is planned at the stream crossing. To improve permeability, construction of an underpass for large animals is proposed.

Rehabilitation of the watercourse is suggested, including the restoration of the riverbed to its natural state, planting vegetation, restoration with environmental engineering methods, restoration of buffer zones and establishing practices to monitor the Sampling points.

Figure 23 Planned M2 crosses Hévíz-stream with planned underpass and retaining wall ©MATE

2.2.3 Description of the area No. 3: M2 segment near the Drégelypalánk municipality, Hévíz-stream

Threat/Pressure 1: New Transport and other linear infrastructure projects may increase the barrier effect at landscape level.

The length of the ecological corridor is about 4,200 m. Its width is almost the same as the width of the watercourse along its entire length. More extensive vegetation is only found in the southern part. It runs through a populated area, so it is subject to strong anthropogenic influence and is easily accessible. The topography is flat. Its continuity is moderated by the main road 2 and the settlement of Drégelypalánk.

Suggested measures:

- To improve permeability, construction of an underpass for large animals is proposed.
- Rehabilitation of the watercourse is suggested, including the restoration of the riverbed to its natural state, planting vegetation, restoration with environmental engineering methods, restoration of buffer zones and establishing practices to monitor the Sampling points.

Table 4 Planned parameters of bridge above Hévíz-streamv

Nr	Starting section (km sz.)	Ending section (km sz.)	Length of the bridge (m)	Mechanical support	Number of pillars (darab)
C11	15+085	15+580	495	25+10*45+20	11

(VIBROCOMP – BOKÚT-TERV KONZORCIUM, 2015)

Table 5 Planned parameters of retaining wall

Nr	Starting section (km sz.)	Ending section (km sz.)	Length of the bridge (m)	Max. depth (m)	Type
TC6	14+710	14+960	250	22	Two-storey: pile wall/single-element retaining wall

(VIBROCOMP – BOKÚT-TERV KONZORCIUM, 2015)

2.2.4 Description of the area No. 4: M2 segment Fekete-stream

Threat/Pressure 1: New Transport and other Linear Infrastructure projects may increase the barrier effect at landscape level.

Specific objectives:
1.1 Maximise the functionality of underpasses (all objects)

1.3 Assign legal status and develop coherent regulations for all objects that form potential wildlife passages

The ecological corridor is about 8,600 m long. Its width varies between 2,700 m and 300 m. The average width is about 1,000 m. There is no full length water connection between the two core areas, so there is no culvert. Its topography is flat. The vegetation is diverse and surrounds the stream on both sides, with both closed and open vegetation types. The surrounding land uses are dominated by arable land with no residential areas. Its continuity is moderated by the main road 2. It is difficult to access due to its wide vegetation cover and, therefore, has a low level of disturbance.

In our research we performed a detailed analysis regarding the suitability for different species of ecological corridors. Just as an example, see below the assessment of the Fekete stream.

The Fekete-stream is the most favourable for small and medium-sized mammals, reptiles and large game and the least favourable for amphibians.

Suggested measures:
- No underpass is planned. Proposed ecological crossing type: overpasses, as it focuses on large game, small and medium-sized mammals and reptiles.

- Rehabilitation of the watercourse is suggested, including the restoration of the riverbed to its natural state, planting vegetation, restoration with environmental engineering methods, restoration of buffer zones and establishing practices to monitor the Sampling points.

Table 6 Assessment of the Fekete stream as ecological corridor for different animal species (Source: Zsombor Bányai)

Animal groups	Species	Width	Length	Vegetation	Land use	Water	Continuity	Suitability	Overall suitability
Large mammal	Red deer	S3	S1	S1	S2	S0	S1	S1,6	S1,6
	Wild boar	S1	S1	S0	S1	S2	S1	S1,2	
	Common lynx	S3	S1	S2	S2	S0	S2	S2	
Small and medium-sized mammals	European hedgehog	S1	S2	S2	S1	S0	S2	S1,6	S1,6
	Otters	S1	S2	S2	S2	S3	S2	S2	
	Red fox	S1	S2	S0	S1	S0	S1	S1,2	
Amphibian	Common toad	S1	S3	S1	S1	S2	S2	S1,6	S2
	Newts	S3	S3	S2	S2	S3	S2	S2,5	
Reptile	Green lizard	S1	S3	S1	S1	S0	S2	S1,6	S1,6
	Aesculapian snake	S1	S3	S1	S1	S0	S2	S1,6	
Fish	Gudgeon	S1	S2	S2	S1	S3	S1	S1,7	S1,8
	Spined loach	S1	S2	S0	S1	S3	S1	S1,6	

***S1, very suitable**: a corridor that does not restrict the movement of animals, nor has minor restrictions that do not significantly affect the movement of animals. This value is given if the animal's needs are fully equal to or below the average value of the corridor (e.g. the brown toad will be satisfied with a narrower corridor, but will still be satisfied with a wider one).*

***S2, moderately suitable**: a corridor with overall constraints that are moderately severe for the animal. This score is given if the animal's needs are only moderately met, but it can still use the corridor. For example, for the green lizard, which prefers open vegetation, it is diverse vegetation, as it has the open space it needs, but also patches of woody vegetation.*

***S3, marginally suitable**: corridor with overall severe limitations for animals. S3 is generally found in categories with a "sufficient" value. E.g. "Sufficient" landscape use is highly disturbing to the common lynx, so it is marginally suitable only for the corridor.*

***S4, Unsuitable**: a corridor with features that preclude passage of animals. E.g. lack of water environment for fish, excessive disturbance, or an insurmountable barrier in the continuity category.*

***S0, neutral value**: used where the animal has no preference in the category (e.g. a roe deer uses a corridor with water as much as without water).*

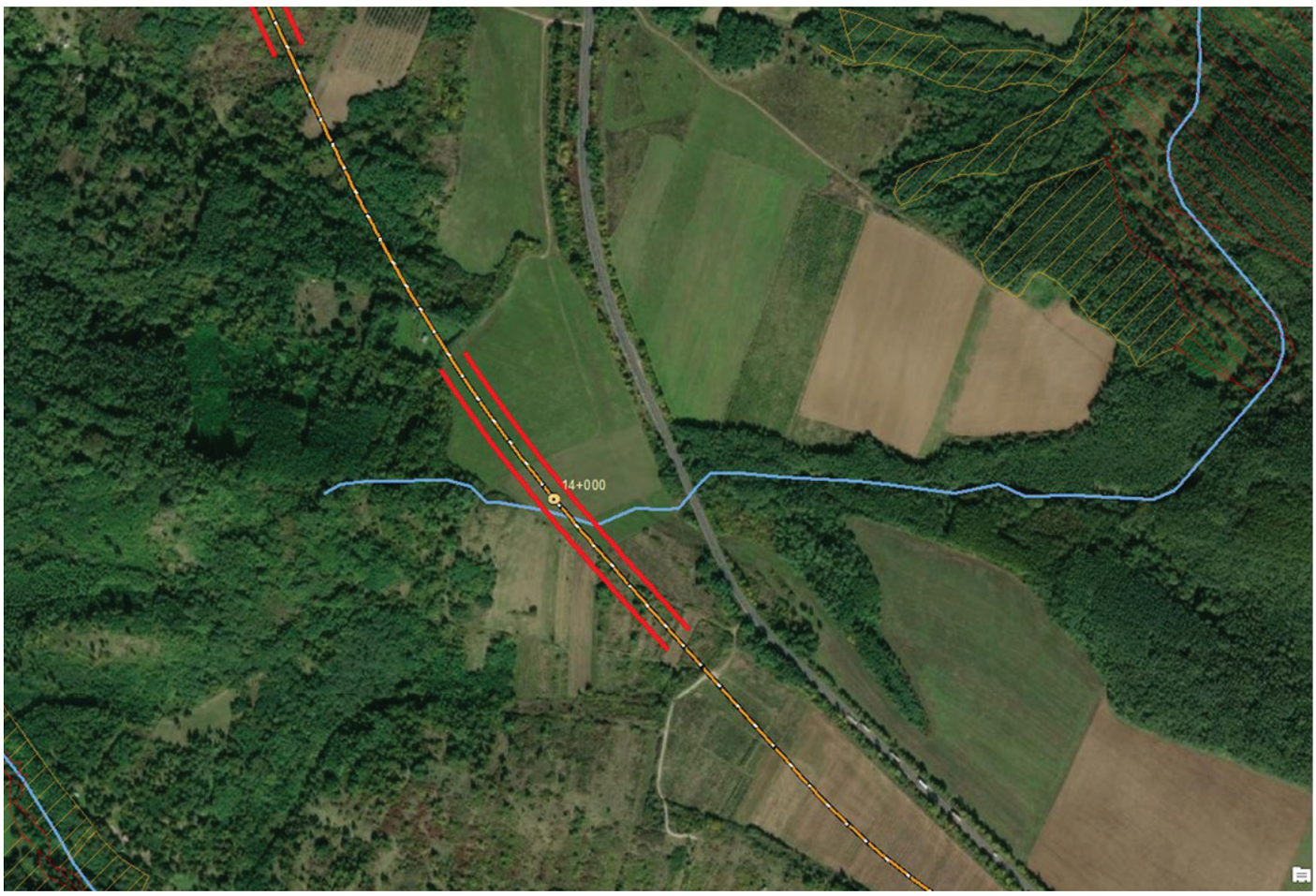


Figure 24 Planned M2 motorway crosses the Fekete-streem ©MATE

Table 7: Planned structure:

