

Urban bird conservation: presenting stakeholder-specific arguments for the development of bird-friendly cities

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Abstract Following the call from the United Nations Convention on Biological Diversity “Cities & Biodiversity Outlook” project to better preserve urban biodiversity, this paper presents stakeholder-specific statements for bird conservation in city environments. Based upon the current urban bird literature we focus upon habitat fragmentation, limited habitat availability, lack of the native vegetation and vegetation structure as the most important challenges facing bird conservation in cities. We follow with an overview of the stakeholders in cities, and identify six main

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groups having the greatest potential to improve bird survival in cities: i) urban planners, urban designers and (landscape) architects, ii) urban developers and engineers, iii) homeowners and tenants, iv) companies and industries, v) landscaping and gardening firms, vi) education professionals. Given that motivation to act positively for urban birds is linked to stakeholder-specific advice, we present ten statements for bird-friendly cities that are guided by an action perspective and argument for each stakeholder group. We conclude with a discussion on how the use of stakeholder-specific arguments can enhance and rapidly advance urban bird conservation action.

Keywords Urban bird conservation · Stakeholder · Argument · Conservation strategy · Urban biodiversity · Urban green

Introduction

In their recent paper called the *Cities & Biodiversity Outlook*, the Convention on Biological Diversity (CBD), ICLEI (the local governments for sustainability), and the Stockholm Resilience Centre calls for action and policy to conserve urban biodiversity, maintain the ecological functioning of cities and offer citizens opportunities to experience and learn about local wildlife in cities worldwide (CBD 2012). “*With the growing awareness of the value of biodiversity and ecosystem services, cities with rich native biodiversity should ensure that their biodiversity is conserved. Cities with impoverished biodiversity should pursue enhancement, restoration, and reintroduction efforts to increase native biodiversity*” (p.25). Following this call, this paper presents a list of 10 statements and arguments—targeting different stakeholder groups—on why we should take steps to transform traditional city environments into more bird-friendly ones. Cities are complex socio-ecological systems (Moffatt and Kohler 2008) in which to roll out a traditional bird conservation programme (that targets only a small number of different stakeholder groups). They have mosaics of divergent land uses, with each land use having its own habitat quality for each bird species. Moreover, cities present a high multi-stakeholder environment, where people have different roles and stakes in different settings (CBD 2012; Teillac-Deschamps et al. 2009). An urban dweller can be a home-owner, an employee, a shopping mall client, a sportsman ... all the same person, but not at the same time. Further, bird conservation in cities is often not seen as a priority when the species themselves may be abundant and when many people feed birds in their gardens (Davies et al. 2009), spending millions of dollars annually to do so (Clucas et al. 2014). However, feeding birds is not the only conservation action that can be taken for birds in cities.

This paper aims to improve existing urban bird conservation practice by exploring ways of engaging people within their different roles by presenting arguments and action perspectives that are tailored to various urban stakeholder groups. These arguments are based upon the opportunities that various urban stakeholders may offer to conserve urban birds through the creation of essential habitat features (e.g., the provision of safe nesting places), whilst reducing urban threats, barriers and disturbances (e.g., reducing window collisions). Specifically, these opportunities vary from creating cohesive and robust green infrastructure planning and design (Tzoulas et al. 2007) to providing wildlife-friendly architecture and garden management. Sufficiently-sized and well-connected green patches cities are necessary to accommodate a rich urban bird community (habitat quantity), but this must also occur in conjunction with proper green design and management to ensure there is also sufficient habitat quality. A variety of stakeholders must be including in order to achieve the habitat quality and quantity required for bird-friendly cities, from the direct ecological influencers (e.g. city park managers, garden owners) to the highly important but often missed city infrastructure influencers (e.g. planners, project developers, architects).

This paper begins with a brief overview of the current value of cities as bird habitat and outlines the major challenges that urban environments may present for bird survival. We then identify the wide range of key stakeholders who play a vital role in ensuring and enhancing urban bird populations and their city habitat. Based upon each stakeholder's characteristics we present ten statements for bird-friendly cities that are guided by an action perspective and a specific argument for the key stakeholder. We conclude with a discussion on how the use of stakeholder-specific arguments can enhance and rapidly advance urban bird conservation action.

