Borrowing a Bird's Eye: Teaching Urban-Based Environmental Science with Humanities and Archival Resources.

PRESENTERS:

Diana C. Lennon, MEd, MS. Teacher of Environmental Science, Regents Chemistry, Earth Science at the Columbia Secondary School for Mathematics, Science and Engineering, where Lennon also offers a “Global Environment” section from the State University of New York, College of Environmental Science and Forestry (SUNY-ESF) *ESF in the High School* program. Lennon is a 2016 recipient of the *Sloan Award for Excellence* in Teaching Science and Mathematics, and a Master Teacher Fellow of Math for America (MfA).

Theresa M. Collins, PhD is a historian, biographer, and a long-time editor of the Thomas A. Edison Papers at Rutgers University. Collins has taught the “Yankee Stadium” section of Byrne First Year Seminars since 2008 and periodically collaborates with the Center for Mathematics, Science and Computer Education; Edison-across-the-curriculum previously. She is also author of *Otto Kahn: Art, Money, and Modern Time* (University of North Carolina Press) and historian for C. B. Murray’s musical, *PEARL*, based on the life of Pearl Bailey (<http://pearlmaebailey.com>).

Introduction

This is a collaborative project to develop and use local geographical, cultural and archival resources in a college-in-high-school environmental science course. The course is taught by Diana Lennon at the Columbia Secondary School (CSS), which is located at the edge of Morningside Park in Manhattan, and the course is offered in partnership with the State University of New York’s Syracuse-based College of Environmental Science and Forestry (SUNY-ESF), through its statewide *ESF in the High School* program for senior students. During 2017-2018, Theresa Collins collaborated with Lennon in developing a number of long-standing themes and interests from our individual teaching careers as well as our shared, local knowledge of civic challenges. In the main, the collaboration focused on such matters as how the parks and cultural institutions of New York City can be regularly used for college-level lessons in biodiversity and bird life; how to improve the full first year experience of future college students; and how to improve a STEM+Humanities bridging for capacity building in the next generation of science students, teachers, and citizens. Our

presentation for the NYU Humanities for STEM symposium was scheduled mid-way during the inaugural year of collaboration and served to highlight several starting points among the archival, manuscript, and primary printed collections of the Wildlife Conservation Society, the American Museum of Natural History, the Hispanic Society of America, and the New-York Historical Society, among others. None of local material or other selected works from digital humanities, including potential source material for future archives (like local falcon and hawk cam live streams) are mentioned in the course textbook, leaving much work to be done at obvious intersections.

Going beyond the use of archival materials for merely illustrative value, this project ultimately seeks to engage students in the local knowledge of their own communities, while also introducing ways to find and use both science and humanities in the transition to college-level learning and experience. In the current summary, we discuss specific lessons on nature journal writing, and we suggest that student practices of journal-keeping and mapmaking work at once to mirror archival holdings and to support active learning. In this combination of primary source material with active learning and place-based education, we are beginning to find that *Borrowing a Bird's Eye* opens several excitingly suggestive opportunities toward the benefits of bird study for urban-based environmental science, and for the development of long-lasting connections between science and humanities.

Of significant concern to us, too, is a discussion of student difficulties. Their readiness for connecting environmental science to questions from the humanities may be difficult, but many lessons are on-hand to prove that transdisciplinary knowledge can be taught and learned. Their bafflement about the world into which they are emerging, as science-minded adults or scientists, is more problematic when students confront the action gap between scientific consensus and public policies, which of late has become a powerful backlash against climate change science, fostered

contrarian narratives, and, we argue, made humanities inquiry and awareness, including access to archives, a more necessary support for their commitments to knowledge-based science itself.

Opportunity

What started out as a humble fundraiser in early 2017 quickly became a greater collaboration in the connecting human-environment and science-humanities in New York City. The fundraiser followed a moment in Diana Lennon's ongoing, placed-based teaching methods. During a 2016 class visit to the newly opened Hallett Nature Sanctuary in Central Park, one of Lennon's students noticed a robin (perhaps for the first time) flit about on the ground in search of food. The student was visibly awestruck with the sight, but Lennon was also brought to realize that an essential scientific instrument was lacking at this moment. *Borrowing a Bird's Eye* thus began with an appeal for binoculars. Lennon raised \$2400 through a *DonorsChoose* [New York Is for the BIRD...ers!](#) Campaign (January - February 2017) and made sixteen (16) Celestron Nature DX 8x42 Binoculars available to the students before the end of June 2017. By then, Lennon and Collins were already testing some ideas that yielded this collaboration in STEM+Humanities that intertwines local archives and special collections with location-based education and global geography for the next generation of New York City's environmental science students.

The decision came early and easily to highlight the archival, manuscript, and primary printed collections of the Wildlife Conservation Society (WCS), the American Museum of Natural History (AMNH), the Hispanic Society of America (HSA) and the New-York Historical Society (N-YHS) among others. The archival-based transdisciplinary bridge would be anchored by journaling, mapping, and all that could imply. The collaborators, Lennon and Collins, are New Yorkers by birth and by choice. We've been informal thought partners for several years and pooled our talents for

capturing good resources during such “teachable moments” as the DeepWater Horizon event and aftermath (2010-2013). We have floated and sunk scores of ideas for STEM+Humanities interplay before Lennon’s birders-with-binoculars project came along and drew our mutual and divergent interests together in this current initiative. Both immediately understood how a school-trip to the Bronx Zoo is also a common experience among NYC public school students. Such building-out from the students’ early and middle-school experience was also already in place among students the who study ecology with Lennon, as part of their curriculum includes examining habitat design in zoos. The American Museum of Natural History is a similarly common experience among New Yorkers, as Marlee Tavlin’s master thesis, *Growing Up at the Museum: A Long-term Science Program’s Effect on Low-income Students* will certainly have much to say about it (see <https://osf.io/v7gsx/>). The AMNH impact on Lennon meanwhile runs through evolution, ecology and more teaching units than can be counted.

By June 2017 the collaboration turned to Lennon’s work as an adjunct instructor with *ESF in the High School* (ESFinHS), the concurrent enrollment program of the College of Environmental Science and Forestry in the State University of New York (SUNY-ESF). Lennon teaches a year-long (September thru June) version of *Global Environment* (EFB120) to senior students, who in effect are gathering their first college credits while also beginning their first year experience as an interestingly cohesive subgroup. Having a pre-screened admission process, CSS enjoys a 98 percent high school graduation rate, well above the city and even state average. Philosophy is also a required course for students at CSS, and the school has access to Outreach Fellows from Columbia University. (Davis, Web, 2018). Data from past graduating classes suggest about 60 percent of the students will declare a major in science at a four-year school upon graduating. In 2017, 65 percent of graduating class matriculated at institutions of higher learning New York City and/or New York State. More than

three-quarters of students come from low income households. Lennon identified an ambitious array of curriculum topics in EFB120 with birding themes. These include systems dynamics, interdependent relationships and group behavior to increase survival (flocks), biodiversity and the anthropogenic changes to it, and understanding the finite resources (biotic and abiotic) that determine carrying capacity of ecosystems. It was also agreed from the start that the priority engagement strategy for integrating humanities-based scholarship and archival resources would be directed at student and teacher response in assessment categories of importance to STEM-learning, including the importance of community-based science and organizations.

Lennon's selection as a Master Teacher in Math for America, allowed her to lead or participate in several professional learning teams between 2014 and 2017 -- exploring place based environmental education, designing strategies for students to comprehend peer reviewed science journals, and implementation strategies for AMNH's Ecology Disrupted case studies. A virtual book club through Teaching the Hudson Valley during summer of 2017 laid the foundations for place based education connecting schools, communities and public lands. Through National Oceanic and Atmospheric Administration's (NOAA) Planet Stewards Education Project (formerly Climate Stewards), Lennon participates in monthly webinars to understand and respond to environmental challenges as well as their virtual book club that explores environment related books such as E.O. Wilson's *Half Earth* (2017) or *Everything Change An Anthology of Climate Fiction*, edited by Miloreit et al (2016).

The SUNY-ESF partnership suggested unique possibilities as well. According to its most recent annual report, SUNY-ESF has partnerships with forty schools in sixteen New York counties,

but Lennon's course is an outlier among them. Only one other partnership currently lies south of Ulster County. That other school is NYC-BOE's High School for Environmental Studies.

