Title

The Swiss defragmentation program–reconnecting wildlife corridors between the Alps and Jura: an overview

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The Swiss Defragmentation Program—Reconnecting Wildlife Corridors Between the Alps and Jura: An Overview

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Abstract: Switzerland has one of the densest infrastructure networks of Europe (3-4 km/km2 on the Central Plateau). Fragmentation of natural habitats has become a major conservation concern as vulnerable species become rarer and the red list of endangered species becomes longer. The mortality of animals on roads remains high, with more than 8,000 roe deer killed yearly by traffic. Many amphibian spawn sites along lakeshore have been cut off from their wintering grounds by roads, with populations then disappearing. Highways have proven to be an impassable barrier for the lynx, impeding colonization of eastern Switzerland.

Switzerland participated actively in the COST 341 European research program "Habitat fragmentation due to transportation infrastructure." A census of bottlenecks where infrastructure intercepts important wildlife corridors was carried out during this program. Fifty-one points needing restoration measures were identified. Many of these are along first-generation highways built along an east-west axis and cutting off any possible exchange between wildlife populations in the Alps and the Jura.

A ministerial guideline sealed a partnership between the Swiss Agency for Environment, Forests, and Landscape (SAEFL) and the Swiss Federal Roads Authority. The defragmentation program has been included in the highway-maintenance program and is to take place over the next 20 years. Five conflict points have been recently retrofitted in the context of highway-widening schemes.

A program methodology is being developed. Conflict points will be addressed as the involved highway section comes up for maintenance. In order to facilitate long-term planning, different instruments have been developed. Standards have been defined by the Swiss Association of Road and Transportation Experts (VSS 2004) to guide engineers and biologists in the analysis of existing structures and potential permeability for fauna. Criteria were developed to facilitate the choice of the optimal type of passage for each given situation.

Further research and standards are being launched to homogenize monitoring programs and develop best practice for retrofitting culverts, as well as to anticipate and eliminate wildlife traps created by certain structures.

Habitat Fragmentation in Switzerland

With 71,000 km of main roads and a total road length of more than 111,000 km, Switzerland has one of the densest infrastructure networks of Europe (3-4 km/km2 on the Central Plateau) (Oggier et al. 2001). Figure 1 shows the high density of roads in the Swiss lowlands.

Figure 1. Road map of Switzerland showing main roads and county roads. (Reprinted with permission from: Bundesamt für Landestopographie BA4827)

Traffic Casualties Influence Wildlife Populations

More than 20,000 large mammal road casualties are counted every year (BUWAL, 2003). This affects a number of wildlife populations. For example, road casualties are responsible for 23 percent of the European lynx mortality in Switzerland (Oggier et al. 2001). The species was reintroduced in the 1970's and has yet to recover on a national basis. Highways have proven to be an impassable barrier for the lynx, impeding colonization of eastern Switzerland. To address overpopulation in the west, Lynx had to be captured and transferred to the east at high cost (Breitenmoser 1995).

As the red lists of endangered species in Switzerland lengthen, fragmentation has become a major conservation concern. Due to pressure on habitat, certain vulnerable species (such as the Capercaillie) have dwindled to small isolated populations. Infrastructure barriers complicate restoration efforts. Forests roads attract leisure activities, creating disturbances in once-tranquil habitats.

Along lakeshores, many amphibian spawn sites have been cut off from their wintering grounds by roads, with populations then disappearing (Ryser 1988). More than 1000 conflicts points where roads cross migration paths are known (Oggier et al. 2001).

Birds of prey also cause a high toll to traffic mortality. Almost 30 percent of known mortality of the Barn owl is along roads (Marti 1998).

Inventory of Environmental Bottlenecks

Switzerland participated actively in the COST 341 European research program "Habitat fragmentation due to transportation infrastructure" (Trocmé 2003). The goal of this European program was to describe in each participating country the extent of fragmentation, give an overview of measures used to address the problem and elaborate (on the basis of shared experience) a manual of best practices (Iuell 2004).

