

Holland Township Environmental Commission Minutes

December 5, 2018 7 PM Meeting

Chairman Keady called the meeting to order. He read the notice satisfying the Open Public Meeting Act. All stood for the pledge of allegiance. All were reminded to turn off their cell phones or put them in silent mode.

Members Present: Jerry Bowers, David Harrison, Mike Keady, Susan Meacham, Ray Note, Dwight Pederson, and Secretary Maria Elena Jennette Kozak.

Present: Township Committee Liaison: Robert Thurgarland

Absent: Henry Gore and Ted Harwick

Let the record show we have a quorum.

Minutes: A motion was made by Jerry Bowers and seconded by David Harrison to dispense with the reading of the September 6, 2018, October 3, 2018 and November 6, 2018 minutes and approve them as such. All present were in favor of the motion with the exception of David Harrison, Susan Meacham, and Robert Thurgarland who abstained from September 5, 2018, Ted Harwick who abstained from October 3, 2018 and Susan Meacham, Dwight Pederson and Robert Thurgarland who abstained from November 6, 2018. Motion carried.

Proposed 2019 meeting schedule. The 2019 meeting schedule was forwarded to Clerk Miller for publication. It is as follows:

Township of Holland
Environmental Commission

2019 Meetings

PLEASE TAKE NOTICE that the Environmental Commission, Township of Holland, County of Hunterdon, New Jersey, will hold their regular meetings on the following dates in 2019 at 7:00 P.M. at the Holland Township Municipal Building, 61 Church Road, Milford, NJ. Meetings are open to the public.

Meeting Dates

January 9, 2019 (Reorganization Meeting)
February 6, 2019
March 6, 2019

April 3, 2019
May 1, 2019
June 4, 2019 * (Tuesday)
July 10, 2019
August 7, 2019
September 4, 2019
October 2, 2019
November 5, 2019 *(Tuesday)
December 4 2019
January 8, 2020 (Reorganization Meeting)

PennEast Pipeline update: Susan Meacham and Mike Keady – Nothing new to report. Still in the courts. The Federal Court is to make a decision on eminent domain. Another state was going to make a decision and New Jersey is interested in seeing how it impacts New Jersey.

Opinion Article from Union of Concerned Scientists, Science for a Healthy Planet and Safer World, October 10, 2018

Bernard McNamee was mentioned and the article as follows outlined why he is not a favorite choice for FERC.

Three Reasons Bernard McNamee is a Horrible Choice for the Federal Energy Regulatory Commission

Sam Gomberg, senior energy analyst | October 10, 2018, 2:57 pm EST



President Trump's [nomination of Bernard McNamee](#) to the Federal Energy Regulatory Commission (FERC) may not grab a lot of headlines but make no mistake – it's a blatant (and [oft repeated](#)) move by the Trump administration to pollute an independent regulatory body with political operatives intent on carrying out his crony capitalism. A hearing to consider McNamee's nomination is already

[set for Tuesday](#), October 16th – a clear sign that Trump’s political allies are trying to ram through his appointment without thoughtful consideration. But here’s three reasons McNamee is a horrible choice to be a FERC commissioner and why his potential confirmation should worry all of us.

But first, what is “FERC”?

The Federal Energy Regulatory Commission – or “FERC” – is an independent federal regulatory body that is organized as part of the Department of Energy and that oversees much of our modern energy infrastructure. From pipelines, to hydroelectric dams, to our interstate transmission system and wholesale electricity markets, FERC is tasked with ensuring “reliable, efficient and sustainable energy services at a reasonable cost”. To put it simply: FERC’s decisions impact our wallets, our environment, and our climate.

Now that we understand why it’s important who our next FERC commissioner is, here are three reasons why Bernard McNamee is the wrong man for the job:

1. McNamee has serious conflicts of interest.

President Trump and the Department of Energy led by Rick Perry have been trying to [bailout their buddies in the coal industry](#) since they got to D.C. In his positions with the DOE, McNamee helped craft a previous proposal to provide subsidies to uneconomic coal plants. That proposal was [unanimously rejected by FERC](#) in January. We also know that DOE is still [working to find the legal authority](#) to order

subsidies – with **cost estimates** of \$34 billion or more – be paid to these same plants.

McNamee almost certainly had a role in crafting this **latest proposal** that is **opposed by nearly everyone** except the coal industry. To date he has not divulged exactly what role he's played, who he's worked with, or what communications he's had with FERC about the upcoming proposal. Working to craft a bailout proposal for the coal industry would create a serious conflict of interest if he were to then be appointed to FERC that would ultimately vote on the proposal.

Imagine if you were accused of a crime and, once the prosecutor had made his closing arguments, he was appointed to be the judge in your case. That is akin to what we're now facing with McNamee's potential appointment to FERC. Free and fair electricity markets, low-cost electricity, and our clean energy future are at stake.

2. He's horribly unqualified.

Bernard McNamee has **no experience** in the utility or natural gas utility industries and has no experience as a regulator of these industries. He was appointed to the Department of Energy (DOE) by President Trump, and before that worked for a conservative think tank in Texas and was an advisor to Senator Ted Cruz and the Texas Attorney General.

3. He would destroy FERC's standing as an independent regulatory body.

FERC has a [long history](#) of steering clear of the political fray, particularly in its responsibility to protect free and fair energy markets. In fact, FERC is specifically designed to be independent from political influence so that it can remain objective. To protect against undue influence at the Commission, no more than three of the five commissioners can be from the same political party, FERC is not funded by taxpayer dollars (and therefore not subject to appropriations battles), and FERC decisions are not reviewed in advance by the President or Congress.

This independence has already been [thrown into question](#) by FERC's chief of staff, Anthony Pugliese – another [unqualified political operative](#) inserted at FERC by President Trump. The appointment of McNamee to be a FERC commissioner would double down on Trump's efforts to make FERC a pawn to his political agenda. Everyone should be concerned about the erosion of independent decision making and the precedent that would set.

Before any hearing is scheduled on his nomination, a full accounting of his activities since joining the DOE, including his communications with the coal industry and his role in the ongoing effort to bailout uneconomic coal plants, should be made public. Then it's up to the Senate to ask serious questions about how he plans to fulfill his duties at FERC given his lack of qualification and his apparent conflicts of interest. If we can't get acceptable answers to these questions, then it's painfully clear that McNamee has no place at FERC.

New Jersey Tree Recovery Campaign for 2019 – Pickup May 3, 2019 with distribution to be Saturday May 4, 2019. Secretary Kozak to fill in the application. Hackettstown is the pickup location.

Route 519 Widening Project – Discussions took place including the drainage basin. Chairman Keady explained how the project evolved from the County accepting a Federally Funded Grant to widen the road. It has been a project in the works for many years. At this time, the population is not as in favor of widening the road but the County is not in the position to reimburse the Federal Government. The Construction season is March thru November with the road being closed in both 2019 and 2020 from Dennis Road to the Mill. Church Road will be the official detour, however, drivers who know Holland will use other roads as shorter alternate routes. The County will maintain Church Road and will reimburse and fix any issues. Cameras will be in place as well as weight restrictions. The Police will be monitoring. Dwight Pederson expressed concerns regarding the tree clearing, the detention basin to catch runoff with emphasis on concerns about Stormwater and runoff entering the Musconetcong River. The trees used to filter the water and now that they have been removed there is great concern about the protections. Jerry Bowers will email MWA to see if there is a way to have the project reviewed with the new regulations in place. More information to follow.

Sub-Committees:

Additional discussion to take place in the future regarding sub-committee titles and positions.

Stormwater Education – Mike Keady, Jerry Bowers and Maria Elena Jennette Kozak as Secretary –nothing new to report. Secretary Kozak is working with DPW Supervisor Turdo because the educational point system has changed and revisions are needed.

Trails – Ted Harwick, Jerry Bowers and Ray Note. Discussions took place about the difficulties in accessing the Holland Park Trail. Signage and trail markings are not visible. The Community Center was also not aware of the trails. Secretary Kozak will print up maps for the Ridge and will talk with Director Neglia on letting front desk staff know about our trails and make trail maps available. The Marquis needs to be updated. (what's the Marquis? Do you mean the kiosk?) We will continue to work on making it more user friendly. Parking concerns were also expressed. More signs are needed.

Community Education and Outreach – Jerry Bowers, Dwight Pederson, and Susan Meacham – If you see additional corrections that are needed please send them to Secretary Kozak. The link is as follows: <http://www.hollandtownshipnj.gov/14-ec/46-environmental-commission.html>.

Jerry Bowers has worked on a draft article that has been submitted for review. He is thinking we need 2 documents. One document (distributed for consideration) would be for Holland Happenings, ANJEC, Hunterdon County, Highlands Coalition, Facebook etc. Another document would be crafted for the Township website with links that readers would find useful. All present were in favor of moving forward. Robert Thurgarland mentioned that the township is exploring doing a Holland Happenings similar to Alexandria Township where we only pay the postage and an outside firm that sells local advertising performs all the work. They are hopeful to have a newsletter out for the spring of 2019. It was suggested that we hold off on submitting to Facebook as the page being used is not endorsed by the Township. He will discuss with the Township Committee and advise.

Holland Township announces environment initiatives

The Holland Township Environment Commission has announced the launch of several new initiatives. These include:

- **“Birds of Holland”**: Lifelong birder and EC member David Harrison has compiled an extensive list of the township’s avian residents (and transients). Based on his own observations over a period of over 20 years, plus additional data from his personal contacts and from sightings posted on eBird (Cornell Lab of Ornithology), the extensive list notes the names, migratory behavior and web links describing over 230 birds observable at various times of the year in the township. The list is posted at <http://www.hollandtownshipnj.gov/bds-committees/environmental-commission> on the EC page of the Holland Township webpage.
- **Holland Park Trail**: With grant support from the Recreational Trails Grant Program of NJDEP/Green Acres and the assistance of the Hunterdon County Division of Parks and Recreation, Holland Township has developed a new walking trail on 140 acres of land (“Holland Park”) purchased by the Township from the Archdiocese of Metuchen. The 1.25 mile trail traverses meadows, hills, and woodlands, and links to an additional two miles of woodland trails maintained by Hunterdon County on an adjoining parcel of land. A map of the Township-County Trails network is at <http://www.hollandtownshipnj.gov/images/Trails/Musconetcong-Mountain-Preserve-Trail-Map-01-09-18.pdf>
- The Holland Township Department of Public Works and the Township Committee worked with the TREX Corporation to create a **recycling program for plastic bags and plastic films** (see the program flyer at <http://www.hollandtownshipnj.gov/images/notices/2018/recycle-bags.pdf>). The Township installed collection boxes at several locations in the community—sites where residents can deposit plastic grocery bags, cereal box liners, ice bags, Ziploc and other reclosable bags, case overwraps (e.g., from cases of water bottles), newspaper sleeves, dry cleaning bags, etc. The collection & recycling initiative is expected to keep tens of thousands of plastic bags and fillers out of the environment each year.

