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Tuesday / 16:30 - 18:00
Room: Dome, Ring 1 and 2

[1] No net loss of biodiversity: tools for stakeholders?

Agnes Mechin, Sylvain Pioch (CEFE - Université Paul Valéry Montpellier 3, France)

Following international agreements on the need to halt biodiversity loss, many countries have implemented an environmental policy to reduce the impact of land development on biodiversity in accordance with the objective of No Net Loss (NNL) of biodiversity. We propose to define the particularity of usability and social acceptability in the case of ecological equivalence assessment method for stakeholders. We rely on a user-centred design in which users actively participate at each step in the method. We make an experimental test of this approach to identify a way to bridge the gap between research and action.

[2] Reduce impacts of the linear infrastructures of terrestrial transport on the amphibian populations (AMPHILTe)

Alain Morand, Luc Chrétien (Centre d'études et d'expertises sur les risques, l'environnement, la mobilité et l'aménagement, France)

The road network is getting denser and acts as a barrier for the amphibians, isolating more and more populations as well as increasing the risk of road mortality with vehicles. Within the research program 2017 ITTECOP, Cerema was selected to construct a European project 'AMPHILTe' over several years with different partners. This applied project takes into account the experiences and skills from different and diverse backgrounds, gathers a group of various stakeholders (public and private; NGOs – naturalists and citizens -, research scientists, managers of protected area, infrastructure managers and road/transport planning experts).

[3] Challenges in realizing fauna

passages

Aldo Hoogenboom, Femke van Schie (Movares, Netherlands)

This presentation will not only discuss the challenges that may occur in the daily practice of engineering small fauna passages, but also possible solutions. In addition, the presentation will offer an insight into Dutch procedures, which can be applied to small fauna passages underneath railways.

[4] The historical co-evolution of river infrastructure networks and biodiversity: findings from the French-German Upper-Rhine region and the Austrian-German Danube region

Andreas Huber, Manon Pons (European Institute for Energy Research, Germany); Jean-Nicolas Beisel (Laboratoire Image Ville Environnement, France); Sebastian Weber, Carine Granier (EDF - Centre for Hydro Engineering, France)

We present results from an interdisciplinary project, which investigates the co-occurrence of biodiversity changes and the expansion of river infrastructures. Our empirical work focuses on three cross-border sites along the Upper Rhine and the Middle Danube, strongly shaped by human activities. We assess the changes of fish, alluvial forests and macroinvertebrates and put them in relationship with the growing networks of infrastructures. Our understanding of river infrastructures as collections of linked artefacts, organised in networks and nodes, will help us in identifying potential adaptation measures, which hold the potential of reconciling the restoration of biodiversity and the operation of infrastructures.

[5] The French railway: Determination of the ecological potential of the SNCF land property for ecologic valuation

Anne Guerrero, Corinne Roecklin, Amandine Orsini (SNCF Réseau, France)

SNCF is a significant property owner with large infrastructure verges and right of ways along more than 38,000 km of railroads. This land property is mainly dedicated to railroad installations. However, a significant part of those land reserves does not have a technical vocation. We should ask the following question: how can those verges and land reserves, directly managed by an infrastructure operator, be used for direct implementation mitigation measures for biodiversity or possible valuation in favour of biodiversity? That is why SNCF Réseau pilots an exploratory study to identify the ecological potentials of its land reserves.

[6] Developing sustainable road verge habitats in Ireland

Aoife McAleenan, David Woodward, Phillip Millar (Ulster University, School of the Built Environment, Northern Ireland)

Sustainable infrastructure is designing in a way as not to lessen economic, social, and ecological development. However, when considering sustainable infrastructure, the economic and social processes can outweigh the environmental processes. By promoting the need to focus on environmental sustainability for the good of nature and men, we can bring a balance to sustainable development.

[7] Green bridges versus increased fragmentation

Arthur Ebregt (Het Loo Royal Estate, Netherlands), Eric Klein Lebbink (National Forest Service, Netherlands)

Defragmentation of the Veluwe (Natura 2000-area) by green bridges has a positive impact on populations of mammals, insects and reptiles. Integrated into a network of ecological corridors, it serves various goals and organisms. Fragmentation by major roads is solved, but problems with traffic on secondary roads needs increased attention. A

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greener transport infrastructure needs to be developed and implemented for these roads. Reducing the number of secondary roads in combination with speed limits and night closures is an appealing option. This approach does not only apply for the Veluwe, but for many other great green areas in Europe as well.

[8] Implications of ecological barriers on cross-border transport between India and its neighbours

Avanth Gunturu (Shiv Nadar University, India)

India's cross-border trade has been minimal due to the hostile relationship it shares with its neighbours and the geography. This paper deals with the latter. The geographical features that make South Asia a subcontinent, lie on the borders of India. This acts as a major impediment to developing cross-border transport systems. This work deals with the implications of geography on transport and vice-versa.

[9] Ecological effects of pipelines: A case study of the Bailadila-Visakhapatnam iron ore slurry pipeline

Avanth Gunturu, Girish Agrawal (Department of Civil Engineering, Shiv Nadar University, India)

Pipelines are generally considered the least destructive mode of transportation due to the lack of significant visible environmental impact. However, pipelines have multiple long-term impacts, the most critical being socio-economic disruption, landscape fragmentation, and soil and water pollution. This paper presents a pilot study of a proposed methodology to conduct preliminary environmental impact studies of the Bailadila-Visakhapatnam iron ore slurry pipeline segments, running through inaccessible areas.

[10] Safety by nature: development of erosion resistant and species-rich river dyke vegetation through adapted management

Bart Vandevoorde, Erika Van den Bergh (Research Institute for Nature and Forest, Belgium); Piet Thys (De Vlaamse Waterweg, Belgium)

Dykes are constructed as a flood control measure. Nowadays, this network of dykes shows a wide range of vegetation types, erosion resistance, and above-ground biomass. We researched the relationship between vegetation patterns and abiotic conditions. Species-rich grassland and species-rich *Arrhenatherum*-grassland combine the best erosion resistance with low maintenance cost and high ecological value. From there, we proposed to design and management guidelines to optimise the combined flood control and ecological functions of the dykes under acceptable maintenance costs. These guidelines have then been spatially specified in a proposed management plan for the dykes.

[11] Complementary use of statistics and simulations for assessing incident-risk with large wild mammals on a 3,500 km railway

Catherine de Roince, Jérémie Cornuau, Sylvain Moulherat (TerrOïko, France); Sébastien Maubon (SNCF Réseau, France)

From 2005 to 2016, in the Southwestern part of the French railway (3,500 km long), train incidents (wanderings and collisions) with large mammals have sharply increased. SNCF réseau has ordered TerrOïko to develop an analysis method including crossing data on the location of the incidents reported by the drivers and demographic and displacement simulated data of large mammals (SimOïko simulator) to map incidents hotspots. 85 hotspots were identified, making it possible to reduce the fine-scale investigations at 27% of the total network.