Nr	Starting section (km sz.)	Ending section (km sz.)	Length of the bridge (m)	Max. depth (m)	Type
TC5	13+750	14+230	480	16	pile wall/single-element retaining wall

Nr	Starting section (km sz.)	Ending section (km sz.)	Type	Length (m)
Cö1	13+750	13+900	Overpass	150

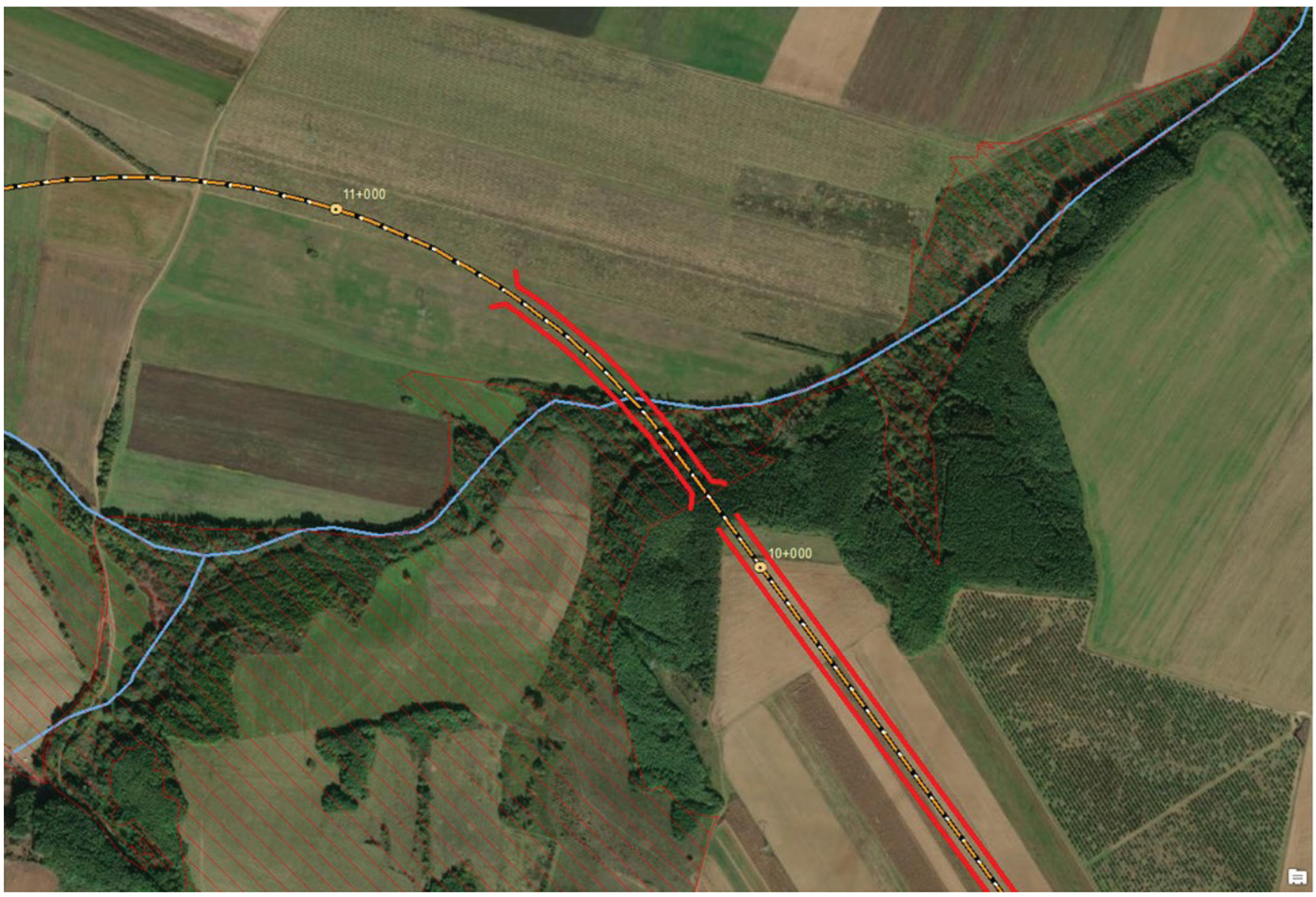


Figure 25 Planned M2 motorway crosses Haraszti-árok ©MATE

2.2.5 Description of the area No. 5: M2 segment crossing Haraszti-árok (ditch)

Threat/Pressure 1: New Transport and other linear infrastructure projects may increase the barrier effect at landscape level.

Specific objectives:
1.1 Maximise the functionality of underpasses (all objects)

1.3 Assign legal status and develop coherent regulations for all objects that form potential wildlife passages

The ecological corridor is about 12,000 m long. Its width varies between 1,400 and 50 m with an average width of about 500 m. It does not have a full length water connection between the two core areas, so there is no culvert. Its vegetation is diverse, with both closed and open vegetation types in almost equal proportions. Its continuity is moderated by plough fields and the main road No 2, and it does not affect inhabited areas. Surrounding land uses are dominated by arable land, but there is also a mosaic of orchards. The high proportion of ploughland means that it is considered to be disturbed.

The Haraszti-árok (Ditch) as ecological corridor is the most favourable for large mammals and the least favourable for amphibians.

Rehabilitation of the watercourse is suggested, including the restoration of the riverbed to its natural state, planting vegetation, restoration with environmental engineering methods, restoration of buffer zones and establishing practices to monitor the Sampling points.

Table 8 Proposed bridge

Nr	Starting section (km sz.)	Ending section (km sz.)	Length of the bridge (m)	Mechanical support	Number of pillars
C9	10+175	10+655	480	35+9*45+40	10

(VIBROCOMP – BOKÚT-TERV KONZORCIUM, 2015)

Table 9 Retaining wall

Nr	Starting section (km sz.)	Ending section (km sz.)	Length of the bridge (m)	Max. depth (m)	Type
TC4	9+160	10+100	940	18	pile wall/single-element retaining wall

(VIBROCOMP – BOKÚT-TERV KONZORCIUM, 2015)

2.2.6 Description of the area No. 6: M2 segment crossing the Nagyoroszi-stream

The Nagyoroszi stream

Specific objectives:
1.1 Maximise the functionality of underpasses (all objects)

1.3 Assign legal status and develop coherent regulations for all objects that form potential wildlife passages

The ecological corridor is about 19,000 m long. Its width varies between 1,200 m and 50 m, with a typical width of about 200 m. Its vegetation is predominantly of a closed type, with a sub-minimum vegetation band in some sections. Its continuity is moderated by plough fields, the main road No 2, the villages of Nagyoroszi and Patak. The culvert here cannot be categorised as an ecological crossing, but it does provide an opportunity for small groups of animals (amphibians, fish, small and medium-sized mammals, reptiles). Its cross-section is trapezoidal, 1.5-2 m in height. The surrounding land uses are dominated by arable land, but there is also a high proportion of inhabited land. The high proportion of arable and residential land makes the corridor appear disturbed and easily accessible.

The Nagyoroszi stream is the most favourable for fish and the least favourable for amphibians. The proposed eco-passage type: underpass for large mammals, as it provides longitudinal stream crossing for all aquatic and semi-aquatic species.

Rehabilitation of the watercourse is suggested, including the restoration of the riverbed to its natural state, planting vegetation, restoration with environmental engineering methods, restoration of buffer zones and establishing practices to monitor the Sampling points.