Figure 1. ESF in the High School 2016-17 Annual Report Partner Schools

You have to look so hard to find Manhattan on a recent ESFinHS map that a prompt "Don't

Forget NYC" was inserted in a recent brochure ([2016-2017 Annual Report](#)). That tag is grist for a good laugh if you're a New Yorker, but it is also a matter for serious discussion. Tourists don't generally come to New York City for its birds and trees and coastlines or rock formations as Lennon had earlier noted (Lennon, 2013) and NYC doesn't fit the expectation of field work that upstate forests and mountains afford. The similarities between Morningside Park in densely urban, upper Manhattan and Taughannok State Park in the Finger Lakes region may seem slim at first glance; the natural Taughannock Falls plunges 215 feet over rocky cliffs towering nearly 400 feet above a gorge while Morningside's 50 foot waterfall into an ornamental pond was created from an excavated crater. However, any one of a dozen or more birds can be found in both --- the Northern Cardinal, Black capped Chickadee, Hairy and Downy woodpeckers (at the least), Blue Jay, and Northern Mockingbird. Most of these are regular year round residents for the Northeast (not unlike ourselves and our students). When seasonal changes bring migratory birds in every Fall and Spring, central

New York wins the boasting rights for best birding sites. We who are watching from Morningside Park are challenged not to compete but to cooperate. With credit due to the New York City Audubon's *Lights Out New York* since 2005 (www.nycaudubon.org), too, almost every NYC student has some preparatory awareness of the upstate/downstate connection and knows that the bright lights of this big city will disturb migratory birds — because many birds fly at night, are attracted to light, and rely upon natural night skies for navigation. CSS students who are new to college-level and advanced scientific research are now prepared through EFB120 to ask how public awareness and action are related to scientific method and evidence — what is lost and what is gained if one compares TV news, public announcements and peer-reviewed scientific literature, such as McClaren, Buler et al (2018).

The archival and cultural resources in New York City, along with its parklands and its long-standing communities of birding enthusiasts make this place uniquely advantageous for a new generation of place-based education. New York City has historically supported some of the greatest organizing efforts in environmental science and conservation history. For example, the National Audubon Society was born and remains headquartered here, the town in which John James Audubon died and in which several outstanding collections of imagery and texts from *The Birds of America* (1827–1839) are easily found, for example, through the New-York Historical Society and the New York Public Library. Audubon Terrace is a nearby backdrop for CSS, too, and the special collections here include the Hispanic Society of America's parchment *Map of the World* (1526), which we reference with “A Collection in Context” digital resource from the Media Center for Art History at Columbia University. We are also drawn to the “Audubon Murals Project” (AMP), which is currently underway in the greater Harlem neighborhood (the contemporary world of the students themselves) and brings a purposeful question, “How is this different from other/earlier combinations

of arts and environmental science?” The course, then, prompts a fruitful exploration of the Documerica Project (1971-1977), a photographic archive from the early years of the Environmental Protection Agency, which has been available online from the National Archives since 2011 (Taylor 2011; NARS).

Several announced events for 2017-2018 made this a good time to do birds. The new year of 2018 opened with the Audubon Society and the National Geographic jointly declaring “The Year of the Bird” and a New-York Historical Society’s exhibit, “Feathers: Fashion and the Fight for Wildlife” which would be opening on 6 April. These both were gathered under the centennial anniversary of the 1918 Migratory Bird Treaty Act, making this an exceptionally opportune year for environmental science students to consider the function of legislative, judicial, and administrative archives and records management. Other events would prompt a reading of the American Antiquities Act of 1906, from which the State of Utah now seeks exemption (Lipe; Washington State Libraries). The Spring and Summer of 2017 had meanwhile helped in shaping the STEM+Humanities effort with the arrival of two notable exhibits. The first, “*Exploratory Works: Drawings from the Department of Tropical Research Field Expeditions*” at the Drawing Center (NYC) brought an archival collection from the Wildlife Conservation Society to new audiences. The second arrived on a wave of Henry David Thoreau (with the 200th anniversary of his birth) and included the Morgan Library exhibition, “This Ever New Self: Thoreau and His Journal.” For our purposes, the online resources of note from the Morgan Library included its audio renderings of the journal online --- in voices of first-year students from New York University (Drawing Center, Morgan Library, Wulf). There was also the “Doomed Earth Catalog” (*New York Magazine's* special issue of July 10–23, 2017), with editor, David Wallace-Wells’ “landmark bird’s-eye-view survey outlining our terrifying best understanding of where our planet is headed, absent aggressive action.”

Then in October, when “climate change *and* nuclear war” were topping many headlines, Elizabeth Kolbert brought the topic of extinction once again to the forefront in her *Jonathan Schell Memorial Lecture on the Fate of the Earth* at the New School.

These examples were all re-enforcing, but on any given day there will be another avenue available to travel in New York City — an offering from the Actors Studio’s climate change series, a Schomburg event about public spaces, a spotlight on the *Found in Nature* series of photographer Barry Rosenthal. The intersectional interest is active and real here, but New York City does have stumbling blocks. The High Line, for example, is unprepared for a STEM+humanities with archives framing of place-based learning; the ruin and its remaking into a zone for what Christoph Linder called “retro-walking” has succeeded thus far with little regard for the documentarian dimensions that archives imply, that historical research rewards, and that the lower Hudson River estuary requires for students of environmental science and humanities (Linder 2016: 93; “[New York’s Life-Line](#)” 1935; [U.S. Fish & Wildlife Service, 1997](#)). Aside from the absence of readymade connections at the High Line, nothing that we’ve learned so far has knocked back a big idea about the sum of all resources here: The Big Apple *is* a great place to study environmental science. While guarding against overreach in this regard, we at least wonder aloud: what role has New York played in *conceptualizing* the Sixth Extinction? If not a driving question, it was definitely honking in our heads during the Fall of 2017.

Before any trips could be scheduled or research visits planned, Lennon had potential archival opportunities in mind for every lesson plan. An introduction to birds in Morningside Park therefore includes historical views of the Park in its glacial formation, of course, but also evidence of human manipulation that consider the 1873 and 1887 planning vision of renowned park architects, Calvert Vaux and Frederick Law Olmsted ([NYPL Digital Collections](#)), and the ongoing impact of wild bird

habitats both within and beyond the greater city. Understanding maps as visualizations of environmental situations then launched into *Mannahatta* (see below). When students in 2017-2018 course were first introduced to birding and citizen science, Lennon also referenced the “E. R. P. Janvrin and the Linnaean Society of New York Archive, 1915–1972,” a collection in the Ornithology Department at the American Museum of Natural History. Students could read an essay online which describes the collection from an insider-enthusiast’s point of view and learn that formal and informal notes have some relation to published works. Notebooks “of varying shapes and sizes. Some ... plain black, some wire-bound” are shown in accompanying images, looking much like everyday objects to us all. A re-purposed pocket notebook “with Dr Janvrin’s sightings of Common Tern and Piping Plover at Long Beach, [Long Island]” was a reminder both of the long traditions in bird watching from this region and of the low cost threshold for its basic undertaking (Baglee, 2015). This early lesson of archives and journaling found additional currency when Andrea Wulf’s essay, “What Thoreau Saw” arrived in the November 2017 issue of *The Atlantic*. It helped to buttress lessons and awareness of citizen science today. For these students it was also fitting in an inaugural view of how science, art and humanities can interact in their own journals where, as Wulf says of Thoreau, “the punctilious scientist revealed himself as an observer whose soul was open to immediate connection with the big messy web of life: The sounds, colors, and smells of the seasons triggered emotions without a need for elaborate explanations” (Wulf, 2017).

The arrival of Emmet and Nye’s *Environmental Humanities* among a deluge of new publications in this field during 2017, finally, was a most practical and theoretical aid. Chapter 2 discusses place as a means of awakening environmental awareness, to cultivate “an interior landscape that responds to character and subtlety of an exterior landscape” (p27). Emmett and Nye continue that in aboriginal society the value of storytelling was to achieve harmony with interior and

exterior landscapes -- a state of psychological confusion could be "reordered" through contact to "the land." Lennon adds, if modern people lack "intimate knowledge" of any one place, imagine the disorder of a teenager's interior landscape. If journaling can help balance this interior landscape with the exterior, then perhaps the connection to local environmental spaces around New York City will help students transfer environmental awareness to a global level, beginning with their own sightings and nurturing of new opportunities, action and research.

The literature relevant to such environmental education, sense of place, and its heritage also points to further opportunities for New York. An influential cluster in this regard is found in works by Marianne Krasny and others from Cornell University concerning resilience (after Hurricane Sandy) and narratives (from out-of-school programs from the Bronx). Recent data mining for success of public school programs often overlooks narratives, yet Russ et al (2015) recognize the value educators place on them. The transfer of three approaches (Fig. 2) common to environmental education programs to within the EFB120 curriculum could accelerate and strengthen students' connection to seeing value in the green spaces of the city.

Figure 2. “Reasons and Approaches to Nurturing Ecological Place Meaning,” from Alex Russ, Scott J. Peters, Marianne E. Krasny and Richard C. Stedman (2015) “Development of Ecological Place Meaning in New York City,” *Journal of Environmental Education*, 46:2, 73-93.