[12] Roadside Grass Collection: benefits and impacts on vegetation management

Christophe Pineau (Cerema Ouest, France); Isabelle Zdanevitch (INERIS, France); Léa Duffo (AILE, France)

In France, different maintenances of roadsides are implemented. In recent years, new types of equipment were built for mowing the verge and grass collection. Their aim is notably to generate renewable energy by integration of the residues into biogas plants. It was relevant to assess the benefits and limits of these new management processes to compare them with traditional mowing. Therefore, an experimental monitoring protocol (Carmen) has been implemented on verges since 2015 to study the impact of each new mowing method on vegetation and road management (costs, pollution, bio-diversity, etc.).

[13] Are movements across roads and their timing linked to the traffic load in the Red Deer?

Claude Fischer, Laurent Huber (University of Applied Sciences of Western Switzerland, Switzerland)

Traffic load and the timing of traffic peaks are likely to influence the fragmentation impact of roads as well as on the crossing behavior of animal species. Fifteen Red Deers were fitted with GPS collars to assess how regularly they would cross a road subjected to heavy traffic and if there was a temporal pattern in the timing of these crossings. Results showed that such a pattern was observable and that it linked to traffic load intensity.

[14] Biodiversity and wildfire prevention at Infra Transport Routes

Constantijn Kok (Safety region North- and East Gelderland, Netherlands)

Can we stop an uncontrolled wildfire? In the Netherlands, wildfires are an underes-

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timated risk. The risk does not only apply to the large concentration of residential and recreational areas but should also be applied to the infrastructure that has been built crossing a nature reserve. Transport movements in highway and railway routes, among other things, increase the chance of the occurrence of a wildfire. The natural compartment borders often include broadleaved belts and thus form a natural stop line where a wildfire is supposed to stop. The aim is not only preventing wildfires but also increasing biodiversity and protecting vulnerable nature.

[15] U.S. Forest Service online Drought and Climate Galleries

Cynthia West, Dixie Porter, Erik Johnson, Nathan Walker (USDA Forest Service Office of Sustainability and Climate, USA)

In 2017, the USDA Forest Service developed online Drought and Climate Galleries to support environmental analysis of the risks and impacts from increasing temperature and drought. The Galleries include maps, tools, GIS layers, fact sheets, and other resources for natural resource specialists, managers, planners, GIS practitioners, and the public.

[16] WWW.ECOLOGICAL-NETWORK.EU and WWW.LEBENSRAUMVERNETZUNG.AT

Daniel Leissing, Horst Leitner (Büro für Wildökologie und Forstwirtschaft, Austria); Roland Grillmayer, Gebhard Banko (Umweltbundesamt GmbH, Austria)

www.ecological-network.eu / www.lebensraumvernetzung.at is an online information portal provided by the Austrian Federal Ministry of Sustainability and Tourism which serves to provide existing geodata and further information on ecological networks and green infrastructure.

[17] Ecological permeability along and across traffic routes in an intermodal transport environment

Daniel S. Esser, Andreas Sundermeier (German Federal Institute of Hydrology (BfG), Germany); Karl-Otto Nagel, Pia Bartels (Federal Highway Research Institute (BASt), Germany); Marion Leiblein-Wild (Federal Railway Authority (EBA), Germany)

We conducted a landscape-scale biodiversity study along an intermodal transport infrastructure network consisting of federal roads, railway lines, and waterways in a typical German low mountain landscape. The potential role of traffic-adjacent green corridors for the conservation of biodiversity was investigated. Here, we present the results of our analysis of intermodal similarity of the vegetation along transportation infrastructure. Our results emphasise the importance of intermodal decision-making to maximise the efficiency of biodiversity promoting measures both in planning and maintenance of the whole transport infrastructure system.

[18] Eco-ducts in Dutch Dunes: Practical tips for construction work!

Dimitri Emond, Gerard Smit (Bureau Waardenburg, Netherlands)

Two green bridges have been built to improve the coherence within the dunes of Zuid-Kennemerland (Netherlands), a third green bridge is under construction. The green bridges facilitate the movement of animals within a unique Dutch dune landscape. Construction workers have to account for the local presence of protected species, such as sand lizards and natterjacks. The design of the green bridges is targeted at the development of the Natura 2000 habitat Grey dunes and a good connection with the available habitat in the direct surroundings. The poster shows practical measures for the design and construction, that function as examples for future projects.

[19] Evaluating the effectiveness of a wildlife overpass in restoring gene flow in a slow worm population

Edgar A. van der Grift, Arjen de Groot, Fabrice G.W.A. Ottburg, Hugh A.H. Jansman, Ivo Laros (Wageningen Environmental Research, Wageningen University and Research, Netherlands)

We studied the genetic structure of a slow worm population that is bisected by a motorway and railroad. We discovered that the motorway had been a genetic barrier; individuals from the western and eastern road verges belong to different genetic clusters. Individuals that were found on a recently constructed wildlife overpass seem to originate from the genetic cluster on the western side of the transport barriers. The genetic differences between the populations will allow for evaluating gene flow after slow worms have had sufficient time to reach and accept the overpass. Therefore, the genetic sampling will be repeated in 2020.

[20] Knotweed: a worldwide problem

Ellen Boontje (ProRail, Netherlands); Florence van den Berg (IV-Infra, Netherlands)

The poster shows the threats of knotweed, but also the opportunities to treat it. It hopefully makes people more aware, that the contamination with knotweed should be taken care of!

[21] Road and ecological network interaction: an analysis of ungulate road accident in the Province of Turin (Italy)

Eloisa Massobrio, Paolo Tizzani (Università degli Studi di Torino, Italy)

The expansion of the road network and the rise in vehicular traffic can cause interruptions of the ecological network, undermining its function. Consequently, in the last years, a significant increase in collisions with wildlife species has been registered, representing one of the most

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significant causes of biodiversity decline due to human activity. In this study we evaluated the consequences of the road network expansion on the ecological connectivity in Province of Turin (Piedmont, Italy), using the distribution of road accidents with wild ungulates as an index to identify critical areas.

[22] Coordinated planning of connectivity for wildlife at a bundled motorway–railway corridor in Sweden

Kajsa Nilsson, Erik Dalman (Swedish Transport Administration, Sweden); Christoffer Ekström (Stockholm University / WSP, Sweden); Jan Olof Helldin (Calluna AB / Swedish Biodiversity Center, SLU, Sweden)

The case of the East link railway line and the E4 motorway in Sweden illustrates the importance of coordinating wildlife connectivity planning across different infrastructures that are bundled together. In this presentation, we describe the planning approach and its output and point out some limitations of coordinated planning of bundled infrastructures.

