Opening Session

IENE 2010: CONCLUSIONS FROM THE INTERNATIONAL CONFERENCE

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ABSTRACT

Infra Eco Network Europe (IENE) is a pan-European network of experts dealing with transport infrastructure, landscape ecology and wildlife mitigation. IENE intends to arrange biannual international conferences alternating and communicating with ICOET to encourage the exchange of knowledge and stimulate a faster development of practical solutions.

The 2010 IENE conference in Hungary, entitled "Improving connections in a changing environment", was attended by about 200 participants from 32 countries worldwide. It emphasised the increasing role of the transport sector for biodiversity, which can be seen both as a threat and as an opportunity: A chance, because investments in transport infrastructure can entail increased understanding, improved planning processes and effective counteractions. A threat, because existing legal frameworks still focus on the protection of designated sites and threatened species and do not suffice to safeguard fundamental biodiversity values such as landscape connectivity.

At the conference, six key tasks have been identified to improve and ensure ecological connectivity in our changing environment:

1. Develop the concept of ecological networks and employ it as a framework in nature protection, landscape management and as a tool in spatial planning. Several European countries have already started this development.
2. Integrate landscape ecological thinking and ecological network approaches both in strategic and design-level planning of infrastructure. This may require a broadening of the corridor concept from the original coherent habitat network towards a strategic designation of functional linkages across complex landscapes.
3. Optimise rather than minimise the ecological impact. Investments in transport infrastructure can be used to introduce new or re-establish missing ecological qualities in the landscape. Transport corridors may offer refuges for rare species and create connectivity between otherwise isolated habitats. These must be balanced against the risk for creating ecological traps and spreading invasive species.
4. Adapt and improve mitigation measures that help to restore landscape permeability. Install de-fragmentation programs with a systematic focus on strategic ecological corridors. Further technical improvements could lead to more cost-efficient and ready to use mitigation options.
5. Collaborate! In order to match the speed of infrastructure development, and contribute pro-actively rather than repairing the damage afterwards, international collaboration is needed. Joint research programs, development projects and information activities appear as highly cost-efficient means to speed up the progress in knowledge and experience.
6. Involve the public in planning and decision-making processes, inform and educate about problems and solutions. Public participation may be essential to safeguard future concern about connectivity measures at local level.

BACKGROUND

The Infra Eco Network Europe (IENE) has been established in 1995 thanks to the initiative of the Road and Hydraulic Engineering Division of the Dutch Ministry of Transport, Public Works and Water Management. It was based on the

conclusions of the International Symposium on Habitat Fragmentation and Infrastructure in 1995, Maastricht, NL, at which the participants from over 25 countries proposed the formation of an international network in order to jointly address fragmentation issues caused by transport infrastructure, share knowledge and resources, and find practical but scientifically sound solutions to the common problems.

IENE, being initially a network of selected national representatives, is now based on the individual membership of experts dealing with landscape, infrastructure, wildlife and traffic. At present, the network consists of 164 registered members from 42 countries representing 142 organizations, including private companies, universities, agencies and governmental bodies. IENE bridges between the sectors of transport and environment, as well as between science and practice, and provides a forum for the international and interdisciplinary dialogue on matters concerning landscape and infrastructure. Despite being a mere network, IENE initiated the COST-action 341, a European joint venture on habitat fragmentation due to transport infrastructure, that produced the European handbook on Wildlife and Traffic (Iuell 2003), the European Review (Trocmé et al. 2003) and a number of national State of the Art Reports on the topic (see www.iene.info/cost-341). IENE arranges annual meetings, scientific workshops, and international conferences, at which decision makers, planners, practitioners, and researchers can interact and learn from each other. The next international conference is currently prepared for October 22-24, 2012, and will be held near Berlin, Germany.

Most of the early input to IENE derived from national agencies/authorities with specific needs for practical guidelines and technical advice. The focus was hence very much on design and efficacy of fauna provisions such as ecoducts and fauna passages. Over time, however, it became obvious that defragmentation must be considered much earlier in the planning process. Strategic planning is essential to achieve effective mitigation, but it requires expert knowledge on whether, where and how connectivity should be maintained or restored for the species in question.

Given the rapid development of road infrastructure, especially in eastern European countries, the envisioned upgrading of the European Network of transport corridors (TEN), and the overarching threat of a changing climate and unbroken loss of biodiversity, there is urge to integrate ecological concern at all levels of infrastructure planning. For this, we need a legal framework that provides incentives to improve connections in our changing environment and new approaches to include connectivity concepts in spatial planning. Successful defragmentation is a goal that cannot be accomplished by the transport sector alone: it requires a concerted effort of all involved stakeholders as well as the public.
These are the questions that were targeted by the IENE 2010 international conference and that will also be of guidance for IENE activities in the following years.