- **Trees of Holland Township:** The Township EC has launched a program to label trees at the Township’s Riegel Ridge Community Center and at the Holland Park site mentioned above. Plaques attached to trees at the sites will include the common and scientific names of each tree, plus a QR code that will enable smartphone-equipped users to access detailed information about the trees. Go to <http://www.hollandtownshipnj.gov/118-trees-of-holland.html> for to view a sample tree sign with QR code.

Visit the Holland Township Environmental Commission website at <http://www.hollandtownshipnj.gov/14-ec/46-environmental-commission.html>. Please send your questions, comments and suggestions to the EC Secretary at planningboard@hollandtownship.org

Highlands Conformance – Jerry Bowers and Mike Keady. Progress is being made with the Water Use and Conservation Management Plan. The Highlands Council is working on a plan for us to have grant money to work on the Chapter 101 Checklist. The other checklists are being revised which triggered the discussion about a checklist for the newly adopted Chapter 101 Highlands Land Use Ordinance. Chairman Keady is also working with Maser on refining the Environmental Impact Assessment Checklist with input to come from the EC. More information to follow.

Shade Tree and Community Forestry Plan Sub-Committee – Henry Gore (emeritus), David Harrison, Ted Harwick, Dwight Pederson and Maria Elena Jennette Kozak as secretary.

Community Forestry Plan Grant - The Township Committee at the scheduled meeting of December 4, 2018 authorized Mayor Bush to sign the DEP Grant paperwork for the Tree Inventory. The sub-committee had a meeting this evening to review the proposals submitted. David Harrison prepared a comparison for review.

	Farr	Maser	Land Conservancy
years’ experience	14	34	37
certification	certified forester plus	licensed Tree Expert	unknown
Holland experience	forestry plan	ongoing various	none?
other experience	2 inventories	unknown	4 inventories
coverage	200 hours	1125 trees	46 miles of roadway
volunteer plan	hazy, but perhaps best	hazy	hazy
report format	iTree or Excel Spreadsheet	TBD	iTree
info gathered **	not specified	well specified	well specified
depth	questionable (1?)	large*	medium (14)

specificity of experience

good

unknown

good

* the company itself is relatively large, but resources specific to our goals may be limited

**minimum of locaton, species, DBH, condition, maintenance needs

The subcommittee after much deliberation recommends Ron Farr as the consultant for the Tree Identification project. A motion was made by David Harrison and seconded by Jerry Bowers to have Secretary Kozak forward the recommendation of the Environmental Commission to hire Consultant Farr and for this to be on the next scheduled Township Committee meeting of December 18, 2018. All present were in favor of the motion. Motion carried. Secretary Kozak will send all the RFPs received to QPA Bill Hance for review. The subcommittee spent a half hour reviewing RFPs this evening and all present spent 15 minutes discussing the consultants, hiring of Farr, process, looking at roads, etc. Chairman Keady stated that a lot has to be done to move forward and once the consultant is hired that the sub-committee should review the best way to move forward, embrace the inventory and account for volunteer involvement. Discussion also took place about renewing the Community Forestry Plan. Secretary Kozak will email everyone the original plan so that everyone can begin looking at it. The subcommittee will start working on it but help from the Commission is greatly appreciated.

Girl Scout Silver Award - - Elizabeth Tamaro. Nothing new to report.

Inventory on Fauna and Flora subcommittee - David Harrison, Dwight Pederson, Ray Note and Henry Gore (emeritus) –

Inventory on Fauna and Flora subcommittee - David Harrison, Dwight Pederson, Ray Note and Henry Gore (emeritus) David Harrison prepared the Birds of Holland Township List for the website. It is as follows.

Birds of Holland Township; November 2018

This annotated list is based on one of the Environmental Commission member's personal experience in Holland Township from December, 1997 through October, 2018, with some additional data provided through his personal contacts or posted sightings on eBird. (citation: eBird 2018: An online database of bird distribution and abundance [web application]. eBird, Cornell Lab of Ornithology, Ithaca, New York. Available: <https://ebird.org/explore> (Accessed: July 2, 2018), a global database managed by Cornell University's Laboratory of Ornithology.)

Links for additional details about regularly occurring species are from Cornell University's Laboratory of Ornithology "All About Birds" website <https://www.allaboutbirds.org/guide/>.

Definitions and Annotations

Seasonal and Breeding Terminology:

Wintering or Winter Visitor – present December through February (loosely)

Migrant – broadly, a species that does not breed or winter. Migration seasons for birds extend over long periods of time and there are very few times during the year when there is not some bird movement taking place. Spring migration typically begins around the end of February and extends into mid-June. Fall migration is even more protracted, beginning around the middle of July and often extending well into December.

Resident – a species that can be found year-round. Some species are truly resident, with individual birds remaining on or near their territories all year, while other species, while present all year, can be represented by different individual birds at different times of year and may show wide fluctuations in numbers as migrants and wintering individuals augment the local populations

Breeding or Breeder – a species known to breed could be resident or may arrive during spring migration, set up territory, raise 1-3 broods of young and depart again during fall migration. Breeding birds' names are preceded by an asterisk (*) with certainty of breeding based on behaviors that indicate confirmed or probable breeding (these criteria were used during the New Jersey Breeding Bird Atlas project of the 1990's. See 1999 Birds of New Jersey, Walsh, Elia, Kane, Halliwell). Species that have possibly bred (lacking the evidence necessary for confirmation or probable breeding status) or are present during the breeding season but are only known to breed in adjacent jurisdictions have their names preceded by a cross (†).

NJ Threatened and Endangered Species – Species that are on the NJ threatened and endangered list are italicized. If you observe one of these species, please contact the Holland Township Environmental Commission via e-mail at: "planningboard@hollandtownship.org" or notify the NJ DEP Division of Fish and Wildlife by completing a Rare Wildlife Sighting Report Form found at [NJDEP Division of Fish and Wildlife](#).

Frequency Terminology:

Abundant – expected in large numbers on any given visit to appropriate habitat

Common – expected to be found on any given visit to appropriate habitat

Fairly Common – expected to be found in small numbers on most visits to appropriate habitat

Uncommon - expected in small numbers on fewer than half of visits to appropriate habitat

Rare – annual or nearly annual, but seldom found on most visits to appropriate habitat

Very Rare – Few records; not found annually. Includes vagrants, which are very rare statewide.

The species that occur on a regular basis (described as abundant, common, fairly common or uncommon) are presented first. Rare and very rare species are shown at the bottom of the list. If you observe one of these rarities, a species that does not appear on this list or simply wish to provide input regarding this list, please contact the Holland Township Environmental Commission via e-mail at: "planningboard@hollandtownship.org"

Regularly occurring species

* - Breeding birds

† - Only known to breed in adjacent jurisdiction

Bolded and italicized - NJ threatened and endangered list

GEESE AND DUCKS		
Snow Goose	Fairly common to abundant migrant and winter visitor	https://www.allaboutbirds.org/guide/snow_goose
*Canada Goose	Common to abundant year around. May become scarce during severe winters	https://www.allaboutbirds.org/guide/canada_goose
*Wood Duck	Common migrant and breeder. Rare in winter	https://www.allaboutbirds.org/guide/wood_duck https://www.allaboutbirds.org/guide/northern_shoveler
Gadwall	Fairly common migrant and winter visitor	https://www.allaboutbirds.org/guide/gadwall
*Mallard	Common migrant and winter visitor – occasionally abundant. Fairly common breeder.	https://www.allaboutbirds.org/guide/mallard
American Black Duck	Uncommon migrant and winter visitor	https://www.allaboutbirds.org/guide/american_black_duck
Green-winged Teal	Uncommon migrant and winter visitor	https://www.allaboutbirds.org/guide/green-winged_teal
Ring-necked Duck	Fairly common migrant and winter visitor	https://www.allaboutbirds.org/guide/ring-necked_duck
Bufflehead	Fairly common migrant and winter visitor	

Common Goldeneye	Uncommon to rare winter visitor	https://www.allaboutbirds.org/guide/common_goldeneye
†Hooded Merganser	Fairly common migrant and rare winter visitor. Possible very rare breeder along the Musconetcong or Delaware Rivers	https://www.allaboutbirds.org/guide/hooded_merganser
*Common Merganser	Fairly common resident and breeder	https://www.allaboutbirds.org/guide/common_merganser
WILD TURKEY, CORMORANTS AND HERONS		
*Wild Turkey	Fairly common resident and breeder	https://www.allaboutbirds.org/guide/wild_turkey
Double-crested Cormorant	Fairly common to common migrant	https://www.allaboutbirds.org/guide/double-crested_cormorant
† <i>Great Blue Heron</i>	Uncommon resident and possible breeder	https://www.allaboutbirds.org/guide/great_blue_heron
*Green Heron	Fairly common to uncommon migrant and breeder	https://www.allaboutbirds.org/guide/green_heron
HAWKS, VULTURES AND EAGLES		
*Black Vulture	Common to abundant resident and breeder	https://www.allaboutbirds.org/guide/black_vulture
*Turkey Vulture	Common to abundant resident and breeder	https://www.allaboutbirds.org/guide/turkey_vulture
* <i>Osprey</i>	Fairly common migrant and breeder	https://www.allaboutbirds.org/guide/osprey

†Northern Harrier	Uncommon migrant and winter visitor. Possible very rare breeder in summer	https://www.allaboutbirds.org/guide/northern_harrier
Sharp-shinned Hawk	Fairly common migrant and winter visitor. Very rare in summer	https://www.allaboutbirds.org/guide/sharp-shinned_hawk
*Cooper's Hawk	Fairly common migrant and winter visitor. Uncommon breeder	https://www.allaboutbirds.org/guide/coopers_hawk
†Bald Eagle	Fairly common resident. Has bred along the Delaware River on islands in Pennsylvania	https://www.allaboutbirds.org/guide/bald_eagle
†Red-shouldered Hawk	Uncommon to rare migrant and winter visitor. Possible very rare breeder in summer	https://www.allaboutbirds.org/guide/red-shouldered_hawk
†Broad-winged Hawk	Uncommon migrant, but occasionally in large numbers. Possible very rare breeder in summer	https://www.allaboutbirds.org/guide/broad-winged_hawk
*Red-tailed Hawk	– Fairly common resident and breeder	https://www.allaboutbirds.org/guide/red-tailed_hawk
PLOVERS AND SANDPIPERS		
*Killdeer	Fairly common breeder and migrant, occasionally common in late summer and fall. Very rare in winter.	https://www.allaboutbirds.org/guide/killdeer
†American Woodcock	Uncommon migrant and possible rare breeder. Usually undetected unless it is performing courtship display at dusk or dawn	https://www.allaboutbirds.org/guide/american_woodcock
*Spotted Sandpiper	Fairly common migrant and uncommon breeder	https://www.allaboutbirds.org/guide/spotted_sandpiper
Solitary Sandpiper	Fairly common migrant	https://www.allaboutbirds.org/guide/solitary_sandpiper

