ANNEX to

Methodology on identification and designation of Ecological corridors of transboundary interest for *Open borders for wildlife in the Carpathians (OBWIC) project*

Regarding Section

1.4. Mapping of ecological network – model fine tuning

PROTOCOL FOR FIELD IDENTIFICATION OF BARRIERS IN ECOLOGICAL CORRIDORS

Version 2.0

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Introduction

Barriers are natural or man-made structures that impede an individuals of certain animal species from moving through an ecological corridor. Barriers affect movement permeability of individuals in their displacement from a core area of distribution to another one.

The barriers can be included in 3 categories:

1. Impermeable (e.g. fences, buildings);
2. Semi-permeable, difficult to permeate (e.g. road guardrails, railway embankment);
3. Permeable but inadequate (e.g. roads, water courses, railways, steep slopes).

All barrier previously mentioned are physical structures that interact directly with moving individuals. From functional point of view there are also other" barriers" that may affect large carnivores' displacement through corridor by influencing the dispersing behavior of the species. This Protocol will not address site conditions that can eventually affect the corridor permeability for species since these conditions are not physical structures. These habitat conditions may refer to land use categories, car traffic, artificial light, noise and other kind of disturbances induced by human activities. All these local circumstances could be mitigated through management measures for ecological corridors.

The protocol will be used to assess the physical permeability of delineated corridors trough GIS-based analyses. On-the-ground studies are necessary to identify, assess and address barriers within identified/assumed corridor.

Field mapping should collect data from the ground that are not documented in existing GIS data. So, we exclude roads, water and built up areas for which GIS layers already exist and are mapped at the project site level according to the Methodology for identification and designation of ecological corridors, Section 1.2.

Nevertheless, new buildup areas or changes in agricultural land use in comparison with existing data used in mapping process should also be recorded during field barriers mapping. For that, the mapper should be provided with detailed map of the corridor that is subject to study. The base of comparison is ”Analysis of current landscape structure based on satellite imagery” made previously in the project.

Target species

Barriers that are subject to present field mapping protocol are those which impede the movement of bears, wolves, lynx and other 2 supplementary species (i.e. golden jackal and red deer), as the Methodology for identification and designation of ecological corridors assumed.

Type of potential barriers

Barriers are not all the time human sourced. Landscape features may exhibit also impermeable characteristics for large mammals. These barriers are difficult to be addressed by management or other means, so it is very important to be identified in the field.

Natural barriers

- Stone walls
- Steep slopes
- Water courses

Usually, stone walls have a low extent in the natural landscape and therefore the impermeability that this feature exhibit is rare. Anyway, in the circumstances of a narrow corridor or combined with other less permeable structures, it can matter.

Regarding steep slopes and big water courses, both barriers are permeable but avoided by animals to be crossed. Individuals usually follow in their movement the mountain crest or level curves, rarely advancing against steep slopes.

Fig. 1. *Lapus River in Maramures is the longest water course that cross-cuts the county.*

Anthropogenic barriers

- **Fences**. There are many kinds and features of fences. The majority of fences (exempt those from built-up areas) are set-up to ensure protection for crops or as enclosure for livestock. In many cases fences are not installed as a result of a permit issuing, thereby such barriers may appear often on agricultural lands or in the forest as game enclosures or tree nurseries. Other consequence of a lack of authorization is that the information of the fenced areas may be obtained only from the field work.
  Some railways may be also fenced on their entire length or just partially on some sections. These fences are made specially to avoid any entrance of animals (domestic or wild) on the road preventing thus any roadkill event.
  Electric fences can be used seasonally by the farmers during some months over the year. As long as this fences are in place, these are barriers for wildlife and should be recorded also trough this protocol to identify some areas in which farmers are using often this kind of barrier.
  Fences came in different stage of degradation or utilization. For that reason, it is important to record characteristics such as type of material (wood, wire, metal, concrete, brick), permanent or temporary structure (electric fences), damaged or intact, in use or abandoned.

Fig. 2. *Near forest edge, many hayfields are fenced to prevent entrance of wild animals.*

Fig. 3. *A fence meant to scare away animals made from aluminum cans.*

Fig. 4. *Barbed wire fences, beside blocking animal movement can produce injury as well*

Fig. 5. *A large enclosure for a blueberry field in Cavnic area, Maramures county.*

- **Transportation infrastructure.** Beside the fenced motorways, roads do not represent an impermeable feature. Nevertheless, the risk over the connectivity arises from the potential of roadkill when animals pass over the road. Among transportation infrastructures with barrier effect it can be mentioned road guardrails, railway embankment, noise barrier panels and light protection panels, structures that may affect the free movement of target species across the roads or railroads.

