



Roads and wildlife: Legal requirements and policy targets

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Safe roads for wildlife and people

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and policy targets**

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Executive summary

The transport sector has acknowledged its responsibility to control the negative impacts of roads and traffic on nature and wildlife, but what this means in terms of requirements for mitigation and compensation is often not clear. EU environmental policy and legislation, transposed into national legislation for EU member states, as well as other international and national policies set overarching goals for the conservation of biodiversity. However, these broad goals have yet to be translated into measurable tasks for road developers.

In this report, we develop guidelines for understanding current EU legal incentives for road mitigation measures, particularly with respect to the barrier and mortality effects of roads on wildlife. We present a review of EU Directives and other international agreements and an analysis of case law and Environmental Impact Statements (EISs) from three EU member states, Spain, Sweden and the Netherlands. We identify unifying patterns and recent developments regarding requirements for mitigation and compensation in road building and maintenance. We highlight some shortcomings in current practice and propose adjustments to help road planners set priorities in mitigation.

We found the Habitats Directive (HD), the Birds Directive (BD), the Environmental Liability Directive (ELD), the EIA Directive, the Bonn Convention, the Bern Convention and the European Agreement on Main International Traffic Arteries (AGR) to be the most relevant with regard to the barrier and mortality effects of roads. These international directives and agreements set out objectives and responsibilities for species conservation, including levels of acceptable impact, priority species, principles for derogation and requirements for remedial action, research and monitoring. The most relevant passages in these agreements are compiled and commented upon in Annex 2.

The HD, the BD and the Bern Convention prohibit the deliberate killing of species of common interest. While road kill does not automatically qualify as non-deliberate, major road projects may derogate from the killing prohibition, given that impacts on species are kept within acceptable levels. EU member states are obliged to establish a system to monitor the incidental killing of animals of community interest and conduct the research necessary to ensure that incidental killing does not significantly impact the species' conservation status. The AGR states – from the perspectives of traffic safety and wildlife conservation – that main international arteries should be so constructed that animals are prevented from entering the roadway and hence protected from collisions with traffic, for example by the construction of adequate fencing in combination with over- or underpasses of suitable size and shape.

The HD, the ELD and the Bonn Convention jointly set an acceptable level of impact on species of common interest; any impact not jeopardising a 'favourable conservation status' and within the natural amplitude of population fluctuations can be considered acceptable. On the other hand, BD points at different, possibly more ambitious goals, i.e. maintaining all species at levels needed to provide ecosystem services, expressed as 'ecological, scientific and cultural requirements'. National objectives for traffic safety and wildlife management may also be more ambitious with regard to the acceptable level of impacts and species for which mitigation is needed.

The EIA Directive states that a developer of a major road project is required to describe impacts on species, and the ELD states that this should be done by means of measurable population data such as i) number of individuals, density or area covered, or ii) the species' capacity to emigrate or iii) the species' capacity to naturally recover. The impacts should be assessed with reference to baseline conditions and take into account a species' natural population fluctuations. We conclude that it is not only an obligation for, but also in the interest of, a road developer to conduct quality research and monitor the impacts on wildlife populations, with monitoring preferably starting well before the onset of the impact.

With regard to the acceptable level of impact, however, recent case law points in a slightly different direction. One important EU case (C-308/08 on road impacts on the Iberian lynx) and a number of national Supreme Court cases (on road or wind energy development) show that it may suffice if an infrastructure developer adopts a high ambition level in mitigation and impact assessment to fulfil the provisions of the EU directives regarding the protection of species. This implies that in a development project where the best available mitigation measures are applied and impact assessment is reasonably well conducted, the developer is relieved from the requirement to show that the impacts stay within acceptable levels; the burden of proof then lies with any party opposing the development. Available case law can thus be interpreted so that the requested conservation effort of a project can be described in terms of technical adaptations rather than population status.

Another potential implication for a road developer, although indicated by only one Dutch case, is the possibility to apply the '1% criterion' to traffic mortality. This criterion, developed by the EU ORNIS committee, states that any toll of $\leq 1\%$ of the natural mortality of the population is negligible and therefore acceptable. Whereas applying this criterion to road projects may facilitate the impact assessment, it appears well out of the range of the application initially intended and corroborated by EU court decisions. Hence we question whether the Dutch case can be leading in that respect.

The major road EISs reviewed all explicitly address barrier effects or habitat fragmentation, and most of them describe specific fauna passages or adaptations of existing bridges, culverts and tunnels as important mitigation measures. Road mortality, on the other hand, appears to be generally underemphasised as a conservation issue. Compensation measures described in the EISs are generally sparse, or even absent. Similarly, only few EISs describe the expected effects in quantified terms, which is necessary to be able to relate to acceptable levels. Also, only few EISs differentiate between effects during the construction phase and the operation phase, which may trigger different requirements for prevention and remedy. Country characteristics include a stronger emphasis on avoiding animal disturbance in Spanish and Dutch EISs compared to the Swedish ones and a strong emphasis on bat mitigation measures in Dutch EISs. Requirements for monitoring appear to be particularly meagre in Swedish EISs. We acknowledge, however, that the apparent differences between the countries may depend on method biases.

We suggest that EISs could be improved by better addressing such issues as the effects of human disturbance on wildlife, the impact of wildlife-vehicle collisions on wildlife conservation, the continuity of wildlife movements in the landscape, the difference between impacts during construction and operation phases and the expected effect levels (quantified).

We close by describing how national objectives and incentives may also affect the transport sector's mitigation of barrier and mortality effects on wildlife, using Sweden as an example.

1 Introduction

Roads and traffic exert a variety of direct and mostly detrimental effects on nature (Forman et al., 2003; Fahrig and Rytwinski, 2009). The transport sector has acknowledged its responsibility to control these impacts and develop appropriate and cost-efficient mitigation (Trocmé et al., 2003). This cannot be done, however, without involving and collaborating with other societal sectors. EU environmental legislation and policy set the overarching goals and define if and where mitigation or compensation may be needed. While in some respects current case law provides a clear framework for mitigation (e.g. chemical pollution, CO₂ emissions), there are other domains (e.g. habitat fragmentation, disturbance of wildlife, wildlife mortality) where the broad goal still has to be translated into measurable tasks.

The EU goals for biodiversity state that species should be kept at a favourable conservation status (FCS in the following; European Parliament, 2012). This implies that EU member states must ensure that populations maintain a certain (favourable) size and exert dynamics that do not lead to a steady decline. The EU goals for biodiversity are embodied in the legally binding Birds Directive (2009/147/EC; BD below) and Habitats Directive (92/43/EEC; HD below), and transposed by member states into their respective national environmental legislation.

Population dynamics are driven by a few key factors:

- i) fecundity of reproduction, which is directly linked to food and resource availability, age structure and the genetic properties of a population;
- ii) survival of offspring and adults, which directly affects population size and thereby the risk of extinction;
- iii) immigration and emigration as a recovery mechanism that prevents local populations from becoming extinct and maintains genetic exchange.

In many species, especially wildlife species with larger body sizes, the transport sector impacts these factors. Survival is directly linked to the death toll wildlife pays as a result of collisions with traffic. Millions of animals are killed annually as they enter or cross transport infrastructure facilities (Seiler and Helldin, 2006), but statistics are often limited only to those species that are of immediate traffic safety concern, and empirical data are scarce.

Immigration and emigration, on the other hand, depend on the permeability of transport corridors for wildlife. Many if not most terrestrial species experience significant movement barriers in roads. This barrier effect often increases with traffic volume and is thus linked to mortality, but in many species it also contains behavioural components (avoidance) that prevent accidents but increase the barrier effect. Here too, empirical data are often scarce, and the knowledge of functional relationships with traffic characteristics (e.g. volume, speed) or road design relies mostly on theoretical assumptions.

Barrier effect and road mortality are rather different in their nature, but they are intrinsically linked in their impact on population dynamics as mortality can partly be compensated for by immigration and vice versa. They may thus be addressed within the same mitigation strategy. Hence, one important question is under which conditions mitigation is needed to reduce mortality, secure permeability or do both. Of course, this depends on the species (abundance, distribution, population dynamics, behaviour, mobility, area requirements, etc.), the landscape (habitat diversity, fragmentation, human population, etc.), environmental settings (climate, seasonality, etc.) as well as on the type of infrastructure, its traffic and its significance to the populations of interest.

Compliance with the provisions of the BD and the HD, as ratified in the national law of EU member states, is a major challenge when seeking consent for road development or maintenance. Existing guidance from the EU builds on limited case law and dates back to 2006 (European Commission, 2006), hence not taking into account any recent cases. Due to

the paucity of case law and limited guidance for consenting authorities in relation to, e.g., environmental impact assessment, the required type and level of mitigation cannot be anticipated before a road project is started. This complicates the environmental assessment and mitigation of effects, which may cause costly delays in the planning process. The minimum requirements set by the BD and the HD need to be clarified.

At the same time, ecological adaptation in road development and maintenance may aim at more than EU directives only. Avoiding barrier effects and animal-vehicle collisions may also be justified by other political goals for biodiversity conservation, such as treaties under the aegis of the UNEP or the Council of Europe or by concerns for traffic safety, ethics, or sustainable development in the broader sense. Cost-efficient road management requires all relevant manifest political goals to be unambiguous, widely known and taken into consideration.

2 Objective and approach

Our objective is to develop guidance to understand current EU legal incentives for road mitigation measures on the conservation of wildlife. To do so, we review current European laws with respect to the barrier and mortality effects of roads on wildlife. We present an analysis of the international practice of how the legal incentives are addressed, as implied by a selection of recent case law and Environmental Impact Statements (EISs in the following) for road projects. In order to understand the national context of international commitments, we selected cases from three countries: Spain, Sweden and the Netherlands – representing a southern, northern and western European country. We outline any unifying patterns and recent developments regarding requirements for mitigation and compensation in road building and maintenance and we highlight gaps and shortcomings in current practice. We briefly discuss the implications of the results for the transport sector, in both national and European contexts, and propose adjustments to help planners set priorities in mitigation.

3 Methodology

We reviewed the following international regulations and agreements, all of which we understood to be relevant to European species conservation and which refer to barrier and mortality effects on wildlife, particularly in relation to roads and traffic:

- Under the European Commission:
 - Habitats Directive (Directive 92/43/EEC, consolidated version 2007);
 - Birds Directive (Directive 2009/147/EC; codified version);
 - Environmental Liability Directive (ELD below; Directive 2004/35/EC);
 - Environmental Impact Assessment Directive (EIA Directive below; Directive 2011/92/EU, as amended by Directive 2014/52/EU);
 - Water Framework Directive (Directive 2000/60/EC).
- Under the United Nations Environment Programme:
 - Convention on Biological Diversity (www.cbd.int);
 - Convention on the Conservation of Migratory Species of Wild Animals (“Bonn Convention”, www.cms.int; see also Council Decision 82/461/EEC);
 - Agreement on the Conservation of African-Eurasian Migratory Waterbirds (www.unep-aewa.org; see also Council Decision 2006/871/EC);
 - European Agreement on Main International Traffic Arteries (AGR below; TRANS/SC.1/2002/3).
- Under the Council of Europe (Conseil de l’Europe):
 - Convention on the Conservation of European Wildlife and Natural Habitats (“Bern Convention”; ETS no. 104).
- Other:
 - The Ramsar Convention on Wetlands (www.ramsar.org).

We reviewed the main texts of these documents for passages on fauna, roads, environmental liability and impact assessment. Regulations/agreements that we judged relevant were reviewed in more detail, and we identified articles or paragraphs that could be relevant in relation to barrier effects and traffic mortality. Articles and paragraphs relating to site protection (such as Natura 2000 areas) were judged relevant only when these relate to the impact of barriers or traffic mortality on species protection. Any available guidelines and additional documents referred to in the main texts were included in the review.

We searched for cases from the Court of Justice of the European Union, using its official web site CURIA (<http://curia.europa.eu>). We limited the cases to those addressing barrier effects or road mortality from road projects on species listed in the BD or the HD annex IV by using the following search terms (in different combinations): *Habitats Directive*; *Article 12(4)*; *Birds Directive*; *Natura 2000*; *species*; *species protection*; *traffic mortality*; *road kill*; *wildlife crossings*; *animal fencing*; *barrier obstacle*; *road*; *road schemes*; *road construction*.

We searched for cases from the national Supreme Courts of Spain, Sweden and the Netherlands by using well-established national judgment databases or periodicals (Spain: CIEDA, <http://www.cieda.es>; Sweden: JP Infonet, <http://www.jpinfonet.se/JP-Miljonet/>; the Netherlands: Rechtspraak, <http://uitspraken.rechtspraak.nl>). We limited the cases to those addressing barrier effects or road mortality by using search terms such as: *traffic victim*; *fauna passage*; *road construction*; *barrier obstacle*; *species*; *mortality*; *traffic mortality*; *species protection legislation* (all terms translated into the national language). In addition we involved one to several practicing legal experts in each country to make sure we did not miss any cases by not using the most efficient search terms. Preference was given to cases on

road projects, but in some instances cases on developments other than roads were included, when these addressed issues of a general nature that we deemed could apply to roads. The ultimate aim was to retrieve the five most relevant court cases for each country to include in the analysis.

By focussing on higher-level court decisions - from the EU and national Supreme Courts - we aimed to retrieve only valid decisions including clarifications of crucial issues currently under discussion. All searches for court cases were conducted between November 2014 and January 2015; only cases from the last six years were included. By limiting the analysis to this time period, we aimed to include only decisions made under current jurisdiction. For example, the latest updates of the HD were in 2007 and of the BD in 2009, and the Swedish Species Protection Ordination has been operative since 2007.