Other books in hand to note were of such types as *The Sibley Guide to Birds* (2nd ed.); Judith Schalansky’s *Atlas of Remote Islands: Fifty Islands I Have Never Set Foot On and Never Will*; *The Climate Change Coloring Book* created by Brian Foo; and the recently arrived collection of the New York City College of Technology faculty, *Interdisciplinary Place-Based Learning in Urban Education: Exploring Virtual Worlds*.

START WHERE YOU ARE (Then, Pick up a Pen, Start Writing)

Journal assignments by themselves may bring an array of student responses from groans to smiles; “the only time I’ve kept a journal is when some teacher assigned it” is not an uncommon phrase from students. The current resonance of *Hamilton: An American Musical* provided a bit of stimulus for journal-keeping enthusiasm, however, with the “Pick up a pen, start writing” line from the lyrics of “One Last Time.” But the nearby collected papers of E. R. P. Janvrin, former president of New York’s local Linnaean Society, showed very clearly that birders write things down while they watch, making a useful connection for students to understand that their course assignments are part of a larger community of data gathering. Students are expected to write some basic data about temperature, time of day, amount of cloud cover and low inference observations such as the species of birds and other wildlife present in the park. Students are encouraged to draw or sketch what they see, and over time they are asked to consider in balance the differences between structured scientific

data capturing and good amateur work as well as the interdependence of professional and citizen science.

Starting with maps jointly allowed quick entry to archival material concepts and served as the necessary bridge to the introductory concepts of stewardship, sustainability, resource consumption, and collaborative work for addressing environmental problems (Raven et al, 2012). The results of the course pre-project survey (Appendix A) had shown minimal map use in the students' prior experience, and made it apparent that young New Yorkers are only marginally aware of the concrete jungle beyond their own apartment block or school route. One goal then is for them to identify with the city as human inhabitants within an ecosystem, collectively responsible to the city as ecosystem concept rather than anti-nature or private property owners. City neighborhoods may seem to be culturally isolated but blend into each other as the inputs and outputs of water, air, goods and yes, humans and their intellectual capital, flow freely between them. When mapping, mapmaking, and advanced geosystem visualization were introduced simultaneously with park-based lessons and journal-keeping, it seemed that students were quick to see the school community within the greater context of a New York City ecosystem, which could compel students to advocate for sustainable growth (Emmett & Nye, 2017, 23). A regular, personal investment in getting to know the sights, sounds and smells of Morningside Park was undoubtedly the foundational element for students to make as Emmet and Nye contend "psychological identification between self and site" (24), which was then leveraged quickly and meaningfully advanced by the humanities-based materials.

Within the educational community at CSS, students can share what will become memories of the childhood landscapes they care deeply about and want to protect. It is this sense of place and caring deeply enough to protect it that will encourage students to unite communities around the notion that indeed urban environmental space is both rare and worth preserving. Birds helped to

bring it together with recurring focus. For example, in teaching bird migration, students may learn ‘why would birds stop in Central Park?’ From a bird’s eye it is an oasis of green, a welcome respite complete with resources to refuel from long hours of flight. Using maps with aerial views of the city, that bird’s eye view of green spaces as rest stop comes into focus for students. Additionally green spaces around Manhattan appear more connected in an aerial view than one would view on the ground. Could borrowing this aerial bird’s eye view invite a more globally connected view of the planet, its people and environments?

Turning then to aerial-dominant-assumptions of the bird’s eye in maps, the science teacher and students may compare and newly critique the practices of several hundred years -- from Barbari (1500) city panoramas (Fig. 3) to Sanderson’s most dramatic rendering of green *Mannahatta: A Natural History of New York City* (2009) (Fig. 4) and back to the Amerigo Vespucci (1526) a jewel of a map from the Hispanic Society of America (Fig 5).

Figure 3. Jacobo De'Barbari's Panoramic View of Venice: Petition for Copyright, 1500. *Renaissance Venice*, Web. 28 Apr. 2016

Figure 4. East Side of Manahatta/Manhattan “Mannahatta: A Natural History of New York City.”
The Globe and Mail, 27 Mar. 2017

Figure 5. *Map of the World - A Collection in Context: The Hispanic Society of America*, Web screen capture 13 September 2017.

Using the Welikia project website (welikia.org), students launched the map explorer to transition the bird’s eye view of 1609 New York City covered by lush green forest to present day (Fig. 6) . The green space of Morningside, Central and Riverside Parks, while much reduced, could still be observed as a high quality stopover habitat during a dangerously artificially lit migration.

Figure 6. Screen capture of map of Riverside, Morningside, and Central Parks. Welikia Beyond Manahatta Web. 13 September 2017.

The layering of sources for the Welikia maps also reinforces an archive-to-big data visualization pattern of lessons for the class. The British Headquarters Map from Sanderson's *Manahatta* (and the Museum of the City of New York) was the geo-reference point for an overlay of the present NYC street grid and buildings with those of 1782 that the Welikia map is based upon. Explanations of human impact within the park were further mapped with the Olmstead and Vaux designs (1873 and 1887), and with evidence of events from the 1960s, when the construction of a gymnasium got underway in the park, and protests by Columbia University students famously halted the project, which left behind a foundation crater that in turn became the small waterfall in Morningside Park (Gray, 2005). Another outdoor lesson turned to the contour lines of "USGS US Topo 7.5 Minute Map for Central Park," a topographic map (Fig. 7), which was used by one student group to walk the park in an east to west direction, while noting the elevation and steep incline of the park. A second group used an exercise trail map (Fig. 8) to describe some human utilization of the park through their

walk, and a third group of used their available human senses instead of a map to identify and record observations of the park as they walked through it.

Figure 7. USGS Central Park, NY US Topo Map quadrant

Figure 8. Green Gym Fitness Trail Map of Morningside Park “Green Gym Map.” Web. 13 September 2017. <http://morningsidepark.org/greengymmap.pdf>

During each new chapter and unit, students were asked to continually identify with Morningside Park and consider environmental topics. The unit on ecosystems and interactions of living organisms with physical environment and energy initiated the nature journaling and

birdwatching in earnest and provided opportunity for several outdoor lessons on the topic. At this point with a focus on food chains and energy pyramids, students were asked to connect the number of birds to the resources available as the season turned. Binoculars help in shifting the points of view --- away from aerial-and-flight dominance to more spatially complex views and movements --- from branch-to-branch, on the ground, and in adaptive use of human constructions. Nature journaling begins a catalog for saving observations of the world around them. As birders learn to log species data and add to their “life lists,” a naturalist will observe interactions and record them to tell the story of the land, and a geologist will reference key geological features and fossils within conventions of time and paleo events such as glaciation, mountain building, or the rise or fall of the oceans.

Getting outside perspectives is vital. It includes places and experts. None of this project advanced, for instance, without assistance from the NYC Department of Conservation during the critical autumn schedule for first-time training on binocular use, birdwatching, and field identification. Recognizing the local in broader contexts, too, no catastrophic storms hit (this) town with the same forceful disruption of Hurricane Maria in our autumn of 2017 when, without enough time to process it all, the season was annotated by coquí sounds and by pleas from Puerto Rico, where so many New Yorkers have familial ties. When a planned showing of the HBO documentary, “Birders: the Central Park Effect” (2012) went on as scheduled, Lennon was prompted to ask: Who are these people in this film? Would they help students to better see the “paradise” of manmade parks as the film suggests? There was not as much diversity among the Central Park birders as there was among the student viewers, whose opinions about birds had been captured in a pre-screening Q & A. The single middle-schooler and one adult black male who appear in this film did little to change these college-bound student viewers’ or attitudes which had earlier formed around their ideas

that birders were probably nerdy, quiet, patient, white, old and wealthy. “Birders: the Central Park Effect” did not do much to alter the comic stereotype of silver-haired white men discussing the birding days of old. The way around this was to first focus on the experts in film ---- silver-haired and white though they were, they nonetheless represented the majority of faculty at colleges and universities to which students would be migrating.

Students were asked next to comment on the academic profile of J. Drew Lanham at Clemson University, an expert who was not in the film (but whose short films and advocacy for birding made every next success for this course possible):

In his teaching, research, and outreach roles, Drew seeks to translate conservation science to make it relevant to others in ways that are evocative and understandable. As a Black American he’s intrigued with how culture and ethnic prisms can bend perceptions of nature and its care.... My past work has focused on the impacts of forest management and other human activities on songbirds, herpetofauna, small mammals and butterflies. More recently I’ve begun to investigate how ethnicity (especially Black Americans) relate to wildlife and other conservation issues.