A survey of bottlenecks where infrastructure intercepts important wildlife corridors was carried out (Holzgang et al. 2001) during the COST program in Switzerland. The basis of this survey was a study of the main wildlife corridors. Hunting statistics and questionnaires to gamekeepers and huntsmen were used to map dispersal patterns of game, such as roe deer, red deer, wild boar, chamois, and ibex. A simple landscape-permeability model using a geographical-information system (GIS) was also used to define movement axes based on topography and habitat continuums. Figure 2 shows the extensive connectedness within Switzerland for terrestrial forest-dwelling wildlife.

The axes of movement are shown as broad green strips. The corridors are sections of the axes where wildlife movement is bounded permanently by natural or anthropogenic structures or intensive agriculture areas.

An overall assessment reveals that 47 (16 percent) of a total of a 303 supraregional wildlife corridors are now largely disrupted and impassable to wildlife. The functionality of more than a half is moderately to severely impaired (171 corridors; 56 percent). Approximately a third (85; 28 percent) can be classified as intact. A total of 78 supraregional corridors have been identified that need restoration in order to guarantee sufficient permeability between the Central Plateau, the Jura, and the Alps and provide an exchange between populations.

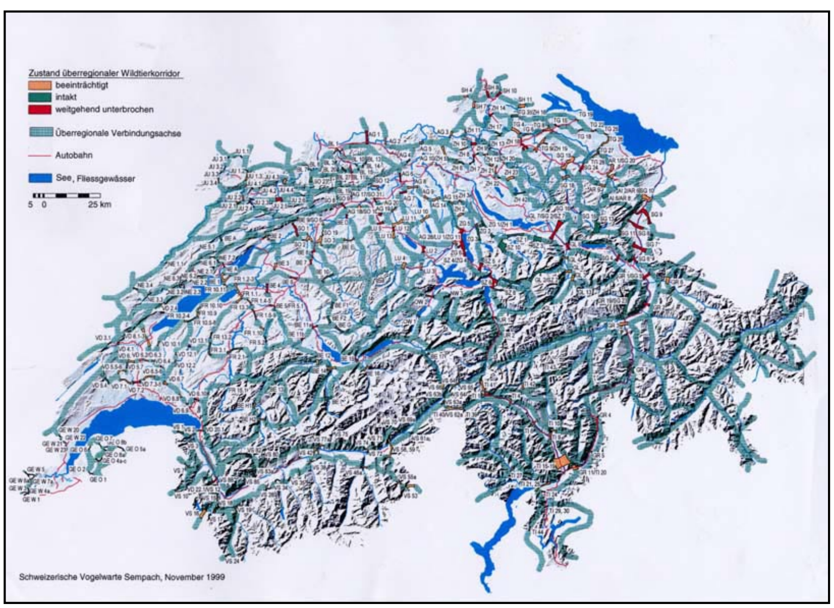

Figure 2. Overview of the wildlife corridors and axes of movement of supraregional importance showing Switzerland's extensive network for terrestrial wildlife. Green is intact, orange is impacted, and red is interrupted corridors (source: Schweizerische Vogelwarte Sempach 1999).

Defragmentation Program

The wildlife corridor study has been embedded in a much larger strategy, namely a national ecological network (REN). The REN (Berthoud 2004) is based on available data of potential habitat (including existing nature reserves) and combined with the data from the wildlife corridors. The purpose of the REN is to optimize habitat connectivity by focusing habitat-upgrading efforts and ecological compensation in agricultural areas in the sites with most potential.

Inventory

The survey of the wildlife corridors showed 51 spots interrupted by infrastructure needing constructive measures to restore permeability. Many spots are along first-generation highways built along an east-west axis and cutting off any possible exchange for wildlife populations between the Alps and the Jura. The measures advocated go from simply planting natural structures leading up to existing mixed use passages to the full retrofitting of highway sections with fauna overpasses for large ungulates. The measures taken along transport infrastructure are to be coordinated with further incentives from the REN.

Figure 3 shows an extract of the Ecogis website (Ecogis 2003) where the inventory can be consulted by the public. The red striped area is a corridor interrupted by a highway. A viaduct allows animals through, but urbanization is encroaching on the passage.