We searched for cases of large road EISs from Spain, Sweden and the Netherlands, using a combination of websites compiling such documents (Spain: Official State Diary, <http://www.sea.gob.cl/transparencia/diariooficial.html>; Sweden: Swedish National Transport Administration, <http://www.trafikverket.se/Privat/Projekt/>; the Netherlands: Netherlands Commission for Environmental Assessment, <http://www.commissiemer.nl/english>) and personal communication with people in national road administrations familiar with recent and ongoing large road projects. Large roads were defined as: a new road of four or more lanes, or realignment and/or widening of an existing road of two lanes or less so as to provide four or more lanes, where such new road, or realigned and/or widened section of road, would be 10 km or more in continuous length (following the definition in the EIA Directive). We limited the cases to those addressing barrier effects or traffic mortality for fauna by searching for these terms (translated into the national language) or by reviewing relevant parts of the documents. EISs with limited information on fauna or for roads passing through highly anthropogenic landscapes were given lower priority; the ultimate aim was to retrieve and include the five most relevant EIS cases for each country. The EIS searches were conducted between November 2014 and January 2015, did not include cases where the accepted document was older than 2009 and thereby covered the same time period as the court cases (see above).

All court and EIS cases identified were reviewed for legislation, species and effects on the wildlife addressed and for and the mitigating/compensating measures prescribed, following a standardised protocol (see Annex 1). The division of documents for review and analysis within the project group is described in the Acknowledgements.

4 Outputs from searches and selections

4.1 International regulations and agreements

We found the following international regulations and agreements to be the most relevant for EU member states in relation to barrier effects and road mortality: the HD, the BD, the ELD, the EIA Directive, the Bonn Convention, the Bern Convention and the AGR. All these regulations and agreements explicitly address the conservation of species and set out conservation objectives and responsibilities, levels of acceptable impact, priority species, principles for derogation and requirements for remedial action, research and monitoring.

We deemed the Water Framework Directive, the Convention on Biological Diversity, the Agreement on the Conservation of African-Eurasian Migratory Waterbirds, and the Ramsar Convention to be too general to contribute to clarifying definitions, requirements or responsibilities in comparison with the regulations and agreements mentioned above.

4.2 Case law

The search for and selection of case law produced a total of 14 cases for the analysis (Table 1). For the Netherlands, the search produced ten cases, but only five were selected for analysis because of the set maximum of five cases from each country. For the other countries and the EU, fewer than five court cases fit the criteria so all were analysed. For Sweden, however, we excluded four cases because they made clear references to other (included) cases in their judgments and therefore could not be considered as independent cases. Not all cases analysed addressed barrier effects or road mortality and not all considered roads or traffic. These were still included in the analysis because they were of general interest and we could extrapolate the court's decisions to the issues central to this study.

Table 1. Number of cases retrieved from the search for case law on barrier effects and road mortality in courts in the EU, Spain (ES), Sweden (SE) and the Netherlands (NL) from 2009-2014.

Country	Number of cases				
	analysed	on road or traffic issues	on barrier effects	on road mortality	relating to N2000 area
EU	1	1	1	1	1
ES	4	3	2	1	4
SE	4	2	2	2	2
NL	5	4	3	2	0

4.3 Environmental Impact Statements (EISs)

The search for and selection of road EISs produced a total of 14 cases for the analysis (Table 2). For Sweden only five cases could be found and for the Netherlands only four – some of which just barely meeting the criteria – therefore all EISs found for these two countries were analysed. Not all EISs analysed addressed barrier effects or road mortality; these were still included in the analysis because we deemed them of interest with regard to the species analysed and mitigation planned.

Table 2. Number of cases retrieved from the search for Environmental Impact Statements for large roads in Spain (ES), Sweden (SE) and the Netherlands (NL) from 2009-2014.

Country	Number of cases					
	analysed	on barrier effects/ fragmentation	on road mortality	on disturbance/ noise	on hydrologic effects	on habitat loss
ES	5	5	4	3	0	4
SE	5	5	0	2	2	2
NL	4	4	0	3	2	3

5 International regulations and agreements: review and analysis

5.1 Review of regulations and agreements

A commented compilation of selected passages of the respective regulation or agreement text is presented in Annex 2. Comments are the authors' analyses of the respective passage, relating specifically to the issue of barrier effects and traffic mortality.

5.2 Implications of regulations and agreements

We argue that the international regulations and agreements reviewed contain the following implications for road developers in relation to the barrier and mortality effects of roads.

5.2.1 Incidental road kill

In principle, the HD, the BD and the Bern Convention prohibit the deliberate killing of species of common interest. In the case of the HD and the Bern Convention, the species aimed at are listed, while the BD encompasses all wild birds.

What is deliberate or not is a matter of current discussion also addressed in several court cases (European Commission, 2006; see also e.g. Swedish case M4937-14 "Boge wind farm" below for a more recent example). Available guidance (European Commission, 2007) points out that the term "deliberate" goes beyond a direct intention and that the unwanted but accepted risk of killing is also prohibited.

While this makes it clear that road kill does not automatically qualify as non-deliberate killing, major infrastructure projects may derogate from the killing prohibition, given that impacts on species are kept within acceptable levels (see section 5.2.2 below).

According to the HD, EU member states (not the transport sector itself) are obliged to establish a system to monitor the incidental killing (deliberate or not) of animals of community interest. While this obligation is not mentioned in the BD, it apparently does not include birds. Member states should also conduct the research necessary to ensure that incidental killing does not have a significant negative impact on the species concerned.

The agreement most clearly addressing animal road kill is the AGR, which states that main international arteries should not only be protected from animals, but also constructed to protect animals from traffic. Such protection should not only include adequate fencing, but also over- or underpasses of suitable size and shape.

5.2.2 Acceptable level of impact

The HD and the ELD jointly define FCS as the conservation goal for species of community interest. Similarly, the Bonn Convention defines FCS as the conservation goal for species of transnational interest. Many of the species designated in the agreements are known to be affected by roads. According to the HD and the Bonn Convention, FCS is reached when i) population dynamics data indicate that the species is maintaining itself on a long-term basis as a viable component of its natural habitats, ii) the range of the species is neither being reduced nor is likely to be reduced in a foreseeable future and iii) there is, and will continue to be, sufficient habitat to maintain the species on a long-term basis. The first two of these (population dynamics and range) are of particular relevance in relation to barrier effects and road mortality. In addition, the ELD points out that the assessment of FCS should take into account natural population fluctuations and species' capacity to recover.

Species of community interest are given by HD Annex IV(a) and BD Annex I. Any lawful derogations from the strict system of protection of these species require that FCS is still reached. Accordingly, an acceptable level of impact on populations has been defined; any impact not jeopardizing FCS and within the natural amplitude of population fluctuations can be considered acceptable.

The BD presents a differently defined conservation goal for populations, namely a level that corresponds to ecological, scientific and cultural requirements (and also takes into account economic and recreational requirements). This goal may well be considered more ambitious than FCS since population levels needed to provide ecosystem services (expressed as, for example, ecological or cultural requirements) should normally be higher than what is needed only for populations to maintain themselves (meaning not becoming extinct). On the other hand, as the BD goal is not further defined in the directive's text nor in any of the related guidelines, it gives poor support to more specific targets for population levels or indications on how to follow up these targets.

5.2.3 Monitoring of impact

The HD requires that member states establish a system to monitor the incidental killing of certain species, but does not otherwise provide for monitoring the impact of derogations nor the effectiveness of measures taken. In this respect, the ELD provides more detail on how to determine the impact on populations ("environmental damage" in ELD terminology). This should be done by means of measurable population data such as:

- the number of individuals, density or area covered;
- the species' capacity for propagation (i.e., capacity to emigrate);
- the species' capacity to recover within a short time without any active intervention (i.e., capacity to reproduce or immigrate).

The ELD further states that impacts on populations should be assessed with reference to baseline conditions and should take into account natural population fluctuations and species' capacity to recover. Baseline conditions are the conditions at the time of the environmental damage that would have existed if the damage had not occurred. This implies that the population dynamics of the species in question need to be reasonably well known and that monitoring should start before, preferably well before, the onset of impact. Otherwise the assessment could become more limiting than what is motivated by conservation goals. Well conducted monitoring should give a developer adequate room for manoeuvre without jeopardising these goals.

While the HD and the ELD do not indicate who is responsible for monitoring (other than "member states"), the EIA Directive states that it is the responsibility of the developer to describe any significant impacts of certain developmental projects or plans on conservation goals. Major roads are such projects. And as shown in the previous paragraph, it is not only an obligation of but also in the interest of an infrastructure developer to monitor the impact on populations.

5.2.4 Remedial action

In development projects where, according to the ELD, significant impacts on populations are likely to occur, the developer must take the necessary preventive measures. Where environmental damage has occurred, the developer must take all practicable steps to immediately control, remove or otherwise manage any adverse factors and take the necessary remedial measures. The specific remedial measures are decided by a competent authority in cooperation with the developer. Environmental damage has been remedied when the environment has been restored to its baseline condition.

6 Court cases: review and analysis

6.1 Review of court cases

Annex 3 presents all court cases analysed and the selected output.

6.2 Implications of case law for road mitigation

We believe that the following findings of the review of available case law in relation to mitigation demands are the most important.

6.2.1 Mitigation action may reverse the burden of proof

Any derogations from the strict system of species protection require that conservation targets for populations (FCS in the HD or a level corresponding to ecological, scientific and cultural requirements in the BD) are still met. A developer seeking consent for a derogation must describe any significant impacts of developmental projects or plans on these population goals (EIA Directive and ELD).

However, the EU case C-308/08 on the impact of upgrading a country road on the Iberian lynx points in a slightly different direction. In this case, the European Commission claimed that Spain had failed to protect the lynx as national courts had allowed the road to be constructed/upgraded despite the risk of increased mortality and barrier effects on the lynx. The EU court, however, concluded that the Commission had failed to prove that the planned mitigation (including animal fencing, wildlife crossings, speed limits and road signs) would not be successful. It was not made clear, and it apparently did not need to be clear, whether these conservation measures were enough to ensure that the road upgrading would not have a significant negative impact on the conservation status of the lynx. This decision from 2010 may well be considered as a leading case and could serve as a guide to subsequent decisions. This judgment follows several previous EU cases (e.g. C-179/06 and C-416/07) stating that it is the Commission's task to prove an alleged failure of a member state to fulfil its obligations.

Some of the national court cases show a similar pattern. In two of the Dutch cases (ECLI:NL:RVS:2012:BW3863 "Ring-Road Buitenring Parkstad Limburg" and ECLI:NL:RVS:2012:BV3215 "Wind energy dikes Noordoostpolder") and one of the Spanish cases (RJCA/2011/824 "4th Centennial Dual Carriageway"), the court stated that significant mortality and/or barrier effects on the species concerned could not be proven, and accordingly the court ruled in favour of the developers. Also in the other three Dutch cases reviewed, the court stated that the mitigation measures, consisting of i.a. under- and overpasses for wildlife and hop-overs for bats, could not be proven unsuccessful in mitigating barrier effects.

These court decisions can be interpreted as a relief in the developer's responsibility to prove that a proposed development has no significant negative impacts on populations if the mitigation planned has only a certain level of ambition. Instead, the conservation side (be it the EC, a national conservation authority or an NGO) must prove that the proposed preventive and remedial actions would not be successful. Because a study of the ecological effects on the population level is both difficult and expensive, in practice this should give mitigation a pivotal role in the consenting process. Available case law can be interpreted so that the requested conservation effort of a project can be described in terms of technical adaptations rather than population status (i.e. output rather than outcome).

The reasoning in the Swedish court on the siting of wind farms points in the same direction; considerate siting is the key to consent. The case "Gullberg wind farm" (M7639-11) is leading

in this respect, but several cases have followed. Irrespective of the actual impact on population status, siting wind farms away from the most important breeding or resting areas for bird species of conservation concern is considered acceptable. The determinant is the action rather than the population effect.

It is, however, an important notion that a minimum level of impact assessment is still required. In the Spanish cases “East variant in Comillas” (RJ/2013/6909) and the Swedish “Gullberg wind farm” (M7639-11), the applied developments were stopped because the court considered the EIS to have an insufficient description of both the impacts on wildlife and an analysis of alternatives. In the EU case on the Iberian lynx, the road kill database would be used to evaluate and, if necessary, improve the mitigation measures. The EU court therefore considered that Spain had fulfilled the requirements of HD Article 12(4) to establish a system to monitor incidental killing and to conduct the further research or conservation measures needed to ensure that the incidental killing does not have a significant negative impact.

6.2.2 Application of the 1% criterion

The Dutch case on “Wind energy dikes Noordoostpolder” (ECLI:NL:RVS:2012:BV3215) is particularly interesting as it addresses the so-called 1% criterion. This criterion refers to killing in relation to natural mortality. According to the 1% criterion, any toll less than or equivalent to 1% of the natural mortality of the population of non-hunted bird species and approximately 1% of the natural mortality of the population of hunted bird species should be considered “small numbers” (sensu BD Article 9.1(c)) and having a negligible effect on the population size. The criterion was developed by the EU ORNIS committee as a guideline for implementing the BD (Commission of the European Communities, 1993) in relation to hunting, and was accepted by the European Court of Justice in the cases C-79/03 (Commission vs. Spain) and C-344/03 (Commission vs. Finland).