The value and challenges that cities offer to birds: A brief summary

Urban birds: Species richness, abundance, spatial dynamics and human experience

To create context for our call to better address the need for urban bird conservation, this section briefly summarizes the value of urban environments for birds, in terms of species richness, abundance, metapopulation dynamics and human experience.

Species richness Numerous studies have highlighted the high avian species richness of city environments (e.g. Donnelly and Marzluff 2004; Marzluff 2005), although most of these studies have focused upon a single, or very few cities. Aronson et al. (2014) compared the lists of birds recorded in 149 cities equally spread around the globe and found that 20 % of all bird species have been recorded in cities. In some parts of the world that have a long history of urbanization, this proportion may be higher. In an overview of the breeding birds in European cities, Kelcey and Rheinwald (2005) showed that 272 bird species (including national Red List species) were observed in at least one of these 11 cities: Berlin, Bonn, Bratislava, Brussels, Florence, Hamburg, Lisbon, Lublin, Moscow, Prague, Rome, St. Petersburg, Sofia, Valencia, Vienna and Warsaw. Given that Hagemeyer and Blair (1997) identified a total of 495 breeding bird species in Europe (excluding the small number of non-breeding European bird species), the 272 bird species observed in cities constitute a substantial part (approximately 50 %) of the total bird species richness of Europe. In addition, a recent survey of 49 countries conducted by BirdLife International that 1.9 to 4.2 % of all 10,500 bird species as currently described by science use city environments as prime habitat (Fergus et al. 2013).

Bird abundance Cities can also be important for the population numbers of certain species. One may expect that, in any given country, the proportion of bird species for which cities are the main habitat depends upon both the area of urban landscape and the age since urbanization, as well as the specific habitat characteristics of the urban area. For example, the Netherlands is a Western European country with a long history of urbanization, which has resulted in an urban area that covers 16 % of the country's surface. For approximately one third of its breeding bird species (45 of the 151 species) the proportion of breeding pairs that settle in urban environments is higher than the actual proportion of the urban land cover (16 %). For 13 of the 151 breeding bird species the urban proportion of breeding pairs was even more than half of the national breeding population (Kwak and Louwe Kooijmans 2009). In this case, the urban environment appears to be a very important habitat. Unfortunately, similar statistics for most other countries are unknown. In the BirdLife International survey of urban birds, only 27 % of participating countries ($n=49$) have a dedicated monitoring scheme for urban birds (Fergus et al. 2013).

Spatial patterns and processes The variable habitat quality of city environments may affect population shifts in birds so that some populations grow, some decline and others remain stable

in an interplay of source-sink dynamism (Oleyar 2011; Marzluff in review). Some studies suggest that urban habitats may act as sinks, recruiting birds from the city edge (e.g., van Heezik et al. 2010), while others classify city environments as suitable habitats for supporting passerine bird populations (e.g. Balogh et al. 2011).

Human experience of birds The world's human populations are becoming increasingly urbanised, with 78 % of the inhabitants of the more developed nations and more than 50 % of the global human population now living in or near cities (United Nations 2007). As a result, the vast majority of people will only experience nature and interactions with wildlife in cities. These interactions benefit both humans and wildlife, for example as people feed birds, they become more abundant, and this increased population may lead to more visibility of the birds by citizens and as such may, in turn, enhance human health and well-being (Clucas 2011; Clucas et al. 2011; Clucas and Marzluff 2012). With more people living in cities, conservation action is becoming increasingly dependent upon people's experiences with nature. In fact, wildlife interactions are argued to be just as important as conservation action itself (Fernández-Juricic and Jokimäki 2001; Savard et al. 2000). This is because enjoying birds in a garden or park may increase the support for bird conservation in cities (Goddard et al. 2013; Clucas et al. 2014) and perhaps concern for wildlife beyond the city.

Summarizing, urban environments:

- may accommodate a *rich diversity* of bird species (including endangered species),
- may contribute substantially as a *prime habitat* for at least some of these species,
- play a role within the overall *metapopulation dynamics* (source/sink/stable) of bird species at the regional or national scale (not studied for most species) or it appears species-specific (varies across studies of different species),
- have the potential to connect people to wildlife and nature, as the majority of the global human population now reside within cities.

