



ESRM 350

Urbanization

Autumn 2016

“The hardest thing to see is what is in front of your eyes”

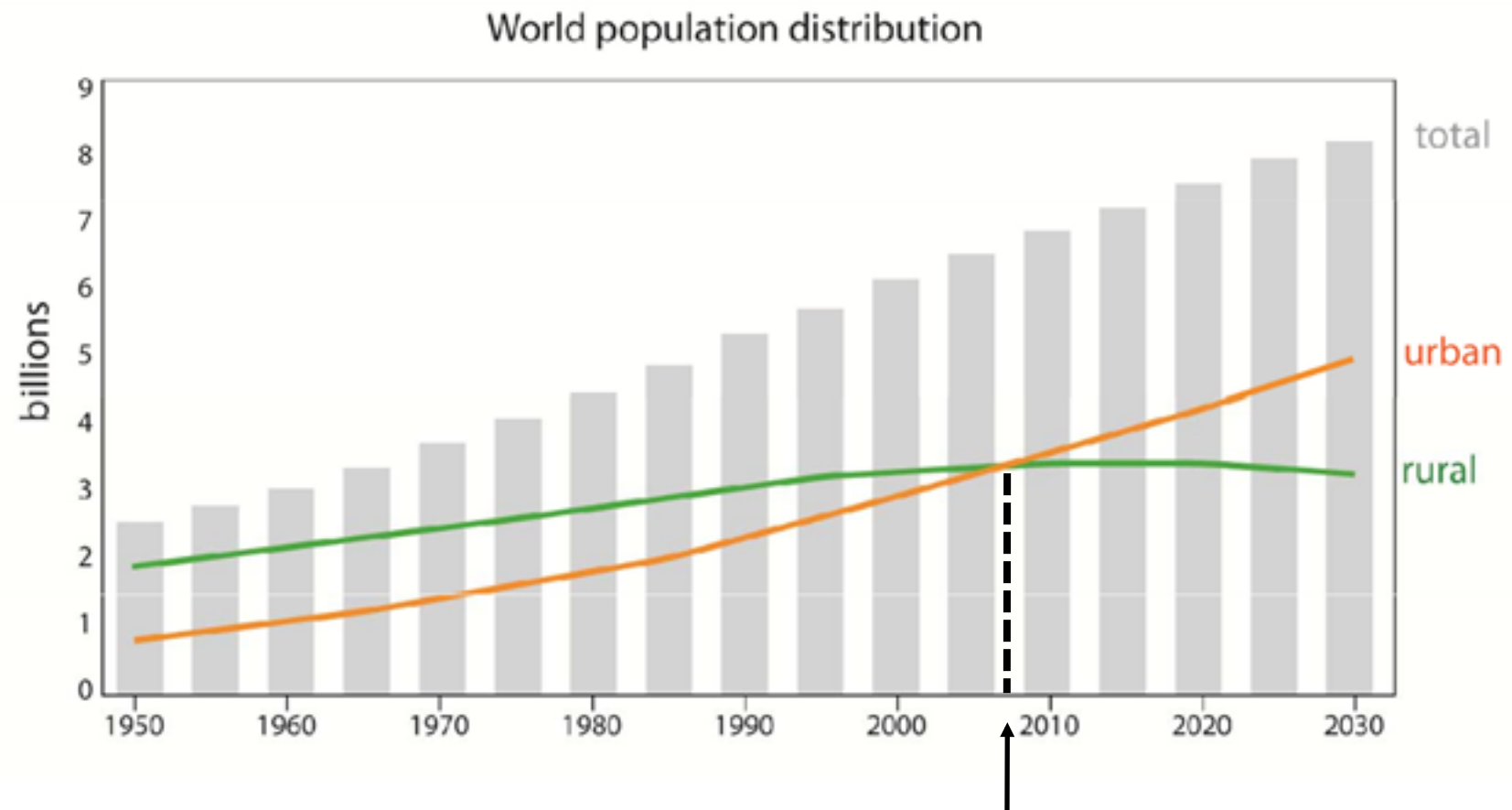
- Goethe, German writer

Urbanization

- The process by which cities form and grow as more and more humans begin living and working in centralized areas