While the EU guidance and the two EU cases concerned deliberate take by hunting, the Dutch case here reviewed concerned incidental killing at wind turbines. Also, with reference to EU case 344/03, no exception from the 1% criterion was made for species that were already in an unfavourable conservation status. Hence, in this Dutch case the court appears to have gone further than the ORNIS committee and the EU court in its interpretation of the 1% criterion.

In relation to impacts on species in an unfavourable conservation status, the Swedish case on “Increased traffic at Risholmen” (M10231-13) is worth noting as it points in a different direction. In this case, species not having a favourable conservation status are expected to be affected, which the court felt would be a significant disturbance.

With the wider application of the 1% criterion expressed in the Dutch case, the criterion may provide a shortcut to evaluating the effect of road mortality on the conservation status of species. Whereas mortality studies are by no means easy to conduct, it should generally be more feasible to get an estimate of road kill numbers and compare these to established figures on population density and mortality rates (which are often known and published for many species, at least the larger ones) compared to conducting a study of the actual impact of road kill on the population status, which would likely require several years of study, including an analysis of all the different factors affecting the population.

It is, however, questionable whether the Dutch position can be leading for other countries as the EU decisions clearly apply the 1% criterion to hunting mortality with no reference to other human-induced mortality sources. Hunting mortality is functionally different than other mortality sources; even if 1% is a similar numerical loss to a population, irrespectively of whether the loss is from hunting or from other human causes such as wind power or traffic, the latter may affect other population segments and is also more difficult to reduce if monitoring indicates population decreases.

7 EISs: review and analysis

7.1 Review of EISs

Annex 4 contains all EISs analysed and selected output.

7.2 Unifying patterns and country characteristics in EISs

A uniform pattern among the three countries is that the EISs describe barrier effects on a variety of taxa or fragmentation of habitats. In all cases but two, specific fauna passages or adaptation of existing bridges, culverts and tunnels for terrestrial or aquatic wildlife are presented as important mitigation measures (Table 3). It seems that in some cases (at least some of the Dutch cases), extra measures in the form of fauna passages will be taken beyond what could be considered legal obligations for mitigation and compensation. Two Spanish cases and two Swedish cases specifically mention the continuity of fauna passages over nearby roads, hence addressing the connectivity issue for wildlife in a larger landscape perspective.

Creating or improving habitat for various taxa is commonly described as a preventive or remedial measure in most of the EISs reviewed (Table 3). This type of measure is mainly justified by the loss of habitat, so its relation to the barrier and road mortality effects in the focus of the present review is only indirect.

With regard to other environmental impacts and mitigation, some interesting country characteristics emerge from the analysis (Table 3). In current Swedish road planning, the careful selection of road corridor routing appears to be a main measure to minimise negative impacts on fauna. The Swedish cases address disturbance from construction work and traffic on animals to a lesser degree than do the Spanish and Dutch EISs. Spanish and Dutch EISs describe noise mitigation measures such as screens, berms, depressed road surfaces or 'silent' asphalt for use in areas of particular conservation value for birds, and customised lighting to minimise impacts on bats. Several Spanish EISs prescribe restrictions on construction work to minimise the impacts during periods when animals are the most vulnerable to disturbance. The Netherlands excels among the three countries for special mitigation measures for bats (construction of hop-overs, nest-boxes, resting sites, etc.).

While wildlife fencing will be done in at least four of the five Swedish cases, the phenomenon of collisions with wildlife is addressed in EISs as an environmental issue only in one of these. This implies that roadkill is viewed primarily as an issue of traffic safety rather than of wildlife conservation. In contrast, Spanish cases describe increased road casualties as a threat to wildlife. For example, in the case of A-76 Ponferrada-Ourense, fencing in combination with escape ramps and fauna passages should be done with special attention to endangered mammals such as the brown bear, wolf, Iberian desman and otter, which are so rare (and in the case of the Iberian desman so small) that they do not pose a large threat to drivers' safety. Another Spanish example in this respect is A-60 Villanubla-Santas Martas, where screens and plantations along roads will be constructed to force birds to higher flight altitudes, hence minimising the risk of road casualties for birds of conservation interest. Lastly, in relation to the court cases reviewed, where several of the cases address the population effects of incidental killing, road mortality appears to be underemphasised as a conservation issue in Swedish and Dutch EISs.

Table 3. Overview of planned mitigation actions in the reviewed EISs from Spain (ES), Sweden (SE) and the Netherlands (NL).

Planned mitigation actions	ES	SE	NL
Adjust time of road works (year, day)	Andalucia, A60, N521, A76, A2	E4, possibly E20	A12
Adaptations in street lighting	A60, N521, A76		A74
Exclusion areas for road works	Andalucia, A76, A2	E20, E4, E12	
Wildlife passages (any kind, specific or adapted)	Andalucia, A60, N521, A76, A2	E20, E22 F-G, E4	Buitenring, A12, A74, A27, A1
Fencing (with escape devices)	Andalucia*, A60*, N521*, A76*, A2*	E20*, E22 L-J, E22 F-G, E4*	
Noise reduction	A60, N521, A76		Buitenring, A12, A74
Plantation or other methods to force birds or bats to higher flight	A60, A2		Buitenring, A74
Protection from power lines	A60, A76, A2		
Create refuges / habitat restoration or improvement	Andalucia, A60, A2	E22 F-G	Buitenring, A12, A74, A27, A1
Conditions to routing or siting of fauna passages	N521	E20, E22 F-G	
Further inventories or studies	Andalucia, A76, N521	E22 F-G	
Prevent effects on hydrology		E20, E4	
Protect individual animals directly	A76		A12

Compensation measures described in the EISs are generally sparse, or even absent. It should, however, be added that for the purpose of this study, we noted only such measures specifically labelled as compensation. We realise that there may be a reluctance to describe compensation measures in EISs as this might suggest one is conceding the fact that there are adverse impacts and that one is turning to a derogation procedure. Some measures described in EISs as mitigation could be understood as compensation, for example habitat restoration or the creation of new badger dens. Requirements for monitoring environmental impacts and the effects of mitigation and compensation are particularly meagre in Swedish EISs, while in the Spanish cases, reference is made to standard prescriptions to monitor measures to overcome barrier effects (Spanish Ministry of Environment and Rural and Marine Affairs, 2008).

In most cases, the expected ecological effects from developments are not quantified but only enumerated, or in a few cases (from Sweden) coarsely quantified on a relative scale (small-intermediate-large). Few assessments (and none of the Dutch cases) differentiate between ecological effects during the construction phase and the operation phase.

Care must be taken when reasoning around these national differences as the process of environmental impact assessment differs between countries, and therefore the documents retrieved may not be fully comparable. For example, aspects not addressed in a certain document can be included in the planning process at a later stage. Also the difference among countries in the size of road projects, with the Spanish roads being considerably longer than the Swedish and Dutch ones, may introduce an apparent difference between countries in the scope of EISs because larger projects potentially span more environmental aspects. Moreover, there may be a researcher bias, despite our attempt to establish a standardised protocol for the review of documents.

7.3 Improvement potentials for EISs

If we choose to trust the national differences described in section 7.2, we see a number of potential improvement for EISs:

- Since the effects of human disturbance (noise, lighting, human presence) on wildlife are well described by science (e.g., Frid and Dill, 2002; Francis and Barber, 2013), such effects need to be assessed and mitigated whenever possible.
- Following the Spanish example, further efforts can be made in road planning to address the impact of road casualties on wildlife conservation as this may affect the type and number of mitigation measures.
- Following Spanish and to some extent Swedish examples, more respect could be paid to the continuity of wildlife movements in the landscape by requiring fauna passages to be constructed in connection with corresponding measures on nearby infrastructures.
- Clearly distinguishing environmental impacts between construction and operation phases may be sensible since the nature and duration of these impacts may fundamentally differ and trigger different requirements for prevention and remedy.
- Better quantification of effects may be needed overall in order to relate the expected effects to the acceptable level of impact on populations set out in the HD, the ELD and the Bonn Convention (i.e. FCS) or the BD (i.e. a level which corresponds to ecological, scientific and cultural requirements).
- Due to the strong conservation status of all bat species (HD Annex IV), the Dutch implication of bat mitigation could serve as example for other EU countries.

8 National regulations and objectives (SE)

While the scope of the review presented above was to aid in understanding international laws, and the methods and analysis were designed accordingly, there are also national objectives and incentives that point out how, where and when wildlife conservation and management should be conducted. This may have important implications for the transport sector's mitigation of barrier and mortality effects on wildlife, which is illustrated here by the Swedish situation.

Sweden's Environmental Objectives (Swedish Environmental Protection Agency, undated) were adopted by the Swedish Parliament in 1999-2005. These objectives relate to a wide range of environmental issues, among them the conservation of biodiversity and ecosystem functions and processes. To a large degree, the objectives regarding biodiversity and ecosystem conservation copy formulations from the HD and the Bonn Convention, for example, the requirement for FCS of naturally occurring species and habitats. The Swedish objectives are, however, more specific regarding requirements for landscape connectivity, stating that animals and plants should be able to move along their natural routes and spread to new areas within their natural range, populations should not be fragmented and genetic diversity should be maintained within and between populations. The objectives can also be considered to be more ambitious than those of the HD and the Bonn Convention regarding harvested species, such as game and fish as the objectives imply (though not clearly state) that populations of these species should be maintained at harvestable levels, thereby conforming to the BD's formulation about levels corresponding to ecological, scientific and cultural requirements as well as economic and recreational requirements. The objectives with their specifications are subject to regular assessment and revision in a parliamentary process and are hence considered to have wide political support.

With regard to harvesting, the official Swedish strategy for game management (most recent version: Swedish Environmental Protection Agency, 2015) further emphasises that game populations should be kept at levels allowing a multitude of uses, including hunting and trapping, wildlife spotting, outdoor recreation and tourism, while minimising the problems caused by some species to, for example, forestry, agriculture or traffic safety. Game management should aim at balancing ecological, social, cultural and economic requirements, implying a higher ambition level than "only" FCS for harvested populations.

The Swedish Council on Wildlife Collisions (Swedish Council on Wildlife Collisions, undated), a national joint committee whose major aim is to organise the tracking and putting down of wildlife injured by traffic, has defined objectives that wildlife collisions should decrease down to certain levels. This objective has been defined mainly with regard to traffic safety, costs of collisions and animal welfare.

All these Swedish national objectives form incentives for the transport sector to conduct mitigation for wildlife and are referred to explicitly or implicitly in many Swedish road EISs, including the ones reviewed above. In many respects, the requirements from international commitments such as the HD or the the Bonn Convention can be considered minimum requirements, whereas the national environmental objectives and the game management strategy point out desirable levels of population density and ecosystem processes and function.

9 Concluding remarks

The present review of legal incentives highlights important aspects and improvement potentials for the transport sector in its efforts to handle impacts on wildlife. While we acknowledge that this report cannot provide the ultimate guidelines on requirements for mitigation and compensation to control the negative impacts of roads and traffic on nature and wildlife, we point out important environmental objectives and accordingly the sector's responsibility for species conservation. This includes outlining the reasoning behind the levels of acceptable impact, priority species and principles for derogation as well as requirements for remedial action, research and monitoring. Meeting such requirements should be a basic condition for the smooth and efficient planning and management of new and existing transport infrastructure.

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Annex 1: Protocols for reviews

Protocol for court case reviews

Court
Case code
Popular name
Country
Source for documents (give relevant pages when applicable)
Date of decision
Type of infra (describe in words)
Developer
Legal history (describe in words)
Legislation/policy addressed
Species addressed
Type and level of effect (describe in words)
Requirement from court (describe in words)

Protocol for EIS reviews

Country
Consenting authority
Popular name
Source for documents (give relevant pages when applicable)
Date of EIA (any date, from report or approval)
Type of infra (describe in words)
Developer
Purpose of the project (fill in if applicable)
Case history (describe in words)
Legislation/policy addressed
Species addressed:
-construction phase -operation phase
Type and level of effect (describe in words)
-construction phase -operation phase
Mitigation measure planned (describe in words)
-construction phase -operation phase
Compensation measure planned (describe in words)
-construction phase -operation phase

Annex 2: International regulations and agreements relating to road barrier effects and road mortality – selected citations with authors' comments

Annex 2a. Habitats Directive

Regulation or agreement	Commentary
<p>Habitats Directive (HD) Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.</p>	<p>Directive text: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:01992L0043-20070101 Guidance document on the strict protection of animal species of Community interest: http://www.am.it/vi/files/0.766182001201187883.pdf Nature and biodiversity cases; Ruling of the European Court of Justice: http://ec.europa.eu/environment/nature/info/pubs/docs/others/ecj_rulings_en.pdf Managing Natura 2000 sites; The provisions of Article 6 of the Habitats Directive 92/43/EEC: http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/provision_of_art6_en.pdf</p>
Article 2. On definitions	
<p>1. The aim of this Directive shall be to contribute towards ensuring biodiversity through the conservation of natural habitats and of wild fauna and flora in the European territory of the Member States to which the Treaty applies.</p> <p>2. Measures taken pursuant to this Directive shall be designed to maintain or restore, at favourable conservation status, natural habitats and species of wild fauna and flora of Community interest.</p> <p>3. [...]</p>	<p>HD is founded on the favourable conservation status concept. According to Article 1 the "conservation status" of a species concerned that may affect the long-term distribution and abundance of its populations within the territory referred to in Article 2.</p> <p>The conservation status will be taken as 'favourable' when:</p> <ul style="list-style-type: none"> - population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and - the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and - there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis".
Article 6. On conservation of natural habitats and habitats of species	
<p>1. [...]</p> <p>2. [...]</p> <p>3. Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public.</p> <p>4. If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, the Member State shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted.</p> <p>Where the site concerned hosts a priority natural habitat type and/or a priority species, the only considerations which may be raised are those relating to human health or public safety, to beneficial consequences of primary importance for the environment or, further to an opinion from the Commission, to</p>	<p>There is much literature on how to understand and apply Article 6. This Article refers to Natura 2000 sites. Article 6(2) states that 'Member States shall take appropriate steps to avoid the deterioration of natural habitats and the habitats of species in the special areas of conservation as well as disturbance of the species for which the areas have been designated, in so far as such disturbance could be significant in relation to the objectives of this Directive'. Because of this, Article 6 is included in our analysis even though it refers to specific areas.</p> <p>The following paragraphs focus on expressions that are of interest in road projects and they have been selected following 'Managing Natura 2000 sites; The provisions of Article 6 of the Habitats Directive 92/43/EEC'.</p> <p>Articles 6(3) and 6(4) are the most important in relation to roads and their effects on animals. These Articles set out the circumstances within which plans and projects with negative effects may or may not be allowed. Some major issues are:</p> <ul style="list-style-type: none"> - how to determine whether a plan or project is 'likely to have a significant effect thereon, either individually or in combination with other plans or projects'; <p>The notion of what is 'significant' needs to be interpreted objectively. At the same time, the significance of effects should be determined in relation to the specific features and environmental conditions of the protected site concerned by the plan or project, taking particular account of the site's</p>