Challenges for bird survival relate to both urban design and human activities

Despite the opportunities that cities present for some birds, urban environments are often un-ideal and challenging habitats for many (with feral pigeons as one of the few exceptions). The extent to which a bird experiences a city as an environment that provides good habitat, is the (mis)match between the bird's habitat preferences and the sum of human decisions to develop and use the city in a certain way (generally without having the bird's habitat preferences in mind). Based upon the literature, we prioritize the following challenges for bird survival in cities:

1) *Habitat fragmentation and availability*

Birds require sufficient and well-connected habitats to establish viable populations. In cities, habitat is fragmented and large suitable patches are lacking. This negatively impacts bird diversity and abundance (Donnelly and Marzluff 2004; Chace and Walsh 2006; MacGregor-Fors and Schondube 2011).

2) *Vegetation composition and structure*

Most bird species prefer a diverse vegetation structure with a multi-layer canopy of native plants (Lancaster and Rees 1979). Native vegetation supports significantly greater bird abundance, diversity, species richness, biomass, and breeding pairs of native species compared

to urban patches with non-native vegetation (Burghardt et al. 2009). However, suburban landscapes, which make up a large proportion of the green space in cities, are generally composed of an abundance of open grass lawns and non-native (ornamental) trees and shrub.

3) *Predation and disturbance by pets*

Domestic cats are one of the biggest predators of urban birds, especially fledglings (Møller 2008; Møller and Ibáñez-Álamo 2012 ; Lowe et al. 2011), while domestic dogs are a source of nuisance (see next point).

4) *Human presence*

Although urban birds have developed a certain tolerance to human presence, people can still be considered a disturbing factor for birds that are foraging, nesting or resting. For example, frequently disturbed birds display greater vigilance behaviour thereby diminishing the time available for foraging (Fernández-Juricic and Tellería 2000).

5) *Buildings*

Older buildings historically offered nesting opportunities for birds under roofs (De Laet and Summers-Smith 2007). However, modern buildings are well-sealed to save energy, and therefore impenetrable to birds. In contrast to the positive aspects of providing habitat, buildings can also present hazards. For example, mirrored windows cause significant bird mortality (Klem et al. 2009).

Other factors that challenge bird survival in cities are road and rail traffic that result in fatal collisions (Ramp et al. 2006) and produce loud noise disabling song birds to defend their territory (Halfwerk et al. 2011; Schroeder et al. 2012), a surplus of artificial light (Faeth et al. 2011) and human waste (Otoni et al. 2009), and the environmental pollution of air, soil, water (e.g., Kamiński 1998; Bonier 2012). Occasionally birds can adapt to the challenges cities provide and this response appears taxon-specific. For example, urban-dwelling great tits *Parus major* have been shown to sing at a higher pitch in order to reduce the masking effects of background urban noise on their song transmission (Slabbekoom et al. 2012). However, these adaptations have a limited added value for the overall survival of birds and do not compensate for a lack of habitat quantity, connectivity and quality in cities—factors which have been identified as critical (Barbosa de Toledo et al. 2012; Kubantsev and Kolyakin 1995; Sierdsema et al. in review; Strohbach et al. 2013).

Overall, city environments present a challenging landscape for birds to survive and thrive. Although many species can already be found in cities, it is clear that ‘being present’ does not mean ‘thriving’. There is a need to better conserve birds in cities, particularly if we want city environments to really contribute to overall bird conservation and wildlife experience.

Identifying key stakeholders and arguments for urban bird conservation

Urban environments present complex structure in both habitat and inhabitants. Unlike, for example, agricultural landscapes where there are a handful of stakeholders (e.g. farmers, water boards), urban environments consist of a greater variety and number of conservation participants such as land owners, institutions and associations (e.g. citizens, housing corporations, businesses, investors, sports clubs etc.). In addition, city development and management include an additional set of stakeholders and processes that are often ignored or simply not considered within urban conservation action plans. These city development professionals

make countless choices that may be relevant for bird conservation, such as the position of vegetation and green space within plans, which tree species are planted, which building materials to use for roofs, and so on. A successful conservation strategy for urban birds should include the full range of stakeholders and identify the groups that are key for bird survival.