GULLS		
Ring-billed Gull	Common migrant and winter visitor, occasionally in large numbers	https://www.allaboutbirds.org/guide/ring-billed_gull
Herring Gull	Fairly common migrant and winter visitor	https://www.allaboutbirds.org/guide/herring_gull
Lesser Black-backed Gull	Uncommon migrant and winter visitor	https://www.allaboutbirds.org/guide/lesser_black-backed_gull
PIGEONS, DOVES AND CUCKOOS		
*Rock Pigeon	Common resident and breeder	https://www.allaboutbirds.org/guide/rock_pigeon
*Mourning Dove	Common resident and breeder	https://www.allaboutbirds.org/guide/mourning_dove
*Yellow-billed Cuckoo	Uncommon migrant and breeder	https://www.allaboutbirds.org/guide/yellow-billed_cuckoo
*Black-billed Cuckoo	Uncommon migrant and breeder	https://www.allaboutbirds.org/guide/black-billed_cuckoo
OWLS AND NIGHTJARS		
*Eastern Screech-Owl	Fairly common resident and breeder	https://www.allaboutbirds.org/guide/eastern_screech-owl
*Great Horned Owl	Uncommon resident and breeder	https://www.allaboutbirds.org/guide/great_horned_owl
Common Nighthawk	Uncommon migrant, occasionally in large numbers	https://www.allaboutbirds.org/guide/common_nighthawk
SWIFTS, HUMMINGBIRDS		

AND KINGFISHERS		
*Chimney Swift	Common migrant and breeder	https://www.allaboutbirds.org/guide/chimney_swift
*Ruby-throated Hummingbird	Fairly common migrant and breeder	https://www.allaboutbirds.org/guide/ruby-throated_hummingbird
*Belted Kingfisher	Fairly common migrant and breeder. Uncommon in winter	https://www.allaboutbirds.org/guide/belted_kingfisher
WOODPECKERS		
*Red-bellied Woodpecker	Common resident and breeder	https://www.allaboutbirds.org/guide/red-bellied_woodpecker
Yellow-bellied Sapsucker	Fairly common migrant and winter visitor	https://www.allaboutbirds.org/guide/yellow-bellied_sapsucker
*Downy Woodpecker	Common resident and breeder	https://www.allaboutbirds.org/guide/downy_woodpecker
*Hairy Woodpecker	Fairly common resident and breeder	https://www.allaboutbirds.org/guide/hairy_woodpecker
*Northern Flicker	Common migrant and breeder. Fairly common winter visitor	https://www.allaboutbirds.org/guide/northern_flicker
*Pileated Woodpecker	Uncommon resident and breeder	https://www.allaboutbirds.org/guide/pileated_woodpecker
FALCONS		
*American Kestrel	Fairly common migrant and breeder. Uncommon in winter	https://www.allaboutbirds.org/guide/american_kestrel
Merlin	Uncommon migrant and winter visitor	https://www.allaboutbirds.org/guide/merlin
<i>*Peregrine Falcon</i>	Rare migrant and winter visitor. Confirmed breeder in area adjacent to Holland Township along the Delaware	https://www.allaboutbirds.org/guide/peregrine_falcon

	River	
FLYCATCHERS		
*Eastern Wood-Pewee	Common migrant and breeder	https://www.allaboutbirds.org/guide/eastern_wood-pewee
*Acadian Flycatcher	Uncommon breeder, usually undetected as a migrant	https://www.allaboutbirds.org/guide/acadian_flycatcher
*Willow Flycatcher	Common migrant and breeder	https://www.allaboutbirds.org/guide/willow_flycatcher
Least Flycatcher	Uncommon to rare migrant	https://www.allaboutbirds.org/guide/least_flycatcher
*Eastern Phoebe	Common migrant and breeder	https://www.allaboutbirds.org/guide/eastern_phoebe
*Great Crested Flycatcher	Fairly common migrant and breeder	https://www.allaboutbirds.org/guide/great_crested_flycatcher
*Eastern Kingbird	Common migrant and breeder	https://www.allaboutbirds.org/guide/eastern_kingbird
VIREOS		
*White-eyed Vireo	Rare migrant and uncommon breeder	https://www.allaboutbirds.org/guide/white-eyed_vireo
*Yellow-throated Vireo	Fairly common migrant and breeder	https://www.allaboutbirds.org/guide/yellow-throated_vireo
Blue-headed Vireo	Fairly common migrant	https://www.allaboutbirds.org/guide/blue-headed_vireo
*Warbling Vireo	Common migrant and breeder	https://www.allaboutbirds.org/guide/warbling_vireo
*Red-eyed Vireo	Common migrant and breeder	https://www.allaboutbirds.org/guide/red-eyed_vireo

JAYS AND CROWS (CORVIDS)		
*Blue Jay	Common resident and breeder. Occasionally abundant migrant	https://www.allaboutbirds.org/guide/blue_jay
*American Crow	Common resident and breeder. Occasionally abundant in winter	https://www.allaboutbirds.org/guide/american_crow
*Fish Crow	Fairly common to common migrant and breeder. Uncommon, but increasing as a winter visitor	https://www.allaboutbirds.org/guide/fish_crow
†Common Raven	Uncommon resident and possible breeder. Confirmed breeder in area adjacent to Holland Township along the Delaware River. Increasing.	https://www.allaboutbirds.org/guide/common_raven
SWALLOWS		
*Northern Rough-winged Swallow	Common migrant and breeder	https://www.allaboutbirds.org/guide/northern_rough-winged_swallow
*Tree Swallow	Common to abundant migrant. Common breeder	https://www.allaboutbirds.org/guide/tree_swallow
Bank Swallow	Rare to uncommon migrant	https://www.allaboutbirds.org/guide/bank_swallow
*Barn Swallow	Common migrant and breeder	https://www.allaboutbirds.org/guide/barn_swallow
† <i>Cliff Swallow</i>	Rare to uncommon migrant. Breeds in small numbers under the Milford-Upper Black Eddy bridge	https://www.allaboutbirds.org/guide/cliff_swallow
CHICKADEES, TITMICE, NUTHATCHES AND		

BROWN CREEPER		
†Carolina Chickadee	Rare resident. Difficult to distinguish from more common Black-capped Chickadee. Holland Township is in the hybrid zone for the Black-capped/Carolina Chickadee as well and most birds seen are indistinguishable without very careful observation of plumage and vocalizations.	https://www.allaboutbirds.org/guide/carolina_chickadee
*Black-capped Chickadee	Common resident and breeder, however, see notes above	https://www.allaboutbirds.org/guide/black-capped_chickadee
*Tufted Titmouse	Common resident and breeder	https://www.allaboutbirds.org/guide/tufted_titmouse
Red-breasted Nuthatch	Uncommon migrant and winter visitor, though in some years it is entirely absent and in others, may be common (irruptive migrant)	https://www.allaboutbirds.org/guide/red-breasted_nuthatch
*White-breasted Nuthatch	Fairly common resident and breeder	https://www.allaboutbirds.org/guide/white-breasted_nuthatch
Brown Creeper	Fairly common migrant and winter visitor	https://www.allaboutbirds.org/guide/brown_creeper
WRENS, GNATCATCHER AND KINGLETS		
*House Wren	Common migrant and breeder	https://www.allaboutbirds.org/guide/house_wren
*Winter Wren	Fairly common to uncommon migrant and winter visitor. Rare breeder on hillsides above the Musconetcong Gorge	https://www.allaboutbirds.org/guide/winter_wren

*Carolina Wren	Common resident and breeder	https://www.allaboutbirds.org/guide/carolina_wren
*Blue-gray Gnatcatcher	Common migrant and breeder	https://www.allaboutbirds.org/guide/blue-gray_gnatcatcher
Golden-crowned Kinglet	Common migrant and winter visitor	https://www.allaboutbirds.org/guide/golden-crowned_kinglet
Ruby-crowned Kinglet	Common migrant. Uncommon to rare winter visitor	https://www.allaboutbirds.org/guide/ruby-crowned_kinglet
THRUSHES, BLUEBIRDS AND ROBINS		
*Eastern Bluebird	Common resident and breeder	https://www.allaboutbirds.org/guide/eastern_bluebird
*Veery	Common migrant and breeder	https://www.allaboutbirds.org/guide/veery
Swainson's Thrush	Rare to uncommon migrant	https://www.allaboutbirds.org/guide/swainsons_thrush
Hermit Thrush	Fairly common migrant and winter visitor	https://www.allaboutbirds.org/guide/hermit_thrush
*Wood Thrush	Common migrant and breeder	https://www.allaboutbirds.org/guide/wood_thrush
*American Robin	Common resident and breeder. Often abundant in winter roosts	https://www.allaboutbirds.org/guide/american_robin
MIMIC THRUSHES, STARLING AND WAXWINGS		
*Gray Catbird	Common migrant and breeder.	https://www.allaboutbirds.org/guide/gray_catbird

*Brown Thrasher	Fairly common migrant and breeder	https://www.allaboutbirds.org/guide/brown_thrasher
*Northern Mockingbird	Common resident and breeder	https://www.allaboutbirds.org/guide/northern_mockingbird
*European Starling	Common to abundant resident and breeder	https://www.allaboutbirds.org/guide/european_starling
*Cedar Waxwing	Common resident and breeder, though sometimes absent in winter	https://www.allaboutbirds.org/guide/cedar_waxwing
WARBLERS		
*Ovenbird	Common migrant and breeder	https://www.allaboutbirds.org/guide/ovenbird
*Worm-eating Warbler	Fairly common breeder. Usually undetected as a migrant	https://www.allaboutbirds.org/guide/worm-eating_warbler
*Louisiana Waterthrush	Fairly common breeder. Usually undetected as a migrant	https://www.allaboutbirds.org/guide/louisiana_waterthrush
Northern Waterthrush	Fairly common migrant	https://www.allaboutbirds.org/guide/northern_waterthrush
*Blue-winged Warbler	Fairly common migrant and breeder	https://www.allaboutbirds.org/guide/blue-winged_warbler
*Black-and-White Warbler	Fairly common migrant and breeder	https://www.allaboutbirds.org/guide/black-and-white_warbler
Tennessee Warbler	Rare to uncommon migrant	https://www.allaboutbirds.org/guide/tennessee_warbler
Nashville Warbler	Uncommon migrant	https://www.allaboutbirds.org/guide/nashville_warbler
*Kentucky Warbler	Uncommon to rare breeder. Very rare or undetected as a migrant	https://www.allaboutbirds.org/guide/kentucky_warbler
*Common	Common migrant and breeder	https://www.allaboutbirds.org/guide/co