Regulation or agreement	Commentary
<p>other imperative reasons of overriding public interest.</p>	<p>conservation objectives.</p> <p>The safeguards set out in Article 6(3) and 6(4) are triggered not by a certainty but by a likelihood of significant effects. Thus, in line with the precautionary principle, it is unacceptable not to make an assessment on the basis that significant effects are not certain. The significant effects are those arising not only from plans or projects located within but also outside of a protected site.</p> <p>- what is meant by 'appropriate assessment of its implications for the site in view of the site's conservation objectives';</p> <p>An Article 6(3) assessment should focus on the implications for the site in view of the site's conservation objectives. Its methodology could usefully draw on the methodology envisaged by Directive 85/337/EEC. In particular, an examination of possible mitigation measures and alternative solutions may make it possible to ascertain that, in the light of such solutions or mitigation measures, the plan or project will not adversely affect the site. 'In combination' effects also need to be addressed in an assessment.</p> <p>- the concept of the 'integrity of the site';</p> <p>It is clear from the context and from the purpose of the Directive that the 'integrity of the site' relates to the site's conservation objectives. A site can be described as having a high degree of integrity where the inherent potential for meeting site conservation objectives is realised, the capacity for self-repair and self-renewal under dynamic conditions is maintained and a minimum of external management support is required.</p> <p>When looking at the 'integrity of the site', it is therefore important to take into account a range of factors, including the possibility of effects manifesting themselves in the short, medium and long-term.</p> <p>The integrity of the site involves its ecological functions. The decision as to whether it is adversely affected should focus on and be limited to the site's conservation objectives.</p> <p>In order to ensure the overall coherence of Natura 2000, the compensatory measures proposed for a project according to Article 6(4) should: (a) address, in comparable proportions, the habitats and species negatively affected; (b) concern the same biogeographical region in the same Member State; and (c) provide functions comparable to those which had justified the selection criteria of the original site.</p> <p>The geographic distance between the original site and the place of the compensatory measures is not therefore an obstacle as long as it does not affect the functionality of the site and the reasons for its initial selection.</p>
<p>Article 12. On protection of species</p>	
<p>1. Member States shall take the requisite measures to establish a system of strict protection for the animal species listed in Annex IV (a) in their natural range, prohibiting:</p> <p>(a) all forms of deliberate capture or killing of specimens of these species in the wild;</p> <p>(b) deliberate disturbance of these species, particularly during the period of breeding, rearing, hibernation and migration;</p> <p>(c) [...]</p> <p>(d) deterioration or destruction of breeding sites or resting places.</p> <p>2. [...]</p> <p>3. The prohibition referred to in paragraph 1 (a) and (b) and paragraph 2 shall apply to all stages of life of the animals to which this Article applies.</p> <p>4. Member States shall establish a system to monitor the</p>	<p>According to the guidance document on strict protection (p. 26), the HD "gives a certain margin of manoeuvre to the Member States, which are responsible for defining, adopting and implementing the requisite measures establishing a 'system' of strict protection".</p> <p>According to the guidance document on case law (p. 43), "for the condition as to 'deliberate' action in Article 12(1)(a) of the Directive to be met, it must be proven that the author of the act intended the capture or killing of a specimen belonging to a protected animal species or, at the very least, accepted the possibility of such capture or killing", whereas "by not limiting the prohibition laid down in Article 12(1)(d) to deliberate acts [...] the Community legislature has demonstrated its intention to give breeding grounds or resting places increased protection".</p> <p>According to the guidance document on strict protection (p.</p>

Regulation or agreement	Commentary
<p>incidental capture and killing of the animal species listed in Annex IV (a). In the light of the information gathered, Member States shall take further research or conservation measures as required to ensure that incidental capture and killing does not have a significant negative impact on the species concerned.</p>	<p>65), the HD does not explicitly provide for the monitoring of the impact of derogations and the effectiveness of compensation measures, but acknowledges that monitoring is a key element to ensure that the proportional and flexible use of the derogation system does not lead to undesired effects.</p>
Article 16. On protection of species	
<p>1. Provided that there is no satisfactory alternative and the derogation is not detrimental to the maintenance of the populations of the species concerned at a favourable conservation status in their natural range, Member States may derogate from the provisions of Articles 12, 13, 14 and 15 (a) and (b):</p> <p>(a) [...]</p> <p>(b) [...]</p> <p>(c) in the interests of public health and public safety, or for other imperative reasons of overriding public interest, including those of a social or economic nature and beneficial consequences of primary importance for the environment; [...]</p>	<p>The HD does not define imperative reasons of overriding public interest, but in the guidance document on strict protection it is acknowledged that:</p> <ul style="list-style-type: none"> - public health, environmental protection, and the pursuit of legitimate goals of economic and social policy are recognised as such imperative requirements, - that the interests must be public (not of companies or individuals) and overriding (long-term). <p>The guidance document on managing Natura 2000 sites (p. 44) implies that imperative reasons include services of general economic interest, which is particularly true of services in transport, energy and communication networks.</p>

Annex 2b. Birds Directive

Regulation or agreement	Commentary
<p>Birds Directive (BD) Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds.</p>	<p>Directive text: http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32009L0147&from=EN Nature and biodiversity cases: Ruling of the European Court of Justice; http://ec.europa.eu/environment/nature/info/pubs/docs/others/ecj_rulings_en.pdf</p>
Article 1	
<p>1. This Directive relates to the conservation of all species of naturally occurring birds in the wild state in the European territory of the Member States to which the Treaty applies. It covers the protection, management and control of these species and lays down rules for their exploitation. 2. It shall apply to birds, their eggs, nests and habitats.</p>	
Article 2	
<p>Member States shall take the requisite measures to maintain the population of the species referred to in Article 1 at a level which corresponds in particular to ecological, scientific and cultural requirements, while taking account of economic and recreational requirements, or to adapt the population of these species to that level.</p>	<p>Neither the BD nor the guidance document on case law defines what "a level which corresponds in particular to ecological, scientific and cultural requirements" means.</p>
Article 5	
<p>Without prejudice to Articles 7 and 9, Member States shall take the requisite measures to establish a general system of protection for all species of birds referred to in Article 1, prohibiting in particular:</p> <p>(a) deliberate killing or capture by any method; (b) [...] (c) [...] (d) deliberate disturbance of these birds particularly during the period of breeding and rearing, in so far as disturbance would be significant having regard to the objectives of this Directive; (e) [...]</p>	<p>Neither the BD nor the guidance document on case law provides any guidance on what makes an action deliberate (cf. HD above).</p>
Article 9	
<p>1. Member States may derogate from the provisions of Articles 5 to 8, where there is no other satisfactory solution, for the following reasons:</p> <p>(a) - in the interests of public health and safety, - in the interests of air safety, - to prevent serious damage to crops, livestock, forests, fisheries and water, - for the protection of flora and fauna; [...]</p>	<p>BD does <i>not</i> say "...or for other imperative reasons of overriding public interest..." (cf. HD above).</p>
Article 10	
<p>1. Member States shall encourage research and any work required as a basis for the protection, management and use of the population of all species of bird referred to in Article 1. Particular attention shall be paid to research and work on the subjects listed in Annex V. [...]</p>	<p>BD does <i>not</i> say "...shall establish a system to monitor the incidental capture and killing ..." (cf. HD above).</p>

Annex 2c. EU Environmental Liability Directive

Regulation or agreement	Commentary
<p>Environmental Liability Directive (ELD) Directive 2004/35/CE of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage.</p>	<p>Directive text: http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32004L0035&from=EN</p>
<p>Article 1. Subject matter</p>	
<p>The purpose of this Directive is to establish a framework of environmental liability based on the "polluter-pays" principle, to prevent and remedy environmental damage.</p>	<p>The ELD includes many useful definitions, see also cells below and Annex II cited at the end of this table**.</p> <p>According to Article 2,</p> <ul style="list-style-type: none"> - environmental damage means "damage to protected species and natural habitats, which is any damage that has significant adverse effects on reaching or maintaining the favourable conservation status of such habitats or species. The significance of such effects is to be assessed with reference to the baseline condition, taking account of the criteria set out in Annex I; [...] Damage to protected species and natural habitats does not include previously identified adverse effects which result from an act by an operator which was expressly authorised by the relevant authorities in accordance with provisions implementing Article 6(3) and (4) or Article 16 of Directive 92/43/EEC or Article 9 of Directive 79/409/EEC or, in the case of habitats and species not covered by Community law, in accordance with equivalent provisions of national law on nature conservation". Annex I is cited at the end of this table*. - baseline condition means "the condition at the time of the damage of the natural resources and services that would have existed had the environmental damage not occurred", estimated on the basis of the best information available. <p>The definition of favourable conservation status copies that of the HD (see above).</p>
<p>Article 3. Scope</p>	
<p>1. This Directive shall apply to:</p> <p>[...]</p> <p>(b) damage to protected species and natural habitats caused by any occupational activities other than those listed in Annex III, and to any imminent threat of such damage occurring by reason of any of those activities, whenever the operator has been at fault or negligent.</p> <p>[...]</p>	<p>According to Article 2,</p> <ul style="list-style-type: none"> - damage means a measurable adverse change in a natural resource or measurable impairment of a natural resource service that may occur directly or indirectly; - natural resource means protected species and natural habitats, water and land; - protected species and natural habitats means the species mentioned in Article 4(2) of Directive 79/409/EEC or listed in Annex I thereto or listed in Annexes II and IV to Directive 92/43/EEC; [...] where a Member State so determines any habitat or species not listed in those Annexes which the Member State designates for equivalent purposes as those laid down in these two Directives; - occupational activity means any activity carried out in the course of an economic activity, a business or an undertaking, irrespectively of its private or public, profit or non-profit character; - imminent threat of damage means a sufficient likelihood that environmental damage will occur in the near future; - operator means any natural or legal, private or public person who operates or controls the occupational activity or, where this is provided for in national legislation, to whom decisive economic power over the technical functioning of such an activity has been delegated, including the holder of a permit or authorisation for such an activity or the person registering or notifying such an activity.
<p>Article 5. Preventive action</p>	
<p>1. Where environmental damage has not yet occurred but there is an imminent threat of such damage occurring, the operator shall, without delay, take the necessary preventive measures.</p> <p>[...]</p>	<p>According to Article 2,</p> <ul style="list-style-type: none"> - preventive measures means any measures taken in response to an event, act or omission that has created an imminent threat of environmental damage, with a view to preventing or minimising that damage.

Regulation or agreement	Commentary
Article 6. Remedial action	
<p>1. Where environmental damage has occurred the operator shall, without delay, inform the competent authority of all relevant aspects of the situation and take:</p> <p>(a) all practicable steps to immediately control, contain, remove or otherwise manage the relevant contaminants and/or any other damage factors in order to limit or to prevent further environmental damage and adverse effects on human health or further impairment of services and</p> <p>(b) the necessary remedial measures, in accordance with Article 7.</p> <p>[...]</p>	<p>According to Article 2,</p> <p>- services and 'natural resources services' mean the functions performed by a natural resource for the benefit of another natural resource or the public;</p> <p>- remedial measures means any action, or combination of actions, including mitigating or interim measures to restore, rehabilitate or replace damaged natural resources and/or impaired services, or to provide an equivalent alternative to those resources or services as foreseen in Annex II.</p>
Article 7. Determination of remedial measures	
<p>1. Operators shall identify, in accordance with Annex II, potential remedial measures and submit them to the competent authority for its approval [...]</p> <p>2. The competent authority shall decide which remedial measures shall be implemented in accordance with Annex II, and with the cooperation of the relevant operator, as required.</p> <p>[...]</p>	<p>Annex II is cited at the end of this table**.</p>

***Annex I Criteria referred to in Article 2(1)(A)**

"The significance of any damage that has adverse effects on reaching or maintaining the favourable conservation status of habitats or species has to be assessed by reference to the conservation status at the time of the damage, the services provided by the amenities they produce and their capacity for natural regeneration. Significant adverse changes to the baseline condition should be determined by means of measurable data such as:

- the number of individuals, their density or the area covered,
- the role of the particular individuals or of the damaged area in relation to the species or to the habitat conservation, the rarity of the species or habitat (assessed at local, regional and higher level including at Community level),
- the species' capacity for propagation (according to the dynamics specific to that species or to that population), its viability or the habitat's capacity for natural regeneration (according to the dynamics specific to its characteristic species or to their populations),

— the species' or habitat's capacity, after damage has occurred, to recover within a short time, without any intervention other than increased protection measures, to a condition which leads, solely by virtue of the dynamics of the species or habitat, to a condition deemed equivalent or superior to the baseline condition.

