NREM/ZOOL 4464 – Ornithology
Dr. Tim O'Connell
Lectures 6–8
26–30 January 2015

Last week:
•Ivory-billed Woodpecker
•Other conservation issues affecting birds

This week:
More conservation
Interpretation/instructions for term projects

Stuff that has always killed birds:
- Predators
- Disease
- Starvation
- Hypothermia
- Natural disasters
- Miscellaneous, e.g., impaled on yucca (happened in a Mississippi Kite a few years ago)

Stuff that has developed over the last few thousand years (mostly since 1750) that kills birds:
- Human hunting with firearms
- Broad scale, rapid landscape conversion
- Invasive species e.g., cats, rats, pigs, etc.
- Intentional poisoning
- Pollution – e.g., acid rain, DDT, eutrophication, pesticides
- Collisions with buildings, towers, automobiles, planes
- Incidental take from longline fishing, other forms of bycatch

All of these factors affect birds today. We divide them into compensatory and additive categories:

<u>Compensatory mortality</u> – the concept that one source of mortality replaces another in animal populations. Assumes density-dependent population regulation.

To illustrate, assume 20% of a population dies in any given year due to starvation. If hunting pressure takes 5% of the population, that leaves more food for the total population, and the percentage that dies from starvation is reduced to 15%. Thus, the addition of hunting pressure does not increase mortality from 20 to 25%, the hunting pressure compensates for existing pressure and overall mortality does not increase.

<u>Additive mortality</u> – the concept that each source of mortality adds to the total mortality rate of the population. Assumes density-**in**dependent population regulation.

To illustrate, imagine 20% starvation mortality and 5% hunting mortality really did add up to 25% mortality. If that was the case, we would consider hunting to be additive mortality for the population, and the population would begin to decline.

In the context of recently-developed sources or recently increased rates of bird mortality since the Industrial Revolution, I submit that these sources are additive. For example, sickness and starvation have always affected migratory birds, but death from collision with windows is a source of mortality barely 200 years old. Birds that are sick or otherwise in poor condition tend not to fly, so they are not the ones that crash into windows on migration. Window collisions tend to kill robust, healthy individuals that are fit enough to engage in long migratory flights. Thus, window collision mortality does not compensate for disease or starvation mortality, it is an additive source.

Of course, human conversion of habitats at broad scales overrides all other factors by reducing the <u>total</u> number of individuals populations can support regardless of other sources of mortality.

Some examples of recently developed mortality sources for wild birds:

Unsustainable harvest/invasive species

It's estimated that 9000 species of birds were hunted or otherwise helped to extinction by the global wave of expansion beginning about 10,000 years ago. In other words, our "set point" number of bird species in the world (9000–10,000) is only about half the total number of species the earth supported at the end of the Pleistocene. As one dramatic example, the first settlers of Madagascar 14,000 years ago hunted the giant, ostrich-like "elephant birds" and their relatives to extinction.

Polynesian Party Crashers – human settlement of oceanic islands has spelled disaster for endemic species time and time again.

- Humans colonized the South Pacific in historical time: 4000 years ago to Fiji; 2000 years ago to Tonga; and 1500 years ago to Hawaii. With each colonization came a wave of extinction.
- At least 39 species of birds have been lost in the Hawaiian Islands, the victims of habitat loss, hunting pressure, and the introduction of exotic, invasive species such as pigs, cats, and rats that themselves have hunted the native birds that evolved in the absence of ground-based predators.
- Problems persist today. On Guam, the accidental introduction of the brown tree snake in the 1940s has brought about the extinction of 9 of the 11 native forest birds on the island. Two of them, the Guam Rail and Micronesian Kingfisher, are hanging by a thread due to aggressive captive breeding programs.

Examples: *As many as 90% of bird extinctions in historical times have involved birds on islands*.

Big, tame, flightless birds were the first to go – too easy a source of food for hungry humans. The classic example of this since the Colonial Period is the dodo, a giant, flightless pigeon from Mauritius in the Indian Ocean (there were some other dodo relatives on a few other Indian Ocean islands that are also extinct). Discovered around 1600, dodos were extinct by 1681. Below: Mauritius today: sugarcane production dominates the landscape; tourism a booming industry. No dodos . . .