An Increasingly Urban Population



Tipping point
(Global avg. = 50.5%; USA = 82%)

Impacts of Urbanization on Wildlife

- Locations of cities exaggerate local effects on wildlife
 - coasts, river mouths, lakeshores, fertile inland areas where cities tend to be built also have high biodiversity
- Yet, urbanization also draws people away from rural areas, potentially promoting ecological recovery
- In cities, natural resource production is displaced, meaning that urban effects extend well beyond city boundaries
- Species respond differently to urbanization
 - process means habitat loss for some, habitat creation for others

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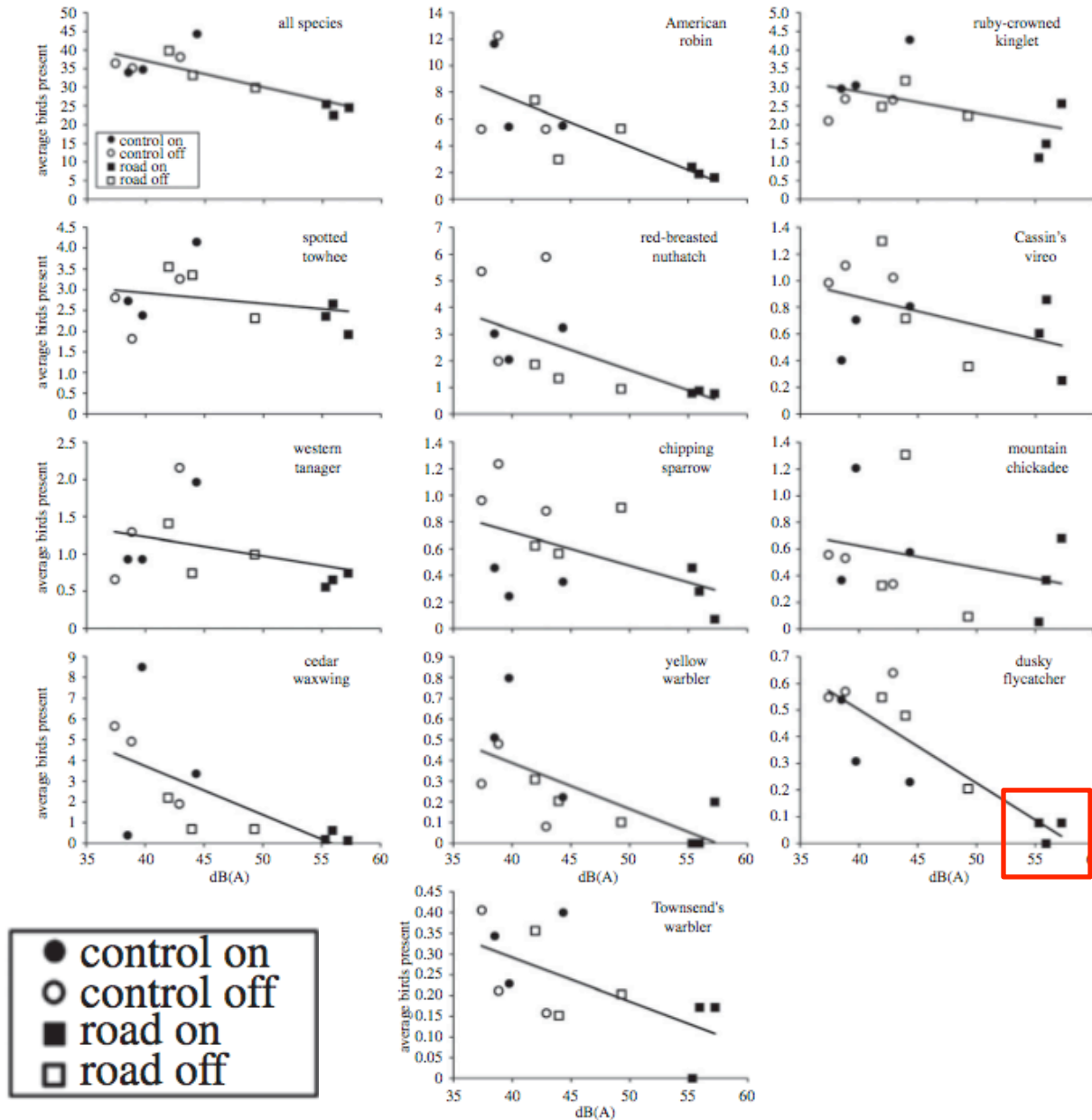
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The Long Reach of Urbanization