[...]

The following does not have to be classified as significant damage:

- negative variations that are smaller than natural fluctuations regarded as normal for the species or habitat in question,
- negative variations due to natural causes or resulting from intervention relating to the normal management of sites, as defined in habitat records or target documents or as carried on previously by owners or operators,
- damage to species or habitats for which it is established that they will recover, within a short time and without intervention, either to the baseline condition or to a condition which leads, solely by virtue of the dynamics of the species or habitat, to a condition deemed equivalent or superior to the baseline condition."

****Annex II Remedying of environmental damage**

"Remedying of environmental damage, in relation to water or protected species or natural habitats, is achieved through the restoration of the environment to its baseline condition by way of primary, complementary and compensatory remediation, where:

- (a) 'Primary' remediation is any remedial measure which returns the damaged natural resources and/or impaired services to, or towards, baseline condition;
- (b) 'Complementary' remediation is any remedial measure taken in relation to natural resources and/or services to compensate for the fact that primary remediation does not result in fully restoring the damaged natural resources and/or services;
- (c) 'Compensatory' remediation is any action taken to compensate for interim losses of natural resources and/or services that occur from the date of damage occurring until primary remediation has achieved its full effect;
- (d) 'Interim losses' means losses which result from the fact that the damaged natural resources and/or services are not able to perform their ecological functions or provide services to other natural resources or to the public until the primary or complementary measures have taken effect. It does not consist of financial compensation to members of the public.

Where primary remediation does not result in the restoration of the environment to its baseline condition, then complementary remediation will be undertaken. In addition, compensatory remediation will be undertaken to compensate for the interim losses."

Annex 2d. EU Environmental Impact Assessment Directive

Regulation or agreement	Commentary
<p>EIA Directive</p> <p>Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment, as amended by Directive 2014/52/EU</p>	<p>Directive text: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:026:001:0021:En:PDF</p> <p>Amendment 2014: http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32014L0052&from=EN</p>
Article 1	
<p>1. This Directive shall apply to the assessment of the environmental effects of those public and private projects which are likely to have significant effects on the environment.</p> <p>[...]</p>	<p>For the purposes of this Directive, "project" is defined as:</p> <ul style="list-style-type: none"> - the execution of construction works or of other installations or schemes, or - other interventions in the natural surroundings and landscape including those involving the extraction of mineral resources; <p>There is no definition of 'significant effect' in EIA Directive. However, Annex III of the Directive contains criteria to determine whether the projects listed in Annex II should be subject to an EIA (see text of the Directive's Annex III). As provided in Recital 10 of the Directive, 'Member States may set thresholds or criteria for the purpose of determining which of such projects should be subject to assessment on the basis of the significance of their environmental effects'.</p>
Article 2	
<p>[...]</p> <p>3. In the case of projects for which the obligation to carry out assessments of the effects on the environment arises simultaneously from this Directive and from Council Directive 92/43/EEC and/or Directive 2009/147/EC of the European Parliament and the Council, Member States shall, where appropriate, ensure that coordinated and/or joint procedures fulfilling the requirements of that Union legislation are provided for.</p> <p>[...]</p>	
Article 3	
<p>1. The environmental impact assessment shall identify, describe and assess in an appropriate manner, in the light of each individual case, the direct and indirect significant effects of a project on the following factors:</p> <p>[...]</p> <p>(b) biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC;</p> <p>[...]</p>	
Article 4	
<p>1. Subject to Article 2(4), projects listed in Annex I shall be made subject to an assessment in accordance with Articles 5 to 10.</p> <p>2. Subject to Article 2(4), for projects listed in Annex II, Member States shall determine whether the project shall be made subject to an assessment in accordance with Articles 5 to 10.</p> <p>[...]</p>	<p>Annex I includes:</p> <ul style="list-style-type: none"> - construction of motorways and express roads (for the purposes of this Directive, 'express road' means a road which complies with the definition in the European Agreement on Main International Traffic Arteries of 15 November 1975); - construction of a new road of four or more lanes, or realignment and/or widening of an existing road of two lanes or less so as to provide four or more lanes, where such new road or realigned and/or widened section of road would be 10 km or more in a continuous length. <p>Annex II includes:</p> <ul style="list-style-type: none"> - construction of roads (projects not included in Annex I); - any change or extension of projects listed in Annex I or II, already authorised, executed or in the process of being executed, which may have significant adverse effects on the environment.

Regulation or agreement	Commentary
Article 5	
<p>[...]</p> <p>3. In order to ensure the completeness and quality of the environmental impact assessment report:</p> <p>(a) the developer shall ensure that the environmental impact assessment report is prepared by competent experts;</p> <p>(b) the competent authority shall ensure that it has, or has access as necessary to, sufficient expertise to examine the environmental impact assessment report; and</p> <p>(c) where necessary, the competent authority shall seek from the developer supplementary information, in accordance with Annex IV, which is directly relevant to reaching the reasoned conclusion on the significant effects of the project on the environment.</p> <p>[...]</p>	<p>Annex IV (information for the environmental impact assessment report) includes:</p> <p>3. A description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without the implementation of the project as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge.</p> <p>4. A description of the factors specified in Article 3(1) likely to be significantly affected by the project: population, human health, biodiversity (for example fauna and flora), [...]</p> <p>5. A description of the likely significant effects of the project on the environment resulting from, inter alia:</p> <p>[...]</p> <p>(e) the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources;</p> <p>[...]</p> <p>The description of the likely significant effects on the factors specified in Article 3(1) should cover the direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the project. This description should take into account the environmental protection objectives established at the Union or Member State level that are relevant to the project.</p> <p>6. A description of the forecasting methods or evidence, used to identify and assess the significant effects on the environment, including details of difficulties (for example technical deficiencies or lack of knowledge) encountered compiling the required information and the main uncertainties involved.</p> <p>7. A description of the measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment and, where appropriate, of any proposed monitoring arrangements (for example the preparation of a post-project analysis). That description should explain the extent, to which significant adverse effects on the environment are avoided, prevented, reduced or offset, and should cover both the construction and operational phases.</p> <p>[...]</p>
Article 8a	
<p>1. The decision to grant development consent shall incorporate at least the following information:</p> <p>(a) the reasoned conclusion referred to in Article 1(2)(g)(iv);</p> <p>(b) any environmental conditions attached to the decision, a description of any features of the project and/or measures envisaged to avoid, prevent or reduce and, if possible, offset significant adverse effects on the environment as well as, where appropriate, monitoring measures.</p> <p>[...]</p> <p>4. In accordance with the requirements referred to in paragraph 1(b), Member States shall ensure that the features of the project and/or measures envisaged to avoid, prevent or reduce and, if possible, offset significant adverse effects on the environment are implemented by the developer, and shall determine the procedures regarding the monitoring of significant adverse effects on the environment.</p> <p>The type of parameters to be monitored and the duration of the monitoring shall be proportionate to the nature, location and size of the project and the significance of its effects on the</p>	

Regulation or agreement	Commentary
environment. Existing monitoring arrangements resulting from Union legislation other than this Directive and from national legislation may be used if appropriate, with a view to avoiding duplication of monitoring. [...]	

Annex 2e. The Bonn Convention

Regulation or agreement	Commentary
<p>Bonn Convention Convention on the Conservation of Migratory Species of Wild Animals</p>	<p>Convention text: http://www.cms.int/en/node/3916 Guidance document on the strict protection of animal species of Community interest: http://www.am.lt/VI/files/0.766182001201187883.pdf</p>
<p>Article I. Interpretation</p>	
<p>a) "Migratory species" means the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries;</p> <p>b) "Conservation status of a migratory species" means the sum of the influences acting on the migratory species that may affect its long-term distribution and abundance;</p> <p>c) "Conservation status" will be taken as "favourable" when:</p> <p>(1) population dynamics data indicate that the migratory species is maintaining itself on a long-term basis as a viable component of its ecosystems;</p> <p>(2) the range of the migratory species is neither currently being reduced, nor is likely to be reduced, on a long-term basis;</p> <p>(3) there is, and will be in the foreseeable future, sufficient habitat to maintain the population of the migratory species on a long-term basis; and</p> <p>(4) the distribution and abundance of the migratory species approach historic coverage and levels to the extent that potentially suitable ecosystems exist and to the extent consistent with wise wildlife management;</p> <p>d) "Conservation status" will be taken as "unfavourable" if any of the conditions set out in sub-paragraph (c) of this paragraph is not met;</p> <p>e) "Endangered" in relation to a particular migratory species means that the migratory species is in danger of extinction throughout all or a significant portion of its range;</p> <p>f) "Range" means all the areas of land or water that a migratory species inhabits, stays in temporarily, crosses or overflies at any time on its normal migration route;</p> <p>g) "Habitat" means any area in the range of a migratory species which contains suitable living conditions for that species;</p> <p>h) "Range State" in relation to a particular migratory species means any State (and where appropriate any other Party referred to under sub-paragraph (k) of this paragraph) that exercises jurisdiction over any part of the range of that migratory species, or a State, flag vessels of which are engaged outside national jurisdictional limits in taking that migratory species;</p> <p>i) "Taking" means taking, hunting, fishing, capturing, harassing, deliberate killing, or attempting to engage in any such conduct;</p> <p>[...]</p>	<p>The species protection provisions of the HD help achieve the aims of relevant international nature conservation conventions such as the Bonn convention.</p> <p>Some migratory species of national importance are not included in Annex I of the BD or in Annex IV of the HD; or some species of these Annexes are present only as migratory species in certain countries.</p> <p>In such cases there are many definitions in this Article that can be useful for roads and wildlife such as: migratory species, conservation status of a migratory species, unfavourable conservation status, endangered migratory species, range, habitat or range state.</p> <p>The natural range roughly describes the spatial limits within which the habitat or species occurs. It is not identical to the precise localities (the area actually occupied) or territory where a habitat, species or sub-species permanently occurs. Such actual localities or territories might be patchy or disjointed for many habitats and species (i.e. habitats and species might not be evenly spread) within their natural range. If the reason for disjunction proves to be natural, i.e. caused by ecological factors, the isolated localities should not be interpreted as a continuous natural range. For example, for an alpine species the range may be the Alps and the Pyrenees but not the lowlands between them. However, the natural range includes areas that are not permanently used: for example, for migratory species, their "range" includes all the areas of land or water that a migratory species inhabits, stays in temporarily, crosses or overflies at any time during its normal migration (see Guidance document).</p> <p>Be aware that although the movements of some animals, such as large carnivores across borders, do not follow the strict definition of seasonal migration, in some cases this convention could be applied.</p>
<p>Article III. Endangered migratory species: Appendix I</p>	
<p>[...]</p> <p>4. Parties that are Range States of a migratory species listed in Appendix I shall endeavour:</p> <p>a) to conserve and, where feasible and appropriate, restore those habitats of the species which are of importance in removing the species from danger of extinction;</p> <p>b) to prevent, remove, compensate for or minimize, as appropriate, the adverse effects of activities or obstacles that seriously impede or prevent the migration of the species.</p> <p>[...]</p>	

Annex 2f. The Bern Convention

Regulation or agreement	Commentary
<p>Bern Convention Convention on the Conservation of European Wildlife and Natural Habitats.</p>	<p>Convention text: http://conventions.coe.int/Treaty/en/Treaties/Html/104.htm</p>
<p>Article 6. On protection of species</p>	
<p>Each Contracting Party shall take appropriate and necessary legislative and administrative measures to ensure the special protection of the wild fauna species specified in Appendix II. The following will in particular be prohibited for these species:</p> <ul style="list-style-type: none"> a. all forms of deliberate capture and keeping and deliberate killing; b. the deliberate damage to or destruction of breeding or resting sites; c. the deliberate disturbance of wild fauna, particularly during the period of breeding, rearing and hibernation, insofar as disturbance would be significant in relation to the objectives of this Convention; <p>[...]</p>	<p>The convention conforms with HD in using the term deliberate (killing, damage, disturbance) but does not state the meaning of it nor does it use the term in relation to 'deterioration or destruction of breeding sites or resting places.</p>
<p>Article 9. On protection of species</p>	
<p>1. Each Contracting Party may make exceptions from the provisions of Articles 4, 5, 6, 7 and from the prohibition of the use of the means mentioned in Article 8 provided that there is no other satisfactory solution and that the exception will not be detrimental to the survival of the population concerned:</p> <p>[...]</p> <p>- in the interests of public health and safety, air safety or other overriding public interests.</p>	<p>The convention conforms with the HD in using the term overriding public interest but does not state the meaning of it.</p>
<p>Article 10. On special provisions for migratory species</p>	
<p>1. The Contracting Parties undertake, in addition to the measures specified in Articles 4, 6, 7 and 8, to co-ordinate their efforts for the protection of the migratory species specified in Appendices II and III whose range extends into their territories.</p> <p>[...]</p>	