The trove of Lanham’s outreach media include videos that are high energy, engaging and demonstrate his passion for birding and nature while also bearing down on what “Birding While Black” specifically means. His candor and humor with the latter --- always have two or more identifications and “never wear a hoodie” -- rings familiarly in a city where stop-and-frisk is a persistent facet of racial disparity. Lanham’s accompanying essays drive home several basic points for birding: the citizen scientists’ contributions to the Breeding Bird Survey (“Get out. Look, listen, and list again. It’s a routine thousands of volunteers have followed during springs and summers ... The data is critical for ornithologists to understand how breeding birds are faring across the continent.”); a comfort with uncertainty, informality and discovery while journaling (“OK. Was that a goldfinch singing from the top of that poplar? Definitely goldfinch”); and, in one of many telling stories, how an increase of white supremacist activity in the Southern Appalachians brought Lanham

to cancel a research project rather than risk his own safety --- it nearly undermined his commitment to wildlife ecology, but instead just stiffened his resolve to “Get more people of color ‘out there.’”

With this knowledge of birders of NYC and beyond, Lennon readied students for their first birding trip away from Morningside, and headed out to Central Park in late October. Students walked through the North Woods from the corner of 110th Street to stairs leading to the Harlem Meer. From these hills and dirt paths, students observed a Hermit Thrush, a juvenile raptor (not identified), Ruby-crowned Kinglet, and several water ducks-- a Northern Shoveler being a highlight among them. Several students proudly took credit for the initial sightings of these birds and several more actively used bird identification guides as their partners peered through their binoculars to identify the ducks in the pond. A few students saw some trash in the pond and quickly used sticks to retrieve some of it from the water. It’s amazing how quickly extracurricular trips enlarge and extend the lessons learned in the classroom. On a second excursion to Central Park in late March, the students were accompanied by Purbita Saha, an Audubon member and journalist, and identified several more duck species at the Harlem Meer: Mallards, Ruddy Ducks and once again, the Northern Shovelers, which made for easy and familiar subjects for behavioral observations. One student exclaimed, “I didn’t know ducks could fly until I just saw the mallards chasing each other!” A female mallard was being chased by two males. A active male Northern shoveler was swimming in circles sweeping its wide black bill side to side to stir up vegetation in the pond filtering out invertebrates and seeds.. A third excursion to Hallett Sanctuary awaited on the calendar for May.

On To the ARCHIVE, Out to the WORLD

Testing the combination of journals and maps with selected collections at the WSC Archives got underway in 28 November 2017. In the interest of expediency, Collins did the advance work of a

research request. Field notes, illustrations and related materials from William Beebe's 1920s tropical research were first on the list. Collins also assumed (and later confirmed) that Lennon had never touched original documents in an archive before and decided to postpone an explanation of finding aids or such things as the differences between archives and manuscripts for a later time when we return to that bridge. The finding aids for WSC Archives are navigated easily online nonetheless and a preliminary introduction to archival organization was provided in the research request itself (Appendix B). Thanks to Madeleine Thompson, Ph.D., now Director of the Library and Archives, Lennon received a jam-packed after-school reconnaissance of the WCS Archives. Thompson, who was also co-curator of the Drawing Center show and co-contributor to its catalogue, shared fresh interpretations of the materials, and Lennon left with a new grasp of the field drawings as scientific records rather than simply illustrations, among other thoughts. These were used in the course on the next day.

Having begun with binoculars, an elementary coupling of STEM+Humanities by this time could apply what was found in the archives to various questions about what media and analytical tools are used to capture, replay, and shape scientific recordings, points of view, and data --- including pens and colors, cameras, radar and all other means of data capture. From a technological if not an engineering viewpoint, how hard has it been to capture wild birds at different historical moments without extracting the bird from its habitat? Some of the ongoing science that is accessible thru the WSC library but not part of the archive includes camera trap data, and suggests other issues in need of solutions, such as visualization and preservation of data. Will our STEM students one day use their skills and efforts to help solve this? It is an idea that would await fuller exploration in the Spring when, for example, the NYU hawk cam goes live again (NYU Hawk Cam) and new outdoor urban forestry programs for teens begin to get underway (K. Heintz, personal communication, Feb

13, 2018). We have yet to test what the students will say about cam-watching as social phenomenon, or whether they can novelly explore new questions about visual-capture in the college curriculum and elsewhere.

We gained more ideas and resources from ninety minutes in an archive than anticipated and we put a few basic lessons in place by sharing the research story with students on the next class, and by acknowledging that the students' participation was influential in deciding what was sought. The students' recent enthusiasm for presentation on bird calls and adaptations (by Brittany DiLeo) had led to a search of some Department of Tropical Research files on "bird throat studies," but after examination it remained unclear whether these drawings pertained to song, digestion, or some other questions. A few other samples from field notes returned to the relevance of students' journals generally. A simple, colorful profile (Fig.9) of the *Piaya melanogaster* (Black-bellied cuckoo) in the hand of Isabel Cooper (and with its identification on the reverse), for example, was readied as a gateway for maps and details on the IUCN Red List of Threatened Species, where students will find the Black-bellied cuckoo is "not believed to approach the thresholds for Vulnerable."

Figure 9. *Piaya melanogaster* (Black bellied cuckoo) identification on reverse. Illustration Isabel Cooper (Appendix B)

Then, William Beebe's story (with its legacy for citizen science and the influence on Rachel Carson) accelerated discussions toward current events. (Lear 2009 89, 114-16, 175-77)

Only days prior to the WCS Archive visit, a OpEd piece appeared in the *Washington Post* (of 22 November) under the heading, "Should We Promote Biodiversity or Allow Extinction?" (Pyron, R. A. 2017, November 22). It was controversial question, only in part because it was posed as a choice between equals, and it brought a torrent of strong reactions quite immediately. The essay poked mockingly at "extinction fearmongers" and served ups such provocative remarks as, "both the planet and humanity can probably survive or even thrive in a world with fewer species," while also oddly arguing that humans don't need as much biodiversity as the world provides ("We don't depend on polar bears for our survival, and even if their eradication has a domino effect that eventually affects us, we will find a way to adapt." To top it all, the essay asserted "We don't need to save endangered species. Extinction is part of evolution. The only creatures we should go out of

our way to protect are Homo sapiens." All of this also appeared under a headline (in its stable digital version), which read:

We don't need to save endangered species. Extinction is part of evolution.

The only creatures we should go out of our way to protect are Homo sapiens.

As it turned out, the essay was intended to be a satire. Its author, R. Alexander Pyron, a biologist at George Washington University, would soon find it necessary to explain his professional embarrassment in a "Statement on Biodiversity Conservation" (The Pyron Lab). It had been Pyron's intention to explain the *urgency* of biodiversity conservation by taking the complete opposite point of view, but he had neither explained his intentions in the publication nor asserted any control over the language of the headline. He had also sent the essay to press without first getting some peer review from academics colleagues, who very likely would have noticed the essay's failures. Pyron's explanation, however, arrived too late for the students in ESF120, whose discussion of the initiating OpEd piece was fairly representative of the many comments that it attracted at the *Washington Post*, and included some speculation that a position so extreme might be a spoof.

Collins and Lennon were meanwhile volleying various news articles, events and editorials related to the Endangered Species Act, extinction, de-extinction and biodiversity, while at the same time working through chapters from Kolbert's *The Sixth Extinction: An Unnatural History*. This topic, like the weather, was depressing. But this trail through the biodiversity vs. extinction debate made for a natural segue into the textbook's chapter on "biological resources" and its focus on endangered species and conservation biology (Raven). EFB120 was also wrapping the ecology unit with a reading from Kolbert's third chapter ("The Original Penguin: *pinguinus impennis*") about the great auk, with its precise and haunting description of how and when great auks were killed (boiled alive in vats of their predecessors body oil). During the debrief of the excerpt, several students

revealed their intrigue with the story. If it seemed to recall Russ et al.'s narratives research method (experience as a story allows one to uncover how meaning is being cultivated), it also found some source in the students' stories at CSS, which "uniquely offers philosophy courses to grades six through twelve." The students freely began to apply concepts from the philosophy program (Ethos Pathos Logos) themselves, and, with their new credentials as journal-keeping researchers, they were participating in a discourse among scientists -- at least in ESB120.

While Pyron was put to their testing, another current reading came into view on 25 November when Cristián Samper retweeted (Figure 10) a link to a breaking, methodical study in *Science Advances*. ESB120 students immediately looked with interest as any deeply concerned scientist should, and took note of the study's conclusions with regard to the effectiveness of the European Union's wild bird trade ban, a its statistically valid support of conservation as well as invasive species control, and the corresponding emergence of alternative trade routes since the EU's ban (Reino et al "Networks of global bird invasion altered by regional trade ban").

Figure 10. @CristianSamper retweet of Reino et al research article. Twitter. Screen capture. 25 Nov 2017.