- A larger, intensively used area is needed to support cities
 - agriculture (food, other resources)
 - infrastructure (transportation and power generation)
 - can be global if resources are not nearby
- Wildlife populations may be negatively affected, displaced from areas far beyond the the urban fringe (boundary)
- Some of these effects can be subtle
 - Case study: road noise effects on bird communities in the Boise foothills of southwestern Idaho

Experimental application of traffic noise to a roadless area at a landscape scale avoided confounding effects of roads present in other studies (e.g., pollutants, visual disturbance, collisions)



4-day intervals with simulated road noise featured reduced bird abundance during autumn migration in ID

Figure 2. Average numbers of birds present per survey during noise-on and noise-off periods along the phantom road and at control sites in the Boise Foothills in southwestern Idaho. Only species with significant differences in abundance among treatments or background sound levels are shown.

Birds in the City: The Good, the Bad, and the Ugly

- Responses to urbanization are species-specific
 - Some species flourish in cities, while others decline
- Research in WA illustrates this variability



The Urban Gradient

urban

suburban

exurban

wildland



- **Shift in**
Imperviousness (paved)
Forest cover
Biodiversity

Bird Species Richness Along Western WA's Urban to Wildland Gradient

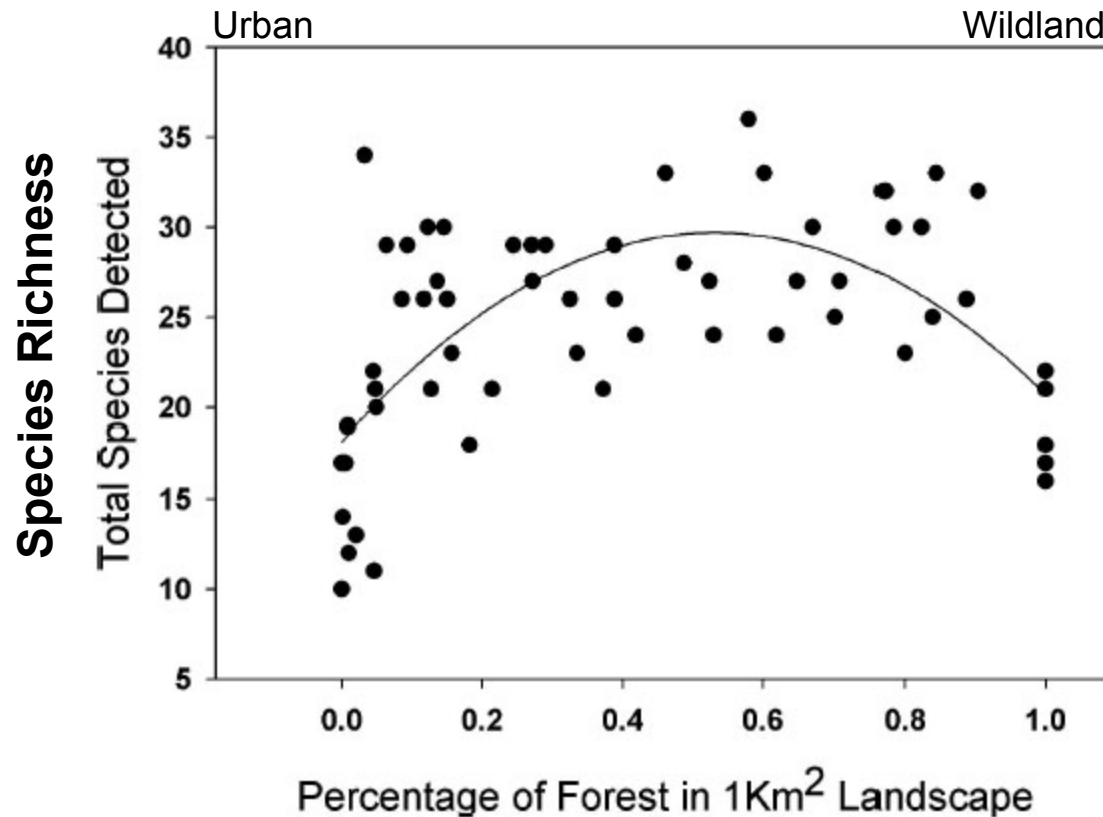


Figure 2. Change in avian diversity with progressively less settlement (more forest). Each point is a study site; control sites ($n = 7$) have 100% forest in their landscapes.