Figure 3. Wildlife corridors near Marin by Neuchâtel in the three-lake district. Extract of the Ecogis website showing in beige is an impaired corridor and in red is an almost fully disrupted corridor (http://www.ecogis.admin.ch.) (Courtesy of BUWAL 2003.)

Application of the inventory: sealing a partnership between nature conservation and road building

The inventory was published (Holzgang et al. 2001) and sent to all the regional authorities. A working group was set up on the federal level between the SAEFL and the Swiss Federal Roads Authority in order to achieve a consensus on what restoration measures were needed and how to initiate them. A ministerial guideline (UVEK 2001) followed. That guideline defined the width of fauna overpasses and the locations where retrofitting would be necessary. A standard width of 40 to 50 m was assigned for overpasses along corridors of supraregional importance with a possibility of narrowing the width to 20-30 m under special circumstances (topography, choice of species). These standards are based on a comparative study of 12 overpasses of different width and their efficiency for wildlife (Pfister et al. 1999). The study showed that between 20 and 50 m width, the frequency of use increases and then flattens off. Small passages were not as readily used.

It was decided to integrate retrofitting in the normal highway upkeep planning, with the result that the defragmentation program will be spread over a time period of 20 years.

A new transport master plan is being developed on the federal level. The inventory of the wildlife corridors is part of the baseline information which will be taken into account by future projects.

On the regional level, the corridor inventory is to be incorporated in the spatial-planning schemes in an effort to keep these corridors free from urbanization. To date, the inventory has been incorporated in 17 of the 26 cantonal spatial-planning schemes. Legally it is weighted only as a recommendation. Because the inventory remains non-binding for local communities, conflicts continue to arise.

However, a federal court injunction stopping a project interrupting a corridor has given new force to the inventory (BGE 2001).

First results of the defragmentation program
To date, five locations have been retrofitted: Grauholz (BE), Neu-Ischalg (BE), Birchiwald (BE), Baregg (AG), and Hirschsprung (SG).

Like the passage shown in figure 4, most of these locations have benefited from transport infrastructure-widening schemes. In such cases the new over- or underpass is part of the environmental-impact study and financed through the infrastructure-building project.

Figure 4. Neu-Ischlag in Canton Bern. The 50-m-wide overpass spans both the existing highway and a new high-speed train line. Photo courtesy of Tiefbauamt canton Bern.

Figure 5 shows the mitigation measures chosen for the T10 road-widening project in the three-lake district (see figure 3). The alignment was modified so as to permit the crossing of a watercourse with a high bridge. The old road was ground level and let the stream through a narrow culvert. The road stretch had been often fatal for European beaver, a species reintroduced in Switzerland and still vulnerable.

Figure 5. The T10 between Morat and Neuchâtel cuts through important wildlife corridors. Appropriate mitigation measures such as this bridge replacing a culvert were taken. Photo courtesy of Marguerite Trocmé.

The highway shown in figure 3 by Cressier will soon undergo major maintenance work. The so called UPlaNS (maintenance plan) underwent an impact assessment (Aquarius 2004). Figure 6 shows the networking measures planned so as to guide wildlife to the viaduct through agricultural land. The project has not yet passed authorization because opposition from farmers has to be addressed.

