TRANSGREEN. Integrated Transport and Green Infrastructure Planning in the Danube-Carpathian Region for the Benefit of People and Nature
January 2017 – June 2019

Effects of transport infrastructure on nature

Project co-funded by the European Regional Development Fund (ERDF).
www.interreg-danube.eu/transgreen
Primary ecological effects

- **Loss of wildlife habitat**
  - Actual physical loss of natural habitat replaced with or significantly altered by the transport infrastructure
  - May seem negligible at larger scales but the impact of this habitat loss can hardly be viewed separately from other effects that inevitably follow (disturbance, barrier effect, etc.).
  - Can be quite serious at a local scale, depending on specific placement of the infrastructure in the landscape and also on the affected habitat type and species.

The mountain environment of the Carpathian region with high vertical relief segmentation is specific for its high local diversity by frequent changes of habitats with different species. For this reason, the loss of wildlife habitat can have greater consequences here as compared to other types of landscape.
Habitat fragmentation (the barrier effect)

Consequence of impermeability of roads or railways for animals

Roads with high traffic density and high-speed railways are basically impossible to pass for most species → limits their ability to move around the landscape in search of food, shelter, mating partners, etc.
The barrier effect can have physical or behavioural character:

- Physical barriers usually associated with completely fenced roads and railways, very high intensity roads, or with unsuitable surfaces or crossing objects, road verges or extra disturbance (typical rather for smaller animals, especially invertebrates, fish, amphibians and reptiles).
Behavioural barriers occur mostly in larger species and lie in various avoidance patterns, when animals do not use at all areas near roads or railways or avoid crossing large open spaces.
Deal with the negative effects of barriers and habitat fragmentation:

- Careful selection and planning of the route

- Making infrastructure more permeable for wildlife by means of fauna passages in combination with fencing and barriers guiding the animals to the fauna passages

Rivers, motorways, railways and many local roads together with dense settlements can, together, make mountain valleys completely **impermeable barriers**, which fragment both the mountain environment and the animal populations living on both sides of the valleys.
Fauna traffic mortality

Most evident and well-known negative impact of transport infrastructure on wildlife: mortality

Common widely spread species: small percentage of their total mortality (1-4%)

More sensitive and rarer species: much greater proportion (e.g. 40%), → significant factor possibly threatening the survival of local populations. To such sensitive species belong:

- Rare species that move long distances and are forced to overcome transport infrastructure while doing that (e.g. otter, large carnivores)
- Species exhibiting daily or seasonal migratory movements between local habitats (e.g. amphibians, some ungulate species)
- Birds, especially raptors and owls that are attracted to prey around road verges or by road-kills
- Some species of bats
Concentration of fauna casualties on roads and railways depends on environmental factors:

- Temperature
- Precipitation or time of day
- Ecological factors associated with affected species (breeding, dispersal, seasonal migrations, food supply, age and sex of animals, etc.)
- Location, landscape context of the infrastructure, its width, traffic value, as well as crop rotation in its surroundings
Disturbance and pollution

Transport infrastructure → various changes, many of them meaning negative interventions into ecological characteristics of the area and lower habitat quality for local wildlife populations. Mountain environment is more sensitive to disturbances than more common types of landscape. The main types of such disturbances are:

- **Hydrological changes** – cuttings and embankments, which may increase soil erosion, drain aquifers or change water regime.

- **Chemical pollution** – various polluting oxides, hydrocarbons, particles or heavy metals are released from motor exhausts. Using de-icing salt in the winter causes pollution by sodium and chloride, contamination by herbicides often occurs during summer road and railway maintenance. Gasoline or other oils can leak out during accidents. All these chemicals then get into and pollute surface and groundwater, as well as soil in the surroundings, and often cause acidification and eutrophication. That can cause serious disturbance of biological functions in the area.
• **Noise and vibration** – these are impacts inseparably connected to traffic and their intensity, road surface, rail type, topography, surrounding vegetation, etc. Sensitivity of different species to these factors varies, some exhibit strong avoidance of areas disturbed by them.

• **Lighting and visual disturbances** – artificial lighting associated with transport infrastructure represents a problem for several animal groups (birds, amphibians, bats, nocturnal mammals), as it can alter their behavioural patterns (in foraging, breeding, etc.) and can in certain cases lead to increased mortality.

When evaluating these disturbing effects, it is necessary to distinguish effects from common operation and risks arising from emergency situations. The second are typically represented by traffic accidents that may be accompanied by leakages of transported chemicals or fires with toxic emissions.
Creating new habitats on transport verges

Most commonly discussed functions of verges: habitat quality/corridor function

- Habitat: depending on geographical location, type of infrastructure, slope and width of verges and its exposure to sunshine etc., roadsides and verges

Typically due to disturbance and pollution of lower quality when compared to natural ones

- Sometimes, roadside communities are as a result dominated by non-native or ruderal species → verge management is extremely important

Increase local biodiversity: planting of native bushes and trees, bush pruning, mowing grassy vegetation and its proper timing or reducing the use of chemicals for weed and insect control
Different management can lead to significant local abundance of local or non-native species.