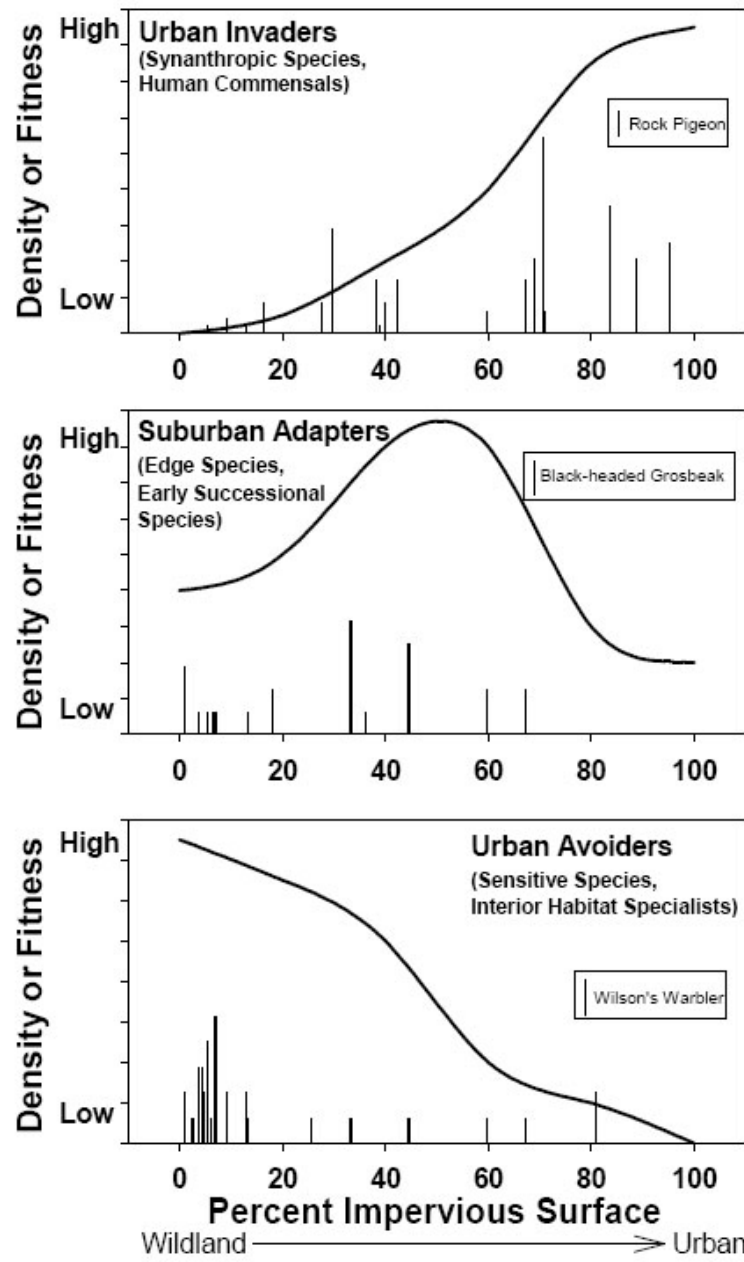


Figure 2. Generalized responses of populations or individuals to urbanization. The density of populations or fitness of individuals that invade (A), adapt to (B), or avoid (C) urban areas is shown as a function of the amount of impervious (sealed) surface in the landscape. Actual abundance data for birds in Seattle, Washington, USA that follow each pattern are plotted in histogram format with each curve. Methods for collecting bird abundance are described in Donnelly and Marzluff (2004).