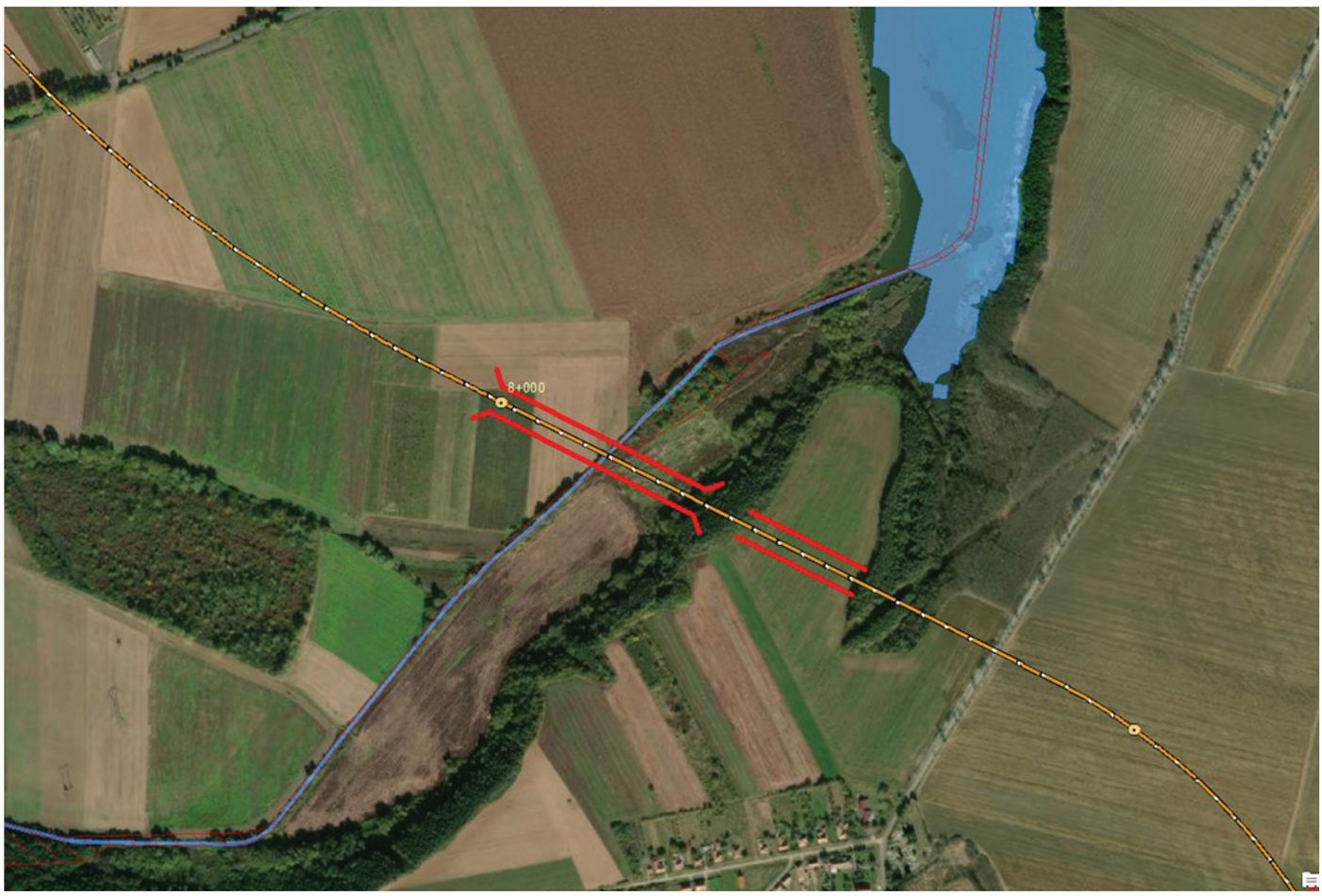


Figure 26 Planned M2 motorway crosses the Nagyoroszi-stream ©MATE

Table 11 Proposed bridge

Nr	Starting section (km sz.)	Ending section (km sz.)	Length of the bridge (m)	Mechanical support	Number of pillars (darab)
C8	7+690	8+010	320	25+6*45+25	9

(VIBROCOMP – BOKÚT-TERV KONZORCIUM, 2015)

Table 12 Retaining wall

Nr	Starting section (km sz.)	Ending section (km sz.)	Length of the bridge (m)	Max. depth (m)	Type
TC3	7+440	7+620	180	12	pile wall/single-element retaining wall

(VIBROCOMP – BOKÚT-TERV KONZORCIUM, 2015)

Summary

According to the permission of 2018, animal-crossings are mainly located in the northern part of the area between the crossing of the two core areas. A total of 4 types of crossings are proposed: 2 viaducts at 20+850-21+150 km and 21+300-22+200 km; 2 small and medium sized mammal crossings at 20+250 and 19+850 km; 3 eco-crossings for amphibians at 20+500, 20+125 and 20+000 km; and 1 big game crossing above roads 13+750-13+900 km. Most of the crossings cover the ecological corridors and the intersection of the planned motorway.

However, there are also places where an animal crossing is missing. An example is the Hévíz creek ecological corridor, where there is no animal crossing planned, although it represents a valuable link between the two core areas. The route of the M2 runs through the core area of the Ipoly River basin where two viaducts and embankment are planned, even though the embankment will cause disturbances in the water flow system of the valley. On the whole sensitive section viaduct would cause the least disturbance, even though it also has negative effects during construction.

It is also necessary to provide a crossing of the creek Hévíz in the form of a big game crossing under the road. Above the creek Fekete an overpass is planned, but according to our research related to the watercourse, an underpass for large game would be more favourable. In case of all watercourses, an animal crossing would be the best ecological solution.

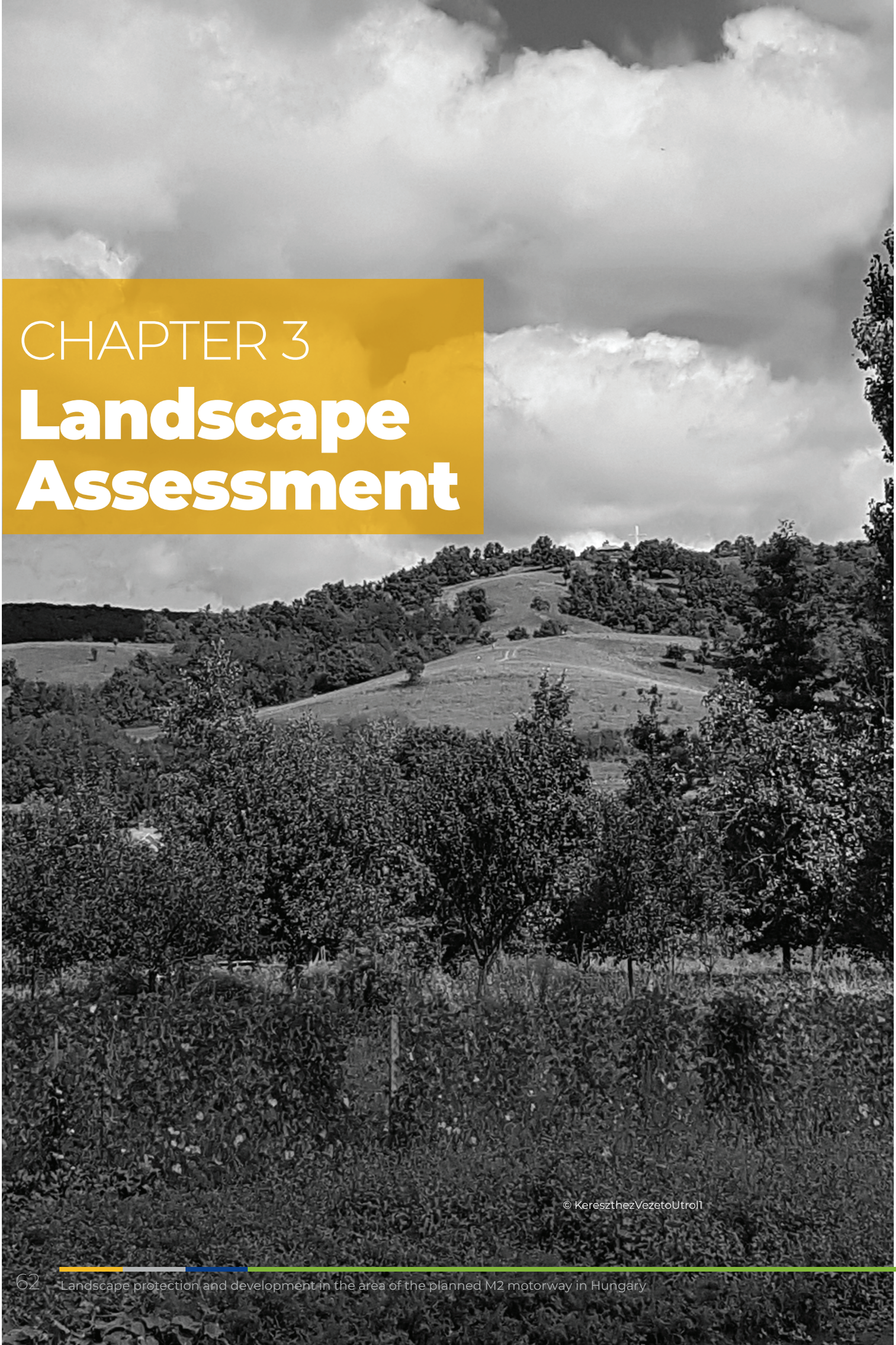
2.2.7 Description of the area No. 6: road No. 2 segment crossing Hévíz-stream

2. Structural interventions on the existing Transport and other Linear Infrastructure (TLI) (maintenance, upgrading without changing the category/class of the infrastructure etc.) and on other linear features may increase the barrier effect at landscape level.