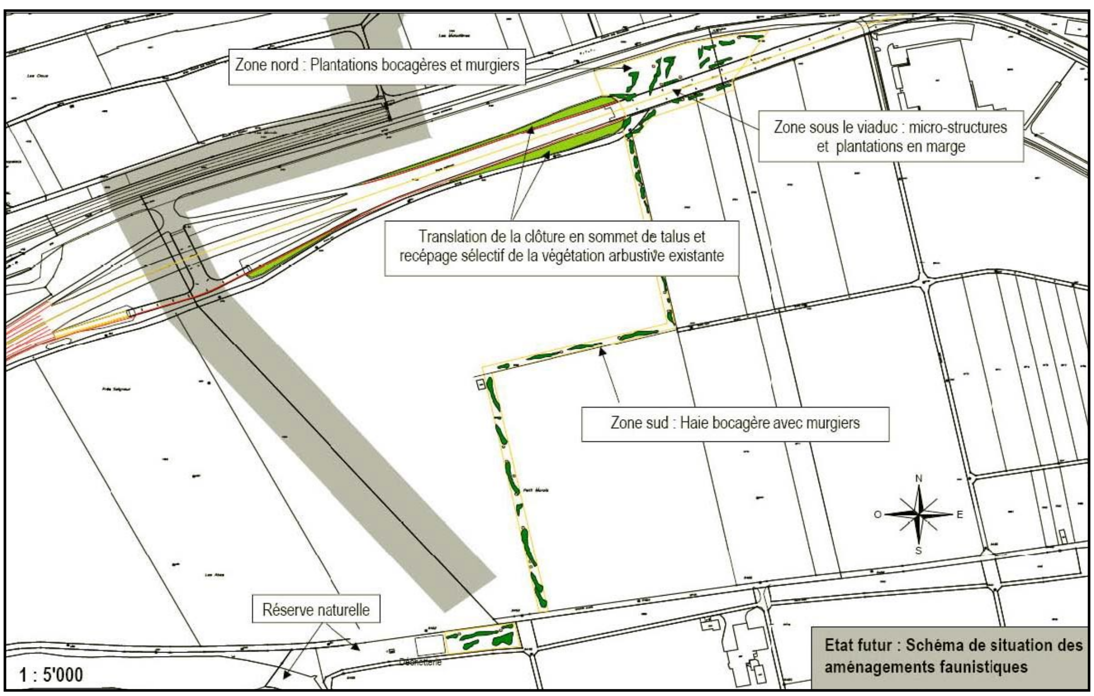

Figure 6. Maintenance program of the A5 includes mitigation measures for wildlife.
Improving the efficiency of a viaduct by planting guiding structures.
Reprinted with permission of Aquarius/BZA/30.6.2004 Document No AQ 80 308 80 8114.

Standards

To facilitate long-term planning, different instruments have been developed. Standards have been defined by the Swiss Association of Road and Transportation Experts (VSS 2004) to guide engineers and biologists in the analysis of existing structures and potential permeability for fauna. The standards were written by a mixed group of engineers and biologists and are based on the results of the COST 341 action.

A base standard SN 640 690a explains ecological networks and the impact of fragmentation by transport infrastructure in simple terms. For each project phase, standard SN 640 691a develops a standardized procedure that explains in which phase which studies need to be made so that specialists are integrated early enough in the project team.

Standard SN 640 692 focuses on permeability models, giving recommendations for the choice of priorities. The idea is to use (as much as possible) topography and related structures. Wildlife-mitigation measures need to be embedded as a clear concept in future ecological networks.

The last standard (SN 640 694) lists the possible mitigation measures with quality requirements. A selection grid should facilitate the choice of the optimal type of passage for each given situation.

Research

A standard procedure for wildlife-passage-monitoring programs is being developed by the SAEFL. Standard questionnaires will be asked for and results are to be stored in a central data base.

A three-phase approach will be tested. Phase A, just after construction, answers simply the qualitative questions of which species are using the passage. Phase B, two years later, looks at the frequency of use, if animals are actually crossing the structure and the influence on wildlife road casualties. Phase C, five to 10 years later, looks at the impact of the passage on wildlife populations. For each phase, best methods will be suggested (Fornat, Righetti, personal communication).

Further research and standards are being launched to develop least-cost practice for retrofitting culverts as well as to anticipate and eliminate wildlife traps created by certain annex structures of roads and rail.

Biographical Sketch: Born in Paris in 1961, Marguerite Trocmé grew up in Ottawa before moving to the U.S. and received her bachelor of science degree in biology from Brown University in Providence, Rhode Island in 1983. In 1985, a master's degree in environmental engineering from the Ecole Polytechnique Fédérale (EPFL) of Lausanne, Switzerland followed. She then worked both for the Swiss World Wildlife Fund and the Swiss Ornithological Institute before joining the Swiss Agency for the Environment, Forests, and Landscape in 1989. She is responsible for the impact appraisal of federal infrastructure projects on nature and landscape. She was vice-chairman of the European COST 341 Project. She has led and edited studies and publications in the areas of the impact of high tension lines, roads, and aviation on natural ecosystems.

