DELAWARE CENTER FOR THE INLAND BAYS
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TO: Sussex County **Council**

FROM: Chris Bason, Executive Director, Delaware Center for the Inland Bays

DATE: **January 11, 2022**

SUBJECT: Markup and Justification for AN ORDINANCE TO AMEND CHAPTER 99, SECTIONS 99-5, 99-6, 99-7, 99-23, 99-24, 99-26, AND 99-30, AND CHAPTER 115 SECTIONS 115-4, 115-25, 115-193, 115-220 AND 115-221 REGARDING CERTAIN DRAINAGE FEATURES, WETLAND AND WATER RESOURCES AND THE BUFFERS THERETO.

Please find attached the following requested changes to the above ordinance with justification provided herein on behalf of the Center for the Inland Bays. I am a biologist with over 20 years of local experience in the field of wetlands and estuarine research, management, and restoration and I had the pleasure of serving on the County's Wetlands and Buffers Workgroup. Part of my past professional experience involved assessing the condition of wetlands within Sussex County and I have published multiple times on wetlands in the peer-reviewed scientific literature as well as through the Center's extensive technical publications. I previously provided in person testimony and reports from the Center to the Planning and Zoning Commission on the day of the hearing of this ordinance. The marked up ordinance I am providing was converted to a word document from pdf and thus there are some formatting inconsistencies that I hope you may forgive. While there are markups throughout the document I am presenting my justification in major areas of focus below.

Buffer Widths

The buffer widths proposed in this ordinance were developed by the consensus of the Wetlands and Buffer Working Group. However, most of these widths are much less than what is generally recommended in the scientific literature to protect the functions of the resources covered by the ordinance. For example, buffers on small streams are generally recommended to be at least 100 feet[1] to protect the water quality, habitat, and biology of the stream, whereas the buffers of streams proposed in this ordinance are 30 to 50 feet. This means that buffers proposed in this ordinance will continue to allow the degradation of the streams in Sussex County where water quality is already poor and wildlife habitat is rapidly disappearing near the coast (see appendix for supporting information).

The Center's science-based recommendations for buffer widths based upon water quality protection alone are provided in our 2008 report[2]. Buffers designed for all the purposes in this

[1] Sweeney, Bernard W. and J. Denis Newbold, 2014. Streamside Forest Buffer Width Needed to Protect Stream Water Quality, Habitat, and Organisms: A Literature Review. Journal of the American Water Resources Association (JAWRA) 50(3): 560-584. DOI: 10.1111/jawr.12203

[2]https://www.inlandbays.org/wp-content/uploads/2011/01/Recommendations-for-an-Inland-Bays-Watershed-Buffer-System-Final.pdf

ordinance are often wider than our recommendations particularly when considering the protection of wildlife habitat. This is born out through a comparison of the proposed ordinance to similar ordinances of other nearby jurisdictions (appendix). Should the Commision seek to increase the width of the buffers, we suggest reference to these resources.

Resource Buffer Width Averaging

The Center supports buffer width averaging which was a point of consensus reached by the Workgroup. However, we request that averaging for buffers of tidal wetlands and waters and for buffers of freshwater mill ponds be limited to within these resource buffers. In other words, a reduced buffer width on a tidal resource could only be compensated for with a wider buffer on another tidal resource and not on an intermittent stream for example.

This will help prevent potential misuse of this provision to minimize buffer width in the highly-desirable for building yet ecologically-sensitive nearshore areas of tidal wetlands and waters and of freshwater mill ponds. There are multiple examples around the County of what can happen when homes are sited too close to sensitive resources in regards, and I offer one from Ellis Point below. Maintaining adequate widths of buffers on tidal areas is particularly important because tidal waters and wetlands migrate inland, often rapidly, with sea level rise. Rates of migration of tidal wetlands over uplands in the Indian River Bay watershed range from 1.44 to 5.25 feet per year on average depending on the slope of the adjacent upland.

This small change will continue to allow flexibility in site design, while discouraging misuse of the provision, and ensure that minimum protections for one type of resource are not exchanged for additional, but less beneficial, protection of a different resource.

Homes on Ellis Point located very close to tidal waters.

Resource Buffer Activities By Zone

The Center is supportive of all the Activities which were achieved by the consensus of the Working Group except for Activity 18. Extended Detention dry and wet stormwater management ponds. Stormwater management ponds provide hydrologic retention and some

water quality improvement benefits. However they clearly do not provide the wildlife habitat function that is one of the purposes of the buffer (see below and an example of Love Creek).

> *"Provide wildlife habitat via nesting, breeding , and feeding opportunities; provide sanctuary/refuge during high water events; protect critical water 's edge habitat; and protect rare, threatened, and endangered species associated with each Resource and its upland edge."*

Dry stormwater detention feature in buffer on Love Creek.