2.3. Safeguard the longitudinal permeability of rivers (including the enhancement of permeability of existing features, when possible)

Figure 27 Road No. 2 crossing of the Hévíz-stream with an inappropriately sized culvert on Google Earth

Figure 28 Road No. 2 crossing of the Hévíz-stream with an inappropriately sized culvert



CHAPTER 3
Landscape Assessment

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Land use conflicts include erosion, deflation, inland water, and fragmentation. These mainly natural processes can be exacerbated by human activity, which can occur due to inappropriate land uses in areas at risk.

3.1 Land use conflicts

3.1.1 Erosion

Erosion is the work of rainwater in the narrow sense, water and ice in the broader sense, and all surface forces in a general sense, in destroying the surface. The degraded material is carried away by water (etc.) and deposited more or less far from its place of origin: the process of deposition is accumulation.

The majority of the area falls into a moderately sensitive category in terms of erosion risk. (The least sensitive areas are located along the Ipoly River, east of Ipolyvece, west of the inner area of Nagyoroszi and south of the inner area of Drégelypalánk. Highly sensitive locations are in the area only observed in few spots: in the mountainous valley areas of Börzsöny, along the road No. 2 and in the higher areas of Börzsöny. A comparison of the map with the contour lines clearly shows the correlation between the slope of the area and its susceptibility to erosion; the steeper the area, the greater the risk of erosion.

3.1.2 Deflation

Deflation is wind-induced erosion that occurs on land surfaces with little or no vegetation. Areas at high risk of deflation are mainly found in Ipolyvece, Patak and Nagyoroszi. In Drégelypalánk, only less vulnerable but large areas are found, and in Hont, only a small deflation-affected patch is observed at the end of Szondy Street. The soil types most exposed to deflation are humic sandy soils and Ramann brown forest soils. The deflation risk range of 1 to 8 on a scale of 7 (less vulnerable) and 8 (highly vulnerable).

3.1.3 Risk of inland water

Inland waters are standing waters that are caused by major rainfall events, sudden snowmelt or rising groundwater levels. It cannot drain away naturally because the free pores in the top layer of soil become saturated with water. If inland water is present for a prolonged period, it causes damage to agriculture by damaging the roots of crops in a permanently wet medium.

Due to the presence of the Ipoly River in the region, there are major areas of inland water, mainly in the north. The most extensive areas at risk of flooding are located in Drégelypalank and Hont.

3.1.4 Fragmentation

Fragmentation is the process of loss and fragmentation of habitats (INT-09). In

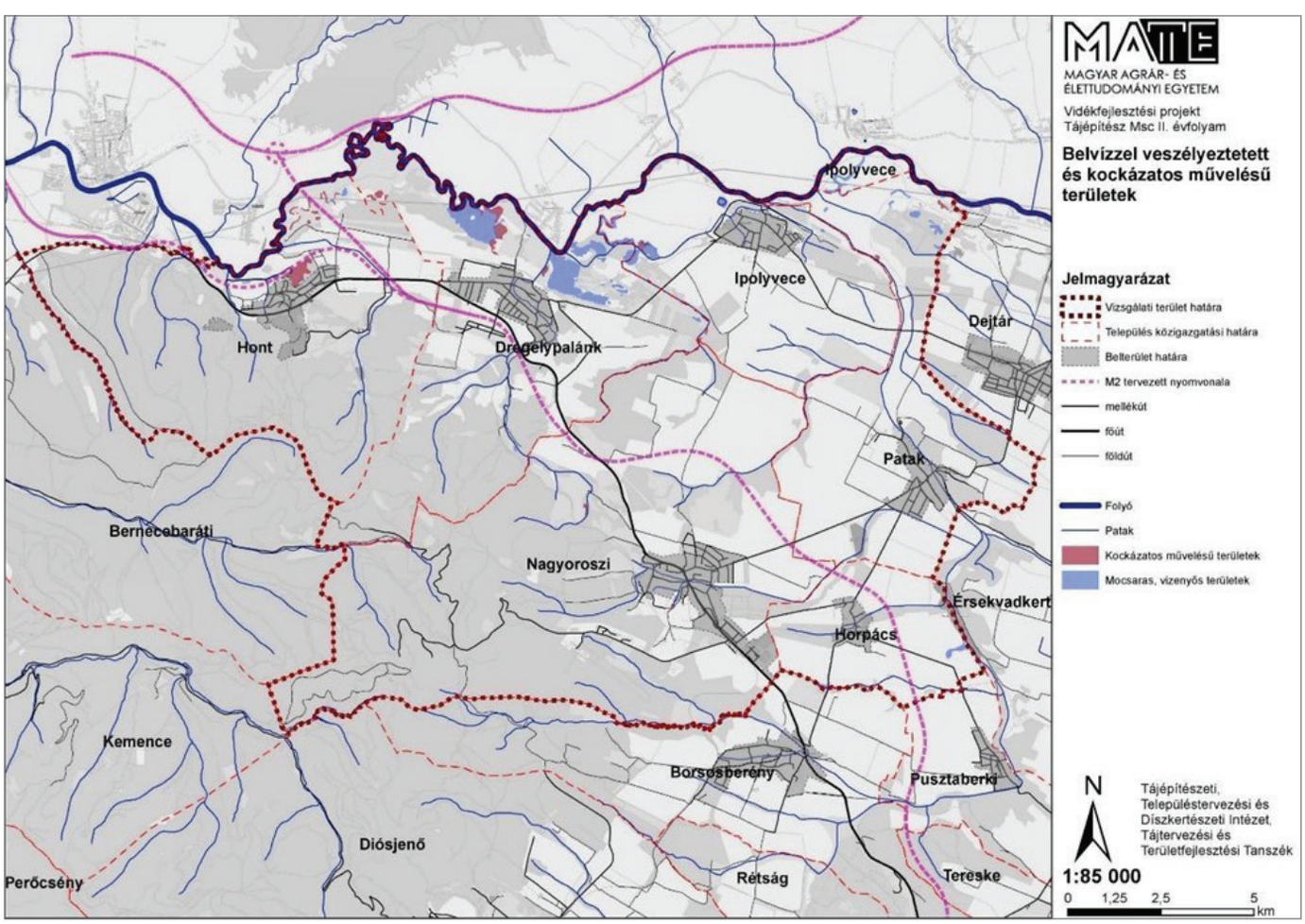

Figure 29 Wetlands, and temporarily flooded areas ©MATE

examining the fragmentation we have considered the extent to which current land uses are divided by linear features, such as paved and dirt roads and railways. Thus, we found that the smallest land use “fragments” range from 0 to 23.7 hectares, while the largest land uses, such as the forests in the Börzsöny, range from 691.81 to 1,377.8 hectares.

Due to the planned motorway route, 5 stream crossings will take place in the municipality of Hont. The route will affect grassland areas along the Ipoly River, as well as core and buffer areas of the National Ecological Network, Natura 2000 sites and Ramsar sites. The new route will cause extensive ecological damage, ecosystem change and fragmentation, with irreversible effects. There will also be a stream crossing in Drégelypalánk and the disappearance of an entire tree allée. The destruction of the Szondi tree allée is not only ecologically significant, but also has cultural and historical implications. The fragmentation will have a very significant impact between Drégelypalánk and Nagyoroszi, as there is an ecological corridor between the Börzsöny upland and the grasslands along the Ipoly River. This section includes a stream and tree allée. This is likely to result in the loss of ecological connectivity. Two further dangerous sections have been identified in the area of Nagyoroszi, where stream cuts and tree allée removal will be necessary. In addition to the degradation of ecological links, the new trail will also cause significant damage to the landscape. Landscape impacts can be partially mitigated.