Yellowthroat		mmon yellowthroat
*Hooded Warbler	Fairly common to uncommon breeder. Usually undetected as a migrant	https://www.allaboutbirds.org/guide/hooded-warbler
*American Redstart	Common migrant. Fairly common breeder	https://www.allaboutbirds.org/guide/american-redstart
Cape May Warbler	Rare to uncommon migrant	https://www.allaboutbirds.org/guide/cape-may-warbler
*Northern Parula	Fairly common to common migrant. Rare breeder	https://www.allaboutbirds.org/guide/northern-parula
Magnolia Warbler	Fairly common migrant	https://www.allaboutbirds.org/guide/magnolia-warbler
Bay-breasted Warbler	Rare to uncommon migrant	https://www.allaboutbirds.org/guide/bay-breasted-warbler
Blackburnian Warbler	Fairly common migrant	https://www.allaboutbirds.org/guide/blackburnian-warbler
*Yellow Warbler	Common migrant and breeder	https://www.allaboutbirds.org/guide/yellow-warbler
*Chestnut-sided Warbler	Common migrant and fairly common breeder	https://www.allaboutbirds.org/guide/chestnut-sided-warbler
Blackpoll Warbler	Fairly common migrant	https://www.allaboutbirds.org/guide/blackpoll-warbler
Black-throated Blue Warbler	Fairly common migrant	https://www.allaboutbirds.org/guide/black-throated-blue-warbler
Palm Warbler	Fairly common migrant	https://www.allaboutbirds.org/guide/palm-warbler
†Pine Warbler	Uncommon to fairly common migrant.	https://www.allaboutbirds.org/guide/pine-warbler

	Possible very rare breeder	e warbler
Yellow-rumped Warbler	Common to abundant migrant. Uncommon in winter	https://www.allaboutbirds.org/guide/yellow-rumped-warbler
*Prairie Warbler	Fairly common migrant and breeder	https://www.allaboutbirds.org/guide/prairie-warbler
Black-throated Green Warbler	Fairly common migrant	https://www.allaboutbirds.org/guide/black-throated-green-warbler
Canada Warbler	Uncommon migrant	https://www.allaboutbirds.org/guide/canada-warbler
Wilson's Warbler	Uncommon migrant	https://www.allaboutbirds.org/guide/wilson-warbler
SPARROWS, JUNCOS AND TOWHEES		
* <i>Grasshopper Sparrow</i>	Rare to uncommon breeder and very rare fall migrant	https://www.allaboutbirds.org/guide/grasshopper-sparrow
American Tree Sparrow	Common winter visitor	https://www.allaboutbirds.org/guide/american-tree-sparrow
*Chipping Sparrow	Common migrant and breeder	https://www.allaboutbirds.org/guide/chipping-sparrow
*Field Sparrow	Common migrant and fairly common breeder	https://www.allaboutbirds.org/guide/field-sparrow
Fox Sparrow	Uncommon migrant and rare winter visitor	https://www.allaboutbirds.org/guide/fox-sparrow
Dark-eyed Junco	Common migrant and winter visitor	https://www.allaboutbirds.org/guide/dark-eyed-junco
White-crowned	Fairly common fall migrant. Rare in	https://www.allaboutbirds.org/guide/white-crowned

Sparrow	spring and uncommon in winter	ite-crowned sparrow
White-throated Sparrow	Common to abundant migrant. Common in winter	https://www.allaboutbirds.org/guide/white-throated_sparrow
<i>*Savannah Sparrow</i>	Fairly common migrant. Rare in winter. Rare breeder in adjacent areas of Alexandria Township and possibly breeds in fields of Holland Township	https://www.allaboutbirds.org/guide/savannah_sparrow
*Song Sparrow	Common to abundant migrant. Fairly common in winter and common breeder	https://www.allaboutbirds.org/guide/song_sparrow
Lincoln's Sparrow	Rare spring migrant and uncommon fall migrant	https://www.allaboutbirds.org/guide/lincolns_sparrow
†Swamp Sparrow	Common migrant. Rare in winter. Possible very rare breeder	https://www.allaboutbirds.org/guide/swamp_sparrow
*Eastern Towhee	Common migrant and fairly common breeder	https://www.allaboutbirds.org/guide/eastern_towhee
TANAGERS, CARDINAL, GROSBEAKS AND BUNTINGS		
*Scarlet Tanager	Common migrant and fairly common breeder	https://www.allaboutbirds.org/guide/scarlet_tanager
*Northern Cardinal	Common resident and breeder	https://www.allaboutbirds.org/guide/northern_cardinal
*Rose-breasted Grosbeak	Common migrant and fairly common breeder	https://www.allaboutbirds.org/guide/rose-breasted_grosbeak
*Indigo Bunting	Common migrant and breeder	https://www.allaboutbirds.org/guide/indigo_bunting
BOBOLINK,		

MEADOWLARK, ORIOLES AND BLACKBIRDS		
* <i>Bobolink</i>	Uncommon migrant and rare breeder	https://www.allaboutbirds.org/guide/bobolink
*Eastern Meadowlark	Rare to uncommon migrant and breeder – formerly more numerous	https://www.allaboutbirds.org/guide/eastern_meadowlark
*Orchard Oriole	Fairly common migrant and breeder	https://www.allaboutbirds.org/guide/orchard_oriole
*Baltimore Oriole	Common migrant and breeder	https://www.allaboutbirds.org/guide/baltimore_oriole
*Red-winged Blackbird	Common to abundant migrant and common breeder. Rare in winter, though spring migrants often arrive in February	https://www.allaboutbirds.org/guide/red-winged_blackbird
*Brown-headed Cowbird	Common migrant and breeder. Uncommon to rare in winter	https://www.allaboutbirds.org/guide/brown-headed_cowbird
Rusty Blackbird	Rare to uncommon migrant and very rare winter visitor	https://www.allaboutbirds.org/guide/rusty_blackbird
*Common Grackle	Common to abundant migrant and common breeder. Uncommon to rare in winter, but spring migrants often arrive in February	https://www.allaboutbirds.org/guide/common_grackle
FINCHES AND HOUSE SPARROW		
*House Finch	Common resident and breeder	https://www.allaboutbirds.org/guide/house_finch
Purple Finch	Uncommon to fairly common migrant and uncommon to rare winter visitor, though in some years it is entirely	https://www.allaboutbirds.org/guide/purple_finch

	absent and in others, may be common (irruptive migrant)	
Pine Siskin	Uncommon migrant and winter visitor, though in some years it is entirely absent and in others, may be common to abundant (irruptive migrant)	https://www.allaboutbirds.org/guide/pine_siskin
*American Goldfinch	Common resident and breeder	https://www.allaboutbirds.org/guide/american_goldfinch
*House Sparrow	Common resident and breeder	https://www.allaboutbirds.org/guide/house_sparrow

RARITIES

Ross's Goose	Very rare migrant and winter visitor (one record)
Greater White	Very rare migrant and winter visitor (2 records)
Brant	very rare migrant (one record)
Cackling Goose	Rare migrant and winter visitor (9 records)
Mute Swan	Rare migrant and winter visitor (13 records)
Tundra Swan	Very rare spring migrant (one record)
Blue-winged Teal	Very rare migrant (2 records)
Northern Shoveler	Very rare migrant and winter visitor (2 records)
American Wigeon	Rare spring migrant and very rare winter visitor (21 records)
Northern Pintail	Rare migrant and winter visitor (19 records)
Canvasback	Very rare spring migrant and winter visitor (6 records)

Redhead	Very rare spring migrant and winter visitor (12 records)
Greater Scaup	Rare spring migrant and winter visitor (10 records)
Lesser Scaup	Rare spring migrant (8 records)
Red-breasted Merganser	Rare spring migrant and very rare winter visitor (12 records)
Northern Bobwhite	Very rare (former?) resident; likely originating from birds released for hunting (3 records)
*Ring-necked Pheasant	Rare to very rare resident; likely originating from birds released for hunting (many records, but only 5 in the past 10 years)
Common Loon	Rare spring migrant (11 records)
<i>Pied-billed Grebe</i>	Rare to very rare migrant and winter visitor (6 records)
Horned Grebe	Very rare spring migrant (one record)
Red-necked Grebe	Very rare migrant and winter visitor (4 records)
Great Cormorant	Very rare migrant and winter visitor (one record)
<i>American Bittern</i>	Very rare spring migrant (2 records)
Great Egret	Rare migrant (14 records)
Little Blue Heron	Very rare warm weather visitor (one record)
Black-crowned Night-Heron	Very rare migrant (4 records)
Glossy Ibis	Very rare warm weather visitor (one record)
Golden Eagle	Very rare fall migrant and winter visitor (2 records)
<i>Northern Goshawk</i>	Very rare migrant (3 records)
Rough-legged Hawk	Very rare winter visitor (4 records)
Virginia Rail	Very rare spring migrant. Possibly undetected due to secretive habits (one record)
Sora	Very rare fall migrant. Possibly undetected due to secretive habits (2 records)

American Coot	Very rare in winter (2 records)
Sandhill Crane –	Very rare fall migrant (one record)
Semipalmated Plover	Very rare spring migrant (one record)
Least Sandpiper	Rare migrant (6 records)
Wilson’s Snipe	Rare migrant and winter visitor (31 records)
Greater Yellowlegs	Very rare migrant (3 records)
Lesser Yellowlegs	Very rare migrant (3 records)
Bonaparte’s Gull	very rare spring migrant (one record)
Iceland Gull –	very rare winter visitor (2 records)
Great Black-backed Gull	Rare winter visitor (13 records)
*Barn Owl	very rare (former?) breeder and year-round resident (2 records)
<i>*Long-eared Owl</i>	Rare winter visitor and possible breeder, though usually undetected due to nocturnal habits (5 records)
<i>Short-eared Owl</i>	Very rare migrant (one record)
Northern Saw-whet Owl	Rare winter visitor, though usually undetected due to nocturnal habits (9 records)
Calliope Hummingbird	very rare visitor (vagrant) (one record over several days)
<i>Red-headed Woodpecker</i>	very rare migrant (2 records)
Crested Caracara	very rare visitor (vagrant) (one record over several days)
Olive-sided Flycatcher	Rare migrant (9 records)
Yellow-bellied Flycatcher	Very rare migrant (2 records)
Alder Flycatcher	Rare migrant (5 records)

Northern Shrike	very rare winter visitor (one record)
Philadelphia Vireo	Rare fall migrant (3 records)
Horned Lark	Very rare winter visitor (3 records)
†Purple Martin	Rare migrant. Breeds in adjacent area of Alexandria Township and birds from that colony occasionally feed in Holland Township (15 records)
Marsh Wren	Very rare fall migrant (4 records)
Gray-cheeked Thrush	Very rare migrant (4 records)
American Pipit	Rare migrant. Very rare in winter (19 records)
Golden-winged Warbler	Very rare migrant (2 records)
*Prothonotary Warbler	Very rare breeder (7 records)
Orange-crowned Warbler – Very rare migrant and winter visitor (3 records)	Very rare migrant and winter visitor (3 records)
Connecticut Warbler –	Very rare fall migrant (2 records)
Mourning Warbler	Very rare migrant (4 records)
*Cerulean Warbler	Rare breeder (formerly?) (20 records)
*Yellow-throated Warbler	Very rare migrant and breeder (13 records)
Nelson’s Sparrow	very rare fall migrant (one record)
Clay-colored Sparrow	Very rare fall migrant (one record)
Vesper Sparrow	Very rare migrant (10 records)
*Yellow-breasted Chat	Rare breeder (formerly) (12 records)
Summer Tanager	very rare warm weather visitor (one record)

†Blue Grosbeak	very rare summer visitor and possible breeder (4 records)
Painted Bunting	very rare winter visitor (vagrant) (one record over several days)
Dickcissel	very rare fall migrant (2 records)
Yellow-headed Blackbird	very rare spring migrant (2 records)
Common Redpoll	very rare winter visitor (irruptive migrant) (3 records)
White-winged Crossbill	very rare winter visitor (irruptive migrant) (one record)
Evening Grosbeak	very rare winter visitor (irruptive migrant) (one record)

After some discussion, all agreed that Secretary Kozak should send it to the Township website. We will have a page similar to our Tree project.