The Great Auk (a flightless seabird from the North Atlantic) survived thousands of years of persecution from subsistence hunters in the Arctic, but was ultimately done in by European sailors who would capture them for storage on their ships as a source of fresh meat when at sea. The last Great Auk died in 1844.

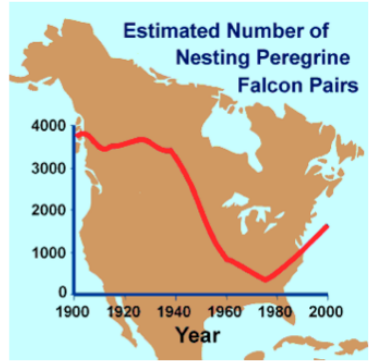
Pollution

One example of a widespread, "non-point" source of pollution in waterways is <u>eutrophication</u> – elevated nutrient load in a waterbody.

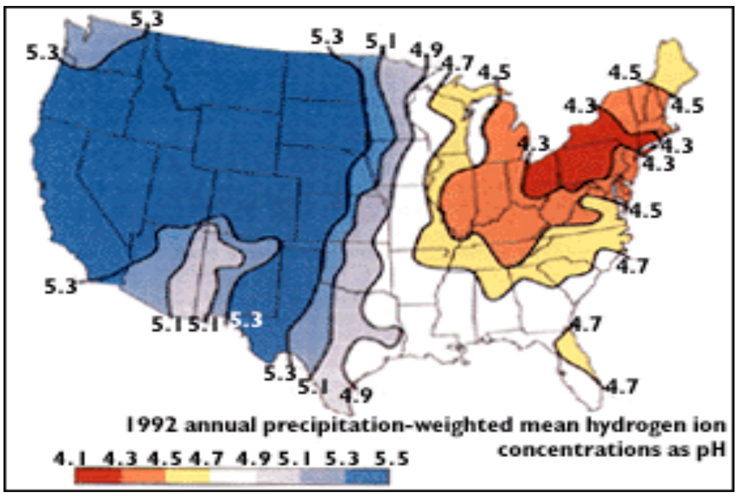
Water enrichment with limiting factors for plant growth such as Phosphorus and Nitrogen leads to a huge and rapid increase in the growth of algae in waterbodies, followed by an increase in the bacteria that feed on the bodies of individual dead algal cells. Those bacteria consume Oxygen from the water at such a high rate that the overall O_2 concentration is reduced. Low O_2 concentration is fatal to many species of aquatic organisms, so euthrophication has often led to a collapse in the food web of waterbodies.

DDT – A highly effective insecticide, DDT in waterways can bioaccumulate in the tissues of top predators to bring about sublethal effects. The best example is eggshell thinning in fish-eating and predatory birds, e.g., waterfowl, terns, gulls, herons, pelicans, eagles, ospreys, and Peregrine Falcons. As the amount of DDT in the environment increased from the 1940s–1970s, reproductive success and populations of Peregrine Falcons plummeted.

The current ban on DDT in the U.S. has helped bring these birds back from the brink of extinction, but there are some lingering issues. For example, DDT is still widely used in other countries (where it is vital to regional fights against malaria, and is saving human lives) and birds may be exposed to it beyond our border. Also, insects that had been largely eradicated as pests in the U.S. thanks to DDT (e.g., bedbugs!) are making a comeback.



Another example of water pollution involves acid precipitation – rain, snow, or fog with a pH < 5.6. Acid precipitation forms when fossils fuels are combusted and release sulphuric and nitrogeneous compounds that form sulphuric and nitric acids when mixed with atmospheric moisture.



Acid precipitation can change the water and soil chemistry over vast areas, especially those downwind of major industrial regions, and is disruptive to food webs. For example, Common Loons abandoned many lakes in their former breeding range in New England and New York because there simply were no longer enough fish to support them.