Removal of a forest to install a stormwater feature in the buffer would be counter to the purpose of the ordinance by resulting in a net reduction in the total desired function of the buffer. And it is unnecessary because stormwater features can be installed elsewhere on a proposed development.

<u>Resource Buffer Standards</u>

Remove the non-forested meadow option and require both maintenance of existing forests and reforestation of non-forested areas.

In addition to the buffer extent and width, the vegetation required within the buffer is the most important aspect to determine its function. Forested buffers clearly provide superior function than do non-forested buffers through 1) their capacity to sequester nutrients within their above

and below ground biomass, 2) their provision of multi-layered animal habitat, 3) their capacity to control flooding and intercept precipitation within their multiple layers, 4) and their provision of a physical buffer between human activities and sensitive aquatic life. For more supporting information, please to the appendix of these comments on forests (page 14).

The inclusion of non-forested meadows as a vegetation option will not protect existing forests and will result in similar situations seen across the County today where highly functioning buffers are torn down. As written, the proposed ordinance will allow a landowner to completely remove a buffer, seed it with a grass mix and then submit an application for development. As written, there is no requirement to reforest the buffer. In fact, the vegetation within the non-forested meadow does not even have to be native. This runs counter to the intent of a buffer ordinance and in fact would be a step backward in protection from the existing code which states:

> *"BUFFER ZONE — An existing naturally vegetated area or an area purposely established in vegetation which shall not be cultivated in order to protect aquatic, wetlands, shoreline and upland environments from man-made encroachment and disturbances. The "buffer zone" shall be maintained in natural vegetation, but may include planted vegetation where necessary to protect, stabilize or enhance the area."*

In Sussex County, forest is the natural vegetation community for nearly all upland areas, and if uplands are left to grow without interference they eventually will undergo natural ecological succession to a forest. Allowing non-forested meadows clarifies any ambiguities of the current code to allow forested buffers to be cut down prior to application and to perpetuate poorly-functioning non-forested buffers. Furthermore, the non-forested meadow section is unclear and seemingly contradictory. For example D.2.a. states that non-forested meadows must be retained but then later D.2.a.ii and D.2.b. state that non-forested meadows be allowed to undergo natural succession or be planted to a forest.

The solution to this is to both require maintenance of existing forested buffers and require the reforestation of buffers using a detailed set of standards where forests do not exist This makes clear that any forested buffer removed prior to an application will have to be reforested as a part of the development project. This takes away any perceived incentive to remove the buffer prior to application. In fact, it creates a disincentive to removing the forest of the buffer because reforestation is costly and takes additional effort to achieve within required timeframes. This approach is similar to that taken in the County code for forested and landscape buffers (perimeter buffer) and is standard in buffer ordinances of nearby jurisdictions.

Maintenance of Drainage Conveyances

We request that the report to identify measures needed for drainage conveyances clarify measure "(b) the location of any stream blockages such as debris jams, fallen or unstable trees, beaver dams or similar impediments to conveyance." Debris dams, fallen trees, and beaver dams are naturally occurring and important components of stream ecosystems that provide important contributions to the functions that this ordinance seeks to protect. These features slow the flow of water, create and enhance zones of sediment pollution trapping and nutrient pollution filtration, and provide essential wildlife habitat diversity. These features have long been known as essential components of healthy streams that improve pollution removal and unless they pose a credible and imminent threat to property or safety should be left in place and not be identified as problems.

Resource Buffer Options

We request that this section be completely removed from the proposed ordinance on the basis that the already narrow widths of the buffers proposed relative to the recommendations in the scientific literature for minimum buffer widths and relative to the greater widths of buffers required by nearby jurisdictions should in no way be reduced. Furthermore, the fact that water quality continues to be poor in Sussex County and the fact that flooding and wildlife habitat loss are increasing dramatically do not support reduction in buffer widths. We believe the opposite should occur and that should incentives for increasing widths of buffers be desired, exploration of win-win solutions including the allowance for a few extra lots be considered in exchange.

The options also inexplicably allow reduction of forested and landscape buffers which were established for a different purpose. Very simply this doesn't make any sense. The section continues to raise important questions such as, how can the County demonstrate that the areas protected in exchange for reduced buffers wouldn't already be protected? (This is the tricky concept of additionality which must be clearly demonstrated for such a program of trade offs to be successful.) How does the County demonstrate functional equivalence of one area being protected by conservation easement in another part of the County in exchange for a buffer being destroyed and the associated loss of protection of water resources that are seriously in need of protection?

Finally, this very simply would allow buffers of 25 feet on tidal waters just as a starting point, and this would constitute a significant roll-back in environmental protection from the current ordinance. How does this relate to the Comprehensive Plan or the Inland Bays Comprehensive Conservation and Management Plan? Could you imagine the public outcry?