Two sides of the corridor function of verges:
- Can enhance the movement of species along the infrastructure (observed so far mainly in small mammals, reptiles and insects)
- Broad verges with low vegetation may reduce fauna casualties by increasing visibility

The negative part lies in the fact that verges can also lead animals to more dangerous crossroads or to urban areas, and that alien species or weeds may spread along the verge corridors even more easily than native ones.
Secondary ecological effects

Represented by changes in land-use, human settlement or industrial development that originate as a result of new road and railway construction

- Increased degree of human access and disturbance associated with denser transport infrastructure

- As these secondary effects fall under the responsibility of many different sectors, not just the transport one, they should always be carefully considered in SEAs and EIAs.

- Especially careful planning: needed in case of sensitive habitats or so far undisturbed wildlife areas. Limiting access of people to valuable wildlife habitats may prove very complicated once any infrastructure is built there

- Secondary effects of transport infrastructure: often very significant in the mountain environment of the Carpathians.

Building of new transport infrastructure in natural areas → development of recreational and sports facilities, new possibilities of industrial use of natural resources
<table>
<thead>
<tr>
<th>Construction component</th>
<th>Negative impacts, problems to be solved</th>
</tr>
</thead>
</table>
| A Road                  | • Land occupation and destruction of original habitats  
                           • Barrier effect  
                           • Coordination and mutual connection of all other components |
| b Junctions (interchanges) | • Land occupation and destruction of original habitats  
                           • Optimization of the use of areas inside interchanges from the viewpoint of animals |
| c Bridges               | • Land occupation and destruction of original habitats  
                           • Changes of habitats under bridges  
                           • Adjustments of watercourses under bridges – threat to fish migration and reproduction  
                           • Overpasses and underpasses for animals  
                           • Nesting possibilities for birds and bats |
| d Tunnels               | • Technology of construction – bored and cut-and-cover tunnels  
                           • Temporary land occupation and destruction of original habitats in cut-and-cover tunnels  
                           • Tunnel portals and ventilation shafts as point sources of emissions |
| e Road and local way/path relocations | • Land occupation and destruction of original habitats  
                           • Barrier effect (cumulation with main construction)  
                           • Lowering the efficiency of fauna passages |
<table>
<thead>
<tr>
<th>Construction component</th>
<th>Negative impacts, problems to be solved</th>
</tr>
</thead>
<tbody>
<tr>
<td>f Drainage</td>
<td>• Quality of water from the road&lt;br&gt; • Retention ponds as substitute habitats&lt;br&gt; • Runoff settling reservoirs as traps for animals</td>
</tr>
<tr>
<td>g Adjustments of vegetation</td>
<td>• Sufficient anti-erosion prevention&lt;br&gt; • Creation of new habitats (e.g. road verges and insects)&lt;br&gt; • Undesirable attractivity for animals (ecological trap)&lt;br&gt; • The spread of invasive plant species</td>
</tr>
<tr>
<td>h Noise barriers</td>
<td>• Improving the quiet environment behind the wall&lt;br&gt; • Increasing barrier effect&lt;br&gt; • Risk of higher mortality when using one-sided walls&lt;br&gt; • Higher mortality of birds on transparent walls&lt;br&gt; • Protection of sensitive sites from noise and light pollution</td>
</tr>
<tr>
<td>i Fences</td>
<td>• Preventing animals from entering roads, escape gates for animals trapped within fences&lt;br&gt; • Increasing barrier effect&lt;br&gt; • Placement of fences in relation to vegetation&lt;br&gt; • Maintenance of fences</td>
</tr>
<tr>
<td>j Other technical components</td>
<td>• Using toll gates as passages for squirrels&lt;br&gt; • Placement of traffic signs warning drivers about animal movements</td>
</tr>
<tr>
<td>k Accompanying objects/buildings</td>
<td>• Land occupation and destruction of original habitats&lt;br&gt; • Risk of cumulative effects together with the road/railway&lt;br&gt; • Necessity to assess the impact on the environment together with the road/railway construction</td>
</tr>
<tr>
<td>Life cycle stage</td>
<td>Potential problematic areas</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------------------------</td>
</tr>
</tbody>
</table>
| a Planning       | • Quality of routing fundamentally influences future impacts of the road/railway on nature  
                    • Availability of data on biodiversity/ecological connectivity |
| b Construction   | • Destruction of natural habitats  
                    • Creation of new artificial habitats, preference for allochthonous/invasive plant species  
                    • Recultivation of sites after construction  
                    • Effect on groundwater and surface water  
                    • Mortality of animals at construction sites – protective measures  
                    • Noise, emissions and contamination of the environment during construction |
| c Operation      | • Barrier effect of the road/railway  
                    • Mortality of animals on roads/railways, human casualties and damages  
                    • Gaseous, liquid and solid emissions from transportation and corresponding contamination of environment  
                    • Noise pollution  
                    • Contamination of the environment by substances used for summer and winter road maintenance  
                    • Both positive and negative effects of new habitats on road/railway verges |
| d Removal        | • Processing and elimination of waste materials (given the long lifetime period of roads/railways complete elimination is usually not discussed, rather just partial reconstructions) |
Thank you!