THE CONFERENCE

The IENE 2010 international conference, entitled "Improving connections in a changing environment", was held in Velence, Hungary, during Sept. 27 - Oct. 01, 2010. It was attended by about 200 participants from 32 countries worldwide and featured 5 plenary and 69 short presentations, 53 posters and 5 workshops among which was a meeting of the CEDR task group on Wildlife and Traffic and a special discussion of the impacts of railways and rail traffic. It also included an educational campaign that preceded the conference with a children's competition for the best illustration of the topic "On dangerous roads" and by that created a public recognition of the issue in Hungary. The conference was followed-up in 2011 through a national meeting in Hungary with 101 participants and 23 presentations. The conference documentation (abstracts, pictures, presentations, audio and video recordings) can be accessed at www.iene.info.

Overall, the conference covered a variety of topics ranging from environmental policy, infrastructure planning, and impact assessment, over road mortality, barrier and disturbance effects, mitigation measures and monitoring experiences, railway and road comparisons, to ecological networks, defragmentation approaches, and the potential of infrastructure corridors as resources for biodiversity.

The conference was opened by István Láng, the honorary chair of the Hungarian national Council for Environmental Protection and by Benedek Jávor, Chair of the Sustainable Development Committee of the Hungarian Parliament.

Plenary talks were held by invited speakers from Japan (Fumihiro Hara, Hokkaido Development Engineering Center), Germany (Michael Below, Deutsche Bahn AG), Sweden (Lars Nilsson, National Transport Administration), USA (Paul Wagner, ICOET), and Canada (Lenore Fahrig, Carleton University, Ottawa). These experts raised important strategic questions concerning ecological research on impacts, differences between rail and road infrastructures, and important similarities and dissimilarities between the US, Japan and Europe, with respect to habitat fragmentation, transport planning and mitigation. From en ecological and technical point of view, it is out of question that the mutual exchange of experience must be global, even if differences in the juridical and political background may require adapted solutions.

MAIN CONCLUSIONS

The IENE 2010 conference led to several conclusions that have implications in research, planning and practice. These conclusions can be summarized by six major tasks that will help to improve and ensure ecological connectivity in our changing environment:

1. ***Develop the concept of green infrastructure or ecological networks and employ it as a framework in nature protection and landscape management and a reference in both strategic and project-level planning of infrastructure.***

At European level as well as in several countries, comprehensive work has been launched during the past years to develop networks of habitats or movement corridors that shall support the exchange of both small and large species among distant populations. These efforts can be seen as an extension of the Natura 2000 network (within EU) and the Emerald Network (other European countries) of protected high biodiversity sites, as they often address non-threatened and unprotected species or sites or even entire landscapes. Above all, however, the approaches focus on the functional connectivity within a network and not between areas in a patchwork.

The European Commission defines Green Infrastructure (http://ec.europa.eu/environment/nature/ecosystems/green_infrastructure.htm) as "a concept addressing the connectivity of ecosystems, their protection and the provision of ecosystem services, while also addressing mitigation and adaptation to climate change. [...] Green Infrastructure helps ensure the sustainable provision of ecosystem goods and services while increasing the resilience of ecosystems. The concept is central to the overall objective of ecosystem restoration, which is now part of the 2020 biodiversity target. [...] Its ultimate aim is contributing to the development of a greener and more sustainable economy by investing in ecosystem-based approaches delivering multiple benefits in addition to technical solutions, and mitigating adverse effects of transport and energy infrastructure."

The essential contribution of green infrastructure and other ecological networks to the environmental adaptation of the transport sector is that they may be used as a reference in the spatial planning of infrastructure and help to prioritize sites where special concern on connectivity (or infrastructure permeability) must be given, and improvements in the existing transport system are necessary. Obviously, it is neither the entire landscape nor the entire length of a new infrastructure barrier that can be mitigated. Fauna provisions should hence be located where their effect is maximized and their long-term functioning ensured. The risk, however, is that all mitigation efforts might be concentrated on intersections with designated ecological corridors, while other opportunities to enhance the permeability of infrastructure barriers are missed.