Lead poisoning. Waterfowl and scavengers are particularly prone to ingesting lead pellets from shotgun shells. In the western U.S., ingestion of lead pellets from consuming the gut piles of hunter-killed deer has emerged as a significant problem for the slowly recovering population of California Condors. Given the expense and effort that has been required to return condors to the wild, there have been calls to ban the use of lead shot. This is an enormously controversial issue in sporting communities, and it remains largely unresolved.

Pesticides can also be considered a form of pollution when they have effects on non-target species. Examples . . .

Exposure to the grasshopper insecticide monocrotophos was responsible for the deaths of an estimated 20,000 Swainson's Hawks wintering in Argentina in 1995.

•Production and sale now being phased out thanks to the efforts of the American Bird Conservancy
•Still, about 70 million birds die in the U.S. every year from LEGAL pesticide use.

Collision Mortality
Before humans started building large structures, it was very rare for a flying bird to die from striking an object such as a tree or cliff. Today in industrialized nations, collision mortality kills more birds than any other human-caused factor. Birds collide with both stationary and moving objects:
- Automobiles, planes
- Lighthouses
- Communications towers (and guy wires that support them)
- Wind turbines
- Bridges, skyscrapers
- Homes and businesses, i.e., any building with glass windows
- Other glass structures, e.g., covered walkways

These examples include (famously) the death of at least 10,000 Lapland Longspurs in a single night in Syracuse, KS in which the lights on a communications tower drew the birds close to the tower under foggy conditions and birds struck the guy wires.

The best known example of mortality from wind turbine collisions concerns thousands of raptors killed at Altamont Pass in CA. At that location, three things combined to make the area especially deadly:
- The site was developed in an around a valley that had always been an important wintering area for hawks and eagles, primarily due to an abundance of small mammal prey.
- The towers had an open lattice structure that encouraged birds of prey to perch on them.
- The blades of the turbines spun very fast.

So birds were attracted to the area, attracted to the towers, and the towers contained a deadly hazard – blades that spun fast enough to appear invisible. Newer designs include slow-turning blades and tubular towers, but some birds are still struck and killed.

Window collisions
- There a dozens of published accounts of birds colliding with windows, with Dr. Dan Klem of Muhlenberg College in PA as a leader in the field.
- 1832 – naturalist Thomas Nuttall publishes an account of a Sharp-shinned Hawk that crashed through two panes of glass in a greenhouse, but was stopped by the third.
- 13 May 197**5** – an Indigo Bunting hits a window of a home in Ontario and is stunned, but OK. The homeowners are bird banders, and they band the bird before releasing it. 15 May 197**6**, the **same** bird hits the **same** window and dies!

Model of window collision mortality from Dan Klem's research: For every 100 birds that strike a window:
50 will die on impact; 50 will survive.
Of the 50 survivors, 25 will ultimately die from their injury and 25 will recover fully.
So, 75% mortality rate for bird collisions.

Window collisions are the #1 cause of human-related death in wild birds in the U.S.:
97.6 million – 975.6 million every year.
0.5 – 5.0% of the 20 billion individuals in the peak, post-breeding population of all species.

Most individuals killed are healthy, and are killed during migration in spring and fall.

Of course, there is some good news to be had:

Management and Conservation of Rare Birds

Oklahoma Department of Wildlife Conservation – Wildlife and Land Management Division
There are no birds listed as Threatened or Endangered at the state level in Oklahoma, but there are 5, regularly occurring Federally listed species:

•Whooping Crane (E)
•Piping Plover (T)
•Interior Least Tern (E)
•Red-cockaded Woodpecker (E)
•Black-capped Vireo (E)

In 2014, Lesser Prairie-Chicken was added to this list as a Federally Threatened species.

Primary management responsibility for these species is with the U.S. Fish and Wildlife Service.