Annex 2g. The European Agreement on Main International Traffic Arteries

Regulation or agreement	Commentary
<p>European agreement on main international traffic arteries (AGR) Consolidated text, 2008</p>	<p>Agreement text: https://www.unece.org/fileadmin/DAM/trans/conventn/ECE-TRANS-SC1-384e.pdf</p>
Annex II. Conditions to which the main international traffic arteries should conform	
<p>[...] IV.6.3 Protection from and of animals In order to protect users from animals adequate fencing shall be provided wherever the topography indicates a risk of animals crossing. Protective measures must also be taken for the animals themselves, such as over- or underpasses of suitable size and shape. [...] VI.2 Integration of roads into the environment When a new project is proposed or existing roads are upgraded, consideration should be given to the direct and indirect effects of the roads and traffic on: - People, fauna and flora; - Soils, sub-soils, water, air, microclimate; - Landscape, physical property and cultural heritage. In this regard the following factors should ideally be taken into account: [...] Acoustic nuisances, vibration and air, water and soil pollution deriving from traffic and from the maintenance and exploitation of roads, should be limited as far as possible by appropriate means, in accordance with the regulations of the countries concerned. [...]</p>	

Annex 3: Court cases relating to road barrier effects and road mortality, from EU and supreme courts in Spain, Sweden and the Netherlands from the period 2009-2014

Case details	Judgement
Court of Justice of the European Union	
C-308/08 20 May 2010 "Iberian lynx"	
<p>Type of development: Upgrading of country road along Natura 2000 site (Donana National Park).</p> <p>Matter: Failure of member state to fulfil obligation to protect fauna of community interest.</p> <p>Parties: Commission vs. Spain.</p> <p>Regulation addressed: Art. 6 and 12(4) Habitats Directive.</p> <p>Species addressed: Iberian lynx (<i>Lynx pardina</i>).</p> <p>Ecological effects addressed: Habitat fragmentation and road kill.</p>	<p>The Court decided that the Commission had to prove the alleged failure. The EC failed to provide the proof as there was: (a) a road kill database Iberian lynx (par 58), (b) wildlife crossings (par 24 and 42; 8 wildlife crossings and 2 bridges, see par 31), (c) animal fencing (par 24 and 42) and (d) speed limits and road signs (par 42). It was not clear whether these conservation measures were enough to ensure that the incidental killing of the Iberian lynx does not have a significant negative impact on the species.</p>
Spain	
RJCA/2012/811 "Oyambre variant"	
<p>Type of development: Realignment of road section + by-pass + roundabout.</p> <p>Matter: Appeal against approval of project and EIS; project affects Natura 2000 area and other protected areas.</p> <p>Parties: NGO vs. Cantabria Autonomous Government.</p> <p>Court: Supreme Court of Cantabria.</p> <p>Regulation addressed: Royal Decree transposing the HD; Cantabrian laws on Nature conservation, on the Natural Park declaration, and on competences of natural parks board's regulation.</p> <p>Species addressed: Riverine species (no details).</p> <p>Ecological effects addressed: Reduced permeability in river environment, effects on population numbers and density.</p>	<p>Appeal partially succeeded. The court nullified the approval of the project and environmental impact statement. Imperative reasons of overriding public interest were not proven. The project was also not necessary for the management of the sites. The arguments to choose the selected alternative failed. The court obliged the Cantabrian administration to restore the area affected by both the construction of the road and the roundabout and the reconstruction of a previously existing parking area.</p>
RJCA/2011/824 "4th Centennial Dual carriageway"	
<p>Type of development: New dual carriageway (1st phase), partly following route of existing road.</p> <p>Matters: (1) Project should be assessed as a whole (1st+2nd phases); (2) the impact assessment doesn't follow legal requirements; (3) fauna species (see below) are affected.</p> <p>Parties: NGO vs. Castilla-la Mancha Autonomous Government.</p> <p>Court: Supreme Court of Castilla-La Mancha.</p> <p>Regulation addressed: BD; Autonomous Region laws on nature conservation, impact assessment; Conservation plans for the Spanish Imperial Eagle.</p> <p>Species addressed: Spanish Imperial Eagle (<i>Aquila heliaca adalberti</i>) and steppic birds.</p> <p>Ecological effects addressed: Project's 2nd phase crosses a N2000 site and dispersal area for the eagle.</p>	<p>Appeal failed. The court believed that the 1st phase made sense by itself and did not necessarily imply the construction of the 2nd phase. Thus, the EIA could be made in relation to only one phase. The court believed that fragmentation of bird habitats already existed as many sections of the new road follow the route of a prior road. The EIS was made according to legal requirements and included enough measures to avoid or reduce the impact on bird populations. The court believed that there were imperative reasons of overriding public interest. The court believed that it was not proven that the construction of the dual carriageway affected the dispersal capability of the Spanish imperial eagle because there were no studies demonstrating this in this case and location.</p>
RJ/2013/6909 "East variant in Comillas"	
<p>Type of development: New road section.</p> <p>Matter: Impact on riverine priority habitats (not yet Natura 2000). Developer argues that the area has been suffering degradation and will not be included as a Natura 2000 site.</p> <p>Parties: NGO vs. Cantabria Autonomous Government.</p> <p>Court: Spanish Supreme Court.</p> <p>Regulation addressed: HD; Bern Convention; Cantabrian laws and Spanish laws on nature conservation and impact assessment.</p>	<p>Appeal succeeded. The court believed that the deteriorated situation of some parts of the riverine habitat was not a reason to declare that the area was now not worthy of N2000 status. Moreover, the court believed that the public administration should have protected the area because of its value. The court believed that the developer did not make enough efforts to decrease the impacts described in a previous (rejected) plan. There was a lack of studies on fauna and no evaluation of the degree of impacts on wildlife, alternatives had not been analysed and other deficits in the process of environmental</p>

Case details	Judgement
<p>Species addressed: Cave species: six bats and an endemic spider (only known location of the species).</p> <p>Ecological effects addressed: Connectivity along the river.</p>	<p>impact assessment were referred to in the judgment.</p>
STSJ EXT 1108/2011 “Arrobyuey wind farm”	
<p>Type of development: New wind farm.</p> <p>Matter: Appeal against previous decision not to permit.</p> <p>Parties: Instituto de Energías Renovables vs. Extremadura Autonomous Government.</p> <p>Court: Supreme Court of Extremadura.</p> <p>Regulation addressed: BD and HD; Autonomous Region laws on nature conservation and impact assessment; Spanish law on biodiversity and natural heritage; Recovery plan for the Iberian lynx.</p> <p>Species addressed: Cinereous vulture (<i>Aegypius monachus</i>), Peregrine falcon (<i>Falco peregrinus</i>), Iberian lynx.</p> <p>Ecological effects addressed: Wind farm borders Natura 2000 sites; critical and irreversible impacts on breeding areas of endangered and threatened birds; birds may collide with turbine blades, lynx (not in the area at present) may experience discomfort.</p>	<p>Appeal failed. The court believed that the wind farm affected the Natura 2000 sites although it was not inside them. Also it affected the range of endangered species. The court agreed that the potential distribution area of the Iberian lynx should be protected.</p> <p>The court believed that the overall environmental interest outweighed the economic interest linked to the wind farm although wind farms are “environmentally friendly”.</p>
Sweden	
M10231-13 “Increased traffic at Risholmen”	
<p>Type of development: Increased construction traffic on existing road to harbour.</p> <p>Matter: Appeal against previous decision not to permit increased traffic. The increased traffic will negatively affect species in the adjacent Natura 2000 area.</p> <p>Parties: NCC Roads vs. Föreningen Torslandavikens Naturresevat and Västra Götalands län County Board.</p> <p>Court: Supreme Environmental Court of Sweden.</p> <p>Regulation addressed: Swedish Environmental Code; HD.</p> <p>Species addressed: Wetland birds, particularly ruff (<i>Philomachus pugnax</i>), smew (<i>Mergellus albellus</i>) and whooper swan (<i>Cygnus cygnus</i>).</p> <p>Ecological effects addressed: Noise disturbance in wintering area for species of community interest, addition to already critical impact.</p>	<p>Appeal failed, development was not permitted. The additional noise of the applied transport activity, together with the existing anthropogenic noise in the area, was a disturbance that could negatively affect the conservation of protected bird species in the area by decreasing distribution, especially in winter. In view of the importance of the area as a wintering area and the fact that several of the species lack favourable conservation status, the disturbance was considered to be significant.</p>
M9438-11 “Housing in Ekerum”	
<p>Type of development: Housing including minor roads.</p> <p>Matter: Appeal against previous permission. The development will have negative impact on adjacent Natura 2000 area.</p> <p>Parties: Swedish EPA vs. Ekerum Golf & Resort.</p> <p>Court: Supreme Environmental Court of Sweden.</p> <p>Regulation addressed: Swedish Environmental Code; HD.</p> <p>Species addressed: Great capricorn beetle (<i>Cerambyx cerdo</i>) and other oak-living beetles.</p> <p>Ecological effects addressed: Barrier effects and deterioration of functional habitat for species in Natura 2000 area.</p>	<p>Appeal succeeded, development was not permitted. The court noted that species’ access to habitat outside of the Natura 2000 area was necessary for the survival of the species for which the area was designated. The development would lead to loss of dispersal corridors and hence to barrier effects. The mitigation and compensation included in the development plan could not be seen as part of the development because this was needed for species conservation anyway.</p>
M7639-11 “Gullberg wind farm”	
<p>Type of development: New wind farm.</p> <p>Matter: Appeal against previous permission.</p> <p>Parties: Gävleborgs län County Board vs. Nordex Sverige.</p> <p>Court: Supreme Environmental Court of Sweden.</p> <p>Regulation addressed: BD/Swedish Species Protection Ordination.</p> <p>Species addressed: Osprey (<i>Pandion haliaetus</i>), Capercaillie (<i>Tetrao urogallus</i>), Black grouse (<i>Tetrao tetrix</i>).</p> <p>Ecological effects addressed: Barrier effects (on flight route to/from nest), collision mortality, disturbance.</p>	<p>Appeal succeeded. The court believed that it was not proven that the siting was appropriate. The wind farm was not inside a designated area, but in the breeding area of particularly vulnerable species or species of community interest. The court found the EIS insufficient in its description of alternative siting and description of relevant ecological effects. The court felt that other sitings with less environmental impact could be found.</p>

Case details	Judgement
M4937-14 “Boge wind farm”	
<p>Type of development: New wind farm.</p> <p>Matter: Appeal against previous decision not to permit.</p> <p>Parties: Boge Vindbruk vs. Gotlands län County Board.</p> <p>Court: Supreme Environmental Court of Sweden.</p> <p>Regulation addressed: BD/Swedish Species Protection Ordination.</p> <p>Species addressed: White-tailed eagle (<i>Haliaeetus albicilla</i>).</p> <p>Ecological effects addressed: Collision with turbines.</p>	<p>Matter remitted back to lower instance. The court found no reason to believe that the meaning of the word ‘deliberate’ should be different in the BD (Article 5(a) and (d)) than in the HD (Article 12(a) and (b)). The court stated that the killing was not a deliberate act of the developer and believed that the requisite on reckless disregard (<i>sensu</i> EU guidance document) was not proven. By remitting back to a lower instance, reasonable considerations would develop in the further process.</p>
The Netherlands	
ECLI:NL:RVS:2011:BU7002 “Ring-Road Buitenring Parkstad Limburg”	
<p>Type of development: New motorway, partly following route of existing road.</p> <p>Matter: Appeal against designation of spatial plan because the plan will be inconsistent with the Flora- and Fauna Act.</p> <p>Parties: Various parties vs. Province of Limburg.</p> <p>Court: High Supreme Court the Netherlands.</p> <p>Regulation addressed: Spatial planning law in relation to the Flora- and Fauna Act.</p> <p>Species addressed: Beaver (<i>Castor fiber</i>), Hermit beetle (<i>Osmoderma eremita</i>), Stag beetle (<i>Lucanus cervus</i>), Smooth snake (<i>Coronella austriaca</i>), Heath spotted-orchid (<i>Dactylorhiza maculata</i>).</p> <p>Ecological effects addressed: Deterioration of functional habitat.</p>	<p>The appeal failed. Permit secures mitigation and compensation, like hop-over for the hermit beetle, optimisations of habitat for the stag beetle and new fauna passages for other species. The court concluded that the argument of the appellants, that not all measures to be taken under the FF Act were included in the integration plan, did not prevent the FF Act from standing in the way of executing the spatial plan. The spatial plan did not need to include details of the mitigation measures needed within the framework of the FF Act. The provincial council stated that, given the scale of the project, it was not possible to include all the measures in the plan. On the basis of the mitigation and compensation plan, the provincial council sufficiently guaranteed that the necessary measures would be taken. The court considered this position reasonable.</p>
ECLI:NL:RVS:2012:BW3863 “Ring-Road Buitenring Parkstad Limburg”	
<p>Type of development: New motorway, partly following route of existing road.</p> <p>Matter: Appeal against permitting derogation Nature Conservation Act, because there will be significant effects on Natura 2000-species.</p> <p>Parties: Vereniging Natuurmonumenten, Stichting Milieufederatie Limburg & Vereniging voor Milieu- en Natuureducatie vs. Province of Limburg.</p> <p>Court: High Supreme Court the Netherlands.</p> <p>Regulation addressed: Nature Conservation Act.</p> <p>Species addressed: Desmoulin’s whorl snail (<i>Vertigo moulinsiana</i>), Jersey tiger moth (<i>Euplagia quadripunctaria</i>) Smooth snake (<i>Coronella austriaca</i>), Stag beetle (<i>Lucanus cervus</i>).</p> <p>Ecological effect addressed: Mortality of Stag beetle; barrier effects on all species.</p>	<p>These appeals failed. The mortality effect on the Jersey tiger moth was not proven, and the appropriate assessment was correct in stating that there would be no significant effect. The barrier effects on all species would be satisfactorily mitigated and mitigation measures could not be proven to be unsuccessful.</p> <p>(However the overall decision was annulled, because the effects of nitrogen on habitats had not been investigated.)</p>
ECLI:NL:RVS:2012:BV9455 “Road construction De Haak”	
<p>Type of development: New highway including broadening of lanes and new crossings.</p> <p>Matter: Appeals against permitting derogation Flora- and Fauna Act. Effects on some species not taken into account in appropriate assessment; mitigation measures not effective enough to prevent deterioration of the favourable conservation status of several bats.</p> <p>Parties: Stichting Behoud Iepen Middelseegebied vs. Ministry of Economic Affairs.</p> <p>Court: High Supreme Court the Netherlands.</p> <p>Regulation addressed: Flora- and Fauna Act.</p> <p>Species addressed: Sparrowhawk (<i>Accipiter nisus</i>), Common buzzard (<i>Buteo buteo</i>), Bitterling (<i>Rhodeus amarus</i>), Spined loach (<i>Cobitis taenia</i>), Serotine bat (<i>Eptesicus serotinus</i>), Pond bat (<i>Myotis dasycneme</i>), Daubenton’s bat (<i>Myotis daubentoni</i>).</p> <p>Ecological effects addressed: Deterioration of functional</p>	<p>Appeal on derogation succeeded. The appropriate assessment on which the derogation was based was insufficient. The licensing authority had to take a new decision based on new research, including the effects on birds and fish.</p> <p>Appeal about mitigation measures failed. The procedure of giving permission (a derogation; by the secretary of state) was correct, on the condition that the derogation would not be detrimental to the maintenance of the favourable conservation status of the species concerned. So the mitigation measures for birds and fish would be effective, but the fact that mitigation measures were needed implied that derogation was needed.</p> <p>(The secretary of state thought that no derogation was needed because mitigation measures would guarantee the maintenance of the favourable conservation status.)</p>