2. ***Enhance the understanding of fragmentation and the scientific knowledge on barrier, mortality and disturbance effects and make it operational in planning contexts.***

Much research has been done so far on how traffic and infrastructure affect wildlife. The evidence for adverse impacts is overwhelming: thousands of individual animals are killed in traffic, disturbed in mating and reproduction or repelled by busy highways and high-speed railways. Most studies, however, have been of descriptive rather than of exploratory nature, with a focus on individuals and local phenomena instead of on populations at regional scales. Few studies allow for drawing general conclusions on dose-response relationships or critical thresholds. This applies especially to monitoring studies commissioned for new infrastructure investments. It is no longer a secret that animals use fauna passages, but there is still uncertainty about which factors are essential for a successful passage and whether the documented use is sufficient at population level to prevent local extinctions (van der Ree et al. 2010). There is further uncertainty about the kind of impact that is most relevant to a given species under certain circumstances. For many if not most species, mortality may be the most significant threat to mitigate, let alone traffic safety aspects, whereas for others, barrier and isolation effects may be a greater issue (Fahrig 2010).

Knowledge about the relative significance of impacts (also in comparison to other land use forms) is essential to decide about whether mitigation should be prioritized and how it can be achieved in a cost-efficient way. Obviously, not all species can be considered, but some may be used as umbrella or focal species in mitigation planning as measures designed for them may also be of benefit to other species. Other species may serve well as indicators of a certain impact (mortality, noise). To rely solely on red listed species, for which there is the only juridical incentive for mitigation, may however not suffice. Infrastructure planners ask for guidance to select the most appropriate species for impact evaluation and monitoring studies. Simpler and clearer recipes on such investigations may further help integrate ecological concern in the planning process (Nilsson 2010). This applies especially to questions on landscape fragmentation at strategic levels and regional scales. Fragmentation of habitat and entire landscapes is a well-established concept by now, and quantitative measures such as the effective mesh size (Jaeger 2010) have proven to

be suitable in providing planners with tools to distinguish areas that are especially sensitive to further fragmentation - from ecological as well as social perspective (Pernkopf & Lang 2010).

3. ***Optimize the ecological impact and take advantage of potentially positive effects that can complement missing ecological qualities in the landscape.***

Traffic and infrastructure have undoubtedly a variety of adverse effects on the adjacent landscape and its wildlife. Yet, through the creation of new, albeit disturbed habitats in transportation corridors, verges, cuts and quarries, infrastructure offers an often unexploited opportunity to enrich landscapes, provide valuable biotopes or compensate for the loss of habitat or reduced accessibility of spatial resources.

With careful design and management, roadsides and railway corridors can offer a refuge to plants (Lennartsson et al. 2010), invertebrates (Kiss et al. 2010) or small mammals (Marques & Mira 2010) that otherwise may not find a suitable habitat in the cultivated landscape. If these habitats are integrated in the "green infrastructure" of the surrounding landscape, and linked through ecoducts to similar habitats across the road, human transport corridors may eventually contribute significantly to the preservation of these species.

However, these benefits must be balanced against the risk of creating ecological traps that mask the dangerous traffic with attractive food and cover resources but cause increased mortality (Dinetti 2010). Also, the downside of connectivity is that it fosters desired as well as undesired species and helps spreading invasive species that require expensive control management (e.g., Thompson et al. 2010). An integrated land use and mitigation plan may help to maximize the potential benefits while minimizing inherent risks and dangers. Again, good knowledge on how individual species respond on traffic, infrastructure and mitigation measures is essential.

4. ***Develop monitoring strategies to validate the efficacy of mitigation measures and create common guidelines for evaluation studies.***

Across Europe, millions of Euros are invested each year on technical measures and innovations to counteract habitat fragmentation and reduce mortality in wildlife without any knowledge about the efficacy and reliability of these investments. It is rather the exception than the rule that mitigation efforts are followed-up and evaluated. Learning by doing should be a standard, but unless monitoring studies are already integrated in the initial exploitation plan or required for other reasons, they are often very difficult to finance.

Monitoring or follow-up studies are important in different ways, they help to gain knowledge about the role of individual components that distinguish effective from non-effective mitigation solutions, and they reduce the risks of over- and underspending in relation to the targeted result, and they are the only way to validate the effect of mitigation efforts. The lessons learned from mistakes made by others or during previous attempts can save lives as well as money. Yet, to allow for this, studies should meet certain scientific and qualitative demands (van der Ree at al. 2010), which often implies higher costs and longer time schedules than what transport authorities may be willing to pay for. International guidelines, such as in the European handbook on Wildlife and Traffic (Iuell et al. 2003), may be a helpful tool to define standards for monitoring studies that both agencies as well as ecologists could refer to. An update of the 2003 handbook has been proposed at the conference and is also recommended by the CEDR Task Group on Wildlife and Traffic (Ujvári, Nilsson, & Rösten, in press).