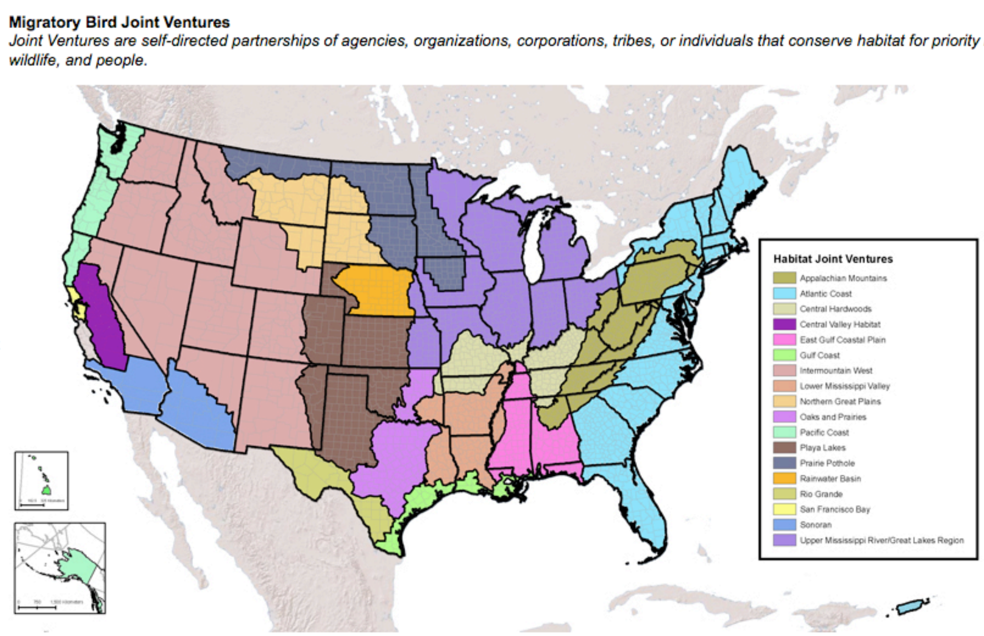
Check out some more on a native Oklahoman and Federally Endangered species:

BirdLife International (2013) Species factsheet: *Vireo atricapilla*. Downloaded from http://www.birdlife.org on 30/01/2013. Recommended citation for factsheets for more than one species: BirdLife International (2013) IUCN Red List for birds. Downloaded from http://www.birdlife.org on 30/01/2013.

Partners in Flight
•Formed in 1990 to advance conservation of native birds in the Western Hemisphere

•Three main goals: 1) Help species at risk, 2) Keep common birds common, and 3) Promote voluntary partnerships for birds, habitats, and people

Joint Ventures
USFWS-led initiatives to build cooperative endeavors among federal agencies, state agencies, tribal governments, NGOs, corporations, and private citizens

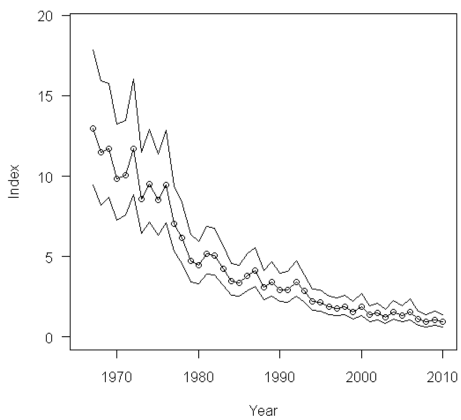


The Joint Ventures' "Bird Conservation Regions" approximate big breaks in ecoregions and regional bird faunas. Thus, they are useful for examining population trends and distributional shifts.

Thanks to this infrastructure melding public and private cooperators, we can access bird data from . . .