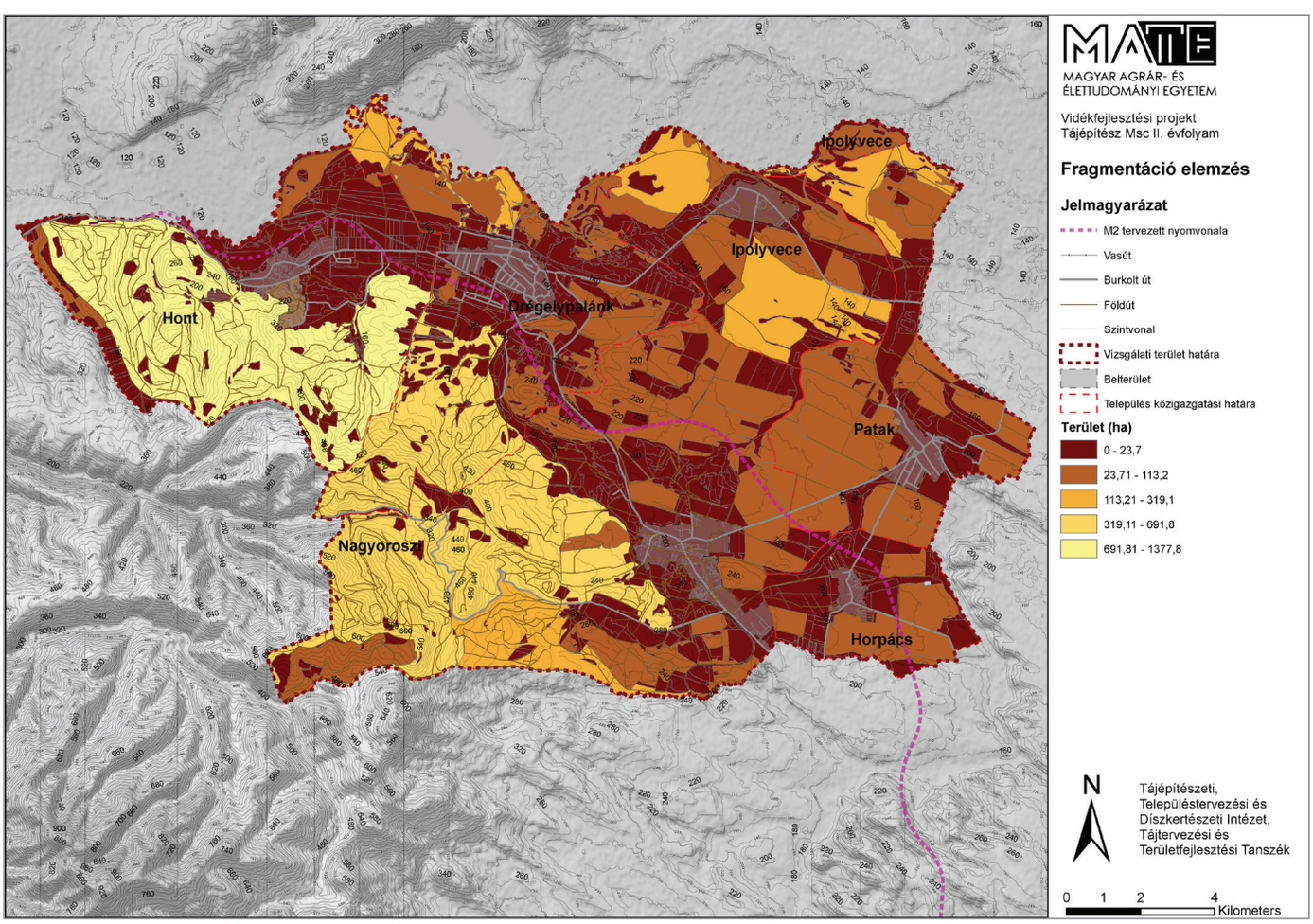

Figure 30 Level of landscape fragmentation ©MATE

3.1.5 Conflicts and problems of green infrastructure elements

By grouping the explored problems together, we can clearly identify the main areas in need of green infrastructure development and landscape rehabilitation.

The study area is crossed by the Road No. 2, which causes very significant land use, environmental and other conflicts. While it does not pass through the internal areas of Hont and Drégelypalánk, Avoiding built-up areas by 20-200 m, it functions as the main road of the municipality of Nagyoroszi. In all three municipalities, it causes significant noise, dust, air pollution and increased vibration. The main problem is the level of traffic noise, which is exacerbated by the poor technical condition of the roads. Another problem with the main road No. 2 is the lack of wildlife crossings/ecological crossings, which in their absence leads to fragmentation and very serious animal hit-and-run situations.

The vulnerability of the area to anthropogenic impacts was assessed, considering areas under protection, areas sensitive to erosion and deflation and surface water protection areas. It is clear that the areas along the Ipoly River, the Börzsöny and the small watercourses are particularly vulnerable, and, therefore, at high risk from anthropogenic impacts. Valuable grasslands are found in the areas along the Ipoly River and valuable forests in the Börzsöny.

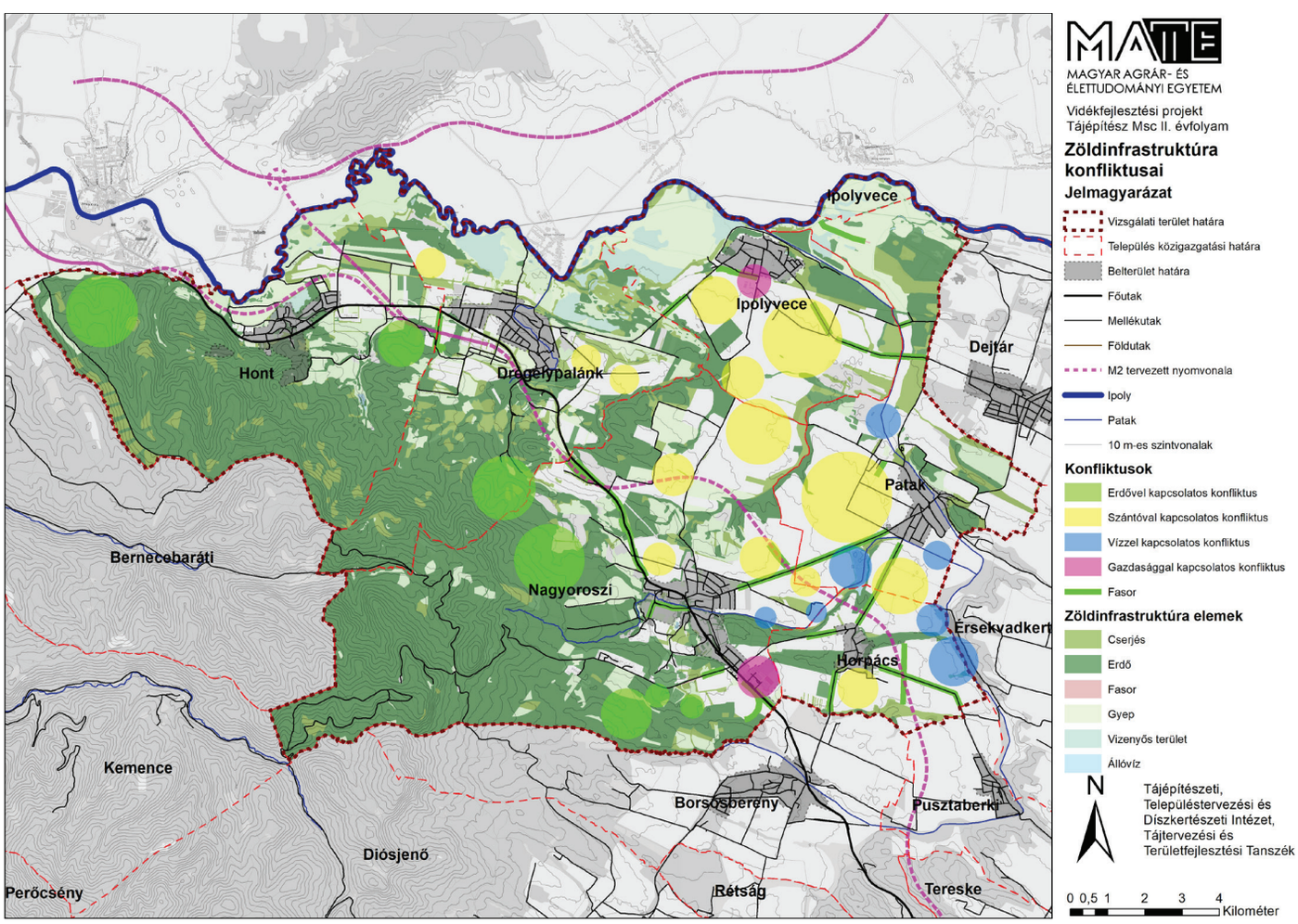

Figure 31 Conflicts of green infrastructure ©MATE

The situation of the ecological network within the area has been examined and assessed: the barriers and lack of connections have been examined and assessed in order to propose landscape rehabilitation measures for restoration. The eastern part of the site is dominated by arable land, which reduces or completely eliminates these links. Ecological connectivity in arable areas is provided by linear green infrastructure elements, which may include tree lines, shelterbelts, shrub strips and watercourses and their riparian strips. In many places, these linear elements are missing. There is no ecological connection in the large arable fields between Nagyoroszi, Horpács, Patak, Ipolyvece and Drégelypalánk.