[23] Evaluation of wildlife mortality and the effectiveness of animal underpasses in the Northern inter-American road, section Cañas-Liberia, Costa Rica

Esmeralda Arévalo-Huezo (Universidad Ulatina de Costa Rica-VAVS, Costa Rica); Alejandra Robledo-Bonilla (Asociación Ornitología de Costa Rica, Costa Rica); Esther Pomareda-García (Centro de Rescate Las Pumas, Costa Rica); Daniela Araya-Gamboa (Panthera Costa Rica, Costa Rica)

The road infrastructure provides an essential basis for the proper functioning of all national economies. Therefore, they are considered as works that represent a wide range of economic and social benefits for the regions. These road projects allow the development of a population that is in constant growth with high demands. In addition, they allow improving the quality of life of the inhabitants. However, roads cause

large negative impacts on the environment. Currently, roads are considered an important cause of anthropogenic disturbance and mortality of wildlife. The physical presence of roads creates new habitats in their vicinity, which can become ecological traps. They can also affect the biological and ecological processes of riparian systems as well as disrupting natural habitats and ecological processes.

[24] Bats overpasses, an insufficient solution to funnel bats crossing the road

Fabien Claireau (National Museum of Natural History, Center for Ecology and Conservation Sciences, France / University of Greifswald, Zoology Institute and Museum, Germany / Naturalia environnement, France); Yves Bas, Jean-François Julien (National Museum of Natural History, Center for Ecology and Conservation Sciences, France); Sébastien J. Puechmaille (University of Greifswald, Zoology Institute and Museum, Germany); Benjamin Allegrini (Naturalia environnement, France); Christian Kerbiriou (National Museum of Natural History, Center for Ecology and Conservation Sciences / Biological Marine Station, France)

Roads have many negative effects on wildlife, including the prominent role as habitat fragmentation. Bats overpasses are among these proposed improvements intended to reduce the fragmentation. We studied three bats overpasses in France and developed an innovative method to characterize bat crossings. Our sampling design involved six pairs of acoustics recorders disposed on both sides of road. Our results suggest that crossings are more numerous at the overpass. However, the proportion of bat crossings in the commuting route remain of the same magnitude than crossings at the overpass, suggesting that overpasses do not fulfil the function of funnelling bats crossings.

[25] No effects of wildlife warning reflectors

Falko Brieger, Robert Hagen, Max Kröschel, Martin Strein, Rudi Suchant (Division of Wildlife Ecology, Forest Research Institute of Baden-Württemberg, Germany)

The comprehensive behavioural study demonstrates that wildlife warning reflectors are not a suitable preventive device for reducing vehicle-wildlife accidents. Blue semicircle reflectors did not cause changes neither regarding behavioural alteration of roe deer at the roadside in the presence of traffic nor in the long term concerning the frequency of road crossings in GPS-collared roe deer. In enclosures under controlled conditions roe deer exhibited the same behavioural patterns compared to roe deer close to roads. These results confirmed those of the field experiment. In addition, feeding experiments did show that blue is not a “warning color” for roe deer.

[26] A push for growth, a pull on the environment: Brazil's highway plans and their environmental impact

Trevor Ray Tisler, Fernanda Zimmermann Teixeira, Rodrigo Affonso de Albuquerque Nóbrega (Institute of Geosciences – Federal University of Minas Gerais, Brazil)

Brazil's current federal National Road System (SNV), built and planned segments, represents a failure in acknowledging the country's ecological resources and areas of conservation concern. However, given that the SNV is still undeveloped compared to developed country standards, Brazil has an opportunity to rethink its SNV and avoid making significant ecological blunders. Using geospatial data such as legally protected areas, official priority conservation areas, land cover classification, and human population density both highways and geographic areas posing environmental concern were identified. Preliminary results show that

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approximately 44% of the SNV, built and planned, are in areas of significant ecological concern.

[27] How long should we survey road kills before taking action?

Júlia Beduschi, Bibiana Terra Dasoler, Larissa Oliveira Gonçalves, Andreas Kindel (Graduate Program in Ecology of Federal University of Rio Grande do Sul, Brazil); Fernanda Zimmermann Teixeira (Graduate Program in Environmental Systems Analysis and Modelling of Federal University of Minas Gerais, Brazil); Ricardo Miranda Braga, Franciane Almeida (Sinhá Laurinha Non-Governmental Organization, Brazil)

Using thirteen years of road kill data, we analysed how long surveys should be carried out before applying mitigation measures, for two animal groups with different locomotion types. We quantified the percentage of identified hotspots in the first year that was also present in the complete dataset and the percentage of new hotspots that emerged during thirteen years of accumulated data. We verified that more than 70% of all hotspots were already present in the first year of survey, indicating that mitigation measures could be applied based on a short-term survey, at least within similar landscape contexts and survey procedures.

[28] Multiple-criteria analysis for the definition of viability corridors for railroad expansion

Rodrigo A.A. Nobrega, Fernanda Z. Teixeira, Trevor R. Tisler, Icaro N. Souza, Marlon Fernandes, Adriana M. Costa, Ursula Ruchkys, Marcilla S. Pena (Graduate Program in Analysis and Modeling of Environmental Systems, Federal University of Minas Gerais, Brazil); Fernanda F. Faria, Cecilia C. Almeida (VLI Logística, Brazil)

Predicting possible environmental impacts has the potential to anticipate mitigation solutions that minimise damages and costs in greener transport

infrastructure projects. We present the example of a partnership between the Federal University of Minas Gerais and the company VLI Logística to improve the planning of the railroad expansion. We studied the environmental viability of a planned railroad with a multiple-criteria analysis. Different spatial layers were overlaid and integrated into this process and were modelled with decision rules based on the interpretation of legal regulations, on knowledge of environmental constraints, and socioeconomic, logistic, and market attractors.

[29] Integrating Multiple Methods for Tracking Shoreline Change Resulting from Sea Level Rise

Fraser M. Shilling (Road Ecology Center, Department of Environmental Science & Policy, University of California, USA); Erik Grijalva (Department of Ecology and Evolution, University of California, USA); Amy Collins (Department of Wildlife, Fish and Conservation Biology, University of California, USA); Mui Lay, Susan Ustin (Land Air and Water Resources, University of California, USA); Edwin Grosholz (Department of Environmental Science & Policy, University of California, USA); Kimberly Andrews (Savannah River Ecology Lab, Odum School of Ecology, University of Georgia, USA)

Shoreline habitats and infrastructure are being negatively affected by sea level rise (SLR) and extreme events. There is very little or no current information available to shoreline agencies on fine temporal and spatial scale changes in shoreline ecosystems and infrastructure in response to SLR. We describe four interacting methods to monitor shoreline and infrastructure changes in response to SLR across a wide range of time and space scales. These techniques fill a critical gap in SLR assessment and can be used to validate commonly-used models of SLR threats to coastal systems and inform transportation decision-makers.

