CENTRE DE LA SCIENCE DE LA BIODIVERSITÉ DU QUÉBEC
QUEBEC CENTRE FOR BIODIVERSITY SCIENCE

Response to the questions from BAPE from the following QCBS member:

Prof. Jochen Jaeger, Concordia University

Question 1: *Comment définissez-vous la notion de connectivité écologique et quelle en est l'importance?*

Connectivity is defined as "**the degree to which the landscape facilitates or impedes movement among resources**" and it can be "measured by the probability of movement between all points or resource patches in a landscape" (Taylor et al. 1993, p. 571). Methods commonly used to enhance **urban connectivity** are **greenway networks**, formed by a variety of interconnected natural or green spaces such as parks, golf courses, cemeteries and wooded areas as well as vegetation planted along residential roads, boulevards, waterways, and rooftops. They enhance survival rates of native species by preserving habitats and dispersal routes. They also improve access to open spaces for humans for recreation and engagement in outdoor activities (Li et al. 2004).

It is increasingly recognized that **cities can contribute significantly to global efforts to reduce the rate of biodiversity loss**. Although urban centers are generally synonymous with environmental degradation, they can also shape effective local solutions for the monitoring and conservation of natural areas and biodiversity. This is particularly important due to the current rates of biodiversity loss in cities, which is a significant global phenomenon and is likely to continue with increased urbanization. The challenge in initiating conservation efforts in cities has been twofold: first, understanding the extent and the importance of biodiversity loss in cities, of which many people are unaware; and second, understanding that there often remain natural areas in cities that can support biodiversity and require conservation at the city level. There is an increasing consensus among scientists that ecological connectivity is of high importance for biodiversity, in particular for native biodiversity, and there is a large amount of scientific literature about this topic. Its importance is not as high as habitat amount and habitat quality, but in places where habitat amount and habitat quality cannot be increased (as is often the case in cities), connectivity is the next most important factor. However, connectivity cannot compensate for the loss of habitat or degradation of habitat quality. If this is ignored, there is a danger that road construction may be considered unproblematic by decision-makers if the new roads are combined with the construction of wildlife passages and fences. This is deceptive when habitat amount and quality continue to decline (Fahrig 2001, 2002). Wildlife passages and ecological corridors will be useless if there is no habitat left to be connected. Therefore, the conservation and restoration of wildlife habitats must be the first priority.

For these reasons, the **connectivity of natural areas in cities has been in included as an indicator** in the City Biodiversity Index (CBI) (CBD 2012). The CBI is a tool to evaluate and monitor the state of biodiversity in cities and to provide insights for improving

conservation efforts. It was proposed at the 9th Meeting of the Conference of the Parties (COP-9) to the Convention on Biological Diversity (CBD) in May 2008 (Chan and Djoghlaf 20009, CBD 2012), motivated by rising awareness of biodiversity loss caused by urban development (Brook et al. 2003). Many species require access to different types of habitat to be able to complete their life cycle. Urban wildlife populations are negatively affected by the inability to move between fragmented habitats, resulting in reduced access to resources and mating partners, loss of genetic diversity, and high rates of extinction among native species (Brook et al. 2003; Di Giulio et al. 2009; Tischendorf & Fahrig 2000). Three main components constitute the Index, including: "native biodiversity in the city; ecosystem services provided by native biodiversity in the city; and governance and management of native biodiversity in the city". They are captured by 23 indicators (CBD 2012). The connectivity of natural areas in cities is indicator 2 in the CBI (and the amount of natural areas in cities is indicator 1), and it can be used to assess the extent to which the built environment permits wildlife and humans to move between habitats and recreational sites.

Brook, B.W., Sodhi, N.S. & Peter, K.L. (2003). Catastrophic extinctions follow deforestation in Singapore. *Nature* 424, 420-425.

Chan, L., Djoghlaf, A. (2009). Invitation to help compile an index of biodiversity in cities. *Nature* 460, 33.

Convention on Biological Diversity. (2012). *User's manual for the City Biodiversity Index.* Retrieved from http://www.cbd.int/authorities/doc/User's%20Manual-for-the-City-Biodiversity-Index18April2012.pdf

Di Giulio, M., Holderegger, R., & Tobias, S. (2009). Effects of habitat and landscape fragmentation on humans and biodiversity in densely populated landscapes. *Journal of Environmental Management, 90*(10), 2959-2968.