Other essential questions are how efficacy should be defined and thus measured. How much mitigation is necessary to obtain the desired results and what are appropriate performance targets in a given situation. When should monitoring be mandatory and when is it acceptable to refrain from expensive programs and rely on simpler follow-up studies or even trust in existing practical experience from elsewhere? Here, ecologists are asked to develop schemes and guidelines that help planners in cost-benefit analyses of infrastructure investments and produce realistic requirements on mitigation.

If provisions for wildlife can be argued for and designed with a solid foundation in scientific knowledge and practical experience, we have taken a big step forward to improve connectivity in our environment.

5. ***Collaborate across borders in joint research projects, defragmentation programs and information activities to contribute proactively to future infrastructure development.***

Across Europe, and worldwide, a growing concern for biodiversity and habitat connectivity in response to the steadily expanding road and rail infrastructure has produced numerous actions at national as well as international level. Examples of international endeavors for restoring habitat connectivity are e.g., the ECONAT forum for the exchange of

best practice concerning Natura 2000 sites in the EU (Bekker & Baader 2010); the ECONNECT project or the Ecological Continuum initiative for the Alps (Kohler 2010), the Trans European Wildlife Network, with a special focus on restoring connectivity for wide ranging species in Eastern Europe (Huber & Spangenberg 2010). National examples are e.g., the Dutch Defragmentation program MJPO (Bekker 2010), the German BUND Habitat network for wildcat (Hoerstermann, Mölich & Vogel 2010); the Czech Territorial System of Ecological Stability (TSES; Hlaváč et al. 2010), or the Swiss Defragmentation program (Trocmé 2010).

Other important international collaborations that also address infrastructure and biodiversity are e.g., the Conference of European Directors of Roads (www.CEDR.fr) with the task group 7 on Wildlife and Traffic (Bekker & Henriksen 2010); the World Road Association (www.PIARC.org) technical committee A1; and very recently the International Union of Railways (www.UIC.org) decided to set up a new network "Sustainable land use", partly in response to the Rail workshop held at the IENE 2010 conference.

Questions concerning landscape connectivity, defragmentation, and mitigation measures rise in very different contexts, many of which are linked to IENE through the involved experts. Nevertheless, there is risk for misunderstanding and confusion simply because of the variety of languages and concepts employed in Europe. IENE proposed therefore to develop a common terminology, based on the glossary of the COST-action 341 and the input of network members. Another risk is that certain questions are studied over and over again whereas others remain unanswered. To counteract this, IENE proposed to establish a scientific advisory group on infrastructure and ecology that identifies important unresolved research questions. Such a list of priority areas could then provide guidance to universities, research councils, transport agencies and other organizations that fund relevant research projects.

Finally, while it is relatively simple to gather scientists at international conferences, practitioners, transport planners, road engineers and environmental consultants are often more bound to their national settings and find fewer opportunities to exchange experiences and questions. New arenas should be established to make scientific knowledge more operative in practice and identify which applied questions that still need continued research.

6. ***Involve the public in planning and decision-making processes, inform and educate about impacts and solutions.***

One of the key factors for a successful life-long functioning of defragmentation measures is the involvement of the general public. Without public acceptance of and concern for technical provisions such as ecoducts or fauna tunnels, there is risk for misuse, disturbance or demolition, as well as for a consequent change in land use triggered by these measures. Ecoducts may be used as conventional road bridges or for recreational purposes, underpasses may be used for storage and shelter, smaller passages may be fenced off by local farmers; examples of such failures are many across Europe. Also, complaints may arise as to why transport authorities favor deer and other wildlife instead of improving crossing facilities for humans. The greatest danger, however, may be that adjacent natural areas that connect fauna passages with the ecological habitat network in the wider landscape, are sooner or later exploited for industrial or urban development. It is easy to forget that not only road or rail infrastructure, but also green bridges, ecoducts and other built provisions, will be in place for many decades to come. Changes in land use, climate and human population that accumulate over time must hence be considered already from the beginning. Without maintained habitat connectivity, even the most expensive ecoducts will lose their significance for wildlife and the initial investments may be rendered valueless.