Fig. 6. *Road guardrails along the county road DJ 109F in Cavnic area, a connectivity hotspot in Maramures*

- **Buildings** are present mainly in built-up areas. Anyway, small buildings like cabins, huts or holiday houses can be found in the field. Like for fences, it is important to describe some parameters for these constructions like: used/abandoned or damaged/intact in order to be able to make an assessment of their possible effect on permeability of the corridor.
- **Anthropogenic walls**. Some railways, roads or motorways may have slope stabilization, which is made from stone, concrete or even steel nets to prevent stones from collapsing over the road. All these structures represent barriers and may be present in surrounding landscape. Similarly, human made watercourses embankments or dams may be inappropriate for animals to cross over, therefore these should be mapped as well.
- **Stone quarries.** Quarrying, and mining as well, produce specific landscape with high stone walls or steep stockpiles, free of any vegetation, which are inadequate for animal movement.

Fig. 7. A stockpile located deep inside forest habitat.

- Agricultural land is permeable but less used by large carnivores, especially arable land. In that respect, it can exhibit a functional barrier for large carnivores, these species avoid large open spaces during their movement. For this protocol it is important to find if changes in land use have been produced (taking into consideration the existent OBWIC project data).

Type of recorded barriers

Due to the fact that in this moment we already have availability of the desktop design of the ecological corridors, not all data for field mapping of barriers will be subject of field recording. Thus, water courses, motorways, roads, railways and built-up areas will be not monitored again. The purpose of field work is to add data to the existing one, especially upon 3D features that are not visible from satellite imagery or other mapping sources.

However, some inconsistency may appear, aside from 3D small features, in land use categories. Even it is not a structural impermeable feature, collecting this type of data will improve the connectivity model with impact on management measures proposed in that specific corridor. These sort of data will be recorded as Additional information in filed form.

Type of recorded barriers are:

Natural: **stone walls, steep slopes**

Anthropogenic: **fences, buildings, road guardrails, railway embankment, stone quarries, walls**

Supplementary data: **changes in land use category**

Type of GIS data

GIS data collected from field work will be points, lines or polygons. Based on recording (X, Y) coordinate, Points, Lines or Polygons will be generated subsequently trough desktop digitalization. No codification will be used from points collected from the field since for every feature (barrier), a single Field Form will be completed. For line type barriers (railway embankment for example) at least two points will be recorded representing the end points of a segment. If the barrier is not linear, a point will be recorded for other location where the barrier is changing the direction. For polygon type barriers (fenced lots for example), at least 3 points will be recorded representing the vertices of the polygon. Therefore, by desktop digitalization, three different layers with barriers will be generated

Recorded barriers parameters

(X, Y) coordinates

Purpose of barriers: agriculture, transportation, watercourse engineering, noise protection, light protection.

Type of material: metal, wood, wire, concrete, stone, brick, plastic.

Height (m)

Length (m)

Permanent or Temporary barrier

Damaged or Intact barrier

Used or Abandoned barrier

Degree of permeability: impermeable, low permeability, medium permeability, high permeability

The existence of some mitigation measures

Field work

For every visit, the field mapper will have a printed map of the ecological corridor previously prepared in desktop design phase for the connectivity model. The map should be as detailed as all knew barriers are visible (roads, motorways, railways, hydrographic network, built-up areas) and land use categories also.

Mapper will browse the corridor systematically, preferable on its long side in order to detect all barriers that might appear within corridor boundary. Drones may be used if available to enlarge the visual range for identification of barriers. The usage of drones could be made randomly as mapper intends. Other means for browsing the corridor area can be considered beside tracking such as: by car, with bike or other means depending of landscape and local regulation.

A mapper may be able to cover per day an area of 50 sq. km depending on the terrain and number of barriers identified and recorded.

For polygons the mapper should record at least 3 GPS points (vertices) as for line should record at least 2 points (end-points) depending of the barrier shape.

The mapper should have a measuring tape, GPS device (e.g. smart phone, tablet) and photo device.

Field Form data fill in. For fences all the field should be completed. The height will be measured with the tape and the length will be estimated by feet, every feet corresponding to 1 m. The precise length of the barrier will be generated after digitalization of data collected from the field. In the same way, data from road guardrails and railway embankment shall be recorded.

For new identified buildings and changes in land use categories it is important to record the vertices of the location in order to be added to the corridor map. Data like permanent/temporary, used/abandoned, damaged/intact are important to be recorded for new identified buildings.

Appendix

FIELD FORM FOR PHYSICAL BARRIERS IDENTIFICATION

Field form No.	

Data:	

Mapper Name:	

Location:	

Ecological Corridor ID:	

Barrier type	natural	fences	building	road guardrails	railway embankment	stone quarries	wall	other

GPS (X,Y) coordinates of vertices or end-points	

Purpose of barrier	agriculture	transportation	watercourse engineering	noise protection	light protection	other

Type of material	metal	wood	wire	concrete	stone	brick	plastic	other

Height (m)	Length (m)

Permanent	Temporary

Damaged	Intact

Used	Abandoned

Permeability	Impermeable	Low	Medium	High

Mitigation measures	Yes	No

Additional information	

Surrounding description	

Photography