How do we even begin to map all the stakeholders in cities? Although several studies have identified the various stakeholders in relation to urban green or biodiversity in cities (e.g. Asikainen and Jokinen 2009; Azadi et al. 2011), no systematic approach currently exists in the literature. As a result, we created a new classification system. We began by categorising stakeholders to the different stages of the urbanization *process*: the development stage, the usage stage and the management stage. We then considered the general lay-out and structure of a city (the *pattern*). Six main categories were distinguished based on urban land use, each with its own set of stakeholders: (i) residential areas, (ii) business areas (including industry and shopping malls), (iii) utilities (e.g. schools, hospitals), the city's main (iv) green and (v) water infrastructure and (vi) the (rail)road infrastructure. Urban green, a major component of bird habitat, can be found in varying degrees within all urban land use types. Large urban green patches like parks, sporting fields and allotment gardens make part of the main green infrastructure. In the other urban land use types urban green is present at a smaller scale (e.g., in gardens, road verges, corporate green, river banks). Finally, we combined these two classifications into a matrix that present a broad range of identified stakeholders (Table 1).

From this stakeholder overview, and following the challenges for urban bird survival, we selected the stakeholder roles below as key for urban bird conservation. We base our selection on years of practical experience in urban bird conservation (e.g. by Birdlife International).

A) *Urban planners, urban designers and architects, and landscape architects*

These professionals, both in municipal and corporate service, shape the demand of land owners and local authorities into spatial zoning and design plans for residential, business, utility, green, water and infrastructure areas. They determine the city's physical layout and thus the overall availability and connectivity of urban green and water.

B) *Urban developers and engineers*

These professionals transform the designers' plans into man-made constructions.

C) *Homeowners and tenants*

These stakeholders predominantly determine the type, character and management of residential areas, including private gardens.

D) *Companies and industries*

These organisations are representatives for business and industrial areas, ports and office sites (including left-over land), in a similar way as the homeowners and tenants.

E) *Landscaping and gardening firms*

These stakeholders maintain both the public and private green space.

F) *Education and communication staff*

Table 1 City stakeholders classified according to urbanization phase (process) and urban land use type (pattern). This table provides an extensive though not complete overview of city stakeholders, and also illustrates the different roles people may fulfil simultaneously

Phases in the urbanization process				
	City development	Owners and users	Management	Residual category
Urban land use types				
Residential areas	Planners, urban designers, (landscape) architects, project developers, construction and engineering companies	Citizens, housing corporations, investors	Citizens, landscaping firms, garden designers, construction companies	Owners associations
Business areas (incl. port, industrial and office sites)	Planners, urban designers, (landscape) architects, project developers, construction and engineering companies	Municipalities, entrepreneurs, employees, business clients, investors	Landscaping firms, construction companies	Entrepreneurs associations
Utilities (incl. schools, hospitals)	Planners, urban designers, (landscape) architects, project developers, construction and engineering companies	School organizations, children; hospital organizations, patients, municipalities	Landscaping firms, construction companies	Parents, health insurance companies
Main green space (incl. parks, sport fields, allotment gardens, cemeteries)	Planners, landscape architects, landscaping firms	Municipalities, sport clubs, allotment gardeners, cemetery organisation, recreationists	Landscaping firms, gardeners and other maintenance personnel	Citizens, environmental NGOs
Main water structure	Planners, urban designers, project developers, water engineers,	Municipalities, water board, waterway transport and recreationists	Waterway managers, dredging companies, landscaping firms,	Water sport NGOs
Main infrastructure	Planners, urban designers, landscape architects, road construction and engineering companies	Municipalities, public and private transport users	Road managers, landscaping firms	Car and bicycle owner associations

The current status of cities as bird habitats implies a need for more education and outreach in urban bird conservation (Miller 2005). Education and communication staff at schools and NGOs can fulfil this need.

Note on the role of governments as actors and regulators:

'Local governments' or 'municipalities' present a challenge for this stakeholder classification: these governmental bodies include a wide array of professional actors (planning, design, conservation, legal, economic, etc.), each with their own specialism and interests. Moreover, the role of local governments may vary largely among cities worldwide. In some cases they coordinate the city's design, development and management. In other cases with different governance practices the role of municipalities is much smaller. In this paper, we have chosen to only highlight the role of local governments in the planning and design of cities in our classification (see the group of professionals in this category). This is as in planning and design the role of local governments is unambiguous in cities worldwide and can obviously be linked with 'habitat fragmentation and availability', a main challenge for urban bird conservation.