[30] Parkway A2: An integrated approach to nature and landscape

Gertjan Jobse, Reinoud Kleijberg (Arcadis, Netherlands); Jos Huisman (Rijkswaterstaat, Netherlands)

The case of the project A2 Het Vonderen – Kerensheide in the Province of Limburg in the Netherlands, is an example of an integrated approach to nature and landscape. By applying new standards, a highway that has been a significant barrier for decades will become part of the regional ecological and landscape network. Ecological principles, engineering and landscape architecture, are combined in designing mitigation works, using a parkway approach. The parkway functions as an ecological corridor that is in turn part of a larger environmental network. Barriers are reduced by the construction of two large wildlife passages.

[31] Evaluation of mitigation measures for a high-speed railway line with a strong amphibian challenge

Guillaume Testud, Dorothée Labarraque (Egis Structures et Environnement / PSL University, UMR 5175 CEFÉ, EPHE, Biogéographie et Écologie des vertébrés, France); Claude Miaud (PSL University, Biogéographie et Écologie des vertébrés, France)

To evaluate the efficiency of amphibians' mitigation measures, a monitoring program was implemented along a French high-speed railway. Several amphibian species were marked with PIT-tag to measure: the use of wildlife crossing structures, and the population functioning in the newly created ponds' network on both sides of the railway line. The crossing behaviour was studied with homing experiments, with marked individuals released in tunnels equipped with Radio Frequency Identification (RFID) antennas. The study aims at testing the effectiveness of the mitigation measures, to assess the long-term amphibian community viability in fragmented landscape.

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[32] Decision support tool for tidal river bank management: Towards a more sustainable riverbank protection

Gunther Van Ryckegem, Alexander Van Braeckel, Erika Van den Bergh (Research Institute for Nature and Forest, Belgium); Piet Thys (The Flemish Waterway, Belgium)

A decision support tool was developed for bank protection in the estuarine river the Sea Scheldt (Belgium). Based on a set of criteria for different types of bank protection guaranteeing safety, safeguarding erosion-sensitive marshes and allowing natural tidal marshes to evolve, a complete bank protection map is compiled through automation in a geographical information system (ArcGIS).

[33] Ecology in Practice: Improving infrastructure habitats along roads (EPIC ROADS) - A new CEDR project

Hans Martin Hanslin, Eveliina Kallioniemi, Johannes Kollmann, Annette K. Bär, Line Johansen, Knut Anders Hovstad (Norwegian Institute of Bioeconomy Research, Norway); Jörgen Wissman, Tommy Lennartsson (Swedish Biodiversity Centre, Sweden); Jan Christian Habel (Technische Universität München, Germany); Marcello D'Amico, Silvia Lacorte (Institute of Environmental Assessment and Water Research, Spain)

A new CEDR funded project aims to provide a knowledge base and guidelines for improved construction and maintenance of European transport infrastructure based on praxis-oriented knowledge syntheses. The EPIC ROADS project targets key questions on how HTI can promote biodiversity, ecosystem services and habitat connectivity in the landscape, as well as assessing potential negative effects related to HTI management and conditions. The approach is based on quantitative surveys of scientific studies and experience-based information across Europe, development and testing of a HTI classification system, and modelling of how landscape connectivity

for different organism groups is affected by roadside characteristics.

[34] The defragmentation programme for the provincial road network in the Province of Noord-Brabant (The Netherlands)

Hans van Zandvoort (Provincie Noord-Brabant, Netherlands)

The province of Noord-Brabant (The Netherlands) started a defragmentation-programme for the provincial road network to solve the problem of habitat fragmentation due to transport infrastructure. Between 2001 and 2008, the province of Noord-Brabant has eliminated 216 bottlenecks. The approach resulted in a total of 385 different fauna facilities crossing the provincial roads.

[35] Small links make great chains: how imposed local eco-measures trigger an entire hinterland (Rupelstreek, Belgium)

Isolde Aelvoet (Dienst Duurzaam Milieu- en Natuurbeleid, Belgium)

Imposed local eco-measures trigger an entire hinterland (Rupelstreek, Belgium) to work on a large-scale defragmentation network. The poster gives an overview of all defragmentation initiatives and involved parties, ongoing studies, other opportunities, and missing links in the Rupelstreek.

[36] Permeability of roads for wildlife in the cross-border area Beskydy - Kysuce

Ivo Dostál, Josef Svoboda, Jiří Jedlička, Marek Havlíček (Transport Research Centre, Czech Republic)

The permeability of 1st and 2nd class roads was analysed in 38 locations distributed over the model area covering cross-border region between the Czech and Slovak Republic. The evaluation was based on traffic intensity patterns over

the time periods with emphasis on night time. The general results confirmed that 1st class roads included in European system have very limited permeability while other roads are more or less permeable for the major part of the night and with intensity around 1,500 vehicles per day even during the daytime.

[37] Dispersal potential of badgers and the importance of badger tunnels

Jaap L. Mulder (Bureau Mulder-natuurlijk, Netherlands); Nico Jonker (Provincie Noord-Holland, Netherlands)

Badgers living along highway A27 near Hilversum, the Netherlands, were studied with GPS-collars. A total of 16 badgers were followed with such collars. Badgers lived in group territories on both sides of the highway. Sometimes badgers made excursions from their own territory, visiting neighbouring territories or making long exploratory trips. Such long trips illustrate the dispersal capacity of the badger, which is a conservative, sedentary species. Badger tunnels under highways, lower grade roads and railways allow the badgers to safely reach new habitat or other badger populations, thus securing gene flow.

[38] Online user-friendly management plans at a wide scale

Jean-Francois Godeau (EcoFirst, Belgium)

An output of the LIFE Elia-RTE project is an open-source web platform containing useful documents for the future management of natural habitats, providing interactive web maps, the timing, and the description of management plans for 460 hectares of the right-of-way of the high voltage network. This tool allows a dynamic, comprehensive, and illustrated presentation of our achievements and is accessible for each of the vegetation management stakeholders as well as technicians of the operator company. The content contains databases that can be updated regularly.

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[39] Measuring bat activity in forest power lines right-of-ways

Jean-François Godeau (EcoFirst, Belgium)

A standardised monitoring of bats was set up in the context of forests right-of-ways of the high-voltage network. We found a variable but locally significant hunting activity. We could differentiate the usage of the R-O-W between hunting and travelling by analysing the types of ultrasound signals. Some rare species, targeted by the EU directives have been observed, pointing out the importance of open areas within forests. We propose new vegetation management strategies that can be implemented to increase the value of forest habitats for bats. The analysis process is developed with an open source environment to stimulate the sharing of experiences.

[40] Convincing significant industries: A case study on the set up of a cost-benefit analysis and communication tools under the high-voltage network

Jean-Francois Godeau (EcoFirst, Belgium)

We have developed solutions for operators that ensure electricity supplying, preventing trees to touch the cables by saving money and increasing biodiversity. A cost-benefit analysis performed on actual data states that alternative methods of vegetation management in forests were (1.4 to 3.9 times on thirty years) cheaper than traditional ones. Since our conclusions were based on actual implementations on sites, we had examples to share with operators of other countries who provided inspiring feedback as well. The communication strategy of the LIFE Elia-RTE project allowed the exchange of seventeen companies and resulted in many meetings throughout Europe and farther.