Breeding birds, through the Breeding Bird Survey: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Let's say you wanted to know something about the population trend of **Loggerhead Shrike** in Oklahoma. Scroll down to "Survey Results" and select "Trend Estimates by Species". If you next selected Loggerhead Shrike you'd be taken here: http://www.mbr-pwrc.usgs.gov/cgi-bin/atlasa10.pl?06220&1&10. If you next scroll down to Oklahoma, you'll see a blue dot – that's good because it means there are plenty of shrike data for Oklahoma. The data in the table suggest that the population has been declining. If you select Oklahoma, you'll get this:

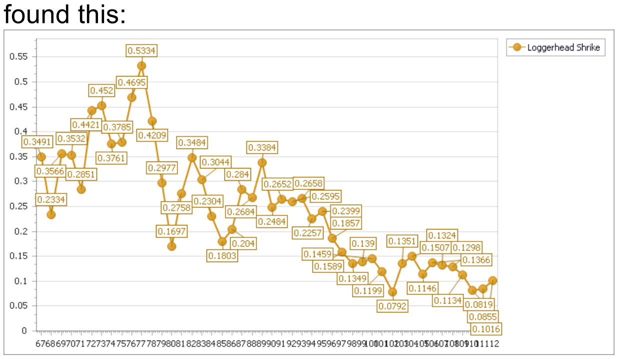


Voila! You just downloaded some data to give you information about **population trend for shrikes in Oklahoma**.

BBS data cited as:
Sauer, J. R., J. E. Hines, J. E. Fallon, K. L. Pardieck, D. J. Ziolkowski, Jr., and W. A. Link. 2011. *The North American Breeding Bird Survey, Results and Analysis 1966 - 2010. Version 12.07.2011 USGS Patuxent Wildlife Research Center, Laurel, MD*

For **wintering birds**, you can use the Christmas Bird Count (http://birds.audubon.org/christmas-bird-count) or the Great Backyard Bird Count (http://www.birdsource.org/gbbc) to find data.

In the CBC, select "Results, Data & Research" and then "Results, Current & Historical." That'll take you here: http://netapp.audubon.org/cbcobservation/ which is a portal to running a database query by count, by species, by year, etc. I did a search by species, put in 1960s to present day, filtered by Oklahoma and found this:



Aha, **shrikes** aren't doing great in winter either.

In the GBBC, you can select "Explore the Results", go to "Detailed Reports" and ask for some more shrike data. I asked for data by state and found a table that showed **just 8 shrikes at 4 localities last year**. I can do the same thing for each year of the GBBC going back to 1998. In 2006, OK had 6 shrikes at 4 localities; in 2000 we had 16 shrikes from 7 locations.

In eBird (http://ebird.org/content/ebird/) you've got maximum flexibility. You can ask for data **on any species, anywhere, and at any time** using "Explore Data" (http://ebird.org/ebird/eBirdReports?cmd=Start). This map demonstrates that **shrikes** are most common in Oklahoma during early winter, and that they are not often reported during the breeding season (e.g., May–July).

Limitations of citizen science databases:

Breeding Bird Survey – This is the best choice for doing population trend analysis for birds in summer. The trends are reliable for most species back to the early 1970s. Note that the data are only available from the specific routes that are surveyed, and the density of routes is much higher in the eastern U.S. and along the Pacific Coast than it is for inland locations. The BBS provides poor population estimates for the following:

- Anything that breeds in the Arctic or any other places without good roads (e.g., big swamps and marshes, mountaintops).
- Anything that isn't likely to be detected by point counts along a road first thing in the morning (e.g. nocturnal birds, hawks, etc.)

Christmas Bird Count – This is the best choice for population trend analysis for birds in winter. I'd consider the data to be reliable back to about 1950. The limitation of the CBC is that the data come only from within those "count circles" – these are the 15-mile diameter circles. If some bird occurred outside one of those circles, it did not get included in the data. The CBC undersamples nocturnal birds and any others that you really need to beat the bushes to find, but otherwise it should be pretty robust.