In addition, the regulatory role that governments play is a key feature that distinguishes them from other urban actors. The ability to make and maintain regulations on every aspect of the city (e.g. from building codes to urban green space design) means that they have the potential to significantly impact the city environment for birds. In international city practice, there are examples of local governments that enforce within their building codes the actual greening of new developments (e.g. green roofs in Germany) and thus stimulate bird habitat development. However, local government can also provide regulations that discourage bird habitat development, for example, by decreeing the removal of shrubs from urban green space for social security reasons. In their book on urban wildlife management Adams et al. (2006) designate a whole chapter on the impact of federal, state, county, city and local laws and ordinances on wildlife conservation. Their extensive discussion only covers the impact of regulations on wildlife in U.S. cities. Incorporating the wide range of regulations which differ between countries and cities into this paper would be impossible. We therefore recognize the impact that regulations can have on urban bird conservation, but do not discuss them here.

Reaching the right city stakeholder with the right (conservation) argument

To improve the current state of urban bird conservation, we've looked to actual practices of nature conservation in cities. Goddard et al. (2013) illustrated that residents reveal a range of motivations for wildlife-friendly gardening. We expect a similar range among other stakeholders and practices other than just gardening. It has been suggested that taking into account the diversity of personal perceptions and practices, thereby providing a range of actions increases the success rate of participation (Teillac-Deschamps et al. 2009). In December 2011, at the International Congress on Conservation Biology (Auckland, New Zealand), the Birdlife International Group on Urban Birds (BIG-UB) organized a symposium and workshop to discuss the current state of art in urban bird science and conservation. Participants included urban bird scholars, conservationists and practitioners from different parts of the world, and with extensive cooperation with the identified stakeholder groups in urban bird conservation. With this group of bird and city practice experts, we formulated ten statements emphasizing the need for increased attention on the challenges and opportunities in urban bird conservation that are specifically linked to key stakeholders and address different perceptions on conservation (Table 2). Based upon the literature and practical experience, we provide for each statement an *action perspective* as well as a *main argument* for the key stakeholder that stress the mutual benefit gained for both humans and birds.

Table 2 Ten statements arguing for increased attention to urban bird conservation that are targeted to key stakeholders. Each statement includes the relevant stakeholders (main stakeholder in **bold**), an action perspective and a leading argument. Each statement also addresses one or more of the bird survival challenges listed in this paper, and some approach a conservation issue from varying stakeholder perspectives

Statements	Key stakeholders					Action perspective for stakeholders	Argument for main stakeholder	Addressed urban bird survival challenges
	Urban planners and designers	Urban developers and engineers	Homeowners and tenants	Companies and businesses	Landscaping and gardening firms			
I. Support for nature conservation starts in cities.	X	X	X	X	X	X	Make general conservation aims more recognizable by linking with the daily perception of citizens, businesses and urban professionals (Miller 2005; Shep and Clegrean 2012)	Habitat fragmentation; vegetation composition and structure
II. People need education and messages to increase the value of bird conservation			X			X	Tailor-made advice increases success rates in conservation practice (Goddard et al. 2013; van Heezik et al. 2012), increase support for NGOs	Vegetation composition and structure at the garden scale
III. Citizens can make a difference when it comes to habitat quality for urban birds			X			X	The actions proposed will attract birds to gardens, enabling people to enjoy them, increase citizens' well-being.	Vegetation composition and structure (Goddard et al. 2010; Lerman and Warren 2011); habitat fragmentation (Rudd et al. 2002); predation by domestic cats (Van Heezik et al. 2010).
IV. Both people and birds benefit from green cities			X	x		X	A green environment may prevent people from fitness and speed up the healing process (De Vries et al. 2003; Ward Thompson et al. 2012)	Vegetation composition and structure of utility areas
V. Incorporating wildlife habitat quality into urban planning and design substantially increases urban bird abundance.	X	X	X			X	People prefer a green living environment with abundant wildlife; increases the well-being for the planners/designers' client (the citizen)	Habitat fragmentation and availability at the larger scale (Stagoll et al. 2010; Ikin et al. 2012; Aiskainen and Jokinen 2009); zoning of human presence

Table 2 (continued)