David Harrison also suggested that everyone read the following article.

Opinion Article from The New York Times, November 27, 2018

The Insect Apocalypse Is Here

What does it mean for the rest of life on Earth?

By Brooke Jarvis

Sune Boye Riis was on a bike ride with his youngest son, enjoying the sun slanting over the fields and woodlands near their home north of Copenhagen, when it suddenly occurred to him that something about the experience was amiss. Specifically, something was missing.

It was summer. He was out in the country, moving fast. But strangely, he wasn't eating any bugs.

For a moment, Riis was transported to his childhood on the Danish island of Lolland, in the Baltic Sea. Back then, summer bike rides meant closing his mouth to cruise through thick clouds of insects, but inevitably he swallowed some anyway. When his parents took him driving, he remembered, the car's windshield was frequently so smeared with insect carcasses that you almost couldn't see through it. But all that seemed distant now. He couldn't recall the last time he

needed to wash bugs from his windshield; he even wondered, vaguely, whether car manufacturers had invented some fancy new coating to keep off insects. But this absence, he now realized with some alarm, seemed to be all around him. Where had all those insects gone? And when? And why hadn't he noticed?

Riis watched his son, flying through the beautiful day, not eating bugs, and was struck by the melancholy thought that his son's childhood would lack this particular bug-eating experience of his own. It was, he granted, an odd thing to feel nostalgic about. But he couldn't shake a feeling of loss. "I guess it's pretty human to think that everything was better when you were a kid," he said. "Maybe I didn't like it when I was on my bike and I ate all the bugs, but looking back on it, I think it's something everybody should experience."

I met Riis, a lanky high school science and math teacher, on a hot day in June. He was anxious about not having yet written his address for the school's graduation ceremony that evening, but first, he had a job to do. From his garage, he retrieved a large insect net, drove to a nearby intersection and stopped to strap the net to the car's roof. Made of white mesh, the net ran the length of his car and was held up by a tent pole at the front, tapering to a small, removable bag in back. Drivers whizzing past twisted their heads to stare. Riis eyed his parking spot nervously as he adjusted the straps of the contraption. "This is not 100 percent legal," he said, "but I guess, for the sake of science."

Riis had not been able to stop thinking about the missing bugs. The more he learned, the more his nostalgia gave way to worry. Insects are the vital pollinators and recyclers of ecosystems and the base of food webs everywhere. Riis was not alone in noticing their decline. In the United States, scientists recently found the population of monarch butterflies fell by 90 percent in the last 20 years, a loss of 900 million individuals; the rusty-patched bumblebee, which once lived in 28 states, dropped by 87 percent over the same period. With other, less-studied insect species, one butterfly researcher told me, "all we can do is wave our arms and say, 'It's not here anymore!'" Still, the most disquieting thing wasn't the disappearance of certain species of insects; it was the deeper worry, shared by Riis and many others, that a whole insect world might be quietly going missing, a loss of abundance that could alter the planet in unknowable ways. "We notice the losses," says David Wagner, an entomologist at the University of Connecticut. "It's the diminishment that we don't see."

Because insects are legion, inconspicuous and hard to meaningfully track, the fear that there might be far fewer than before was more felt than documented. People noticed it by canals or in backyards or under streetlights at night — familiar places that had become unfamiliarly empty. The feeling was so common that entomologists developed a shorthand for it, named for the way many people first began to notice that they weren't seeing as many bugs. They called it the windshield phenomenon.

To test what had been primarily a loose suspicion of wrongness, Riis and 200

other Danes were spending the month of June roaming their country's back roads in their outfitted cars. They were part of a study conducted by the Natural History Museum of Denmark, a joint effort of the University of Copenhagen, Aarhus University and North Carolina State University. The nets would stand in for windshields as Riis and the other volunteers drove through various habitats — urban areas, forests, agricultural tracts, uncultivated open land and wetlands — hoping to quantify the disorienting sense that, as one of the study's designers put it, "something from the past is missing from the present."

When the investigators began planning the study in 2016, they weren't sure if anyone would sign up. But by the time the nets were ready, a paper by an obscure German entomological society had brought the problem of insect decline into sharp focus. The German study found that, measured simply by weight, the overall abundance of flying insects in German nature reserves had decreased by 75 percent over just 27 years. If you looked at midsummer population peaks, the drop was 82 percent.

Riis learned about the study from a group of his students in one of their class projects. They must have made some kind of mistake in their citation, he thought. But they hadn't. The study would quickly become, according to the website Altmetric, the sixth-most-discussed scientific paper of 2017. Headlines around the world warned of an "insect Armageddon."

Within days of announcing the insect-collection project, the Natural History Museum of Denmark was turning away eager volunteers by the dozens. It seemed there were people like Riis everywhere, people who had noticed a change but didn't know what to make of it. How could something as fundamental as the bugs in the sky just disappear? And what would become of the world without them?

Anyone who has returned to a childhood haunt to find that everything somehow got smaller knows that humans are not great at remembering the past accurately. This is especially true when it comes to changes to the natural world. It is impossible to maintain a fixed perspective, as Heraclitus observed 2,500 years ago: It is not the same river, but we are also not the same people.

A 1995 study, by Peter H. Kahn and Batya Friedman, of the way some children in Houston experienced pollution summed up our blindness this way: "With each generation, the amount of environmental degradation increases, but each generation takes that amount as the norm." In decades of photos of fishermen holding up their catch in the Florida Keys, the marine biologist Loren McClenahan found a perfect illustration of this phenomenon, which is often called "shifting baseline syndrome." The fish got smaller and smaller, to the point where the prize catches were dwarfed by fish that in years past were piled up and ignored. But the smiles on the fishermen's faces stayed the same size. The world never feels fallen, because we grow accustomed to the fall.

By one measure, bugs are the wildlife we know best, the nondomesticated animals whose lives intersect most intimately with our own: spiders in the shower, ants at the picnic, ticks buried in the skin. We sometimes feel that we know them rather too well. In another sense, though, they are one of our planet's greatest mysteries, a reminder of how little we know about what's happening in the world around us.

We've named and described a million species of insects, a stupefying array of thrips and firebrats and antlions and caddis flies and froghoppers and other enormous families of bugs that most of us can't even name. (Technically, the word "bug" applies only to the order Hemiptera, also known as true bugs, species that have tubelike mouths for piercing and sucking — and there are as many as 80,000 named varieties of those.) The ones we think we do know well, we don't: There are 12,000 types of ants, nearly 20,000 varieties of bees, almost 400,000 species of beetles, so many that the geneticist J.B.S. Haldane reportedly quipped that God must have an inordinate fondness for them. A bit of healthy soil a foot square and two inches deep might easily be home to 200 unique species of mites, each, presumably, with a subtly different job to do. And yet entomologists estimate that all this amazing, absurd and understudied variety represents perhaps only 20 percent of the actual diversity of insects on our planet — that there are millions and millions of species that are entirely unknown to science.

With so much abundance, it very likely never occurred to most entomologists of the past that their multitudinous subjects might dwindle away. As they poured themselves into studies of the life cycles and taxonomies of the species that fascinated them, few thought to measure or record something as boring as their number. Besides, tracking quantity is slow, tedious and unglamorous work: setting and checking traps, waiting years or decades for your data to be meaningful, grappling with blunt baseline questions instead of more sophisticated ones. And who would pay for it? Most academic funding is short-term, but when what you're interested in is invisible, generational change, says Dave Goulson, an entomologist at the University of Sussex, "a three-year monitoring program is no good to anybody." This is especially true of insect populations, which are naturally variable, with wide, trend-obscuring fluctuations from one year to the next. When entomologists began noticing and investigating insect declines, they lamented the absence of solid information from the past in which to ground their experiences of the present. "We see a hundred of something, and we think we're fine," Wagner says, "but what if there were 100,000 two generations ago?" Rob Dunn, an ecologist at North Carolina State University who helped design the net experiment in Denmark, recently searched for studies showing the effect of pesticide spraying on the quantity of insects living in nearby forests. He was surprised to find that no such studies existed. "We ignored really basic questions," he said. "It feels like we've dropped the ball in some giant collective way."

If entomologists lacked data, what they did have were some very worrying clues. Along with the impression that they were seeing fewer bugs in their own jars and nets while out doing experiments — a windshield phenomenon specific to the sorts of people who have bug jars and nets — there were documented downward slides of well-studied bugs, including various kinds of bees, moths, butterflies and beetles. In Britain, as many as 30 to 60 percent of species were found to have diminishing ranges. Larger trends were harder to pin down, though a 2014 review in *Science* tried to quantify these declines by synthesizing the findings of existing studies and found that a majority of monitored species were declining, on average by 45 percent.

Entomologists also knew that climate change and the overall degradation of global habitat are bad news for biodiversity in general, and that insects are dealing with the particular challenges posed by herbicides and pesticides, along with the effects of losing meadows, forests and even weedy patches to the relentless expansion of human spaces. There were studies of other, better-understood species that suggested that the insects associated with them might be declining, too. People who studied fish found that the fish had fewer mayflies to eat. Ornithologists kept finding that birds that rely on insects for food were in trouble: eight in 10 partridges gone from French farmlands; 50 and 80 percent drops, respectively, for nightingales and turtledoves. Half of all farmland birds in Europe disappeared in just three decades. At first, many scientists assumed the familiar culprit of habitat destruction was at work, but then they began to wonder if the birds might simply be starving. In Denmark, an ornithologist named Anders Tottrup was the one who came up with the idea of turning cars into insect trackers for the windshield-effect study after he noticed that rollers, little owls, Eurasian hobbies and bee-eaters — all birds that subsist on large insects such as beetles and dragonflies — had abruptly disappeared from the landscape.

The signs were certainly alarming, but they were also just signs, not enough to justify grand pronouncements about the health of insects as a whole or about what might be driving a widespread, cross-species decline. “There are no quantitative data on insects, so this is just a hypothesis,” Hans de Kroon, an ecologist at Radboud University in the Netherlands, explained to me — not the sort of language that sends people to the barricades.

Then came the German study. Scientists are still cautious about what the findings might imply about other regions of the world. But the study brought forth exactly the kind of longitudinal data they had been seeking, and it wasn’t specific to just one type of insect. The numbers were stark, indicating a vast impoverishment of an entire insect universe,

even in protected areas where insects ought to be under less stress. The speed and scale of the drop were shocking even to entomologists who were already anxious about bees or fireflies or the cleanliness of car windshields.