Great Backyard Bird Count – This has some of the limitations of "birding effort" as seen in the CBC, but the 4-day window helps reveal rarities better than the CBC. Population trend analysis is really problematic for two reasons. First, the GBBC is still a new program, and I'd be leery of any trend longer than about 5 years. Second, the number of participants is still growing each year. Until the effort levels off at a more consistent amount year to year, the increased number of participants will continue to be a big source of bias. For all its limitations, however, the GBBC should be a great resource to document distributions of birds in winter, and I'd be confident going back about 10 years for that.

eBird – The great benefit of eBird is that the data address bird distributions at any time of year. It should be a great resource for migratory behaviors, range shifts, etc. eBird is generally not appropriate for analysis of populations, and for the same reason as the GBBC: effort is not accommodated well. The more people eBird, the more checklists are submitted, the higher the species totals that one will find in the database. For some really common species, eBird can provide some population insights over the last 5 years or so; in contrast, distribution data for almost any species should be pretty robust even going back about 10 years.

Data on distribution, abundance, and life history of birds can be put to other cool uses, too.

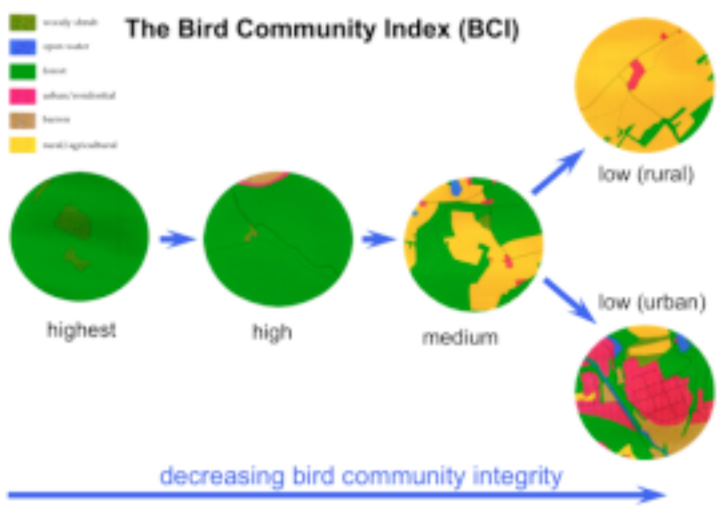
The Bird Community Index – BCI

The original BCI (which we usually term the "Appalachian BCI") is based on the premise that species differ in their life history traits. Some species adapt well to novel/anthropogenic influences on the landscape; I call these "generalists". Other species do not respond well to these influences and I consider them to be "specialists". The delineation is not strictly a response to human disturbances, however, because living things are more complicated than that. Thus folded into these concepts is the idea that some species face inherent challenges to maintaining their populations that others do not, and these might have little to do with response to humans. For example, Nearctic-Neotropical migrants (specialists) face a hazardous two-way journey each year that resident birds (generalists) do not. Birds that normally raise just one brood per year (specialists) might be at a competitive disadvantage against species that might normally raise two or even three (generalists). Integrity at a species assemblage level is a function of the proportions of specialists and generalists in that assemblage.

I find it too limiting, however, to assign individual species as either a specialist or generalist. Most species are mixes of both. For example, a single-brooded resident that must probe bark to find insect prey is a specialist with respect to reproduction and foraging, but a generalist with respect to migratory behavior. To address the variability in life history *within* species, the BCI does not use the proportion of specialist versus generalist *species*, it uses the proportion of specialist versus generalist *traits* among all the species in an assemblage.

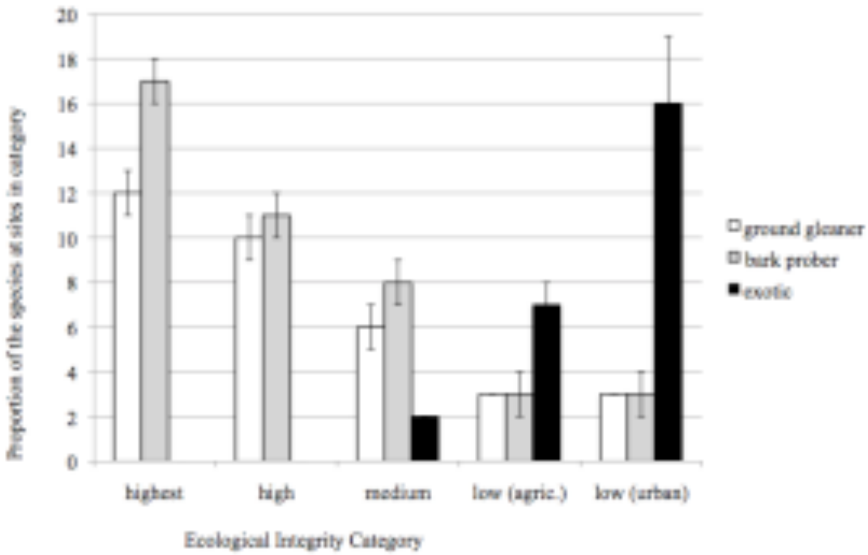
(left) This Grasshopper Sparrow is a generalist with respect to its short-distance migrant behavior, but a specialist with respect to its ground-nesting behavior.