Each land use conflict was assessed according to its significance. On the assessment map, four different colours indicate the landscape rehabilitation conflicts associated with each land use. The size of the circle indicates the severity of the problem. In addition to the significance of the conflicts, the potential for restoration through landscape rehabilitation tools to resolve these problems was also examined and assessed. We classified them into four categories: fully restorable/resolvable, partially reversible, mitigable/compensable, and irreversible conflicts.

The problems of the green infrastructure elements were divided into 6 groups depending on what the conflict is mainly related to, so that the groups were as follows: conflicts related to forests, fields, water, farm and tree lines. The main problems affecting forests include a high proportion of invasive species resulting from clear-cutting. The most common invasive species is the false acacia (*Robinia pseudoacacia*), which forms coherent communities in some areas. These forests benefit some agricultural activities, such as beekeeping, but ecologically they cause serious damage to native habitats. The problem with clear-cutting is that the ecological value of forests is low. Tree species diversity and age distribution are low. The microclimate of the area changes after logging. This is intolerable for many species, so most forest species are not found in these forests.

The problems associated with ploughing are affecting most green infrastructure elements such as valuable wetland and dry grassland areas, e.g. alder bog in Hont, which is gradually disappearing, both due to the decline in grazing and lack of maintenance. The lack of maintenance has led to intensive spreading of invasive plant species, which is gradually degrading the habitat. Other threats to these areas are landfills. Another major problem of ploughland is the so-called fragmentation effect, whereby the connection between habitats is lost due to the location of the ploughland.

The use of fertilisers, which has a negative impact on watercourses, is a complex issue. In most cases, there is no wide buffer strip along the streams that run through the area, so ploughing continues up to the banks of the stream. Fertilisers are washed into the stream, increasing the organic matter content of the water and consequently accelerating eutrophication.

An economic conflict is the lack of a protective forest belt around some industrial buildings, such as the caravan factory in the area of Nagyoroszi.

There are two large areas of semi-natural green space in the area, which are elements of the National Ecological Network as core areas (INT-10). One of these is the Börzsöny foothills and the other is the Ipoly river basin. The two large areas of high value are linked by a number of ecological corridors, mainly along watercourses crossing the agricultural landscape. These corridors are also crossed by the main road No. 2, which currently passes through the area, and the planned M2 motorway, thus impeding their permeability. On the main road No. 2, the connection has been reinstated by means of culverts of different diameters, depending on the type of wildlife groups using them. In many places, the technical solutions for the culverts

are unsatisfactory, making it impossible for certain groups of animals to use them. Areas where the continuity of the ecological corridor is interrupted are marked on the map. In red, where the crossing is almost completely interrupted, this may be at the crossing of a busy road or the presence of a settlement. Orange colour indicates areas where connectivity in the corridor is partial, such as at the intersection of a low-traffic road or the presence of agricultural land use. Ecotones, or edge areas, have also been identified in the area as habitats of high value and species diversity. They occur most frequently at the foot of the Börzsöny, where continuous forest cover is beginning to break up, grassland and scrub patches are present, or where agricultural land use is possible, creating diverse habitats. The area functions as ecotones where woody vegetation and grassland meet, as these are considered to be the most valuable. Ecologically sensitive areas should be mentioned as

Figure 32 During SaveGREEN Transnational Experience Exchange Workshop we visited “the amphibian guidance (wall) system”

wetlands, which are most often linked to small watercourses or remnants of the remaining groves along the Ipoly River.

A particular ecological conflict is “the amphibian guidance (wall) system” near Hont, which has faults in its construction and maintenance. As mentioned before, the Borzsöny Mountains and the Ipoly River represent important core areas for a wide range of wildlife but especially amphibians. In spring, the Honti frogs emerge from their frost-free winter hiding places in Börzsöny and head for their breeding grounds in the Ipoly River floodplain. The Hont is home to thousands of frogs, the largest part of the Börzsöny brown toad population, with 10 of Hungary’s 12 frog species found in the area. Unfortunately, the road No. 2. crosses the core areas causing serious ecological damage.

To solve the conflicts in 2015 a new amphibian guidance (wall) system replaced the former solutions. A concrete baffle has been built to the drainage system to prevent frogs from entering the road. The baffle wall, which has been installed, will allow the frogs to pass safely under the road through existing and newly constructed culverts. At the connecting roads, a grid cover will be installed to prevent frogs from entering the road, the grid being designed to allow amphibians coming from the access road to fall safely into the culvert, where they will find the tunnel along the baffle. On the upstream side of the road, where the concrete baffles have already been installed in part, the existing baffle will need to be rebuilt and extended. Unfortunately, there are several problems with the maintenance; the operator of the facility does not follow the instructions in the management manual. It is rare that the diversion system is cleared of vegetation, even once the diversion wall has been damaged. The STOP ditches are not regularly cleaned, which is important because the sediment in them allows animals to crawl out and onto the road. The STOP ditch on the forest road near Parassapusta is already completely filled with soil.

The diversion wall is often overgrown with vegetation, and in some sections the vegetation cover is so extensive that the wall is not visible at all. The same is the case in the section where, due to the terrain, the polymer concrete baffle is replaced by steel mesh. The cleaning of this is also problematic.

The upper and lower parts of the diversion wall have – in a unique way in the world – concrete pavement panels. The concrete panels at the top put pressure on the diversion wall at ground level, and the gaps between the concrete panels and the wall are covered in vegetation, which also puts pressure on the diversion system and reduces the functionality (https://greenfo.hu/hir/tonkremegy-a-honti-terelorendszer/).

3.2 Landscape development proposals

3.2.1 Proposals for green infrastructure development (ecological proposals)

One of the main groups of our proposals is to connect the fragmented areas. The connection, if interrupted by a linear element, can be provided by means of different culverts. It is important to note that in most cases, these culverts are present at the points where they are needed, but their function is not satisfactory. One of the most important and complex culverts is part of the amphibious diversion system in Hont. It is recommended that these culverts be reviewed and any defects corrected and regularly maintained and monitored. Where fragmented areas are separated by superficial elements, such as ploughland and settlements, it is proposed to provide connectivity through linear elements; for example, a tree line, a strip of woodland or shelterbelt.

The other main group of proposals is the preservation of ecologically valuable areas. These include grasslands, wetlands and watercourses. It is proposed to maintain grassland by mowing twice a year where grazing is not possible. The protection of wetlands and watercourses is important. The buffer zone of watercourses should be completed and increased where possible to prevent fertiliser infiltration while creating new habitats. Monitoring of wetlands and streams is recommended, with the aim of eliminating possible waste dumping and eradicating invasive plant species. One of these valuable areas is the Hont alder bog, which can be protected through permanent maintenance and the installation of information signs. The proposed application for detecting and eliminating illegal dumping is a waste radar, which is available and managed free of charge by the community. In order to prevent littering and raise awareness of the value of our environment, it is proposed that young people be educated and environmental education in schools be introduced.

We will briefly look at the proposals on ecological conflicts caused by ploughland. The over-exploitation of ploughland has resulted in cultivation of valuable grassland and woodland, where the quality of the crop is far from acceptable. To remedy this, it is proposed that low value arable land be reclassified as pasture, meadow or orchard appropriate to the conditions of the area. In this context, particular attention should be paid to ploughland on the floodplain of the Ipoly River, which is threatened by inland water and has a greater difference in level.