On the other hand, public awareness about the impact of traffic on wildlife is an often underestimated factor that may help implementing mitigation and compensatory measures where the legal framework is insufficient. Traffic killed animals and highway barriers are well recognized phenomena, even among school children, and can easily create a public opinion that may justify planners to invest in fauna provisions for ethical reasons, despite a lack of ecological necessity. Yet, the public opinion can be tricky, as it may not be the most affected and threatened species that arise the people's interest, but rather the common and cute one. It will hence require a well-planned public information to translate the ecological problem into a communicable tale with well-known images and recognizable icons. Some of the projects on ecological networks mentioned above have been successful in promoting a focal or "umbrella" species that helps in establishing mitigation measures from which many other species benefit as well. Public participation in spatial planning is a powerful tool that ecologists should well learn to take advantage of if they seek to improve connections in our changing environment and accomplish a more permeable and environmentally sustainable transport infrastructure. After all, concern for biodiversity is not merely a task for experts alone, but a challenge to everyone.

CLOSING REMARKS - SUGGESTIONS FOR FURTHER ACTIONS

Improving ecological connections in a changing environment is clearly not a simple task that the transport sector can take responsibility for or even accomplish alone! It requires strategic and long term spatial planning as well as better knowledge about mitigation needs and possibilities. It will require collaboration between ecologists, engineers, planners, stakeholders, and the general public; but last not least a well-founded argumentation to convince decision makers when and where action is to prioritize.

At the conference, a number of specific tasks have been identified that could be addressed by IENE members and in collaboration with ICOET. The following examples are not an exclusive list. We could/should:

- set up an open glossary on matters relating to fragmentation, mitigation and infrastructure that can help to establish a common conceptual basis and a harmonized terminology,
- establish a scientific advisory group that can highlight important gaps in knowledge with respect to e.g., impact assessment, mitigation, and monitoring,
- create a work group that focuses on ecological impacts and mitigation options related to railways and high-speed trains with the aim to increase knowledge and support new research,
- update the European Handbook on Wildlife and Traffic with respect to new empirical data, revised technical guidelines and new environmental policy,
- develop general guidelines and criteria for when and where what kind of mitigation should be required,
- develop guidelines for follow-up studies and monitoring programs and establish long-term funding opportunities,
- develop attractive and appropriate information material and create education opportunities for the general public as well as for policy makers.

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BIOGRAPHICAL SKETCHES

Dr. Andreas Seiler has his PhD in wildlife biology from the Swedish University of Agricultural Sciences in 2003 and has since 1994 worked on animal-vehicle collisions, barrier effects of roads and traffic on wildlife, traffic noise disturbance in birds, monitoring of mitigation measures along new infrastructure, and landscape fragmentation issues. He has a close collaboration with the Swedish Transport Administration, and is a member of the IENE Steering committee and the IENE Secretariat.

Dr. Lars E. Nilsson, Environmental director of the Swedish Transport Administration. Previously environmental director of the Swedish Road Administration, political advisor to the transport minister and a scientist from the universities of Stockholm, Leiden and Uppsala. Lars has been working on the subject of transport and environment for more than 15 years at a policy level. He has been active in many research programs including being chairman of the Swedish emission research program EMFO and Transport-Mistra program.

Dr. Miklós Puky is a senior research fellow at the Hungarian Danube Research Institute of the Hungarian Academy of Sciences and the Chair of the IUCN SSC Declining Amphibian Populations Task Force Hungary. Most of his work is dedicated to different conservation and environmental education programs and he also teaches conservation ecology at the University Eötvös, Budapest. Miklós started amphibian road kill research and conservation in 1986, which was a first attempt in the Central-European region. For organizing and leading international programmes he was presented several conservation and education prizes such as Pro Natura, For the Environment, Géza Entz and the Henry Ford European Conservation Award and he was also a winner of the Ten Outstanding Young People competition.

Anders Sjölund has an MSc in ecology from Uppsala University and studied biology and geology at Stockholm University and forestry at the Swedish University of agricultural in Umeå. Anders started his working life, as engineer at the Ericsson Ltd, developing phone applications in telephone exchanges. After studies in biology he was employed at

environmental departments in municipalities, County Administrative Boards, the Road Administration and at the Swedish Transport Administration. Anders is chairman of the Natural and Cultural Heritage Group in the Nordic Road Association, and of the Technical Committee 555 Standardized nature inventory at the Swedish Standards Institute. Anders also chairs the Steering committee of the Infra Eco Network Europe (IENE).

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