Solutions for stopping "negligent homicide" of billion birds

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Birds are crucial chains in the biosphere. They provide many ecosystem services (natural processes that benefit humans), not to mention their impacts on ecosystem functions. All four major types of ecosystem services (e.g., provisioning services, regulating services, cultural services, and support services) are contributed by birds [1]. Nevertheless, bird populations are dropping dramatically due to many factors, including urbanization [2].

As urbanization happens, more and more buildings are built, leading to the increasing deaths of birds due to collisions with buildings, especially in the United States (US). According to a systematic estimate based on 26 datasets from North America [3], around 365 and 988 million birds are killed annually by crashing into buildings in the US. Collisions with low-rise buildings (4 to 11 stories tall) account for the highest proportion of mortality, with 56%.

Collisions with residences (1 to 3 stories tall) and high-rise buildings (more than 12 stories tall) come after with 44% and less than 1%, respectively. Apart from the large number of mortalities, building collisions also threaten many high-risk species listed in the national Birds of Conservation Concern, such as the Golden-winged Warbler (*Vermivora chrysoptera*), Painted Bunting (*Passerina ciris*), Canada Warbler (*Cardellina canadensis*), Wood Thrush (Hylocichla mustelina), Kentucky Warbler

(*Geothlypis formosa*), and Worm-eating Warbler (*Helmitheros vermivorum*).

Can this tragedy be prevented?

Probably yes. Loss et al. [3] suggest that reducing vegetation near windows, angling windows to lessen reflection, and putting netting, closely spaced decals, or UV light-reflecting glass are all possible mitigating strategies for residences [4-6]. Meanwhile, reducing light emission at night and combining bird-friendly design features into existing and new structures are effective prevention methods for low-rise and high-rise buildings [7,8].

However, these measures might not be effectively conducted if the public mindset does not change. As peoples' thinking and behaviors are greatly influenced by their mindset (a set of core values) [9,10], the absent consideration of impacts on birds while designing and constructing buildings is a result of lacking environment-oriented core values. Therefore, it is necessary to build an eco-surplus culture in US societies and other countries to stop the "negligent homicide" of billions of featured individuals in the upcoming years [11].

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