The conflicts with forests are, on the one hand, the way of harvesting, which we propose to change to forest wilderness management. Here, the idea is to create a semi-natural forest in which the harvesting method would be felling. It is characterised by a smaller forest cycle, so that the forest microclimate remains constant, allowing the establishment of organisms that prefer the forest climate. It is characterised by a variable age and species distribution, which increases biological diversity. It is important to stress that in plantation forests, priority is given to native tree species. White acacia (Robinia pseudoacacia) is an economically important species because of its valuable timber and nectar. It is recommended that these species be monitored, their spread be prevented, and their plantation in semi-natural or ecologically valuable areas be prohibited.

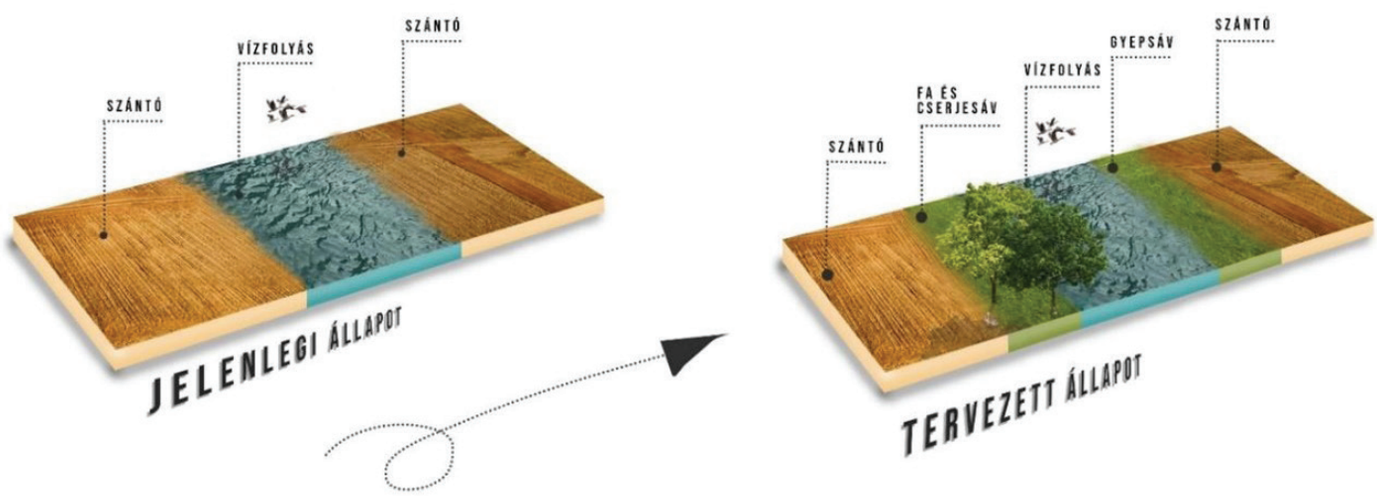

Figure 33 General scheme for buffer zones along watercourses ©MATE

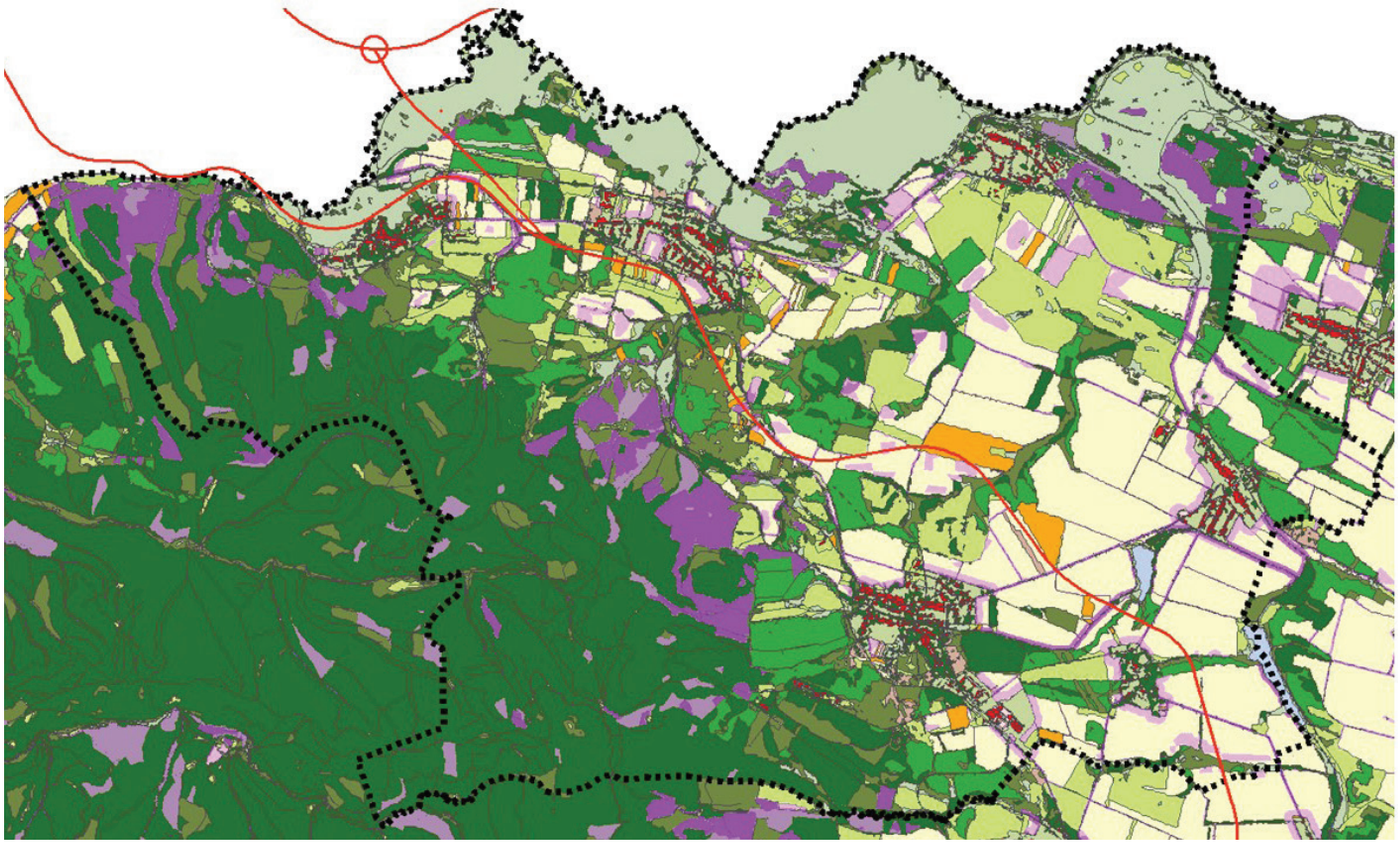

Figure 34 Green infrastructure development possibilities in the study area ©MATE

3.2.2 Landscape rehabilitation proposals

Our recommendations for landscape rehabilitation are based on the study findings and the assessment. The aim of the study is to restore degraded surfaces caused by natural processes and artificial interventions.

The identified functional landscape use conflicts and the future construction of the M2 motorway require significant landscape rehabilitation interventions.

A number of solutions can be envisaged to resolve the environmental and landscape conflicts associated with the roads. One of these is the creation of roadside buffer strips, which are installed with regard to road safety principles. They have an ecological conditioning effect, increasing biodiversity and providing noise and vibration attenuation, thus reducing negative impacts from roads (in this case the M2). They also have an aesthetic value, both in terms of providing a varied image for the traveller and preventing strong views from the surrounding areas, due to their screening function.

The planned M2 route is close to the settlements of Hont and Drégelypalánk, which could be significantly affected by noise pollution. This can be reduced by the installation of noise protection walls in addition to protective fencing. Green noise barriers on roads, with vegetation, are a way of promoting environmental awareness and sustainability. This is not only environmentally friendly, but also aesthetically pleasing, blending in with the landscape. The installation of bird screens

is also justified in some places, especially near the Ipoly River, as it is a Natura 2000 Birds protection area.

The motorway track crosses and bisects several streams and tree lines.

In addition, several watercourses run through agricultural areas lacking buffer zones. Rehabilitation of small watercourses includes the restoration of the riverbed to its natural state, planting vegetation, restoration with environmental engineering methods, restoration of buffer zones and establishing practices to monitor the Sampling points will be established at designated locations where the load is most typical and dominant for aquatic life. Such points include the estuary of the streams that join the Ipoly River.

Several methods can be used to control siltation and eutrophication of reservoir lakes in the area. The solutions include the use of advanced wastewater treatment technologies to reduce the phosphorus content in the water, or the use of soil protection and soil conservation methods. Other methods include aeration and oxygenation of stagnant water, while dredging would threaten the natural biota.