[41] A six-lifestyle grid to interpret cumulatively (diffuse) impacts of high-speed railways (HSR) on wildlife-relationships (organism interactions / population-to-individual links)

Jean-Marc Fourès, Pierre Pech (Paris 1 Pantheon-Sorbonne University, France)

Land transport infrastructures (LTI) impact biodiversity throughout their life. Strategic and scientific studies show three significant effects at a fine scale (road kill; barrier-effects; pollutions), while models show diffusion of direct, indirect, induced and cumulated effects. At a large scale, landuse-rolling looks poorly affected by LTIs, whereas these indisputably feed biodiversity-loss. Additionally, we propose to show their cumulative effects on wildlife with a six-potential-life-interactions background plus two diffuse series of criteria: organism interactions (inter- / intra-specific) and population-organism links ('learning'-periods / lifetime), to identify what groups and species are most at risk around the recently constructed Bretagne – Pays-de-la-Loire High-speed railway (BPL-HSR).

[42] Successful implementation of ecological measures in road construction: From burden to added value

Jeroen Mos (Combinatie Buitenring, Netherlands)

The implementation of ecological measures in a project organisation for the construction of a 26km ring road, resulted in less planning risks and failure costs, effective minimization of the impact on protected species and areas, contribution to a positive image of the organisation, support of environmental stakeholders and local communities and a more than satisfied client. Critical factors for success: proactive 'hands-on' experienced ecological support on all levels in the project organization, taking time to invest, involvement, respect and

recognize different interests within the organization, clear overall communication skills, sharing ecological knowledge and enthusiasm.

[43] How river lampreys deal with the weirs, locks and fish passes in the fragmented river Scheldt, Belgium

David Buysse, Jeroen Van Wichelen, Lore Vandamme, Ans Mouton, Johan Coeck (INBO – Research Institute for Nature and Forest, Belgium)

In the highly fragmented cross border River Scheldt restoration actions are undertaken, such as the building of nature-like bypasses. In 2011 and 2012 forty-one adult river lamprey were followed during their upstream migration in the tidal and/or non-tidal part of the river using acoustic telemetry (Vemco). The migration patterns in the river catchment and their behaviour at a tidal barrier, lock-weir complexes and fish bypasses (passage timing and delay) show that the disrupted water management of the river and in consequence of its barriers and bypasses are the key to (un)successful spawning migration in the catchment.

[44] valuation of green infrastructure along canals as aquatic habitat for fish populations

Sophie Vermeersch, Raf Baeyens, Nico De Maerteleire, Emilie Gelaude, Ans Mouton, Sébastien Pieters, Karen Robberechts, Jeroen Van Wichelen, Johan Coeck (Research Institute for Nature and Forest (INBO), Belgium)

Ecological bank protection techniques are increasingly implemented in Flanders to achieve the objectives of the Water Framework Directive. In this study we evaluated the suitability of the resulting shallow water zones along the banks of canals as aquatic habitat for fish communities, showing their importance for the survival of sensitive fish species. As such, a more comprehensive applica-

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tion of green infrastructure should be considered to enhance the biodiversity in heavily modified and artificial waterways in Flanders.

[45] Modelling wildlife road kill hotspots in Flanders using citizen science data and surrounding landscape characteristics

Joris Everaert, Dirk Maes, Koen Van Den Berge, Frank Huysentruyt, Jan Gouwuy, Jim Casaer, Ivy Jansen, Carine Wils, Toon Van Daele, Jeroen De Reu (Research Institute for Nature and Forest, Belgium)

We modelled wildlife road kill hotspots in Flanders using available road kill observations and the surrounding landscape characteristics. We will use the final results of the model to update current guidelines and tools for road kill mitigation.

[46] Evaluating the Egnatia Highway as case study of environmental policy on transport development towards securing ecological connectivity for wildlife in Greece

Lazaros Georgiadis (IENE, Sweden); Niki Voumvoulaki (Egnatia Odos SA, Greece)

The harmonized “grey” - “green” infrastructure coexistence is of tremendous importance in a developing world. Egnatia Odos SA and IENE evaluate the Egnatia Motorway with its Vertical Axes in Greece as such a case. The lessons extracted from its planning, construction and operation in the last twenty years can be used in order to shape a roadmap of recommendations for policy and applied biodiversity conservation on ecological connectivity. This case designates a framework of factors that need to be taken into account when planning transportation projects, such as the dynamics of the wildlife species’ populations and especially their potential increase.

[47] Long-term studies of the impact of WVA on rare mammal species, advised in education and planning

Linus Balčiauskas, Jos Stratford, Laima Balčiauskienė (Nature Research Centre, Lithuania)

Officially registered wildlife-vehicle accidents focus on economic and human safety issues, not showing the real impact on mammal diversity and populations. We show different results through 11 years of observations of unregistered WVA across Lithuania and four years of constant monitoring on one road, emphasizing the impact on threatened or rare mammal species. We propose changes in WVA evaluation, involving citizen science activity and using road monitoring and long-term observation data in the planning of the road safety infrastructure, with the European bison and Eurasian otter as flagship species.

[48] Kill the killer

Magnus Per Anders Sjölund (Väg och Miljö AB, Sweden); David Brobäck (Trafikverket, Sweden)

The roadside spread of invasive species is a menace to biodiversity, both on a local and on a landscape level. Garden lupin (*Lupinus polyphyllus*) is among these species, aggressively spreading across large parts of Europe. Therefore, we need easy methods to put the proliferation of garden lupin to a halt, making this a critical study. Lime may be a solution since the species indicates to be a calcifuge. By using lime to raise the pH levels in the roadside soils, we hope to establish a level where regrowth of garden lupin is efficiently reduced.

[49] Artificial nighttime lighting influences the use of wildlife crossing structures by insectivorous bats in Southeast Australia

Manisha Bhardwaj (University of Melbourne, Australia / SLU, Sweden); Kylie

Soanes (School of EcoSystems and Forest Sciences, University of Melbourne, Australia); Jose Lahoz-Monfort (Quantitative and Applied Ecology Group, School of BioSciences, University of Melbourne, Australia); Lindy Lumsden (Wildlife Ecology, Arthur Rylah Institute - Department of Environment, Land, Water & Planning, Australia); Rodney van der Ree (Ecology and Infrastructure International, Australia)

In this study, we evaluated the impact of light on structure use by insectivorous bats, using a before-during-after-control-impact experiment. We monitored the level of bat activity under and above underpass bridges and culverts along a major freeway in Victoria, Australia. When lights were introduced, bat activity was lower under the structures but higher above the structures. This suggests that bats actively avoided the lit passageway, even if that meant potentially accessing ‘unsafe’ habitat such as a roadway. Where possible, lighting should be avoided around critical bat habitat and in crossing structures actively used by bats.