The results were surprising in another way too. The long-term details about insect abundance, the kind that no one really thought existed, hadn't appeared in a particularly prestigious journal and didn't come from university-affiliated scientists, but from a small society of insect enthusiasts based in the modest German city Krefeld.

Krefeld sits a half-hour drive outside Düsseldorf, near the western bank of the Rhine. It's a city of brick houses and bright flower gardens and a stadtwald — a municipal forest and park — where paddle boats float on a lake, umbrellas shade a beer garden and (I couldn't help noticing) the afternoon light through the trees illuminates small swarms of dancing insects.

Near the center of the old city, a paper sign, not much larger than a business card, identifies the stolid headquarters of the society whose research caused so much commotion. When it was founded, in 1905, the society operated out of another building, one that was destroyed when Britain bombed the city during World War II. (By the time the bombs fell, members had moved their precious records and collections of insects, some of which dated back to the 1860s, to an underground bunker.) Nowadays, the society uses more than 6,000 square feet of an old three-story school as storage space. Ask for a tour of the collections, and you will hear such sentences as "This whole room is Lepidoptera," referring to a former classroom stuffed with what I at first took to be shelves of books but which are in fact innumerable wooden frames containing pinned butterflies and moths; and, in an even larger room, "every bumblebee here was collected before the Second World War, 1880 to 1930"; and, upon opening a drawer full of sweat bees, "It's a new collection, 30 years only."

On the shelves that do hold books, I counted 31 clearly well-loved volumes in the series "Beetles of Middle Europe." A 395-page book that cataloged specimens of spider wasps — where they were collected; where they were stored — of the western Palearctic said "1948-2008" on the cover. I asked my guide, a society member named Martin Sorg, who was one of the lead authors of the paper, whether those dates reflected when the specimens were collected. "No," Sorg replied, "that was the time the author needed for this work."

Sorg, who rolls his own cigarettes and wears John Lennon glasses and whose gray hair grows long past his shoulders, is not a freewheeling type when it comes to his insect work. And his insect work is really all he wants to talk about. "We think details about nature and biodiversity declines are important, not details about life histories of entomologists," Sorg explained after he and Werner Stenmans, a society member whose name appeared alongside Sorg's on the 2017 paper, dismissed my questions about their day jobs. Leery of an article that focused on him as a person, Sorg also didn't want to talk about what drew him to entomology as a child or even what it was about certain types of wasps that had made him want to devote so much of his life to studying them. "We normally give life

histories when someone is dead," he said.

There was a reason for the wariness. Society members dislike seeing themselves described, over and over in news stories, as "amateurs." It's a framing that reflects, they believe, a too-narrow understanding of what it means to be an expert or even a scientist — what it means to be a student of the natural world.

Amateurs have long provided much of the patchy knowledge we have about nature. Those bee and butterfly studies? Most depend on mass mobilizations of volunteers willing to walk transects and count insects, every two weeks or every year, year after year. The scary numbers about bird declines were gathered this way, too, though because birds can be hard to spot, volunteers often must learn to identify them by their sounds. Britain, which has a particularly strong tradition of amateur naturalism, has the best-studied bugs in the world. As technologically advanced as we are, the natural world is still a very big and complex place, and the best way to learn what's going on is for a lot of people to spend a lot of time observing it. The Latin root of the word "amateur" is, after all, the word "lover."

Some of these citizen-scientists are true beginners clutching field

guides; others, driven by their own passion and following in a long tradition of "amateur" naturalism, are far from novices. Think of Victorians with their butterfly nets and curiosity cabinets; of Vladimir Nabokov, whose theories about the evolution of *Polyommatus* blue butterflies were ignored until proved correct by DNA testing more than 30 years after his death; of young Charles Darwin, cutting his classes at Cambridge to collect beetles at Wicken Fen and once putting a live beetle in his mouth because his hands were already full of other bugs.

The Krefeld society is volunteer-run, and many members have other jobs in unrelated fields, but they also have an enormous depth of knowledge about insects, accumulated through years of what other people might consider obsessive attention. Some study the ecology or evolutionary taxonomy of their favorite species or map their populations or breed them to study their life histories. All hone their identification skills across species by amassing their own collections of carefully pinned and labeled insects like those that fill the society's storage rooms. Sorg estimated that of the society's 63 members, a third are university-trained in subjects such as biology or earth science. Another third, he said, are "highly specialized and highly qualified but they never visited the university," while the remaining third are actual amateurs who are still in the process of becoming "real" entomologists: "Some of them may also have a degree from the university, but in our view, they are beginners."

The society members' projects often involved setting up what are called malaise traps, nets that look like tents and drive insects flying by into bottles of ethanol. Because of the scientific standards of the society, members followed certain procedures: They always employed identical traps, sewn from a template they first used in 1982. (Sorg showed me the original rolled-up craft paper with great

solemnity.) They always put them in the same places. (Before GPS, that meant a painstaking process of triangulating with surveying equipment. "We are not sure about a few centimeters," Sorg granted.) They saved everything they caught, regardless of what the main purpose of the experiment was. (The society bought so much ethanol that it attracted the attention of a narcotics unit.)

Those bottles of insects were gathered into thousands of boxes, which are now crammed into what were once offices in the upper reaches of the school. When the society members, like entomologists elsewhere, began to notice that they were seeing fewer insects, they had something against which to measure their worries.

"We don't throw away anything, we store everything," Sorg explained. "That gives us today the possibility to go back in time."

In 2013, Krefeld entomologists confirmed that the total number of insects caught in one nature reserve was nearly 80 percent lower than the same spot in 1989. They had sampled other sites, analyzed old data sets and found similar declines: Where 30 years earlier, they often needed a liter bottle for a week of trapping, now a half-liter bottle usually sufficed. But it would have taken even highly trained entomologists years of painstaking work to identify all the insects in the bottles. So the society used a standardized method for weighing insects in alcohol, which told a powerful story simply by showing how much the overall mass of insects dropped over time. "A decline of this mixture," Sorg said, "is a very different thing than the decline of only a few species."

The society collaborated with de Kroon and other scientists at Radboud University in the Netherlands, who did a trend analysis of the data that Krefeld provided, controlling for things like the effects of nearby plants, weather and forest cover on fluctuations in insect populations. The final study looked at 63 nature preserves, representing almost 17,000 sampling days, and found consistent declines in every kind of habitat they sampled. This suggested, the authors wrote, "that it is not only the vulnerable species but the flying-insect community as a whole that has been decimated over the last few decades."

For some scientists, the study created a moment of reckoning. "Scientists thought this data was too boring," Dunn says. "But these people found it beautiful, and they loved it. They were the ones paying attention to Earth for all the rest of us." The current worldwide loss of biodiversity is popularly known as the sixth extinction: the sixth time in world history that a large number of species have disappeared in unusually rapid succession, caused this time not by asteroids or ice ages but by humans. When we think about losing biodiversity, we tend to think of the last northern white rhinos protected by armed guards, of polar bears on dwindling ice floes. Extinction is a visceral tragedy, universally understood: There is no coming back from it. The guilt of letting a unique species vanish is eternal.

But extinction is not the only tragedy through which we're living. What about the species that still exist, but as a shadow of what they once were? In "The Once and

Future World,” the journalist J.B. MacKinnon cites records from recent centuries that hint at what has only just been lost: “In the North Atlantic, a school of cod stalls a tall ship in midocean; off Sydney, Australia, a ship’s captain sails from noon until sunset through pods of sperm whales as far as the eye can see. ... Pacific pioneers complain to the authorities that splashing salmon threaten to swamp their canoes.” There were reports of lions in the south of France, walruses at the mouth of the Thames, flocks of birds that took three days to fly overhead, as many as 100 blue whales in the Southern Ocean for every one that’s there now. “These are not sights from some ancient age of fire and ice,” MacKinnon writes. “We are talking about things seen by human eyes, recalled in human memory.”

What we’re losing is not just the diversity part of biodiversity, but the bio part: life in sheer quantity. While I was writing this article, scientists learned that the world’s largest king penguin colony shrank by 88 percent in 35 years, that more than 97 percent of the bluefin tuna that once lived in the ocean are gone. The number of Sophie the Giraffe toys sold in France in a single year is nine times the number of all the giraffes that still live in Africa.

Finding reassurance in the survival of a few symbolic standard-bearers ignores the value of abundance, of a natural world that thrives on richness and complexity and interaction. Tigers still exist, for example, but that doesn’t change the fact that 93 percent of the land where they used to live is now tigerless. This matters for more than romantic reasons: Large animals, especially top predators like tigers, connect ecosystems to one another and move energy and resources among them simply by walking and eating and defecating and dying. (In the deep ocean, sunken whale carcasses form the basis of entire ecosystems in nutrient-poor places.) One result of their loss is what’s known as trophic cascade, the unraveling of an ecosystem’s fabric as prey populations boom and crash and the various levels of the food web no longer keep each other in check. These places are emptier, impoverished in a thousand subtle ways.

Scientists have begun to speak of functional extinction (as opposed to the more familiar kind, numerical extinction). Functionally extinct animals and plants are still present but no longer prevalent enough to affect how an ecosystem works. Some phrase this as the extinction not of a species but of all its former interactions with its environment — an extinction of seed dispersal and predation and pollination and all the other ecological functions an animal once had, which can be devastating even if some individuals still persist. The more interactions are lost, the more disordered the ecosystem becomes. A 2013 paper in Nature, which modeled both natural and computer-generated food webs, suggested that a loss of even 30 percent of a species’ abundance can be so destabilizing that other species start going fully, numerically extinct — in fact, 80 percent of the time it was a secondarily affected creature that was the first to disappear. A famous real-world example of this type of cascade concerns sea otters. When they were nearly wiped out in the northern Pacific, their prey, sea urchins, ballooned in number and decimated kelp forests, turning a rich environment into a barren one and also

possibly contributing to numerical extinctions, notably of the Steller's sea cow.

Conservationists tend to focus on rare and endangered species, but it is common ones, because of their abundance, that power the living systems of our planet. Most species are not common, but within many animal groups most individuals — some 80 percent of them — belong to common species. Like the slow approach of twilight, their declines can be hard to see. White-rumped vultures were nearly gone from India before there was widespread awareness of their disappearance. Describing this phenomenon in the journal *BioScience*, Kevin Gaston, a professor of biodiversity and conservation at the University of Exeter, wrote: "Humans seem innately better able to detect the complete loss of an environmental feature than its progressive change."

In addition to extinction (the complete loss of a species) and extirpation (a localized extinction), scientists now speak of defaunation: the loss of individuals, the loss of abundance, the loss of a place's absolute animalness. In a 2014 article in *Science*, researchers argued that the word should become as familiar, and influential, as the concept of deforestation. In 2017 another paper reported that major population and range losses extended even to species considered to be at low risk for extinction. They predicted "negative cascading consequences on ecosystem functioning and services vital to sustaining civilization" and the authors offered another term for the widespread loss of the world's wild fauna: "biological annihilation."