We built the original, Appalachian BCI to be one indicator used in concert with many others for a overall ecological assessment of the Mid-Atlantic Highlands Assessment. After proposing a draft indicator based on field data representing a gradient of conditions from the region, we applied the indicator to field data collected from 126 randomly selected locations distributed throughout the assessment region. We identified 4–5 different categories of ecological condition in the region. Typical landcover from sample sites in the different categories looks like this:

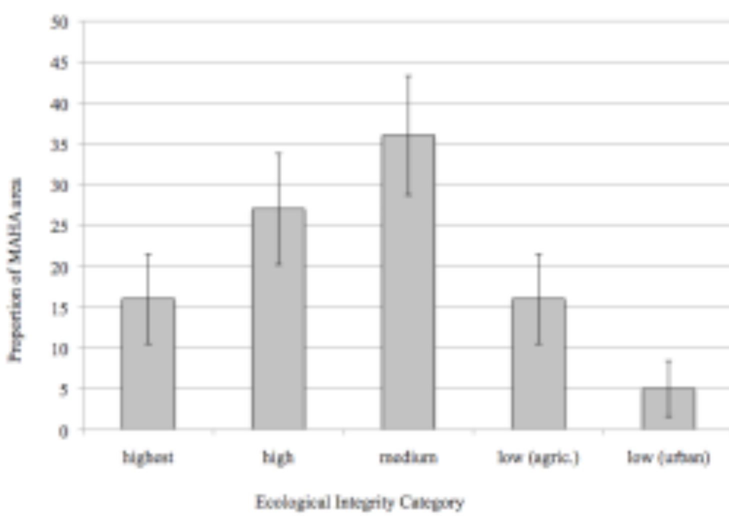


Note how ecological condition is highest in landscapes in which the matrix (the most abundant land cover type) is the native vegetation of the ecoregion. It is only where native forest cover ceases to be the landscape matrix (in this ecoregion taken over by either agricultural or urban land cover) that condition is "low". The difference between "highest" and "high" condition communities is not that there was more forest cover at the best sites, but rather that those forests generally supported taller trees with a larger trunk diameter and a more dense canopy. In other words, they were *older* forests than typically found in sites supporting "high" condition bird communities.

Here is an example of the sort of basic changes in life history groups represented at sites in the different categories of condition:

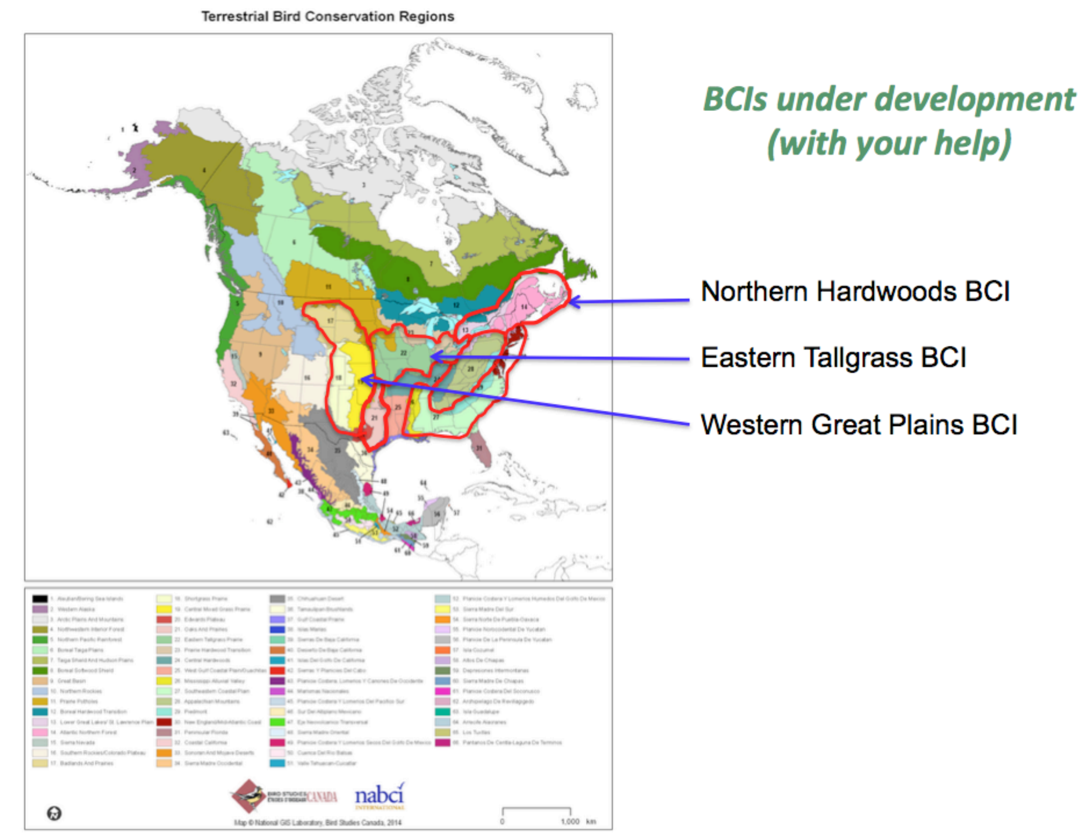


In this illustration, specialist invertivores that forage on the ground or from the bark of trees are very poorly represented at sites in low condition where they represent < 4% of the species in bird communities. Their prevalence increases at sites in better condition, where they can occupy about 11 – 18% of the species at sites in the highest condition category. Exotic species illustrate a similar relationship in reverse: they do not occur at all among the species in highest and high condition communities, but increase to as much as 19% of the species in highly urbanized areas.
The appropriate use of the indicator is to report on the condition of the entire ecoregion, rather than on any individual sample site:



Our work in the Appalachians illustrated that about 10 – 20% of the land area in the Mid-Atlantic Highlands supported "highest" condition bird communities, about 2 – 7% of the land area was in the "low-urban" category, and that most of the region (about 29 – 44% of the land area) was on the cusp between "high" and "low" condition. Any one of those metrics provides a benchmark state against which changes can be modeled or monitored over time. This is the "report card of ecological condition" for the ecoregion.

Term Project Instructions: 100 pts, due Apr. 20
Your term project for Ornithology will be to provide the life history information necessary to build one of three new BCIs:



•I will provide an individual number for you that equates to a group of 10 species in one of the three regions: Northern Hardwoods, Eastern Tallgrass, or Western Great Plains.
•I will assign your 10 species at random.
•You will enter 1s and 0s on your portion of the spreadsheet to code for different life history traits, and email your spreadsheet back to me.

Information source 1 – the Birds of North America species accounts:

First, go to the BNA proxy login website via the American Ornithologists' Union:
https://login.bnaproxy.birds.cornell.edu/login?url=http://bna.birds.cornell.edu/BNA/

In the login fields, use the following access:
username: AUK00282141
password: O'Connell

(You also have access to the BNA accounts in the OSU Library – they're in the Reference section.)

Information source 2 – I will post a spreadsheet with the foraging information for all species of birds in the world – use this one to code dietary information for your 10 species.

These instructions and your particular spreadsheet will be posted to a page on the course website.