[50] What are we not seeing? Impacts of a short and narrow road on wildlife

Marcelo Magioli, Alex Bovo, Fernanda Abra, Renata Miotto, Victor Andrade, Adriana Nascimento, Maísa Martins, Katia Ferraz (Laboratório de Ecologia, Manejo e Conservação de Fauna Silvestre (LEMAC) - ESALQ/USP, Brazil); Marcel Huijser (Western Transportation Institute, Montana State University, USA)

We collected roadkill data along CPM road from 2010-2016, and we estimated roadkill variation along SP-348 by dividing the road into sections of 1, 5 and 10 km, and compared roadkill numbers and variation between sections, and roads. The average roadkill numbers in SP-348 was similar between different sections, but the variation number per kilometre decreased with longer sections. Spatial scale alone explained the high roadkill rate in CPM road when compared to SP-348. Therefore,

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even short and narrow roads can cause substantial damage to wildlife, and our results stress the need to look at these types of roads carefully.

[51] Scaling the importance of Roadless Areas to improve overall connectivity in Natura 2000 network

Maria Zomeni (School of Pure and Applied Sciences, Open University of Cyprus, Cyprus); Maria Psaralexi, Nefta-Eleftheria Votsi (Department of Ecology, School of Biology, Aristotle University, Greece)

We propose a method which makes use of existing graph-based software and habitat availability metrics, to evaluate the synergistic potential of individual Roadless Areas (RAs) for improving the overall connectivity of Natura 2000.

We examine study areas in Greece, Estonia and France and demonstrate which RAs have the potential to act as connecting elements (new potential habitat sites, links or stepping stones) among protected areas, improving overall connectivity in Natura 2000. The proposed method can be used as a tool to support decision-making in landscape planning and biodiversity conservation, in various geographical contexts and under different conservation goals.

[52] The French railway: Between ecological transparency and security of railway circulations

Marine Le Lay (SNCF Réseau, France)

The collisions with wildlife cause approximately 200,000 minutes lost per year. It has an impact on both infrastructure and trains, and travellers. The classic lines are generally not enclosed, that guarantees certain ecological transparency. However, every autumn, a peak of collisions is observed. The simultaneity of the movement of animals and humans forms a logical explanation for this. To mitigate it, SNCF RESEAU imagines solutions adapted to every

case: a fence or not, crossed landscapes, configuration, and width of railways premises. According to these parameters, new arrangements or requalification of existing bridges, best practices of maintenance, implementation of fauna regulators are set up.

[53] Graffiti Art Ecoduct Groenendaal

Marleen Moelants, Yoeri Bellemans, Andreas Baele (Flemish Government, Agency for Roads and Traffic, Belgium)

Tackling a problem and turning it into added value is what happened in this case. 600 meter of concrete canvas was commissioned to a graffiti artist and turned into a giant signboard for nature conservation.

[54] Migration permeability assessment of selected linear transport infrastructure in the Eastern part of the Czech Republic

Martin Strnad (Nature Conservation Agency of the Czech Republic, Department of species conservation, Czech Republic); Ivo Dostal (Transport Research Centre, Czech Republic)

Wildlife passages identification and assessment of their actual permeability for wildlife have been done in the scope of project DTP1-187-3.1 TRANS-GREEN, funded by Interreg Danube Transnational Programme. The pilot study area encompassed primarily the Protected Landscape Area Beskydy and its great surroundings. Knowledge and assessment of the current status of existing mitigation structures on the linear infrastructure are a prerequisite to carry out further steps to improve the migration permeability for wildlife in the area.

[55] Ecoduct Sandsjöbacka: Challenges and solutions when constructing an ecoduct over an existing highway

Mattias Olsson (EnviroPlanning AB, Sweden); Mats Lindqvist, Kristina Balot (Swedish Transport Administration, Sweden)

Ecoduct Sandsjöbacka will be completed in the summer of 2018 and stretches over an existing highway south of Göteborg at the Swedish west coast. Several jurisdictions due to the presence of the Natura 2000 site, a rich biological diversity at the construction site, and all aspects of constructability challenged the project during the planning phase and set the framework for the construction conformation. Dry heather moorland and dry meadows serve as the primary target vegetation types on the ecoduct. The ecoduct is adapted to suit a wide range of species such as moose, fallow deer dormice, sand lizards, and smooth snakes.

[56] Effects of a retrofitted protection screen on wildlife use of an underpass in southern Sweden

Mattias Olsson (EnviroPlanning AB, Sweden); Andreas Seiler (SLU, Sweden); Jennifer Fredberg (Swedish Transport Administration, Sweden); Annelie Rossander (Swedish Transport Administration, Sweden); Ulrika Lundin (Swedish Transport Administration, Sweden); Kristina Rundcrantz (Swedish Transport Administration, Sweden)

Wildlife crossings may not be as effective at mitigating the road-caused fragmentation as planned initially. In the attempt to enhance the use of an underpass by deer, a noise and light-reducing screen will be installed along the road above the entrances of the underpass. In the baseline data before retrofitting the screen, roe deer utilised the underpass quite frequently, with 67.3% of visits resulting in passage use. Red deer and fallow deer were more reluctant, as only 56.0% and 31.4% respectively of the recorded visits resulted in one or more individuals crossing the underpass.

[57] Nature inventories of bats, insects, lichens, mosses and mushrooms in tree avenues along public roads in western Sweden in 2004-2017

Svante Hultengren, Petter Bohman (Naturcentrum AB, Sweden); Mats Lindqvist (Swedish Transport Administration, Sweden)

During more than a decade we made surveys of bats, insects, lichens, mosses and fungi in 19 tree avenues in western Sweden. In total, 2,000 trees were studied. In total, 691 species were recorded, of which 63 are red listed. A large number of indicator species and rare species were noted, and 11 species of bats. Beetles was the most prolific group of 366 species, followed by 191 species of lichens. The knowledge that the tree avenue environments are so rich in biodiversity is essential for the traffic authorities in the management of these tree habitats.

[58] Surveys of ants (Formicidae) and carabid beetles (Carabidae) along public roads in Southwestern Sweden in 2014

Ola Alinvi (Flitiga myran, Sweden); Mats Lindqvist (Swedish Transport Administration, Sweden)

Occurrence of carabid beetles and ants were studied at road sides using pitfall traps. The localities were "species rich" in respect to interesting plant life. We found 426 individuals and 40 species of carabids, circa 11% of the Swedish fauna. We found 5,642 individuals and 37 species of ants, circa 46% of the Swedish ant fauna. Dominating ant species are *Formica exsecta*, *Formica fusca* and *Myrmica sabuleti*. Overall our conclusion is that road sides containing open ground, especially sandy exposed ground, and ground with sparse vegetation may have high species richness of both carabids and ants.