Case details	Judgement
habitats of species concerned; Mitigation measures will not be effective.	
ECLI:NL:RVS:2014:577 “Road construction Traverse Dieren”	
<p>Type of development: Reconstruction of roads.</p> <p>Matter: Mitigation and compensation measures will be only effective in the long time, and in the meantime will lead to significant effects on species protected by the Flora- and Fauna Act.</p> <p>Parties: Various appellants vs. Province of Gelderland.</p> <p>Court: High Supreme Court the Netherlands.</p> <p>Regulation addressed: Spatial planning law in relation to the Flora- and Fauna Act.</p> <p>Species addressed: Badger (<i>Meles meles</i>), bats like Common pipistrelle (<i>Pipistrellus pipistrellus</i>), Serotine bat, Pond bat.</p> <p>Ecological effects addressed: Barrier effects, loss of habitat (foraging and resting places).</p>	<p>The appeal failed. The appellant had not disputed the findings of the Flora and Fauna assessment nor explained why the planned mitigation measures would not be effective in time. The evidence provided by the appellant did not give rise to the decision that the provincial council should reasonably have realized in advance that the FF Act would prevent the feasibility of the integration plan.</p> <p>Mitigation planned consisted of grids and fauna tunnels as well as greenery to force low flying species to fly higher.</p>
ECLI:NL:RVS:2012:BV3215 “Wind energy dikes Noordoostpolder”	
<p>Type of development: New wind farm.</p> <p>Matter: Appeal against designation of the plan, because the plan is not based on the right data and research methods and so underestimates the mortality (collision) of birds. Also appeal against decision that there will be no significant effects on bats.</p> <p>Parties: Various appellants vs. Ministry of Economic Affairs and others.</p> <p>Court: High Supreme Court the Netherlands.</p> <p>Regulation addressed: Spatial Planning Law; Dutch Law Natuurbeschermingswet.</p> <p>Species addressed: Birds in general, in particular Bewick’s swan (<i>Cygnus columbianus</i>), geese (not specified), Spoonbill (<i>Platalea leucorodia</i>), Marsh harrier (<i>Circus aeruginosus</i>); bats, e.g. Common pipistrelle, Pond bat, Nathusius’s pipistrelle (<i>Pipistrellus nathusii</i>), Particoloured bat (<i>Vespertilio murinus</i>).</p> <p>Ecological effects addressed: Collision mortality in birds and bats; barrier effects on birds.</p>	<p>Both appeals failed. The method and data to calculate collision victims of birds was not shown to be incorrect. The application of the 1% criterion of the ORNIS-committee (if a negative effect is less than 1% of the annual natural mortality, it is not significant) was not shown to be incorrect. Appellants stated that this criterion did not take in account the unfavourable conservation status of the species and so may not be used. This argument failed because the judgment of ECJ Case C-344/03 did not follow the argument that the 1% criterion should not be applied to species that are already in an unfavourable conservation status. Argument that barrier function would lead to a loss of up to 10% of foraging areas, and thus a significant negative effect, also failed because it was not plausible that, from energetic point of view, geese and swans would no longer be able to reach (other) foraging areas.</p>

Annex 4: Environmental Impact Statements on large road projects in Spain, Sweden and the Netherlands from the period 2009-2014, with overview of expected impacts and planned mitigation relating to road barrier effects and road mortality

Case details	Planned preventive / remedial action
Spain	
Andalucia corridor	
<p>Type of development: Dual carriageway, 100 km total length, including 22 alignment corrections and 2 alignment variants.</p> <p>Developer: Roads General Directorate (Ministry of Development).</p> <p>Species addressed: Many species, i.a. Wolf (<i>Canis lupus</i>), Iberian lynx (<i>Lynx pardina</i>), Spanish imperial eagle (<i>Aquila heliaca adalberti</i>), Bonelli's eagle (<i>Hieraaetus fasciatus</i>), Eel (<i>Anguilla anguilla</i>), Gypsy barbel (<i>Barbus sclareti</i>), Vogue of the Guadiana (<i>Chodrostoma willkommii</i>), Loach (<i>Cobitis paludica</i>), Bogardilla (<i>Iberocypris palaciosi</i>), Calandino (<i>Squalius alburnoides</i>).</p> <p>Ecological effects addressed:</p> <ul style="list-style-type: none"> - Impact on Natura 2000 area Cuencas del Rumblar, Guadalén y Guadalmena. - In terrestrial environment, disturbance from traffic on Wolf and Lynx (cumulative effects of construction machinery, traffic from A-4, increased human disturbance) leading to loss of habitat and increased barrier effects. - In river ecosystem, habitat changes can affect fishes (Vogue of the Guadiana, Bogardilla and Calandino) and Otter. Barrier effect due to a new viaduct. For Otter, also deterrent effect during construction. It should be noted the presence of a dam at a distance of 2 km upstream of the crossing area, which is now a permanent barrier. 	<p>Mitigation:</p> <ul style="list-style-type: none"> - Adapted timing of construction works and forest felling. - Exclusion zones such as landfills, coinciding with Natura 2000 areas, Natural Park, Important Bird Area (IBA), Habitats of Community Interest, streams and forests. - Adaptation of new viaduct over River Rumblar (piers placed outside the river bed, bridge abutments located outside the right of way zone and riparian vegetation). Morphological and vegetation restoration of the river. - The construction project should examine and report, whether to implement one or more specific passages for critically endangered species such as the Iberian lynx and the wolf. In particular, the possibility of building a wildlife overpass in the Special Area of Conservation (SAC) should be examined. - Wildlife passages, restoration of cattle trails, adequacy of drainages and road fencing should be done according to technical prescriptions for the design of wildlife passages and perimeter fences. <p>Compensation: Restoration of cattle trails.</p> <p>Monitoring: Should be conducted during the operation phase according to technical prescriptions for evaluating the effectiveness of measures to correct the barrier effect of transport infrastructure.</p>
A-60 Villanubla-Santas Martas	
<p>Type of development: Dual carriageway, 92 km total length.</p> <p>Developer: Roads General Directorate (Ministry of Development).</p> <p>Species addressed: Otter (<i>Lutra lutra</i>), Wild boar (<i>Sus scrofa</i>), Wolf, Great bustard (<i>Otis tarda</i>), Little bustard (<i>Tetrax tetrax</i>), Black-bellied sandgrouse (<i>Pterocles orientalis</i>), Pin-tailed sandgrouse (<i>Pterocles alchata</i>), Stone curlew (<i>Burhinus oedipnemus</i>), Hen harrier (<i>Circus cyaenus</i>), Lesser kestrel (<i>Falco naumanni</i>), Peregrine falcon (<i>Falco peregrinus</i>), Montagu's harrier (<i>Circus pygargus</i>).</p> <p>Ecological effects addressed: Alteration and occupation of biotopes, barrier effect and road casualties.</p>	<p>Mitigation (selection):</p> <ul style="list-style-type: none"> - Adapted timing of construction works, avoidance of night lighting during construction. - Wildlife fencing (progressive mesh) with escape systems. - Limitation of clearing. - Tree-shrub linear plantations in stretches near two Special Protection Areas (SPAs), to force greater flight altitude for birds crossing the highway. - To avoid impacts on water birds of interest: i) viaduct or porch over two streams to avoid affecting riparian vegetation, nearby pasture and streaming water, ii) screens to minimise noise, visual impact and the risk of collision with birds. - Passages and fences for amphibians. - Changes to the current parallel road N-601 to give continuity to the wildlife passages and to cross drainages. - Wildlife adaptation of existing overpasses and cross-drainages (enlargement and vegetation). - Installation of elements of refuge for bats recommended in underpasses and overpasses. - Protection of power lines against bird collision and electrocution. <p>Compensation: None described.</p> <p>Monitoring: Should be conducted during the operation phase according to technical prescriptions for evaluating the</p>

Case details	Planned preventive / remedial action
	effectiveness of measures to correct the barrier effect of transport infrastructure.
N-521 bypass of Malpartida de Cáceres	
<p>Type of development: Dual carriageway, 10.7 km total length. New stretches, and extension of an existing road.</p> <p>Developer: Roads General Directorate (Ministry of Development).</p> <p>Species addressed: Black stork (<i>Ciconia nigra</i>), Egyptian vulture (<i>Neophron percnopterus</i>), Montagu's harrier, Little bustard, Pin-tailed sandgrouse, Black-bellied sandgrouse, Cinereous vulture (<i>Aegypius monachus</i>), Marsh harrier (<i>Circus aeruginosus</i>), Lesser kestrel, Great bustard, Whiskered tern (<i>Chlidonias hybridus</i>), Little bittern (<i>Ixobrychus minutus</i>), Sand martin (<i>Riparia riparia</i>), Mediterranean turtle (<i>Mauremys leprosa</i>), Iberian newt (<i>Lissotriton boscai</i>), Otter.</p> <p>Ecological effects addressed: During construction: Blasting during construction may affect animals. Main impact on concentration areas of White stork, minor effect on foraging area for Great bustard and Cinereous vulture and nesting area for Egyptian vulture. During operation: Increased barrier effect and mortality due to road casualties on medium size mammals, amphibians and reptiles (highlighting the Mediterranean turtle).</p>	<p>Mitigation:</p> <ul style="list-style-type: none"> - Adapted timing of construction works, species-specific indications. - Cessation of blasting and large earthworks during the breeding period of bird species, no night work performed if lights and noise emissions are produced. - Conditioning of drainage, over- and underpasses for wildlife, perimeter fencing, escape systems for wildlife. - Wildlife over- and underpasses locations should prioritise those passages with less traffic and those that are farthest from humanised areas. - Ensure the continuity of the passages in service roads and spare paths. <p>Compensation: None described.</p> <p>Monitoring: Should be conducted during the operation phase according to technical prescriptions for evaluating the effectiveness of measures to correct the barrier effect of transport infrastructure.</p>
A-76 Ponferrada-Ourense	
<p>Type of development: New dual carriageway, 126 km total length, some stretches use current road N-120.</p> <p>Developer: Roads General Directorate (Ministry of Development).</p> <p>Species addressed: Iberian desman (<i>Galemys pyrenaicus</i>), Otter, Brown bear (<i>Ursus arctos</i>), Wolf, Wild cat (<i>Felis silvestris</i>), Stoat (<i>Mustela erminea</i>), Common bent-wing bat (<i>Miniopterus schreibersi</i>), Greater horseshoe bat (<i>Rhinolophus ferrumequinum</i>), Lesser horseshoe bat (<i>Rhinolophus hipposideros</i>), Mediterranean horseshoe bat (<i>Rhinolophus euryale</i>), Greater mouse-eared bat (<i>Myotis myotis</i>), Lesser mouse-eared bat (<i>Myotis blythii</i>), Barbastelle (<i>Barbastella barbastellus</i>), Mediterranean turtle, Schreiber's green lizard (<i>Lacerta schreiberi</i>), Iberian rock lizard (<i>Lacerta monticola</i>), Iberian painted frog (<i>Discoglossus galganoi</i>), Gold-striped salamander (<i>Chioglossa lusitanica</i>), Capricorn beetle (<i>Cerambyx cerdo</i>), <i>Geomalacus maculosus</i>, <i>Elona quimperiana</i>, <i>Macromia splendens</i>, <i>Oxygastra curtissi</i>.</p> <p>Ecological effects addressed: Clearing and grubbing of vegetation during the construction phase, which involves loss of refuge and feeding areas and shoed of animals.</p> <p>Wildlife nuisance by works.</p> <p>Creating tracks and access paths, earthworks, transit of vehicles and heavy machinery, generating loan and landfill areas or auxiliary facilities, building structures and drainages and effluent production (lesser effects).</p> <p>Wildlife habitats loss because of the permanent occupation of soil by the platform.</p> <p>Territory fragmentation due to barrier effect that limits animal movements, especially regarding terrestrial vertebrates.</p>	<p>Mitigation (selection):</p> <ul style="list-style-type: none"> - The unique environments for wildlife are considered exclusion areas for any temporary or permanent construction. - Timing of construction work outside sensitive periods for wildlife. Limited artificial lighting at night. - Control of discharges to surface. - Detailed inventories of endangered species of fauna (i.a. rock bird fauna, karst caves with bats). - Fauna passages, fencing and escape systems (special attention to endangered or sensitive species, especially for the brown bear, wolf, Iberian desman and otter). - Cross-drainages over rivers and streams adapted to fish and other aquatic organisms. - Amphibian tunnels, escape systems and fencing. - In viaducts of the current N-120, the project will join measures to ensure minimal impacts on colonies of bats. - Measures to minimise the effects of noise on rock birds during construction and operation: suitable pavement, slow circulation in the stretch, false tunnels or noise barriers. - Possibility of adopting measures to minimise electrocution and collision on power lines in SPA. - Protective staking in areas of interest for the fauna. - Actions to avoid direct elimination of individuals of protected fauna species. - Minimise the impact on bats in colonies nearby two rivers. <p>Compensation: None described.</p> <p>Monitoring: Monitoring the effectiveness of measures to avoid the impact of infrastructure on wildlife. The criteria set out in the document Technical prescriptions for monitoring and evaluating the effectiveness of measures to correct the barrier effect of transport infrastructure (Spanish Ministry of Environment and Rural and Marine Affairs, 2008) should be followed.</p> <p>Semi-annual monitoring of the state, functionality and use of passages, of perimeter fences and of escape systems by wildlife. During the first three years, an annual report with data collected will be developed.</p>