It is estimated that, since 1970, Earth's various populations of wild land animals have lost, on average, 60 percent of their members. Zeroing in on the category we most relate to, mammals, scientists believe that for every six wild creatures that once ate and burrowed and raised young, only one remains. What we have instead is ourselves. A study published this year in the *Proceedings of the National Academy of Sciences* found that if you look at the world's mammals by weight, 96 percent of that biomass is humans and livestock; just 4 percent is wild animals.

We've begun to talk about living in the Anthropocene, a world shaped by humans. But E.O. Wilson, the naturalist and prophet of environmental degradation, has suggested another name: the Eremocene, the age of loneliness.

Wilson began his career as a taxonomic entomologist, studying ants. Insects — about as far as you can get from charismatic megafauna — are not what we're usually imagining when we talk about biodiversity. Yet they are, in Wilson's words, "the little things that run the natural world." He means it literally. Insects are a case study in the invisible importance of the common.

Scientists have tried to calculate the benefits that insects provide simply by going about their business in large numbers. Trillions of bugs flitting from flower to flower pollinate some three-quarters of our food crops, a service worth as much as \$500 billion every year. (This doesn't count the 80 percent of wild flowering

plants, the foundation blocks of life everywhere, that rely on insects for pollination.) If monetary calculations like that sound strange, consider the Maoxian Valley in China, where shortages of insect pollinators have led farmers to hire human workers, at a cost of up to \$19 per worker per day, to replace bees. Each person covers five to 10 trees a day, pollinating apple blossoms by hand.

By eating and being eaten, insects turn plants into protein and power the growth of all the uncountable species — including freshwater fish and a majority of birds — that rely on them for food, not to mention all the creatures that eat those creatures. We worry about saving the grizzly bear, says the insect ecologist Scott Hoffman Black, but where is the grizzly without the bee that pollinates the berries it eats or the flies that sustain baby salmon? Where, for that matter, are we?

Bugs are vital to the decomposition that keeps nutrients cycling, soil healthy, plants growing and ecosystems running. This role is mostly invisible, until suddenly it's not. After introducing cattle to Australia at the turn of the 19th century, settlers soon found themselves overwhelmed by the problem of their feces: For some reason, cow pies there were taking months or even years to decompose. Cows refused to eat near the stink, requiring more and more land for grazing, and so many flies bred in the piles that the country became famous for the funny hats that stockmen wore to keep them at bay. It wasn't until 1951 that a visiting entomologist realized what was wrong: The local insects, evolved to eat the more fibrous waste of marsupials, couldn't handle cow excrement. For the next 25 years, the importation, quarantine and release of dozens of species of dung beetles became a national priority. And that was just one unfilled niche. (In the United States, dung beetles save ranchers an estimated \$380 million a year.) We simply don't know everything that insects do. Only about 2 percent of invertebrate species have been studied enough for us to estimate whether they are in danger of extinction, never mind what dangers that extinction might pose.

When asked to imagine what would happen if insects were to disappear completely, scientists find words like chaos, collapse, Armageddon. Wagner, the University of Connecticut entomologist, describes a flowerless world with silent forests, a world of dung and old leaves and rotting carcasses accumulating in cities and roadsides, a world of "collapse or decay and erosion and loss that would spread through ecosystems" — spiraling from predators to plants. E.O. Wilson has written of an insect-free world, a place where most plants and land animals become extinct; where fungi explodes, for a while, thriving on death and rot; and where "the human species survives, able to fall back on wind-pollinated grains and marine fishing" despite mass starvation and resource wars. "Clinging to survival in a devastated world, and trapped in an ecological dark age," he adds, "the survivors would offer prayers for the return of weeds and bugs." But the crux of the windshield phenomenon, the reason that the creeping suspicion of change is so creepy, is that insects wouldn't have to disappear altogether for us to find ourselves missing them for reasons far beyond nostalgia. In October, an entomologist sent me an email with the subject line, "Holy

[expletive]!” and an attachment: a study just out from Proceedings of the National Academy of Sciences that he labeled, “Krefeld comes to Puerto Rico.” The study included data from the 1970s and from the early 2010s, when a tropical ecologist named Brad Lister returned to the rain forest where he had studied lizards — and, crucially, their prey — 40 years earlier. Lister set out sticky traps and swept nets across foliage in the same places he had in the 1970s, but this time he and his co-author, Andres Garcia, caught much, much less: 10 to 60 times less arthropod biomass than before. (It’s easy to read that number as 60 percent less, but it’s sixtyfold less: Where once he caught 473 milligrams of bugs, Lister was now catching just eight milligrams.) “It was, you know, devastating,” Lister told me. But even scarier were the ways the losses were already moving through the ecosystem, with serious declines in the numbers of lizards, birds and frogs. The paper reported “a bottom-up trophic cascade and consequent collapse of the forest food web.” Lister’s inbox quickly filled with messages from other scientists, especially people who study soil invertebrates, telling him they were seeing similarly frightening declines. Even after his dire findings, Lister found the losses shocking: “I didn’t even know about the earthworm crisis!”

The strange thing, Lister said, is that, as staggering as they are, all the declines he documented would still be basically invisible to the average person walking through the Luquillo rain forest. On his last visit, the forest still felt “timeless” and “phantasmagorical,” with “cascading waterfalls and carpets of flowers.” You would have to be an expert to notice what was missing. But he expects the losses to push the forest toward a tipping point, after which “there is a sudden and dramatic loss of the rain-forest system,” and the changes will become obvious to anyone. The place he loves will become unrecognizable.

The insects in the forest that Lister studied haven’t been contending with pesticides or habitat loss, the two problems to which the Krefeld paper pointed. Instead, Lister chalks up their decline to climate change, which has already increased temperatures in Luquillo by two degrees Celsius since Lister first sampled there. Previous research suggested that tropical bugs will be unusually sensitive to temperature changes; in November, scientists who subjected laboratory beetles to a heat wave reported that the increased temperatures made them significantly less fertile. Other scientists wonder if it might be climate-induced drought or possibly invasive rats or simply “death by a thousand cuts” — a confluence of many kinds of changes to the places where insects once thrived.

Like other species, insects are responding to what Chris Thomas, an insect ecologist at the University of York, has called “the transformation of the world”: not just a changing climate but also the widespread conversion, via urbanization, agricultural intensification and so on, of natural spaces into human ones, with fewer and fewer resources “left over” for nonhuman creatures to live on. What resources remain are often contaminated. Hans de Kroon characterizes the life of many modern insects as trying to survive from one dwindling oasis to the next but with “a desert in between, and at worst it’s a poisonous desert.” Of particular

concern are neonicotinoids, neurotoxins that were thought to affect only treated crops but turned out to accumulate in the landscape and to be consumed by all kinds of nontargeted bugs. People talk about the “loss” of bees to colony collapse disorder, and that appears to be the right word: Affected hives aren’t full of dead bees, but simply mysteriously empty. A leading theory is that exposure to neurotoxins leaves bees unable to find their way home. Even hives exposed to low levels of neonicotinoids have been shown to collect less pollen and produce fewer eggs and far fewer queens. Some recent studies found bees doing better in cities than in the supposed countryside.

The diversity of insects means that some will manage to make do in new environments, some will thrive (abundance cuts both ways: agricultural monocultures, places where only one kind of plant grows, allow some pests to reach population levels they would never achieve in nature) and some, searching for food and shelter in a world nothing like the one they were meant for, will fail. While we need much more data to better understand the reasons or mechanisms behind the ups and downs, Thomas says, “the average across all species is still a decline.”

Since the Krefeld study came out, researchers have begun searching for other forgotten repositories of information that might offer windows into the past. Some of the Radboud researchers have analyzed long-term data, belonging to Dutch entomological societies, about beetles and moths in certain reserves; they found significant drops (72 percent, 54 percent) that mirrored the Krefeld ones. Roel van Klink, a researcher at the German Center for Integrative Biodiversity Research, told me that before Krefeld, he, like most entomologists, had never been interested in biomass. Now he is looking for historical data sets — many of which began as studies of agricultural pests, like a decades-long study of grasshoppers in Kansas — that could help create a more thorough picture of what’s happening to creatures that are at once abundant and imperiled. So far he has found forgotten data from 140 old data sets for 1,500 locations that could be resampled.

In the United States, one of the few long-term data sets about insect abundance comes from the work of Arthur Shapiro, an entomologist at the University of California, Davis. In 1972, he began walking transects in the Central Valley and the Sierras, counting butterflies. He planned to do a study on how short-term weather variations affected butterfly populations. But the longer he sampled, the more valuable his data became, offering a signal through the noise of seasonal ups and downs. “And so here I am in Year 46,” he said, nearly half a century of spending five days a week, from late spring to the end of autumn, observing butterflies. In that time he has watched overall numbers decline and seen some species that used to be everywhere — even species that “everyone regarded as a junk species” only a few decades ago — all but disappear. Shapiro believes that Krefeld-level declines are likely to be happening all over the globe. “But, of course, I don’t cover the entire globe,” he added. “I cover I-80.”

There are also new efforts to set up more of the kind of insect-monitoring schemes researchers wish had existed decades ago, so that our current level of fallenness, at least, is captured. One is a pilot project in Germany similar to the Danish car study. To analyze what is caught, the researchers turned to volunteer naturalists, hobbyists similar to the ones in Krefeld, with the necessary breadth of knowledge to know what they're looking at. "These are not easy species to identify," says Aletta Bonn, of the German Center for Integrative Biodiversity Research, who is overseeing the project. (The skills required for such work "are really extreme," Dunn says. "These people train for decades with other amateurs to be able to identify beetles based on their genitalia.") Bonn would like to pay the volunteers for their expertise, she says, but funding hasn't caught up to the crisis. That didn't stop the "amateurs" from being willing to help: "They said, 'We're just curious what's in there, we would like to have samples.'"

Goulson says that Europe's tradition of amateur naturalism may account for why so many of the clues to the falloff in insect biodiversity originate there. (Tottrup's design for the car net in Denmark, for example, was itself adapted from the invention of a dedicated beetle-collecting hobbyist.) As little as we know about the status of European bugs, we know significantly less about other parts of the world. "We wouldn't know anything if it weren't for them," the so-called amateurs, Goulson told me. "We'd be entirely relying on the fact that there's no bugs on the windshield."

Thomas believes that this naturalist tradition is also why Europe is acting much faster than other places — for example, the United States — to address the decline of insects: Interest leads to tracking, which leads to awareness, which leads to concern, which leads to action. Since the Krefeld data emerged, there have been hearings about protecting insect biodiversity in the German Bundestag and the European Parliament. European Union member states voted to extend a ban on neonicotinoid pesticides and have begun to put money toward further studies of how abundance is changing, what is causing those changes and what can be done. When I knocked on the door of de Kroon's office, at Radboud University in the Dutch city Nijmegen, he was looking at some photos from another meeting he had that day: Willem-Alexander, the king of the Netherlands, had taken a tour of the city's efforts to make its riverside a friendlier habitat for bugs.