[59] Development of a deterrent sound for the prevention of deer-train collisions

Minoru Shimura, Tomoyoshi Ushiogi, Masateru Ikehata (Biotechnology Laboratory, Railway Technical Research Institute, Japan)

Deer-train collisions have become a serious problem in Japan. To keep deer away from tracks, we have invented a deterrent sound and investigated its effectiveness. It consists of a deer alarm call and vocalization of a dog. It is observed that playing the deterrent sound at deer being around a track made them run away immediately. According to a survey on the frequency of the observation of deer, playing the deterrent sound from a train resulted in a 45% reduction of the frequency of deer that were observed every 100 km track.

[60] Why do the deer jump out suddenly?

Misako Noro, Fumihito Hara (Hokkaido Development Engineering Center, Japan); Toru Hagiwara (Graduate School of Engineering, Hokkaido University, Japan)

The authors discussed wildlife-vehicle collision situations based on driver visibility. 78% of people, who collided with a deer, answered that the animal seemed to come out of nowhere. Why did the deer jump out suddenly? We believed 'the driver's useful field of view' to be related. When we drive a car, we always confirm whether it is safe in front of us. When an animal approaches a vehicle, the driver is still looking in front of him rather than at the side of the car. In that case, the driver does not notice that there is an animal. As a result, the driver feels as if the animal comes out of nowhere.

[61] Egnatia Motorway: Fish protection measures in a major landslide stabilization project

Niki Voumvoulaki, Dimitrios Kaltsas (Egnatia Odos SA, Greece); Lazaros Georgiadis (IENE, Greece)

As part of the construction of a major landslide stabilization project in North-West Greece, to ensure the operability of the Egnatia Motorway, a river of permanent flow had to be conducted through a twin culvert of 150 m length. Due to environmental terms for fish protection, special measures were taken, to ensure the upward travel of migrating fish, such as the indigenous trout. The measures also include a natural lighting system of the closed culvert, using solar tubes. Further monitoring of fish presence in the river is needed, to evaluate the success of the engineering solutions.

[62] Guidebook for the identification of eco-ethological criteria to be considered for ecological continuity restoration close to transport infrastructures

Olivier Pichard, Anastasia Sanchez de Launay (CEREMA Nord Picardie, France)

CEREMA Nord Picardie has drawn up a guidebook to identify the eco-ethological criteria to be analysed when designing or improving existing wildlife crossing structures. The guide is intended for infrastructure managers. Its purpose is to help them identify the important criteria to be taken into account to optimise ecological continuity close to transport infrastructure.

[63] Designing nature with infrastructure: the Antwerp Left Bank infrastructure works

Rik Houthaeve, Koen Maes, Bart Steenwegen (Sweco Belgium nv, Belgium)

The Antwerp Left Bank infrastructure works involve the reconstruction of the

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existing highway infrastructure on the left bank, a unique and delicate area where the ecological network is currently under great strain. The large-scale motorway infrastructure forms an insuperable barrier for fauna and flora. The design of the Left Bank infrastructure works links green areas, which are currently fragmented, into one large nature area connected through ecoducts, ecotunnels, streams and cycle and footpaths. The project provides a number of local underpasses for ecological links, cycle paths or local roads. The design of the infrastructure and engineering structures is tightly interwoven with the landscape.

[64] Stimulating biodiversity and circular economy in rail verges

Rudi van Hedel (Sweco, Netherlands); Gerald Olde Monnikhof, Mariëtte van Rooij (ProRail, Netherlands)

ProRail maintains more than 7,000 km of verges and wants to improve the maintenance so that this stimulates biodiversity and the circular economy. Biodiversity will improve if biomass is removed, but the present practice is that this isn't done. Sweco advised how to improve the maintenance contracts and how to redesign the verges to enhance the biodiversity. They concluded that contracts should contain criteria on when and how the verges are being moved and how to remove the biomass. Furthermore, they advised dividing the verges into a technical and ecological zone.

[65] Citizen science approach revealing impacts of the extensive road system on wild fauna in Cyprus

Savvas Zotos, Maria Zomeni, Thelma Georgiou, Ioannis Vogiatzakis (Open University of Cyprus, School of Pure and Applied Sciences, Cyprus)

Through a newly deployed citizen science road kill observation system (CyROS) and the collaborative effort of volunteers, the impact of the extensive

road network in Cyprus on its wild fauna is revealed for the first time. Reptiles and hedgehogs are the animal groups that are most frequently a victim of road kill regardless of the type of road or geographic location. This is an ongoing process, and the data provided by volunteers are increasing every day. We expect to obtain an adequate amount of data through CyROS in the upcoming years so that we can contribute to examining transportation ecology on a small island with rapid urban and road expansion.

[66] Identifying blackspots of wildlife collisions on the Swedish railroad

Sofia Willebrand (EnviroPlanning AB, Sweden); Andreas Seiler (Swedish University of Agricultural Sciences, Department of Ecology, Grimsö Wildlife Research Station, Sweden)

The number of wildlife train collisions (WTC) on the Swedish railroad is increasing and it is essential to identify and predict blackspots, areas with high frequencies of WTC. We identified such areas by calculating frequencies at railroad segments combined with a measure of stability. The identified blackspots were tested with logistic regression to compare with "cold spots". Logistic model strength was best for blackspots with the highest requirements on stability over time. This suggests that segments with recurring high WTC frequencies can be primarily foreseen using a rather simple set of environmental criteria and thus targeted with mitigation plans.

[67] Assessing realism of metapopulation modelling tools deployed in French EIA

Sylvain Moulherat, Jonathan Remon, Lucie Gendron (TerrOiko, France); Jérôme Prunier (SETE-CNRS, France)

The CIRFE project aimed to determine whether various metapopulation models could mimic the actual species meta-

population dynamic to contribute to the Environmental Impact Assessments (EIA), especially for substantial survey areas. In this project, we tested how five different models, used in French EIA, estimate metapopulation functioning by comparing the different model outputs with actual field estimates. We demonstrated that the different models are not equally realistic and that their performances are linked to the required land cover quality for each model. We also determined that agent-based models can adequately mimic metapopulation functioning.

[68] The assessment of the ecological quality of roadside verges as a building block for optimising functions along Dutch highways

Toine Morel, Marieke de Lange, Erik Verhalen (Rijkswaterstaat, Netherlands)

The roadside verges along the Dutch highways could have different functions, i.e., a location for solar panels, biomass harvesting or increasing biodiversity. A decision support tool will be developed to make a well-informed decision which function (or functions) is most suitable at a particular location. As a building block for this decision support tool, we developed an ecological quality assessment for roadside verges, using six parameters describing the abiotic and biotic conditions, and the current management. We will give background information on the choice of parameters and how these are ranked, illustrated by results from our pilot project (Dutch highway A37).

[69] Van Gogh National Park defragmented

Toine Cooijmans (Natuurmonumenten, Netherlands)

Eight area alliances in Brabant are the initiators of a significant new National Park as the green heart of Brabantstad: the Van Gogh National Park. They aim to

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better connect some top nature reserves, which are fragmented by certain highways. We desire to create robust nature passages on these massive infrastructures on eight specifically indicated locations. The alliances have developed a new standard (Nieuwe Brabantse Standaard), This standard includes agreements on the quality of the ecopassages for animals so that they eventually will be able to move freely through the entire area.