References

Aquarius (2004) N5 , UPlaNS–T68.8-St-Blaise–La Neuveville-ESt, Notice d'impact sur l'environnement, République et Canton de Neuchâtel,30 juin 2004. 36pp.

Berthoud G., R.P.Lebeau, and A. Righetti. 2004. *Réseau écologique national REN. Rapport final.* Cahier de l'environnement No373. Office fédéral de l'environnement, des forêts et du paysage. Berne. 132 pp.

Breitenmoser, U. 1995. Lynx Lynx (Linnaeus, 1758)–Luchs. In *Säugetiere der Schweiz. Verbreitung, Biologie, Ökologie*. Denkschriftenkommission der Schweizerischen Akademie der Naturwissenschaften. J. Hauser (ed.). Birkhäuser, Basel.

Bundesamt für Umwelt, Wald, und Landschaft. 2003. *Fallwildstatistik*. http://www.umwelt-schweiz.ch/buwal/de/fachgebiete/fg_wild/dienstleistungen/jagdstatistik/index.html#sprungmarke5.

EcoGIS .2003. Office fédéral de l'environnement, des forêts et du paysage. Berne. http://www.ecogis.admin.ch/mapengine.mps

Holzgang, O., H.P. Pfister, D. Heynen, M. Blant, A. Righetti, G. Berthoud, P. Marchesi, T. Maddelena, H. Müri, M. Wendelspiess, G. Dändliker, P. Mollet, and U. Bonrhauser-Sieber. 2001. *Les corridors faunistiques en Suisse.* Cahier de l'environnement No 326. Officie fédéral de l'environnement, des forêts et du paysage, Société suisse de Biologie de la Faune et Station ornithologique suisse de Sempach. 120 pp.

Iuell, B., G.J. Bekker, R. Cuperus, J. Dufek, G. Fry, C. Hicks, V. Hlavac, V. Keller, C. Rosell, T. Sangwine, N. Torsolv, and B. I. Wandall. 2003. *Wildlife and Traffic: A European Handbook for Identifying Conflicts and Designing Solutions*. KNNV Publishers.

Marti, C. 1998. Auswirkungen von Freileitungen auf Vögel–Dokumentation. Schriftenreihe Umwelt Nr 292 Bundesamt für Umwalt, Wald und Landschaft (BUWAL). Bern. 90 pp.

Oggier, P., A. Righetti, and L.I. Bonnard. 2001. *Zerschneidung von Lebensräumen durch Verkehrsinfrastrukturen* COST 341. Schriftenreihe Umwelt Nr. 332, Bundesamt für Umwelt, Wald und Landschaft. Bundesamt für Raumentwicklung, Bundesamt für Verkehr, Bundesamt für Strassen.

Pfister, H.P., D. Heynen, B. Georgii, V. Keller, and F. Von Lerber. 1999. Häufigkeit und Verhalten ausgewählter Wildsäuger auf unterschiedlich breiten Wildtierbrücken (Grünbrücken). Schweizerische Vogelwarte, 6204 Sempach. 49 pp.

Ryser, J. 1988. Amphibein und Verkehr, Teil 2: Amphibienrettungsmassnahmen an Strassen in der Schweiz–gegenwärtiger Stand, Erfahrungen, und Bedeutung für den Artenschutz. KARCH, Bernastr. 15, 3005. Bern. 10 pp.

Trocmé, M. et al. 2003. COST 341–*Habitat Fragmentation due to transportation infrastructure: The European Review*, Office for Official Publications of the European Communities. Luxembourg. 251 pp.

Eidgenössisches Department für Umwelt, Verkehr, Energie und Kommunikation (UVEK) Richtlinie vom. 10. November, 2001. Planung und Bau von Widltierpassagen an Verkehrswegen. http://www.uvek.admin.ch/dokumentation/medienmitteilungen/artikel/20020117/00905/index.html?lang=de

VSS. 2004. Swiss Standards 640 691a to 640 694 *Fauna and Traffic*, VSS Seefeldstrasse 9, 8008. Zürich.