Stemming insect declines will require much more than this, however. The European Union already had some measures in place to help pollinators — including more strictly regulating pesticides than the United States does and paying farmers to create insect habitats by leaving fields fallow and allowing for wild edges alongside cultivation — but insect populations dropped anyway. New reports call for national governments to collaborate; for more creative approaches such as integrating insect habitats into the design of roads, power lines, railroads and other infrastructure; and, as always, for more studies. The necessary changes, like the causes, may be profound. "It's just another indication that we're destroying the life-support system of the planet," Lister says of the Puerto Rico

study. "Nature's resilient, but we're pushing her to such extremes that eventually it will cause a collapse of the system."

Scientists hope that insects will have a chance to embody that resilience. While tigers tend to give birth to three or four cubs at a time, a ghost moth in Australia was once recorded laying 29,100 eggs, and she still had 15,000 in her ovaries. The fecund abundance that is insects' singular trait should enable them to recover, but only if they are given the space and the opportunity to do so.

"It's a debate we need to have urgently," Goulson says. "If we lose insects, life on earth will. ..." He trailed off, pausing for what felt like a long time.

In Denmark, Sune Boye Riis's transect with his car net took him past a bit of woods, some suburban lawns, some hedges, a Christmas-tree farm. The closest thing to a meadow that we passed was a large military property, on which the grass had been allowed to grow tall and golden. Riis had received instructions not to drive too fast, so traffic backed up behind us, and some people began to honk. "Well," Riis said, "so much for science." After three miles, he turned around and drove back toward the start. His windshield stayed mockingly clean.

Riis had four friends who were also participating in the study. They had a bet going among them: Who would net the biggest bug? "I'm way behind," Riis said. "A bumblebee is in the lead." His biggest catch? "A fly. Not even a big one."

At the end of the transect, Riis stopped at another parlous roadside spot, unfastened the net and removed the small bag at its tip. Some volunteers, captivated by what the study revealed about the world around them, asked the organizers for extra specimen bags, so they could do more sampling on their own. Some even asked if they could buy the entire car-net apparatus. Riis, though, was content to peer through the mesh, inside of which he could make out a number of black specks of varying tininess.

There was also a single butterfly, white-winged and delicate. Riis thought of the bet with his friends, for which the meaning of bigness had not been defined. He wondered how it might be reckoned. What gave a creature value?

"Is it weight?" he asked, staring down at the butterfly. In the big bag, it looked small and sad and alone. "Or is it grace?"

Tree City USA program –Ray Note handed out information on how to write a tree ordinance and the same sample City Tree Ordinance as last month.

should be designed to fit its specific needs.

**SAMPLE
CITY
TREE ORDINANCE**

Be it ordained by the City Commission of the City of:

(City) _____

(State) _____

Section 1. Definitions

Street trees: "Street trees" are herein defined as trees, shrubs, bushes, and all other woody vegetation on land lying between property lines on either side of all streets, avenues, or ways within the City.

Park Trees: "Park trees" are herein defined as trees, shrubs, bushes and all other woody vegetation in public parks having individual names, and all areas owned by the City, or to which the public has free access as a park.

Section 2. Creation and Establishment of a City Tree Board

There is hereby created and established a City Tree Board for the City of:

(City) _____

(State) _____

which shall consist of five members, citizens and residents of this city, who shall be appointed by the mayor with the approval of the Commission.

Section 3. Term of Office

The term of the five persons to be appointed by the mayor shall be three years except that the term of two of the members appointed to the first board shall be for only one year and the term of two members of the first board shall be for two years. In the event that a vacancy shall occur during the term of any member, his successor shall be appointed for the unexpired portion of the term.

Section 4. Compensation

Members of the board shall serve without compensation.

Section 5, Duties and Responsibilities

It shall be the responsibility of the Board to study, investigate, council and develop and/or update annually, and administer a written plan for the care, preservation, pruning, planting, replanting, removal or disposition of trees and shrubs in parks, along streets and in other public areas. Such plan will be presented annually to the City Commission and upon their acceptance and approval shall constitute the official comprehensive city tree plan for the City of:

(City) _____

(State) _____

The Board, when requested by the City Commission, shall consider, investigate, make finding, report and recommend upon any special matter of question coming within the scope of its work.

Section 6. Operation

The Board shall choose its own officers, make its own rules and regulations and keep a journal of its proceedings. A majority of the members shall be a quorum for the transaction of business.

Section 7. Street Tree Species to be Planted

The following list constitutes the official

Street Tree species for:

(City) _____

(State) _____

No species other than those included in this list may be planted as Street Trees without written permission of the City Tree Board.

** Please note: The above species are offered as size-class examples only and may not be suitable for planting in your area. Please check with local sources to develop a species list for your*

Section 8. Spacing

The spacing of Street Trees will be in accordance with the three species size classes listed in Section 7 of this ordinance, and no trees may be planted closer to any Trees, 2 feet; Medium Trees, 3 feet; and Large Trees, 4 feet.

Section 9. Distance from Curb and Sidewalk

The distance trees may be planted from in accordance with the three species size classes listed in Section 7 of this ordinance, and no trees may be planted closer to any Trees, 2 feet; Medium Trees, 3 feet; and Large Trees, 4 feet.

Section 10. Distance from Street Corners

No Street Tree shall be planted closer than the point of nearest intersecting curbs or closer than 10 feet of any fireplug.

Section 11. Utilities

SMALL TREES	MEDIUM TREES	LARGE TREES
Apricot	Ash, Green	Coffeetree, Kentucky
Crabapple,	Hackberry	Maple, Silver
Flowering (sp)	Honeylocust	Maple, Sugar
Golden Rain Tree	(thornless)	Oak, Bur
Hawthorne (sp.)	Linden or	Sycamore
Pear, Bradford	Basswood (sp.)	Sycamore, London
Redbud	Mulberry, Red	plantree
Soapberry	(fruitless, male)	Cottonwood
Lilac, Jap. Tree	Oak, English	(Cottonless,
Peach, Flowering	Oak, Red	male)
Plum, Purpleleaf	Pagodatree,	
Serviceberry	Japanese	
	Pecan	
	Birch, River	
	Osageorange	
	(Male,	
	thornless)	
	Persimmon	
	Poplar, White	
	Sassafras	

in accordance with the three species size classes trees may be planted closer together than Small Trees, 2 feet; Medium Trees, 3 feet; and Large Trees, 4 feet; except by a landscape architect.

curbs or curblines and sidewalks will be in accordance with the three species size classes listed in Section 7 of this ordinance, curbs or sidewalk than the following: Small Trees, 2 feet; Medium Trees, 3 feet; and Large Trees, 4 feet.

and Fireplugs

35 feet of any street corner, measured from curblines. No Street Tree shall be planted

No Street Trees other than those species listed as Small Trees in Section 7 of this ordinance may be planted under or within 10 lateral feet of any overhead utility wire, or over or within 5 lateral feet of any underground water line, sewer line, transmission line or other utility.

Section 12. Public Tree Care

The City shall have the right to plant, prune, maintain and remove trees, plants and shrubs within the lines of all streets, alleys, avenues, lanes, squares and public grounds, as may be necessary to insure public safety or to preserve or enhance the symmetry and beauty of such public grounds.

The City Tree Board may remove or cause or order to be removed, any tree or part thereof which is in an unsafe condition or which by reason of its nature is injurious to sewers, electric power lines, gas lines, water lines, or other public improvements, or is affected with any injurious fungus, insect or other pest. This Section does not prohibit the planting of Street Trees by adjacent property owners providing that the selection and location of said trees is in accordance with Sections 7 through 11 of this ordinance.

Section 13. Tree Topping

It shall be unlawful as a normal practice for any person, firm, or city department to top any Street Tree, Park Tree, or other tree on public property. Topping is defined as the severe cutting back of limbs to stubs larger than three inches in diameter within the tree's crown to such a degree so as to remove the normal canopy and disfigure the tree. Trees severely damaged by storms or other causes, or certain trees under utility wires or other obstructions where other pruning practices are impractical may be exempted from this ordinance at the determination of the City Tree Board.

Section 14. Pruning, Corner Clearance

Every owner of any tree overhanging any street or right-of-way within the City shall prune the branches so that such branches shall not obstruct the light from any street lamp or obstruct the view of any street intersection and so that there shall be a clear space of eight feet (8') above the surface of the street or sidewalk. Said owners shall remove all dead, diseased or dangerous trees, or broken or decayed limbs which constitute a menace to the safety of the public. The City shall have the right to prune any tree or shrub on private property when it interferes with the proper spread of light along the street from a street light or interferes with visibility of any traffic control device or sign.

Section 15. Dead or Diseased Tree Removal on Private Property

The City shall have the right to cause the removal of any dead or diseased trees on private property within the city, when such trees constitute a hazard to life and property, or harbor insects or disease which constitute a potential threat to other trees within the city. The City Tree Board will notify in writing the owners of such trees. Removal shall be done by said owners at their own expense within sixty days after the date of service of notice. In the event of failure of owners to comply with such provisions, the City shall have the authority to remove such trees and charge the cost of removal on the owners property tax notice.

Section 16. Removal of Stumps

All stumps of street and park trees shall be removed below the surface of the ground so that the top of the stump shall not project above the surface of the ground.

Section 17. Interference with City Tree Board

It shall be unlawful for any person to prevent, delay or interfere with the City Tree Board, or any of its agents, while engaging in and about the planting, cultivating, mulching, pruning, spraying, or removing of any Street Trees, Park Trees, or trees on private grounds, as authorized in this ordinance.

Section 18. Arborists License and Bond

It shall be unlawful for any person or firm to engage in the business or occupation of pruning, treating, or I en-loving suet or paik trees within the City without first applying for and procuring a license. The license fee shall be \$25 annually in advance; provided, however, that no license shall be required of any public service company or City employee doing such work in the pursuit of their public service endeavors. Before any license shall be issued, each applicant shall first file evidence of possession of liability insurance in the minimum amounts of \$50,000 for bodily injury and \$100,000 property damage indemnifying the City or any person injured or damaged resulting from the pursuit of such endeavors as herein described.

Section 19. Review by City Commission The City Commission shall have the right to review the conduct, acts and decisions of the City Tree Board. Any person may appeal from any ruling or order of the City Tree Board to the City Commission who may hear the matter and make final decision.

Section 20. Penalty

Any person violating any provision of this ordinance shall be, upon conviction or a plea of guilty, subject to a fine not to exceed \$_____

The discussion of moving forward with this was tabled. A discussion needs to be held with our liaison to get a feel if the Township Committee would support this program. The Township Committee would have to invest in the program and while it is a worthwhile program we have to weigh the benefits for Holland Township. A suggestion was to explore the program being applicable for only public lands. Ray Note will develop a list of positives and negatives for the next meeting.

Public Comment: No one is present in the public.

Reminder for sub-committee sessions. We created a subcommittee so that you can have meetings, talk and work together.

Secretary Kozak to resend the Volunteer Form for tracking of volunteer hours.

At 8:35 pm Jerry Bowers made a motion to adjourn.

Respectfully Submitted

Maria Elena Jennette Kozak

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Environmental Commission Secretary