[70] The Ringerike Railway line and E16 Main Road Joint Project

Torgeir Isdahl (Norconsult, Norway)

The joint project is located in one of Norway's most precious natural areas, including the unique wetlands and floodplains along the river Storelva protected by both national and international designation. Through a series of mitigation measures, the joint project has aimed to reduce the impacts on the natural environment. The developer aspires to achieve a 'no net loss' of natural values. An ecological compensation plan has been implemented.

[71] Lessons learned about animal-vehicle collisions from dash cam videos uploaded to YouTube

Victor Colino Rabanal (Department of Animal Biology, Faculty of Environmental Science, University of Salamanca, Spain)

In this study, we have compiled 507 videos through YouTube searches from 21 countries with dash cams showing AVC or animal crosses of 17 large-sized species. We categorized the animal behavior according to speed and crossing path, as well as the driver behavior. The results show that a remarkable number of AVC is caused by the sudden onslaught of an animal or group of animals running at high-speed perpendicular to the road. According to the results of the study, this animal behavior decreases the effectiveness of measures such as

animal detection systems, since the time that elapses between the detection of the animal and its arrival to the road is minimal.

[72] The relationship between roads, human diversity, and biodiversity

Víctor Colino-Rabanal, Salvador Peris Álvarez, Miguel Lizana (Department of Animal Biology, Faculty of Environmental Science, University of Salamanca / AnthopoNatura, UNESCO Chair Initiative, Spain); Roberto Rodríguez-Díaz, María José Blanco-Villagas (Department Physical Anthropology, University of Salamanca / AnthopoNatura, UNESCO Chair Initiative, Spain)

Considering that those factors related to biological speciation are also involved in cultural differentiation, human diversity (in this study linguistic diversity) is likely to respond to roads in ways similar to biodiversity. Roads tend to homogenize both diversities in such a way that for many parts of the world there is a negative correlation between road density and biodiversity and linguistic diversity.

[73] An overview of wildlife-train collisions in the Czech Republic

Vojtěch Nezval (University of Ostrava, Czech Republic); Michal Bíl, Clara Grilo (Transport Research Centre, Czech Republic); Bohumír Trávníček (Czech National Railway Administrator, Czech Republic)

We collected and analysed data on wildlife train collisions (WTC) in the Czech Republic. Between 2008 and 2017, a total of 1,600 WTC records were collected. More than half of all WTC were crashes with roe deer (32%) or with wild boar (27%). 9% of WTC were caused by unidentified animal (this number differs largely from WVC on roads, 50%). The rest of the collisions are with other animal species (e.g. sheep, horses, dogs, foxes, etc.). The results will be presented in www.srazenazver.cz.

[74] Impact assessment of a wildlife corridor on a human populated area in Thailand

Win Trivitayanurak (Ministry of Transport, Department of Highways, Thailand); Somying Thunhikorn (Wildlife and Plant Conservation, Department of National Parks, Thailand)

The study examines the proposed wildlife corridor site on National Highway 317 in Chantaburi Province in the Eastern region of Thailand. The site is located in the Eastern Forest Complex, ranked high priority among Thailand's forest complexes for its habitat for elephants as the key species and potential connectivity to Cambodian forests. Wildlife crossing structures are proposed on NH317. While aiming to bridge the Khao Soi Dao Wildlife Sanctuary and Khlong Kruewai Chalearm Phrakiat Wildlife Sanctuary for unobstructed movement of elephants, existing houses and orchards will face the impact to their socio-economic status. Novel approach for human-elephant coexistence is proposed.

[75] Mapping green infrastructure based on ecosystem services and national ecological network: a case study in Taiwan

Yu-Fang Lin (Studio Sustainability & Environmental Management, Taiwan)

This article describes the methodology of mapping green infrastructure based on ecosystem services and national ecological network. The natural capacity to deliver ecosystem services and the identification of core habitats and wildlife corridors are included in the mapping data. The results of the green infrastructure classification will contribute to evaluate the ecosystem services, as well as developing the national ecological network. Finally, the evaluation results will provide decision makers with a vision for environmental sustainability and nature conservation in the planning context.

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[76] Meta-population models in Environmental Impact Assessments

Yann Le Gallic, Klervi Le Floch (Setec international, France) ; Sylvain Moulherat (Terroiko, France)

The CIRFE project aimed to determine whether various meta-population models could mimic the original species meta-population dynamic to contribute to Environmental Impact Assessments (EIA), especially for massive survey areas. Its economical session demonstrated that the average cost of current fauna and flora studies are far higher than the estimated modelling costs. Habitat survey procurement is by far the main cost compared to the other modelling costs and is comparable to the cost of those in current EIA. So, they could be used for modelling with no additional costs.

[77] ITTECOP: the French public-private research programme on infrastructure and environment

Yannick Autret (Ministère de la transition écologique et solidaire – direction de la recherche et de l'innovation, France)

Since 2008, ITTECOP, an integrated research program is aiming at the effects of infrastructure on landscapes and biodi-

versity, and has been seeking to produce scientific responses and methods directly from the lab to the land.

[78] The effects of habitat fragmentation and isolation on Japanese raccoon dog (*Nyctereutes procyonoides viverrinus*) roadkill in Japan

Yoichi Sonoda (Regional Environment Planning Inc., Japan)

The objective of this study was to examine how habitat fragmentation and isolation in urban and suburban areas influence the occurrence of Japanese raccoon dog (*Nyctereutes procyonoides viverrinus*) roadkill. Our aim was to determine potential migration directions in greenspaces and contribute to road planning to increase the viability of raccoon dog populations. We constructed a model to predict the probability of raccoon dog roadkill occurrence in an urban area, and then analyzed the effects of various roadkill risk factors.

[79] Effective culvert design to facilitate amphibians across roads in Changbai Mountain Area, China

Yun Wang, Lei Guan, Hongping Zhou, Yaping Kong (China Academy of Transportation Sciences, China)

We placed experimental arrays of culverts of varying sizes, types and substrate type to examine the preference of both species during migration season in May and September of 2016 and 2017. We concluded that box culverts with side length ≥ 1 m line with soil and accompanied by ≥ 0.4 m high guide fencing and $\leq 45^\circ$ gradient of roadside ditch walls would best facilitate road crossing for both the species and likely other amphibian species in Changbai Mountain area, China.

[80] Developing the National Ecological Network in Taiwan

Yuping Chen (Taiwan Ecological Engineering Development Foundation, Taiwan)

We propose a framework for developing the national ecological network by identifying habitat types and landscape connectivity before bottlenecks are highlighted. Three case studies targeting representative bottlenecks will be conducted to demonstrate a strategic process of action plans in the future.