Lennon prepared a facilitated reading of the research for the 27 November class meeting, and asked students to contextualize the global flows of wild bird trade and the new areas of concern since the Europe ban. (Fig 11) The students' map-reading work had prepared them to confidentially proceed

with Reino et al. as an introduction to research methods at “combine a large data set on wild bird trade among biogeographical realms derived from CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) with the analysis of trade network topology.”) The students would both logically and ethically decide that Reino et al was more persuasive than Pyron; in other words, simply, conservation was preferable to extinction.

Figure 11. Map of global flows of wild bird trade Reino, Luís, et al. “Networks of Global Bird Invasion Altered by Regional Trade Ban.” *Science Advances*, American Association for the Advancement of Science, 1 Nov. 2017.

What has this to do with archives? That referral tweet had come from Cristián Samper, Ph.D., the President and CEO of the WCS at the Bronx Zoo, which all of the EFB120 students had visited a few weeks earlier on a school-wide field trip. Lennon’s research at the WCS Archives and

the students' advancing, life-long connections with learning at the Bronx Zoo may have helped to pique their enthusiasm; a social media connection with the WSC President seemed to ease the students toward a glide into advanced studies, too. Whichever cause was dominant, the students were noticeably drawing themselves into the narrative of worldwide biodiversity science. Could WCS be the deciding guide to their next steps in higher learning? An important institution in their lifelong learning, WCS has always been a leader in America's wildlife conservation movement, and even now is actively protecting the last wild places in sixty counties in ongoing. The action-gap narrowed momentarily, but New Yorkers should not be surprised. WCS has been forming and advancing a unique urban-based connection for human agency in extinction debates since its earliest days as the New York Zoological Society, when its famous support, advocacy and science were decisive factors in saving the American bison.

After subsequent readings, discussions and assignments, by February the students were developing even more informed voices and putting their knowledge and experience to work on a number of important debates that may decide the difference between existence and extinction (Kudryavstev 2013; Wilson 2016, 71-73; Safina 2018). A typical student may still need time to reckon the difference between a raptor and a hawk, or take note of such in their journals, but birds like the peregrines, bald eagles, and ospreys were by now better recognized them as species that, like the bison, have come brought back from the brink of extinction due to the transgenerational efforts of local commitments to wildlife conservation.

Winter, Final Quarter and Fledge

There were still leaves on trees to distinguish tulip poplar from London plane and pin oak from locust trees when we began in September. But as the days grew colder and shorter, students were less enthusiastic to venture outside. We returned to William Beebe's work in February with an

excerpt from *The Log of the Sun; A Chronicle of Nature's Year* (1906), which is available to students from the Biodiversity Heritage Library:

No time is more propitious or advisable for the amateur bird lover to begin his studies than the first of the year. Bird life is now reduced to its simplest terms in numbers and species, and the absence of concealing foliage, together with the usual tameness of winter birds, makes identification an easy matter.

In January and the succeeding month we have with us birds which are called permanent residents, which do not leave us throughout the entire year; and, in addition, the winter visitors which have come to us from the far north.

With each chapter being a month, the fifty-two short essays in Beebe's chronicle intertwine artfully with the practices of journaling and, by keeping us in the moment rather than waiting impatiently for Spring, and made a perfect reading to show that February (and winter) is *the best time* for amateur birders because life will be "reduced to its simplest terms" in number, species and camouflaging leaves. The birds around in January and the succeeding month (Beebe's "permanent residents") led us to speak of ourselves and other New Yorkers who are the "persistent locals," then reach for help from the paintings of Norman Lewis, a resident of Harlem and first generation American in mid-century New York --- *Migrating Birds* (1953), *Winter Branches # 5* (1954); *Street Music* (1950), *Every Atom Glows* (1951) and *Birds* (1950) especially. (Lewis, et al. 2015)

By now, one of the students had already requested to take their journal home in order to bird on her own. And another, after reviewing Beebe's journal entry from Guyana, had exclaimed, "our journals are archives." Several journal entries showed that a promising connection to place was underway. Beyond the listing of birds, students were also identifying with their own internal landscapes. One student on 23 October wrote, "I noticed this was the first time I actually stopped to look at a small bird before." That same student, who on the 3 November walk in Central Park had decided it was a "cool experience... peaceful experience," had a relatively hefty written list of the birds seen, too. Another student connected their observations on 1 February to their hometown and

other cities “...the weather reminds me of cold Paris... the red berries remind me of my hometown in Senegal.” Yet another student’s entry while birding and journaling Central Park (3 November) was, “This reminded me of a scavenger hunt looking for different types of gold.”

While it was possible to see more action in a winter that tends to seem bare and limiting, it was now that those AMP street murals (Audubon Mural Project) seemed to matter most. The students had seen and drawn their own pictures forever. Thanks to Maddie Thompson (WCS), they have learned to spot the difference between drawing-as-illustration and illustration-as-science. The murals provided a bridge from the observations of our persistent winter birds to our work for spring semester, which explores climate data visualization, the effects of climate change, and the science-action gap. The AMP plans to represent all 314 birds facing possible extinction in Audubon’s Bird and Climate Change Report from 2014 (PBS NYC-Arts Episode 382 Mar 8, 2018), which the course employs to connect the climate data with local parks and bird habitats.

The trip started by paying homage to John James Audubon at his gravesite in Trinity Cemetery, amid chirping starlings which students found eerily fitting. A student spotted the building mural “Endangered Harlem” at 1883-1887 Amsterdam Avenue. Completed in 2015 by Gaia, its four endangered birds (black-and-white warbler, magnolia warbler, scarlet tanager, and tree swallow) present a strikingly large work of mixed imageries and unifying themes, as the artist explains:

Above in the top right corner is a portrait of Audubon as a young man, to the bottom right of the composition is a photo by Russell Lee taken in the South Side of Chicago in 1941 during the swell of the second great migration. To the bottom left is the white hand of James Lancaster, who led the East India Company’s first fleet in 1600, resting on a globe. These three patterns of migration run parallel to one another. But the greatest irony of it all is raising ecological awareness whilst the people of Harlem are endangered of significant gentrification.

The issue of gentrification was not lost on a few of the students, who began to connect these birds, habitat destruction, and climate change with the patterns of gentrification in local neighborhoods.

Further along the tour, there are two large building murals on Broadway, between 155th and 156th streets (“Fish Crow” by Hitnes and “Swallow tailed Kite [and others]” by Lunar New Year). Two students who live in the neighborhood revealed that they had never seen these huge murals before because, well, “New Yorkers don’t look up while walking.” Another student who lives in the neighborhood DID notice the murals prior to the tour, and loved them for their beauty, but had no clue why they are around the neighborhood before the class tour. Both truths would find parallel views in the next season’s cycle.

Soon spring arrives. The trees that we repeatedly named throughout the winter will bear buds, return their leafy cover, begin to flutter, and attract migrating birds. A new ease of bird identification has been attained for the persistent locals. The blue jay, cardinal, and mockingbird, together with their respective territories within the park, are by now quite familiar frames of observation. While students prepare for welcoming and identifying neotropical migrants as they arrive in April and May, they are at the same time awaiting for the arrival of letters that will bear some news about their own next migration to full-time college. At an upcoming visit to the “Feathers” exhibit at New-York Historical Society, students will see “original watercolor models by John James Audubon for The Birds of America,” which they have only previously known as digital reproductions from printed formats. Attention will then turn to the accompanying recorded bird songs in the exhibits. These come from collections at the Macaulay Library of the Cornell Lab of Ornithology (N-YHS). We shall see how students from this course explore the science and stories, among many online resources of the Macaulay (“Collecting, Archiving, and Distributing Wildlife Media Since 1929”), for which they have been prepared with bioacoustics lessons about oceans and marine mammals earlier in the class. Our inaugural of STEM+Humanities work, furthermore, should have prepared them to pose questions about what media and analytical tools are used to capture and

replay, or how any technological tools can shape scientific recordings or points of view. Why has it been so hard to capture audio and other recordings of wild birds at different points of time? And for several answers from all angles, students will be asked to consider the papers of Albert Rich Brand and related collections of bioacoustic pioneers (also at the Macaulay). The Brand papers represent his work as a student, making it an appropriate topic for the final quarter's emphasis on academic research challenges, science literature, climate change, evidence and data. One of the final project choices will be a bird vision study (question what can bird vision teach us about the world; what sees the world better -- satellite imagery, an MRI, pen/ink, and photography; who knows better about the earth's magnetic fields, people or birds, and how do you know?). The preparation will include a review of how to look for peer-reviewed articles on the topic (e.g. how to use the SUNY library resources of appropriate databases and scientific publication) and show how searching, cataloguing, annotating, and researching work in tandem. In a culminating portfolio for the class, students will be asked to explain a topic of meaningful importance in environmental science.