Statements	Key stakeholders					Action perspective for stakeholders	Argument for main stakeholder	Addressed urban bird survival challenges
	Urban planners and designers	Urban developers and engineers	Homeowners and tenants	Companies and businesses	Landscaping and gardening firms			
VI. Incorporating wildlife habitat quality into <i>building design and development</i> increases urban bird abundance locally.	X	X	X	X	X	Apply bird-friendly construction materials; select green roofwall types with added value for birds. Use check lists for bird-friendly buildings (e.g. http://www.checklistsgroenbouwen.nl/).	Accounting for biodiversity is an increasingly popular issue within green building practices (Hostetter 2012). Offering habitat opportunities for wildlife may appeal to land owners and users (Kaplan 2007). the (indirect) clients of the designers and landscape managers	(recreation paths) in urban green Bird-friendly buildings: green walls (Chiquet et al. 2012); green roofs (Fernandez-Cacero and Gonzalez-Redondo 2010); built-in nesting boxes
VII. Incorporating wildlife habitat quality into <i>urban green design and management</i> substantially increases urban bird abundance.		X	X	X	X	Combine aesthetic and cost-effectiveness aims with habitat creation (Lovell and Johnston 2009). Establish native vegetation with sufficient variety in green design and maintenance (Margui and Macias 2010; Wilkinson 2006).		Vegetation composition and structure; habitat availability; zoning of human presence (recreation paths) in urban green
VIII. Both employees and birds benefit from green business and office parks.			X	X		Companies may utilize various options to physically green corporate environments, e.g. green walls and roofs.	A green outdoor environment at work appears to be an asset for employees' wellbeing and level of stress (Kaplan 2007; Lottrup et al. 2013)	Habitat availability at business areas (Sneep et al. 2009); bird-friendly corporate buildings
IX. Urban bird conservation can help companies to express their corporate social/environmental responsibility				X	X	Companies may employ activities to simulate wildlife presence and wildlife experience at their corporate land (Sneep et al. 2009)	Increased employee commitment, improved relationships with environmental NGOs, positive effect on community relations, improved relationship with regulators, annual cost savings (Carekshadden and Lober 1998)	Habitat availability, composition and structure at business areas

Table 2 (continued)

Statements	Key stakeholders	Homeowners and tenants	Companies and businesses	Landscaping and gardening firms	Education staff (school and NGOs)	Action perspective for stakeholders	Argument for main stakeholder	Addressed urban bird survival challenges	
X. Corporations can make a difference when it comes to habitat quality for urban birds	Urban planners and designers	Urban developers and engineers	Homeowners and tenants	Companies and businesses	Landscaping and gardening firms	Education staff (school and NGOs)	Companies may explore how their corporate land (e.g. left-over land) can contribute to regional conservation aims (Snep and Ortborg 2008; Snep et al. 2011).	Companies can move beyond current corporate biodiversity practices and make a profile at the next CSR-level of conservation (CSR: Corporate Social Responsibility).	Habitat fragmentation and availability at the city region scale

Our overview (Table 2) can be used to inform conservationists and governments about the wide range of actors that all may contribute to urban bird conservation. It provides targeted arguments and action perspectives for each stakeholder that can be used to inform action. Given that the practical approach to implementing these suggestions may vary between countries and cities, we suggest the incorporation of communication experts in any future discussions. We emphasize the importance of stakeholder-specific arguments instead of one general message.

Discussion

Momentum for urban bird conservation

If urban bird conservation is to be considered a serious part of bird conservation worldwide, conservation efforts must be more strategic and less non-committal than current practices in most cities (Fergus et al. 2013). As in nature reserves, conservation aims in the urban landscape should be focused on maintaining bird species diversity and preventing vulnerable populations from local extinction. Some countries have taken the step to appoint Important Bird and Biodiversity Areas (IBBA) within urban areas, although there is still a majority of countries and cities that lack an urban bird conservation program (Fergus et al. 2013). With on-going urbanization and an increasing global human population that consists predominantly of urban dwellers, it seems to be the right moment to more prominently address urban biodiversity conservation (CBD 2012), including birds. Scientific studies offer a plethora of evidence to consider urban birds worthy of conservation. The next issue then is how to achieve such ambitious goals in a built-up landscape that is not considered, and managed, as an ecosystem.