Fahrig, L. (2001). How much habitat is enough? *Biological Conservation* 100, 65–74.

Fahrig, L. (2002). Effect of habitat fragmentation on the extinction threshold: A synthesis. *Ecological Applications* 12, 346–353.

Taylor, P.D., Fahrig, L., Henein, K. and Merriam, G. (1993). Connectivity is a vital element of landscape structure. *Oikos, 68*(3) 571-573.

Li, F., Liu, X., Paulussen, J., & Wang, R. (2004). Comprehensive concept panning of urban greening based on ecological principles: a case study in Beijing, China. *Landscape and Urban Planning,* 72(2005), 325-226.

Tischendorf, L., & Fahrig, L. (2000). On the usage and measurement of landscape connectivity. *Oikos, 90*(1), 7-19.

Question 2: *Le projet de parachèvement de l'autoroute 19 avec voies réservées au transport collectif à Laval et à Bois-des-Filion par le MTQ pourrait-il, par les mesures d'atténuation et de compensation prévues au projet, contribuer à améliorer la connectivité entre les habitats et les écosystèmes régionaux, stimulant ainsi la diversité biologique? Vous référer à l'étude d'impact du promoteur (PR3.1, section 5.3 et p. 287 et suivantes) sur le site du BAPE à l'adresse suivante : www.bape.gouv.qc.ca/sections/mandats/autoroute_19-bois-des-filion_laval/documents/liste_cotes.htm*

To answer this question it will be necessary to consult the **greenway network plan** of the City of Laval and the information about biodiversity on the island of Laval and in Bois-des-Filion. If the City of Laval does not yet have a greenway network plan, then such a plan should be created. This task will require collaboration with the City of Laval about available data. Information about a much larger area than just a 500 m buffer zone around Autoroute 19 will be required for this task.

We have done similar work for the Island of Montreal (Asgary 2012, Deslauriers 2013): We have applied the connectivity metric of the CBI to Montreal in collaboration with the Ville de Montreal, Direction des grands parcs et du verdissement (Asgary 2012). We also used a similar approach in Southwest Montreal, where a greenway network has been proposed. Plans for residential development on the site of the Meadowbrook Golf Course may however, compromise the viability of this network by decreasing access to high quality habitat (for biodiversity) and public space (for humans). Connectivity for this network was measured to assess the role of the Meadowbrook golf course for the connectivity of the greenway network in Southwest Montreal and the effect that its development would have, comparing various scenarios. Current and potential future levels of connectivity were measured for spaces used by wildlife and by urban residents. Presently, spaces available for wildlife are limited and somewhat isolated due to large distances and barriers, such as roads, that impede movement between them. However, the identification of sites to be enhanced or established as habitats or recreational zones in the future exposed the possibility to increase connectivity substantially in the network. The destruction of Meadowbrook would eliminate its large potential to serve as a vital component of this greenway network in the future. Similarly, city planners and government officials of the City of Laval should consider the potential for enhancing or establishing habitats or recreational zones to increase connectivity substantially in the greenway network of Laval in the future, with particular consideration of the effect of Autoroute 19.

Please find the poster by Asgary and Jaeger (2014) included as a PDF as an example for the island of Montreal.

Asgary, A. (2012): Measuring the connectivity of natural areas in the City Biodiversity Index (CBI) using the effective mesh size (m_{eff}). Honour's thesis, Department of Geography, Planning and Environment, Concordia University Montréal. 90 pp.

Asgary, A., and Jaeger, J. (2014): Measuring the connectivity of natural areas in cities as an indicator in the City Biodiversity Index (CBI) using the effective mesh size (m_{eff}). Poster presented at the conference "Partnerships for the Living City: Promoting Urban Biodiversity" at Concordia University in Montreal, QC, March 7, 2014.

Deslauriers, M. (2013): Measuring the connectivity of the greenway network in Southwest Montreal: Scenarios for enhancing the wellbeing of biodiversity and humans. Honour's thesis, Department of Geography, Planning and Environment, Concordia University Montréal. 84 pp.

7 octobre 2014

Dr. Jochen Jaeger, Professeur agrégé
Université Concodia Department of Geography, Planning and Environment
1455 de Maisonneuve Blvd. W., Suite H1255
Montréal, Quebec, H3G 1M8, Canada
Tel.: (+1) 514 – 848-2424 extension 5481
Email: jochen.jaeger@concordia.ca
Web: http://gpe.concordia.ca/faculty-and-staff/jjaeger/