Conclusion

In the best of all worlds, this is a perfect time to advance education through hinged-themes and place-based education for students at the college-entry stage in New York City. The speedy time frame from idea to action was buttressed by several supporting professional development (PD) experiences for pursuit of this plan. The PD experiences most familiar to STEM teachers that lack an honest intersection with humanities scholarship could be improved by *borrowing a birds eye*. The connection of birding with a sense of place through archives and local cultural resources was repeatedly rewarding to students, who seemed more willing, confident, and ambitious in bringing their command of content to a deeper level than other senior-year student cohorts that Lennon has

known. A learning partnership with the humanities, meanwhile, endowed the educator with sufficient tools and knowledge to become a developer and incorporator of place based modules to benefit students' critical thinking and reflective practices. *Borrowing a birds eye* also demonstrated the importance of archival material to forming a successful learning partnership of STEM+humanities, as well as the value of New York's cultural and educational institutions for the continual development of its teachers and students.

Moving forward, we will be looking to develop more specific and lasting research projects for the college-in-high-school students, and to extend the ease with which they develop new opportunities for learning in their communities. Alumni of the class will be asked to reach back when they have advanced far enough in college, and to share stories of their challenges as well as successes. If interest is there, we can continue building a community of persistent locals who are NY-schooled, critical thinkers. Wherever these students study next (70 percent of previous classes continued within New York City or New York State based on previous class data), we will encourage them to use hinged-themes (like borrowing a bird's eye) and continue with the practice of recognizing, capturing, and advancing in their role as environmental stewards. Ornithology especially depends on communities of citizen science, and skills learned from this course have prepared the students to join the corps of Breeding Bird Survey volunteers, so we will ask students to consider how bird-science support might help to an answer to the science action-gap, if only on a small, start-where-you-are scale.

In general, teachers are often viewed as implementers of curriculum rather than co-designers or critical users. Similarly, teachers do not often solicit input from students in design or implementation of curriculum (Gunckel & Moore, 2005). *Borrowing a Bird's Eye* as a STEM+humanities, college-in-high-school, first-year-experience made it easier for the EFB120 to

pursue collaborative strategies among students, teachers, and additional learning partners, but always with an awareness that a tough terrain lies ahead for environmental science. If the interdisciplinarity becomes too weighty, the inclusion of environmental science in STEM can be jeopardized, and the inclusion of environmental science in STEM does matter for NSF and ICE. (Geidel and Winner, 2016 p. 336). On the other hand, philosophers, historians and literary scholars should not be relegated to mere transcribers or communicators of scientific findings. Humanities graduates (or final year high school students at CSS) are just as likely to analyze a social-environmental problem and take action to make a difference (Emmet & Nye, 2017 p165). In fact at CSS, similar to Lansiquot and MacDonald's explanation of a place based project by Borgelt et al, there have been discussions between Lennon and her CSS humanities colleague to develop a community action project that bridges both the twelfth grade Participation in Government and Environmental Science courses into a critical thinking and civic responsibility with an eye to the environmental repercussions of various choices.

We are already aware that the idea of student journals and data as living archives was not lost on students when, during a look at Beebe journal archives (worth repeating here) at least one student loudly exclaimed, "Our journals are archives!" Toward the end of the course students began the task of entering class bird sightings and weather data from journal entries into a spreadsheet to be used with future EFB120 classes. An account for Cornell's Lab of Ornithology ebird project will be established so Morningside Park bird data can be entered. A search through the ebird did not return any entries for bird sightings in Morningside. This could be as helpful as Central Park bird data as migration patterns are identified, especially for rare or returning birds, such as Kirtland's warbler, which recently caused a stir in the NYC birding community as it was sighted this year (only 1 of 4 recorded sighting in NY state ever). (Chung, 2018) Lennon's recent sighting in the park of a

Magnolia Warbler, Rose breasted grosbeak, enarmored students and led to curiosity-- what else has been seen (or missed) in Morningside Park.

The students' larger role in maintaining records of weather, birds seen, as well as bud bursts in Morningside Park will lay foundation to the idea of using history as a lens that students might see answers in the actions of those before them; recognizing that data matters, who is recording it matters, and how we choose to preserve the data matters. Sharing these lessons and reflection on this initial pairing of STEM and humanities to foster environmental awareness, enhance student knowledge of local issues and prepare students for college level inquiry and critical thinking are intended to provide an introductory road map of possibilities for motivating the next generation of naturalists and activists.

APPENDIX A

Development of STEM+Humanities Project

A pre-journaling survey was conducted in order to determine how much time students spend outdoors regularly. The survey was adapted from Arnold (2012) regarding online nature journaling. Taking some of Arnold's recommendations to improve upon her work, the pre-test was designed to provide baseline data to determine if documenting observations leads to greater environmental awareness that persists in daily life (Arnold, 2012, p135). Figure 1 shows one third of the class keeps a personal journal and time spent outdoors ranged from 0 hours to 12 hours per week prior to the implementation of lessons and two thirds of students recorded being able to identify just 1 to 3 birds.

Figure 1. Pre-Test Survey Results

We believe the opportunity to increase journaling, time outdoors and identification of bird species will encourage familiarity and improve environmental awareness of New York City's urban green spaces. Majority of students (82%) reported having an average to above average awareness of the natural environment, although we did not define what above average meant.

With a broad definition of "science as a major" for intended review of data, 7 students (25% of class) expressed pursuing science as a major (landscape architecture, health, computer science).

Based on these results it became clear that with deliberate journaling sessions and use of archival

material, students may develop a deeper self reflection and nurture a personal connection and sense of belonging among the city's green spaces and nature wherever their post high school journey takes them.

Between having some success leading students with binoculars through Morningside Park and then Hallett Sanctuary in Central Park during the Spring of 2017, the 2017-18 school year began with several essential questions driving the environmental science course, "What is your responsibility to self, community, and the world? How can one individual make a difference?" . Collins continually brought to the forefront the concept "start where you are" to the project. Students in grades 6 through 12 utilize Morningside Park as an extended campus to CSS, not just for science classes but as part of the outdoor curriculum for physical education, as well as year-end field day activities, so this park was a natural entry point for place based learning. Part of the introductory lesson included identifying what students knew and wanted to know about Morningside Park.

APPENDIX B

Theresa Collins / Diana Lennon, WCS Archival Research, 28 Nov 2017

- 1) Charles Townsend Whale Research? elephant seal photo scrapbook?
- 2) [Department of Tropical Research. Terrestrial Expeditions. British Guiana and Venezuela records, 1916-1924](#) Collection 1005-B. Wildlife Conservation Society Archives, New York.
Series 6: Birds general, box 5

	Box
Avifauna of Guiana, includes keys,	5
List of Kartabo birds,	5
Bird notes, 1920	5
Notes on bird voices,	5
Breeding records, 1922 and 1924	5
Nests and eggs,	5
Check list of birds (1 and 2) and chart of breeding records,	5
Guiana birds's food,	5
Hummingbirds,	5
Keys to Guiana vertebrates,	5
Birds of Georgetown,	5
Copied notes on color-birds,	5

Series 7: Birds data, sample (discuss with Diana) boxes 6-10 species list
<http://ielc.libguides.com/c.php?g=692839&p=4908423#ref577>

Series 8: Kartabo birds anatomy. Box 11

- 3) [Department of Tropical Research expedition illustrations and related visual materials, circa 1916-1964](#) Collection 1039. Wildlife Conservation Society Archives, New York.
Subseries 1A. British Guiana expedition illustrations, 1916-1922, 1924 [bulk 1920-1924]

Series 2. Bird syrinx illustrations, 1919-1946 [bulk 1919-1922] sample?

- 4) [Department of Tropical Research general records, 1900-1971](#) Collection 1005A. Wildlife Conservation Society Archives, New York.
Series 7: Research station guest books, 1916-1971

Kartabo, 1916-1922 5

British Guiana, 1916-1922 5

Series 8: Specimen catalogs, 1916-1958

Subseries a: Vertebrate specimen catalogues, 1916-1958

Series 9: Catalogues of color plates, drawings, and motion pictures, 1919-1940

Venezuela and Caripito Station, 1942 7

Venezuela and Rancho Grande Station, 1945-1946 7

- 5) [Center for Field Biology and Conservation records, 1962-1982](#) Collection 4062. Wildlife Conservation Society Archives, New York.
Series 2: Roger Payne, 1962-1982 (Bulk, 1970-1982)

National Geographic Society, 1971-1972

Carton Folder 1 23

Proposed designation of a dual marine sanctuary for humpback whales in Hawaii and Alaska,

Carton Folder 1 29

Series 3: George Schaller, circa 1974-1979 / Subseries c: Funding, 1975-1979

Explorers' Club grant for jaguar study in Brazil, 1977

Carton Folder Text (00003944) 1 60

National Science Foundation grant for jaguar study in Brazil, 1976-1979

Carton Folder Text (00003944) 1 61

World Wildlife Fund for maned wolf and marsh deer study in Argentina and Paraguay, 1975

Carton Folder Text (00003944) 1 62

Literature Review.