Case details	Planned preventive / remedial action
A-2 Pina de Ebro-Fraga	
<p>Type of development: Dual carriageway, 64 km total length, partly following current national road.</p> <p>Developer: Roads General Directorate (Ministry of Development).</p> <p>Species addressed: Great bustard, Common bittern (<i>Botaurus stellaris</i>), Dupont's lark (<i>Chersophilus duponti</i>), Lesser kestrel, Montagu's harrier, Egyptian vulture, endemic crustaceans (<i>Eucypris aragonica</i>, <i>Candacypris aragonica</i>), moths (<i>Coscinia romeii</i>, <i>Eremopola lenis</i>).</p> <p>Ecological effects addressed: During construction: Destruction or degradation of wildlife habitats during breeding and rearing periods. During operation: Increased risk of road casualties (previous casualties involving Red deer (<i>Cervus elaphus</i>) and Wild boar), barrier effects and fragmentation of habitats. Fragmentation impacts on steppe avifauna (especially Great and Little bustard), and on game species (Red deer and Wild boar).</p>	<p>Mitigation:</p> <ul style="list-style-type: none"> - Stops of construction works in periods for breeding and rearing of protected species. - Collision and electrocution avoidance measures on power lines. - Measures to improve the permeability of the road to game animals. - Adapting drainages and over- or underpasses as multi-functional structures. - Specific fauna passages. - In sensitive stretches for steppe birds, depressed road profile, berm or opaque screens of at least 4 m effective height. - Fencing as well as escape systems for wildlife. - Avoidance of construction works in territories of lesser kestrel. Avoidance of effects on buildings occupied by large colonies of lesser kestrel. <p>Compensation: Repairing roofs and installing artificial nests for lesser kestrel.</p> <p>Monitoring: Monitoring of road permeability.</p>
Sweden	
E20 Alingsås-Vårgårda	
<p>Type of development: 18 km 110 km/h 4-lane motorway, width 18-21 m, with wildlife fences. Partly new road, partly upgrading of existing 2(-3) lane road.</p> <p>Developer: Swedish Transport Administration.</p> <p>Species addressed: Bird species, limnic species in stream environments (not specified), forest wildlife, various species in oak grasslands.</p> <p>Ecological effects addressed: During construction: Noise in Natura 2000 area, hydrological effects (draining, clouding, spill). Small to intermediate effects expected. During operation: Barrier effects, habitat loss and fragmentation of forests and oak grasslands, barrier effects and hydrological effects in streams, traffic noise in Natura 2000 areas and in previously undisturbed areas. Intermediate to large effects expected.</p>	<p>Mitigation:</p> <ul style="list-style-type: none"> - Smaller fauna passages or larger wildlife overpass, amphibian tunnels. - Wildlife fences to avoid impact on fauna, possibly with escape ramps. - Siting to avoid most sensitive areas. - Small areas of particular importance for biodiversity excluded from construction. - Possible restriction of construction work in water to certain seasons. - Bridges over streams not affecting stream environment. - Special actions to avoid draining and protect water from spill and clouding. <p>Compensation: Construction of breeding ponds for amphibians.</p> <p>Monitoring: Not described.</p>
E22 Lösen-Jämjö	
<p>Type of development: 14 km 110 km/h 4-lane motorway, width 18-21 m, with wildlife fences. Partly new road, partly upgrading of existing 2(-3) lane road.</p> <p>Developer: Swedish Transport Administration.</p> <p>Species addressed: Large and medium-sized mammals, amphibians (no further specifications).</p> <p>Ecological effects addressed: Barrier effects on animals in previously un-fragmented forest areas. Movement corridors may change. Intermediate to large effects on wildlife (game) species (size of effects depend on route selected).</p>	<p>Mitigation:</p> <ul style="list-style-type: none"> - Wildlife fencing may be needed (depending on route selected), for traffic safety reasons. - Careful siting to avoid most sensitive areas. <p>Compensation: None described.</p> <p>Monitoring: Not described.</p>
E22 Fjälkinge-Gualöv	
<p>Type of development: 9 km 110 km/h 4-lane motorway, width 18.5 m, with wildlife fences. Partly new road, partly upgrading of existing 2(-3) lane road.</p> <p>Developer: Swedish Transport Administration.</p> <p>Species addressed: Wildlife/game species, mainly ungulates, also smaller species like Badger mentioned.</p> <p>Ecological effects addressed: Barrier effects, to some degree habitat loss. Possible dissection of tree rows and forest edges. Intermediate (partially large) effects.</p>	<p>Mitigation:</p> <ul style="list-style-type: none"> - Wildlife passages, possibly also over minor parallel road. - Additional wildlife fencing (some parts are already fenced). - Selection of route to minimise effects, avoiding forests with higher biodiversity. - Further wildlife studies. <p>Compensation: Forest plantation to compensate loss of forest. Re-planting of lost tree rows.</p> <p>Monitoring: Not described.</p>

Case details	Planned preventive / remedial action
E4 Sundsvall section Myre-Stockvik	
<p>Type of development: 11 km new road, mainly motorway (width 18.5-21.5 m), shorter part 3-lane road.</p> <p>Developer: Swedish Transport Administration.</p> <p>Species addressed: During construction: Salmonid fish, benthic organisms. During operation: Moose (<i>Alces alces</i>), Roe deer (<i>Capreolus capreolus</i>), Mountain hare (<i>Lepus timidus</i>), Lynx (<i>Lynx lynx</i>), Tetraonid birds, Trout (<i>Salmo trutta</i>), Salmon (<i>Salmo salar</i>), Grayling (<i>Thymallus thymallus</i>), Otter.</p> <p>Ecological effects addressed: During construction: Clouding of streams with potentially large effects on fish eggs and benthic organisms. During operation: Barrier effects, isolation of forest areas leads to loss of larger species in these areas, noise disturbance. Intermediate to large effects expected.</p>	<p>Mitigation:</p> <ul style="list-style-type: none"> - No construction work near water during spawning period of salmonid fishes. No driving in streams. Protective devices (filters) to minimise clouding. - Land bridges for terrestrial and aquatic fauna. - Road bridge adapted for fauna. Also fauna-adapted bridges on minor parallel roads. - Fencing where the road passes through forested areas. - Escape ramps along fences. - Water culverts wide and with natural substrates to allow connectivity for aquatic species. - Small areas of particular importance for biodiversity excluded from construction. <p>Compensation: None described.</p> <p>Monitoring: Not described.</p>
E12 Västra länken	
<p>Type of development: Total 11 km, but not all stretch relevant (through suburban area). Mainly motorway/major through-road, with intersections and entrances.</p> <p>Developer: Swedish Transport Administration.</p> <p>Species addressed: Ungulates, roosting birds, Great yellow bumblebee (<i>Bombus distinguendus</i>), <i>Elampus constrictus</i>.</p> <p>Ecological effects addressed: Barrier effect (in forest area), habitat fragmentation, disturbance on birds in Natura 2000 area. Small effects expected.</p>	<p>Mitigation:</p> <ul style="list-style-type: none"> - Minimise disturbance of birds. - Small areas of particular importance for biodiversity excluded from construction. <p>Compensation: None described.</p> <p>Monitoring: Not described.</p>
The Netherlands	
Buitenring Parkstad Limburg	
<p>Type of development: Broadening of motorway or highway >10 km, or conversion to other motorway (total 26 km, new motorway 18 km, upgrading 8 km, up to 100 km/h).</p> <p>Developer: Province Limburg.</p> <p>Species addressed: Bats, mammals, amphibians, reptiles, insects, birds, plants.</p> <p>Ecological effects addressed:</p> <ul style="list-style-type: none"> - Loss and deterioration of habitat for birds, mammals, reptiles, amphibians, insects and plants. - Disturbance by noise on birds. - Fragmentation for mammals, reptiles and amphibians. - Loss of hibernation places for bats. - Destruction of plant specimens. 	<p>Mitigation:</p> <ul style="list-style-type: none"> - 130 fauna passages for mammals, reptiles, amphibians. - Hop-overs for bats. - Creation and improvement of habitat for amphibians, reptiles, insects. - Acoustic barriers and 'silent' asphalt. - 200 nesting boxes for birds and bats. - Relocation of plants. <p>Compensation:</p> <ul style="list-style-type: none"> - New habitat and new sets for badgers. - Creating new hibernation locations for common pipistrelle (<i>Pipistrellus pipistrellus</i>). - Creating new habitat for birds. <p>Monitoring: Not described.</p>
Widening A12 Ede-Grijsoord	
<p>Type of development: Broadening of circa 11 km motorway with one lane in each direction (2x2 becomes 3x2) and broadening of several existing crossovers.</p> <p>Developer: Ministry of Infrastructure and Environment.</p> <p>Species addressed: Whiskered bat (<i>Myotis mystacinus</i>), Common pipistrelle, Red squirrel (<i>Sciurus vulgaris</i>), Smooth snake (<i>Coronella austriaca</i>), Slow worm (<i>Anguis fragilis</i>), Common lizard (<i>Zootoca vivipara</i>), Sand lizard (<i>Lacerta agilis</i>), various bird and plant species.</p> <p>Ecological effects addressed: Loss and fragmentation of habitat, deterioration of vegetation by changes in water level, deterioration of habitat quality of birds by noise.</p>	<p>Mitigation:</p> <ul style="list-style-type: none"> - Noise-reducing pavement. - Fauna passages for badger and small mammals. - Fauna passages above the motorway for pine marten (<i>Martes martes</i>). - Habitat improvement for reptiles. - During construction captivation and translocation of individual reptiles. - Redesign of vegetation in roadsides and optimising roadside habitats for species. - Relocation of plants. - Felling of trees outside the breeding season of birds. <p>Compensation: Compensation of resting places for bats.</p> <p>Monitoring: Monitoring of reptiles during a period of 16 yrs.</p>

Case details	Planned preventive / remedial action
Rijksweg A74	
<p>Type of development: Construction of new motorway circa 2 km, 2x2 lanes.</p> <p>Developer: Ministry of Infrastructure and Environment.</p> <p>Species addressed: Red squirrel, Stone marten (<i>Martes foina</i>), bats (9 species), Alpine newt (<i>Triturus alpestris</i>), Common buzzard (<i>Buteo buteo</i>), Goshawk (<i>Accipiter gentilis</i>), House sparrow (<i>Passer domesticus</i>), Little owl (<i>Athene noctua</i>).</p> <p>Ecological effects addressed: Barrier for fauna, fragmentation of habitat, destruction of plant-habitat, deterioration by noise for birds.</p>	<p>Mitigation:</p> <ul style="list-style-type: none"> - Customised lighting for bats. - Fauna passages like hop-overs for bats, wildlife overpasses and wildlife tunnels. - Plantings as guiding structures for animals. - Noise barriers and depressed road profile for noise reduction. <p>Compensation: Construction of compensation area; unclear for which species and which negative impact.</p> <p>Monitoring: As there is no guarantee that mitigation and compensation measures will be ecologically effective, a monitoring plan will be developed.</p>
A27/A1	
<p>Type of development: Broadening of lanes and construction of median verge over a total length of 14 km for A27 and 9 km for A1.</p> <p>Developer: Ministry of Infrastructure and Environment.</p> <p>Species addressed: Diverse: Badger, bats, fish, amphibians, Ramshorn snail (<i>Anisus vorticulus</i>).</p> <p>Ecological effects addressed: Barrier for Badger, habitat deterioration for bats (3 species), habitat loss for reptiles (2), fish (2), amphibians (2) and Ramshorn snail due to damping of ditches and conducting excavation work.</p>	<p>Mitigation: For the badger: wildlife overpass, two new wildlife tunnels and improvement of habitat as foraging area. Adaptation of light used during construction phase.</p> <p>Compensation: Compensation for loss of nature values of Dutch nature network by 2 ha.</p> <p>Monitoring: Review of effectiveness of mitigation and compensation measures will take place after these measures are installed; the review will take into account the specific measures.</p>



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