In this paper we provided an overarching perspective on how the many challenges that birds face in cities could be overcome by taking into consideration all landscape classification types and including the various stakeholders and participants in urban conservation programs. Cities are crowded places where people live and work in a landscape composed of buildings, roads, green space and water. Without human activities they would be ghost cities and without man-made structures it's simply a group of people conducting activities in a non-urban environment (e.g. in a natural area). In both cases there still will be an impact on the birds' habitat. However, it is the combination of urban design and human activities that really defines how a city environment is experienced by birds. The challenges for urban bird survival as mentioned in this paper originate from both categories. Based on literature (e.g. Marzluff 2005) we however consider *habitat fragmentation and availability*, and *vegetation composition and structure* to have the highest impact on the suitability of cities as bird habitat. The habitat fragmentation challenge must be addressed from a city-wide scale down to the neighbourhood level and the vegetation structure challenge from the neighbourhood down to the building level. For each of these challenges, the right decision taken by the right stakeholder could mean a lot in terms of bird-friendliness of a city. The right decisions concern connecting habitats and providing sufficient habitat area (planning) as well as designing and maintaining urban green spaces in a wildlife-friendly manner (design). As illustrated by Table 2, the right stakeholder in this case means that all six key stakeholder groups could make a contribution. However, the conservation policy and expertise of local governments

here play a crucial role. Other challenges we mentioned could be more easily assigned to one or few key stakeholders. For example, predation by domestic cats is primarily linked to homeowners and tenants, and education professionals. The ten statements for urban bird conservation listed here illuminate the triangle relationship of ‘city stakeholder—urban land use—birds’ from various angles. By providing these arguments with concrete action perspectives and leading arguments for the main stakeholder we have provided an overarching view on how to transform urban landscapes into bird-friendly cities.

A new approach to urban bird conservation?

Our approach centres on the notion that cities are multi-stakeholder and multi-land use environments as such a complex socio-ecological system as the city requires more than a straight-forward conservation approach. However most publications on urban bird conservation list conservation measures derived from the bird’s needs rather than offering a conservation strategy that shows insights in the underlying socio-economic drivers required for the transformation towards bird-friendly cities. Marzluff (2005) linked actions for bird conservation to specific stakeholders. Fernández-Juricic and Jokimäki (2001) discussed how from a landscape ecological point of view the right decisions in urban development could support urban birds. Whilst they mention several stakeholder groups, they did not elaborate how to motivate these stakeholders to really take action for urban birds. In fact, only a few studies have looked into socio-economic drivers that could support urban bird conservation. Lerman et al. (2012) analysed how residents may contribute to urban bird conservation by a wildlife-friendly design of their gardens, and determined different attitudes and practices among different socio-economic groups. Residents’ motivations towards bird-feeding were described in various studies (Gaston et al. 2007; Davies et al. 2009; Clucas and Marzluff 2012) and a recent study by Goddard et al. (2013) discussed drivers and barriers for citizens to manage their gardens in a wildlife-friendly way. They addressed the oft-cited barrier of a lack of knowledge but stressed the importance of ‘got to want to know’. Several studies have also illustrated the failure of top-down planning to incentivise behaviour change in residents of new ‘green’ or sustainable developments (Youngentob and Hostetler 2005; Hostetler and Noiseux 2010). According to Goddard et al. (2013), communicating information to the public is most successful when it involves a two-way process of dialogue and advice is tailored to the individual householder rather than a one-size fits all solution. They refer to the successful practice at Dunedin, New Zealand (Van Heezik et al. 2012) as a case study.

Altogether, this paper contributes to existing literature by presenting an overarching approach that interconnects urban land use, stakeholder groups and urban bird survival challenges at different scales, as well as providing statements, action perspectives and concrete arguments for each key stakeholder. However this paper also makes many generalizations due to its large scope and therefore cannot incorporate all details related the rich diversity among urban bird species and their ecology across the globe. We are also writing this paper from the perspective of the western practice in which offering sufficient space for green and water makes part of the urban development planning and design tradition. In other parts of the world, city development may be less planned, and urban bird conservation therefore has a lower priority when it comes to ensuring the health and wellbeing of residents. We therefore acknowledge the

need to fine-tune conservation programmes at a country or culture specific level, and thus consider this study as a first step in the transformation towards bird-friendly cities.

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