“2/18/2017.” *IBM Cloud Video*, New York University, www.ustream.tv/recorded/100074469.

“A Collection in Context: The Hispanic Society of America.” *Map of the World - A Collection in Context: The Hispanic Society of America*, www.learn.columbia.edu/hispanic/monographs/vespucci-map.php.

Adamson, J., & Davis, M. (Eds.). (2017). *Humanities for the environment : integrating knowledge, forging new constellations of practice*. London: [Routledge] Taylor and Francis.

Arnold, G. (2012, 02). Enhancing college students' environmental sensibilities through online nature journaling. *Environmental Education Research*, 18(1), 133-150. doi:10.1080/13504622.2011.589000

“As ‘Climate Change’ Fades from Government Sites, a Struggle to Archive Data.” *PBS*, Public Broadcasting Service, www.pbs.org/wgbh/frontline/article/as-climate-change-fades-from-government-sites-a-struggle-to-archive-data/.

“The Atlas of Remote Islands, in Which Are Found Both Poetry and Cartography.” *Aleph*, www.faena.com/aleph/articles/the-atlas-of-remote-islands-in-which-are-found-both-poetry-and-cartography/.

Audubon Society, National. "Audubon and National Geographic Declare 2018 as Year of the Bird" Audubon Press Room," 5 Jan. 2018. <http://www.audubon.org/news/audubon-and-national-geographic-declare-2018-year-bird>

Audubon Society, NYC. "Lights Out New York -- Have an impact... prevent an impact" <http://www.nycaudubon.org/lights-out-new-york> and <http://www.audubon.org/conservation/project/lights-out> accessed 21 March 2018

Baglee, Patrick (2015) E. R. P. Janvrin and the Linnaean Society of New York archive 1915–1972” Linnaean Society New York, 2015. <http://linnaeannewyork.org/news/news/20150113-Janvrin-LSNY-1915-1972.html>

Bailey, Ronald. "How Concerned Should You Be About Species Extinction?" *Reason.com*, 24 Nov. 2017, reason.com/blog/2017/11/24/how-concerned-should-you-be-about-specie.

Bryce Dubois & Marianne E. Krasny (2016) Educating with resilience in mind: Addressing climate change in post-Sandy New York City, *The Journal of Environmental Education*, 47:4, 255-270, <https://goo.gl/Vub8h6>

Beebe, William. "*The Log of the Sun; a Chronicle of Nature's Year.*" 1906, *doi:10.5962/bhl.title.54138*.

"Birders: The Central Park Effect." *All About Birds*, 21 May 2015,

www.allaboutbirds.org/birders-the-central-park-effect/.

Birders: The Central Park Effect. Directed by Jeffrey Kimballs. Music Box Films, 2012.

Amazon. October 2017.

Capelouto, J.D. "In Generational Shift, College Republicans Poised to Reform Party..." *Reuters*, Thomson Reuters, 12 Apr. 2017, www.reuters.com/article/us-climatechange-politics-youth-feature/in-generational-shift-college-republicans-poised-to-reform-party-on-climate-change-idUSKBN17E2XF. Accessed 20 May 2018.

Columbia University Media Center for Art History. Map of the World - A Collection in Context: The Hispanic Society of America. <http://www.learn.columbia.edu/hispanic/monographs/vespucci-map.php> Accessed 26 March 2018

"Conservation." *Lights Out NY Program*, www.nycaudubon.org/lights-out-new-york.

Corbett, Jeffrey. "Jacobo De'Barbari's Panoramic View of Venice: Petition for Copyright, 1500." *Renaissance Venice*, 28 Apr. 2016, www.renaissancevenice.org/content/jacobo-debarbaris-panoramic-view-venice-petition-copyright-1500.

Davis, Jessica. Philosophy as a Required Course at Columbia Secondary School. (n.d.). Retrieved from <http://blogs.cuit.columbia.edu/philosophyoutreach/2013/09/11/philosophy-as-a-required-course-at-columbia-secondary-school/>

Dion, M., McLeod, K., Thompson, M. M., Drayton, R. H., Schaller, G. B., & Drawing Center (New York, N.Y.). (2017). *Exploratory Works: Drawings from the Department of Tropical Research field expeditions*. Drawing Papers No. 132. New York, NY : The Drawing Center
https://issuu.com/drawingcenter/docs/drawingpapers132_exploratoryworks

Drawing Center. Exploratory Works Press Release. 21 March 2017
<http://www.drawingcenter.org/en/drawingcenter/5/exhibitions/9/upcoming/1460/exploratory-works/>

Emmett, R. S. & D. N. Nye (2017). *The Environmental Humanities: A Critical Introduction*. MIT Press.

Faculty of Science - University of Copenhagen. "EU trade ban brings down global trade in wild birds by 90 percent." ScienceDaily. ScienceDaily, 22 November 2017.
<www.sciencedaily.com/releases/2017/11/171122151048.htm> .

Felix, Sherry Lynn. *News - Janvrin 1915-1972*, linnaeannewyork.org/news/news/20150113-Janvrin-LSNY-1915-1972.html.

“Found in Nature: Barry Rosenthal Interview.” *Musée Magazine*, 22 Dec. 1970,
museemagazine.com/features/2017/12/22/found-in-nature-barry-rosenthal-interview.

Geidel, Gwendolyn and William E. Winner, 2016. "[Environmental Science: the interdisciplinary](#)

STEM field," *Journal of Environmental Studies and Sciences*, Springer; Association of Environmental Studies and Sciences, vol. 6(2), pages 336-343.

Gray, Christopher. "An Oasis of Green, Reclaimed by City and Community." *The New York Times*, The New York Times, 31 July 2005, www.nytimes.com/2005/07/31/realestate/an-oasis-of-green-reclaimed-by-city-and-community.html.

"Green Gym Map." Web. 13 September 2017. <http://morningsidepark.org/greengymmap.pdf>

"Ground Conditions: British Headquarters Map." *Geography*, thegreatestgrid.mcny.org/greatest-grid/geography/8.

Gunckel, Kristin and Moore, Felicia. "NARST 2005 Annual Meeting." *Including Students and Teachers in the Co-Design of the Enacted Curriculum*, pp. 1–10, eric.ed.gov/?id=ED498676.

Gunckel, Kristin L., et al. "Addressing Challenges in Developing Learning Progressions For Environmental Science Literacy." *Learning Progressions in Science*, 2012, pp. 39–75., doi:10.1007/978-94-6091-824-7_4.

"Humanities for STEM Symposium." *Eventbrite*, www.eventbrite.com/e/humanities-for-stem-symposium-registration-42879557912 .

"The IUCN Red List of Threatened Species." *The IUCN Red List of Threatened Species*, www.iucnredlist.org/.

Kolbert, Elizabeth. "The Fate of Earth." *The New Yorker*, The New Yorker, 13 Oct. 2017, www.newyorker.com/tech/elements/the-fate-of-earth.

Kolbert, Elizabeth. *The Sixth Extinction an Unnatural History*. Picador, Henry Holt and Company, 2015.

Kudryavtsev, Alexey. 2013. "Urban Environmental Education and Sense of Place." Cornell University, Ann Arbor (Krasny supvr)

Lanham, J.Drew "Birding While Black." *Literary Hub*, 11 May 2017, lithub.com/birding-while-black/.

Lansiquot, R. D., & In MacDonald, S. P. (2018). *Interdisciplinary Place-Based Learning in Urban Education: Exploring Virtual Worlds*. Palgrave Macmillan, Cham

Lennon, Diana (2017) "New York is for the Bird...ers". *DonorsChoose.org*, https://www.donorschoose.org/project/new-york-is-for-the-birders/2398001/?utm_source=dc&utm_medium=page&utm_campaign=project&utm_term=teacher_407646&rf=page-dc-2018-02-project-teacher_407646&challengeid=272998

Lennon, D. 2013. "Exploring the Geosciences in the New York Metro Area" MS Thesis. Mississippi State University. Mississippi State, MS. 2013.

Lewis, Norman, et al. *Procession: the Art of Norman Lewis*. Pennsylvania Academy of the Fine Arts, 2015.

“Lights Out.” *Audubon*, 16 Mar. 2015, www.audubon.org/conservation/project/lights-out.