Habitats will be lost during the construction of the M2 motorway; to

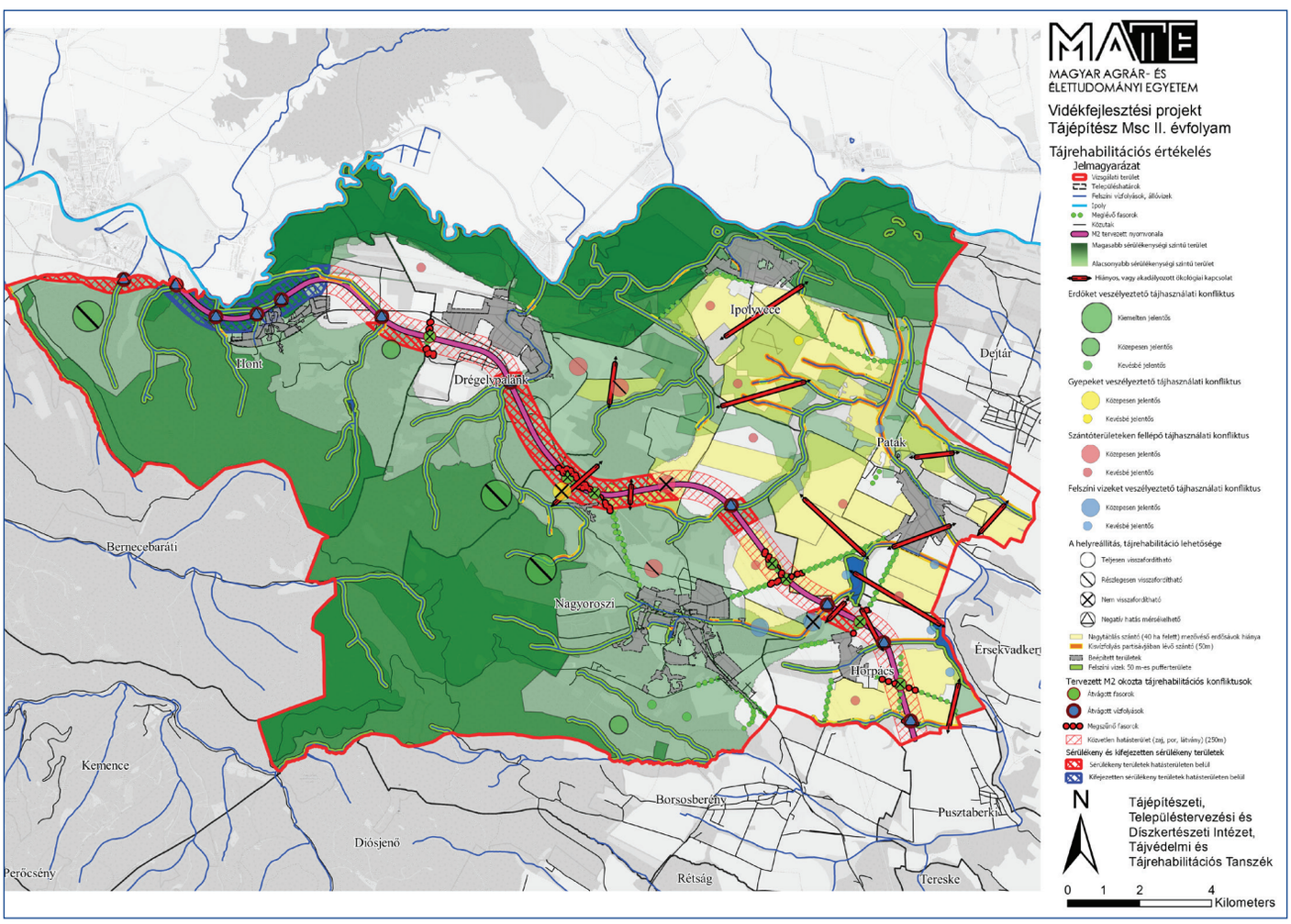

Figure 35 Landscape rehabilitation assessment ©MATE

compensate for this, grassland areas and arable land within the planning area have both been identified as suitable for conversion to valuable habitats. Along the Ipoly River, the complexity of the problem requires complex habitat rehabilitation. To preserve and maintain sensitive grassland and biodiverse habitat communities, viaduct is proposed, with the potential for a landscape bridge underneath. Construction will still cause major damage to the habitat, so ecologically the most optimal solution would be to modify the track.

The area is characterised by large-scale cultivation, often with monoculture, which can lead to a number of problems. There are many advantages to subdividing the fields with shelterbelts in order to protect the fields. Forest strips have been proposed in arable fields larger than 20 ha, mainly in the areas of Ipolyvece, Patak and Horpács.

The lack of ecological connections in the area is a major problem, and their restoration is a priority. The creation of local-scale elements of the ecological network is possible with shelterbelts, roadside tree-lines, protective forest strips and shrub planting.

In areas at risk of erosion, soil and grassland can be stabilised by vegetation and good agrotechnical practices.

The landscape character of the area has been strongly influenced by fruit growing in the past. At present, only a few small plots of land are involved (0.1% of the area). However, the climatic conditions of the area make it suitable for fruit growing (Dövényi, 2010). It is possible to restore fruit-growing to a dominant landscape character and, thus, boost the economy of the area.

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INT-04	Ramsar areas,	http://www.ramsar.hu/teruletek/11.htm
INT-05	Ipoly völgye Natura2000	https://natura.2000.hu/hu/teruletek/b/HUDI20008
INT-06	Börzsöny és Visegrádi-hegység Natura2000	https://natura.2000.hu/hu/terkepek/hudi10002
INT-07	Börzsöny Natura2000	https://natura.2000.hu/hu/teruletek/b/HUDI20008
INT-08	OTrT, Ecological Network, Interaktiv map	https://www.oeny.hu/oeny/4tr/#/tudastar/interaktiv-terkep
INT-09	Nógrád megye helyi jelentőségű természetvédelmi területei	https://provertes.hu/index.php/termeszeti-ertekek-es-vedelmuk/helyi-vedett-teruletek-magyarorszagon/308-nograd-megye-helyi-jelentosegu-termeszetvedelmi-teruletei
INT-10	OKIR map	http://web.okir.hu/map/?config=TIR&lang=hu
INT-11	Wildlife of cropland	https://provertes.hu/index.php/termeszeti-ertekek-es-vedelmuk/helyi-vedett-teruletek-magyarorszagon/2-fomenu/341-szantofoldek-elovilaga
INT-12	KDVVIZIG Ipoly	http://vizeink.hu/wp-content/uploads/2020/04/1_8_Ipoly_JVK_2020_jovahagyott.pdf

PILOT AREAS:

Austria

1 Kobernausser forest

2 Pöttsching (Alpine-Carpathian Corridor)

Czech Republic/Slovakia

3 Beskydy-Kysuce CZ-SK cross-border area

Hungary/Slovakia

4 Novohrad-Nógrád SK-HU cross-border area

Ukraine

5 Zakarpattia region

Romania

6 Mureş valley (Arad-Deva)

7 Mureş Valley (Târgu Mureş – Târgu Neamţ)

Bulgaria

8 Rila-Verila-Kraishte corridor

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Project partners:

Austria: WWF Central and Eastern Europe (Lead Partner), Environment Agency Austria

Bulgaria: Black Sea NGO Network, Bulgarian Biodiversity Foundation

Czech Republic: Friends of the Earth Czech Republic – Carnivore Conservation Programme, Transport Research Centre Czech Republic

Hungary: CEEweb for Biodiversity, Hungarian University for Agriculture and Life Sciencis

Romania: Zarand Association, EPC Environmental Consultancy Ltd., WWF Romania

Slovakia: Slovak University of Technology in Bratislava – SPECTRA Centre of Excellence of EU

Associated Strategic Partners:

Austria: Ministry for Climate Action, Environment, Energy, Mobility, Innovation, and Technology

Bulgaria: Ministry of Agriculture, Food and Forestry – Executive Forest Agency, Southwestern State Enterprise SE – Blagoevgrad

Czech Republic: Ministry of the Environment, Nature Conservation Agency

France: Infrastructure and Ecology Network Europe (IENE)

Germany: Bavarian State Ministry of the Environment and Consumer Protection

Greece: Egnatia ODOS S.A.

Hungary: Natinoal Infrastructure Developing Private Company Ltd. (NIF Ltd.), Ministry of Agriculture, Danube-Ipoly National Park Directorate

Romania: Ministry of Environment, Waters and Forests, Ministry of Public Works, Development and Administration, Ministry of Transport, Infrastructure and Communications

Slovakia: State Nature Conservancy, Ministry of Environment, Ministry of Transport and Construction, National Motorway Company

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