Bird Diets and Responses to Urbanization

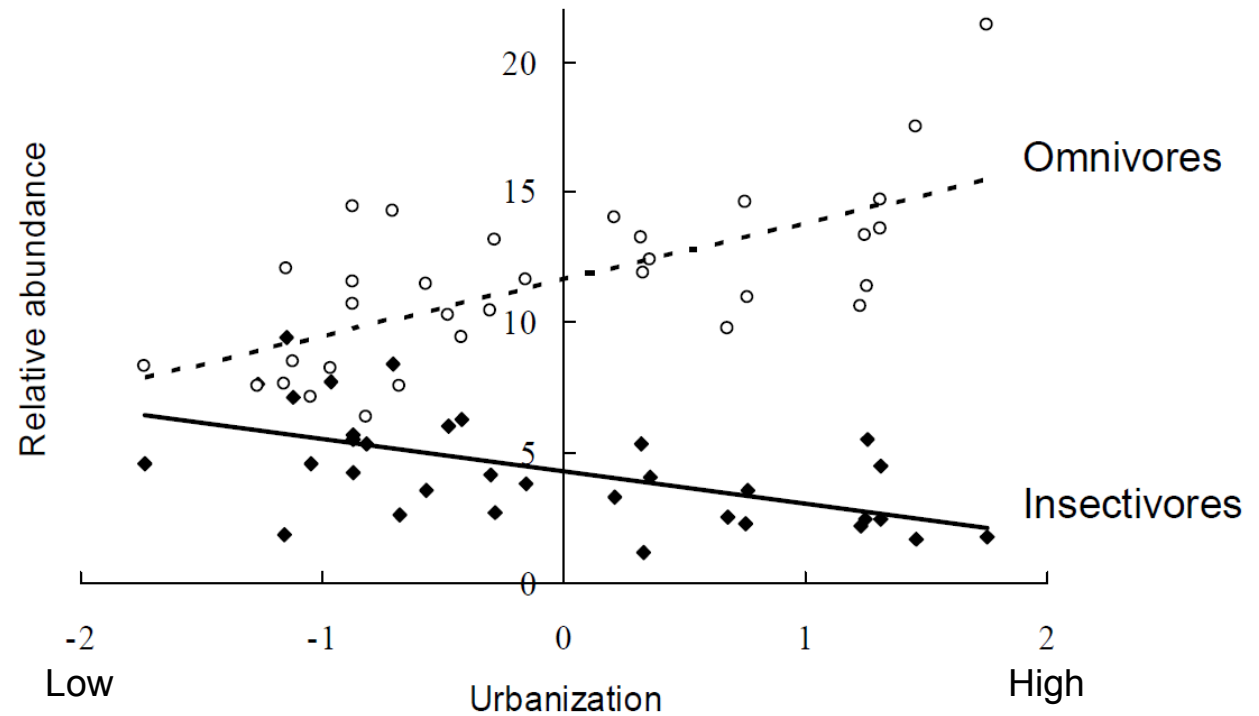
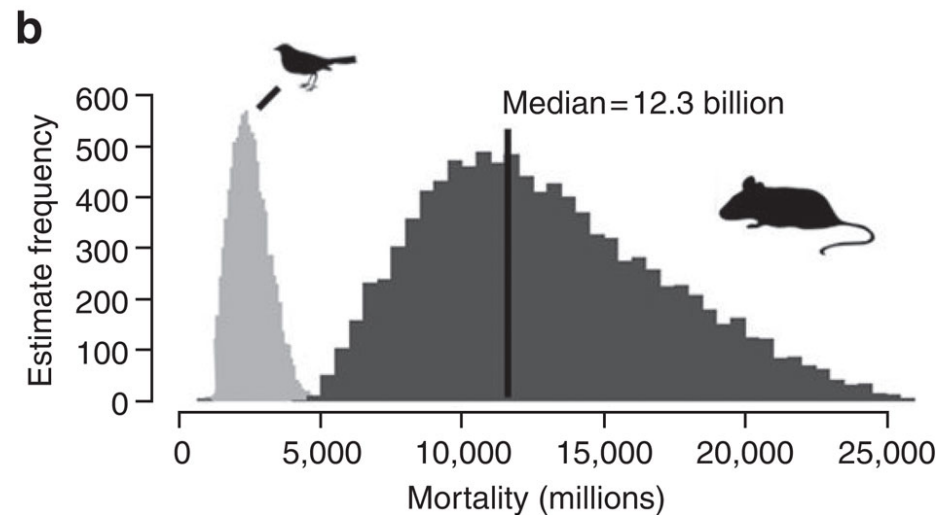
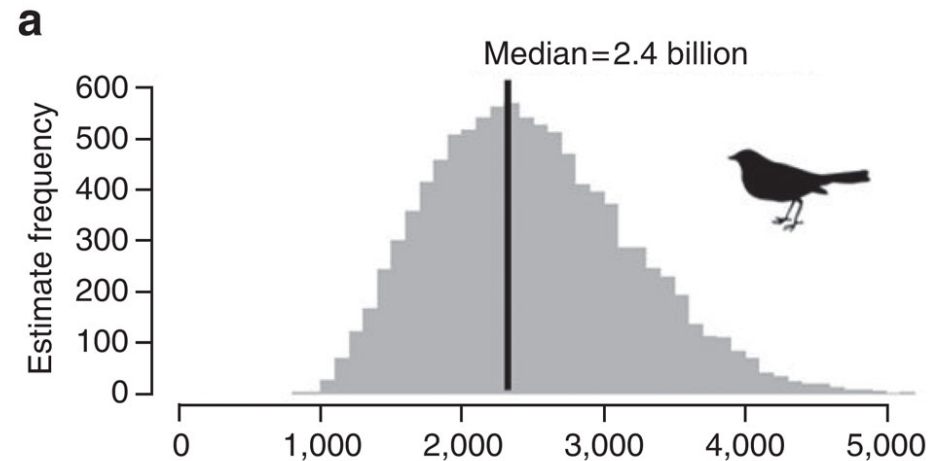


Figure 6. Changes in the abundance of birds with omnivorous or insectivorous diets in riparian forests located along a rural (negative numbers) to urban (positive numbers) landscapes in central Ohio, 2001-2004 (from Rodewald, in press).



The Ugly: Cat Predation on Urban Birds

- Cats are estimated to be the biggest source of US mortality for birds and small mammals
 - up to 3.7 billion birds and 20.7 billion mammals *annually*
- Un-owned cats responsible for more predation
 - In US, ~ 80 million owned cats; 60-100 million un-owned
 - owned cats: 31 birds killed (per cat per year)*
 - un-owned: 52 birds killed (per cat per year)*



*PA study

Loss et al. (2013) *Nature Communications*