Lindner, Christoph, "Retro-Walking New York," in *Deconstructing the High Line: Postindustrial Urbanism and the Rise of the Elevated Park*, ed. C. Lindner and B. Rosa (New Brunswick: Rutgers University Press, 2017), 92-106.

“Lin-Manuel Miranda: Coqui Frog Is a Metaphor for PR.” *NBC New York*,
www.nbcnewyork.com/on-air/as-seen-on/Lin-Manuel-and-Darlene-Talk-about-the-Coqui_New-York-452531463.html .

Lipe, Bill. “Some Monumental Issues” *Archeaology Southwest*, Preservation Archeology Blog.
<https://www.archaeologysouthwest.org/2018/01/08/some-monumental-issues>.

Mclaren, James D., et al. “Artificial Light at Night Confounds Broad-Scale Habitat Use by Migrating Birds.” *Ecology Letters*, vol. 21, no. 3, Sept. 2018, pp. 356–364., doi:10.1111/ele.12902.

Metz, Justin. “On the Cover of New York Magazine: The Doomed Earth Catalog.” *New York Press Room*, 10 July 2017, nymag.com/press/2017/07/on-the-cover-of-new-york-the-doomed-earth-catalog.html.

Morgan Library. "This Ever New Self: Thoreau and His Journal"

<http://www.themorgan.org/exhibitions/thoreau>

Morgan Library. Thoreau's Journal: A Life of Listening.

<http://www.themorgan.org/exhibitions/online/thoreau>

New-York Historical Society. "New-York Historical Society to Explore Fashion, Feathers, and the Rise of Animal Rights Activism," 23 January 2018 [http://www.nyhistory.org/press/releases/new-](http://www.nyhistory.org/press/releases/new-york-historical-society-explore-fashion-feathers-and-rise-animal-rights-activis-0)

[york-historical-society-explore-fashion-feathers-and-rise-animal-rights-activis-0](http://www.nyhistory.org/press/releases/new-york-historical-society-explore-fashion-feathers-and-rise-animal-rights-activis-0) Accessed 26

March 2018

"[New York's Life-Line](#)," Railway Wonders of the World, Part 29 (August 1935): 906-909

<http://www.railwaywondersoftheworld.com/index.html> Accessed 26 March 2018

"NYC-ARTS Full Episode: March 8 2018." *PBS*, Public Broadcasting Service,

www.pbs.org/video/nyc-arts-full-episode-march-8-2018-cbxkfa/.

NYU Hawk Cam. (n.d.). Retrieved from <https://www.ustream.tv/channel/e3uYJSDgmbz>

New York Zoological Society, & Department of Tropical Research. (n.d.). New York Zoological Society. Department of Tropical Research. Terrestrial expeditions. British Guiana and Venezuela records. Retrieved from <https://wcsarchives.libraryhost.com/repositories/2/resources/52>

“Parks, Recreation and Historic Preservation.” *Taughannock Falls State Park*, parks.ny.gov/parks/62/details.aspx.

“The Pyron Lab.” *The Pyron Lab*, colubroid.org/.

Pyron, R. Alexander. “Perspective | We Don't Need to Save Endangered Species. Extinction Is Part of Evolution.” *The Washington Post*, WP Company, 22 Nov. 2017, www.washingtonpost.com/outlook/we-dont-need-to-save-endangered-species-extinction-is-part-of-evolution/2017/11/21/57fc5658-cdb4-11e7-a1a3-0d1e45a6de3d_story.html?utm_term=.cceb36ca02b4.

Racing Extinction. Directed by Louie Psihoyos. Oceanic Preservation Society. 2015. Amazon. 27 November 2017.

Raven, P. H., Berg, L. R., & Hassenzahl, D. M. (2012). *Environment*. Hoboken, NJ: Wiley.

“Reimagining Community: Finding Sanctuary in Public Spaces.” *The New York Public Library*, www.nypl.org/events/programs/2018/04/09/reimagining-community-finding-sanctuary-public-spaces .

Reino, Luís, et al. “Networks of Global Bird Invasion Altered by Regional Trade Ban.” *Science Advances*, American Association for the Advancement of Science, 1 Nov. 2017, <http://advances.sciencemag.org/content/3/11/e1700783>

“Revised General Plan for Morningside Park, to Accompany Report by Frederick Law Olmsted and Calvert Vaux . . . September 28th, 1887.” *NYPL Digital Collections*,
digitalcollections.nypl.org/items/ccd47f50-f3a2-0130-de45-58d385a7b928.

Russ, Alex, Scott J. Peters, Marianne E. Krasny & Richard C. Stedman (2015) Development of Ecological Place Meaning in New York City, *The Journal of Environmental Education*, 46:2, 73-93

Safina, Carl. “In Defense of Biodiversity: Why Protecting Species from Extinction Matters.” *Yale E360*, Yale School of Forestry & Environmental Studies, 12 Feb. 2018,
<https://e360.yale.edu/features/in-defense-of-biodiversity-why-protecting-species-from-extinction-matters> .

Sanderson, E. W., Boyer, M., & Robertson, C. (2013). *Mannahatta A Natural History of New York City*. Abrams.

“Save the Turtles! And the Grizzlies? Or the Woodpeckers? Prioritizing Endangered Species Conservation (2013-1).” *SESYNC*, 21 July 2017, www.sesync.org/save-the-turtles-and-the-grizzlies-or-the-woodpeckers-prioritizing-endangered-species-conservation.

Science Daily. City lights setting traps for migrating birds: How birds are drawn to artificial light pollution in urban areas

<https://www.sciencedaily.com/releases/2018/01/180119125817.htm> Accessed 27 March 2018.

Smith, Wendy. "The Actors Studio at 70, Estelle Parsons at (Almost) 90." *AMERICAN THEATRE*, 2 Aug. 2017, www.americantheatre.org/2017/07/19/the-actors-studio-at-70-estelle-parsons-at-almost-90/

"Support a Classroom. Build a Future." *DonorsChoose.org*, www.donorschoose.org/?utm_source=dc&utm_medium=directlink&utm_campaign=project&utm_term=teacher_407646&rf=directlink-dc-2018-02-project-teacher_407646&challengeid=272998.

Taylor, Alan (2011) "DOCUMERICA: Images of America in Crisis in the 1970s." *The Atlantic*, Nov. 16, 2011. <https://www.theatlantic.com/photo/2011/11/documerica-images-of-america-in-crisis-in-the-1970s/100190/> Accessed 26 March 2018

"USGS US Topo 7.5-Minute Map for Central Park, NY-NJ 2011." *USGS US Topo 7.5-Minute Map for Central Park, NY-NJ 2011 - Data.gov*, Responsible Party U.S. Geological Survey, National Geospatial Technical Operations Center (Point of Contact), 9 Jan. 2016, catalog.data.gov/dataset/usgs-us-topo-7-5-minute-map-for-central-park-ny-nj-2011.

U.S. Fish and Wildlife Service. Significant Habitats and Habitat Complexes of the New York Bright Watershed, 1997, excerpt for Lower Hudson River Estuary COMPLEX #21. https://nctc.fws.gov/pubs5/web_link/text/low_hud.htm

U.S. National Archives. Environmental Studies: Documerica Highlights

<https://www.archives.gov/research/environment/documerica-highlights.html> Accessed 26 March

2018

Warkentin, T. (2011, 11). Cultivating Urban Naturalists: Teaching Experiential, Place-based Learning through Nature Journaling in Central Park. *Journal of Geography*, 110(6), 227-238.

doi:10.1080/00221341.2011.566345

Washington State University Libraries. Research Exchange. "Bears Ears Controversy. (Cedar Mesa Project) <https://research.libraries.wsu.edu:8443/xmlui/handle/2376/12882>

"Welcome to the Wildlife Conservation Society Archives." *Wildlife Conservation Society Archives*, wcsarchives.libraryhost.com/.

"The Welikia Project » Welikia Map." *The Welikia ("Way-LEE-Kee-Uh") Project*, welikia.org/explore/mannahatta-map/.

Wildlife Conservation Society. Department of Tropical Research. Terrestrial Expeditions. British Guiana and Venezuela records. Collection 1005-B. Wildlife Conservation Society Archives, New York. <https://library.wcs.org/Archives/Finding-Aids.aspx> Accessed March 27, 2018.

Wilke, S., & Johnstone, J. (Eds.). (2017). *Readings in the Anthropocene : The Environmental Humanities, german studies, and beyond.* , Bloomsbury Academic & Professional.

Wilson, Edward O. *Half-Earth: Our Planet's Fight for Life*. Liveright Publishing Corporation, a Division of W.W. Norton & Company, 2016.

Wulf, Andrea. "What Thoreau Saw," *The Atlantic* Nov. 2017

<https://www.theatlantic.com/magazine/archive/2017/11/what-thoreau-saw/540615/>