Resource and Resource Buffer Maintenance and Management

Under Section G.2., the definition of positive conveyance is not provided and needs to be made clear prior to inclusion. It is completely unclear what the County would be requiring a developer to do to the water resources. We look forward to providing comments once clarity

is provided. In the meantime, it seems like this is an unnecessary part of the code and that in rare situations where a stream is not flowing a condition of approval could be placed on the development.

Enforcement

Numerous instances of vegetation removal in buffers of HOAs have occurred over the past few years around the Inland Bays. HOAs are often not equipped or educated to understand and properly manage a buffer. In such situations, the County needs to be able to ensure that buffers are maintained to provide their functions to protect public resources through a program of inspection and enforcement. This is a critical part of ensuring this ordinance is successful. It is requested that the proposed ordinance include a clear statement of the County's authority and responsibility to enforce the maintenance of the buffer including level of penalties and mitigation requirements in the instance when an HOA does not.

APPENDIX: SUPPLEMENTARY INFORMATION

Buffer Policy Comparison

Characteristic	Sussex Co. Current	Sussex Co. Proposed	Inland Bays Recommends	Kent Co.	New Castle Co.	State of NJ	State of MD Critical Areas.
Tidal Wetlands & Waters Width	50 ft.	100 ft.	80 - 500 ft.	100 ft.	100 ft.	300 ft.	100 - 200 ft.
Nontidal Wetlands Width	0 ft.	30 ft.	50 - 100 ft.	25 ft.	50 ft.	0 - 150 ft.	25 ft.
Smaller / Intermittent Streams Width	0 ft.	30 ft.	35 - 150 ft.	50 ft.	100 ft.	300 ft.	≥100 ft.
Larger / Perennial Streams Width	0 - 50 ft.*	50 ft.	80 - 150 ft.	100 ft.	100 ft. or 50 ft. from floodplain	300 ft.	≥100 ft.
Variable Width Buffer Allowance	No	Yes**	No	No	No	Yes***	No
Vegetation Type	Natural	Forest or meadow ****	Natural/ Forest	Natural/ Forest	Natural/ Forest	Existing Veg. or Natural/ Forest	Natural/ Forest
Protects Existing Forest	Yes*	Yes and No	Yes	Yes	Yes	Yes	Yes
Replanting of Trees	No	No	Yes	Yes	Yes	Yes	Yes

Note: Some variation may exist within a jurisdiction due to overlapping regulations and site considerations. Based upon 2/14/20 version of Sussex County draft ordinance.

**Currently interpreted and enforced irregularly*

*** By right, buffer can be reduced to half its width with equal square footage compensation to twice the width of any other buffered feature.*

**** Through a highly conditioned waiver process*

***** Non-native species allowed*

Buffer Facts & Rationale for Improvement

What is a Buffer and What Do They Do

In general, buffers are natural areas between developments and wetlands and waters that are managed to protect these features from human encroachment and pollution. Buffers improve the health of wetlands, protect water quality, prevent flooding, and provide wildlife habitat.

- Buffers remove large amounts of pollutants from groundwaters and surface water runoff while improving the ecological health of the wetland and waterway they buffer.
- Buffers protect wetlands and waters from the impacts of an adjacent development. And buffers also help absorb and treat flood waters and pollution originating from far away (upstream).
- Buffers on tidal wetlands and waters allow the natural inland migration of these dynamic resources with sea level rise.
- Buffers protect against hazards of climate change including more extreme storm events, more intense floods, and sea level rise.
- Buffers serve as habitat for aquatic and wetland-dependent species of wildlife (particularly bird species) that rely on complementary upland habitat for critical stages of their life. They also screen adjacent human disturbance and serve as habitat corridors through the landscape.[3]
- Buffers protect shallow water habitats such as baygrass meadows and oyster reefs.
- Buffers sustain open space, property values and the rural character of Sussex County.

Why Should Sussex Require Better Buffers?

Better Buffers Will Protect Sussex County's Wetland Resources

Sussex County has 47% of all of Delaware's wetlands. Wetlands protect the quality of our drinking water and our streams, rivers, and bays by filtering pollutants. They also protect property by storing flood waters and buffering coastal storm surge. Wetlands are biologically diverse and hold high concentrations of rare species: 41% of wetland plant species in Delaware are rare.

But Sussex is losing its wetlands. About half of this area's original wetlands have been lost due to drainage, conversion to other landuses, and sea level rise. Wetlands and their beneficial functions continue to be lost: 1,434 acres of Sussex County's wetlands were lost from 1992 to 2007[4]. At that rate another 1,147 acres would have been lost from 2007 to 2019. Saltmarshes

[3] Environmental Law Institute. 2008. Planner's Guide to Wetland Buffers for Local Governments.
[4] Tiner et al. 2011. Delaware Wetlands: Status and Changes from 1992 to 2007

in particular continue to disappear. Saltmarshes around the Inland Bays have decreased from 10,838 acres in 1938 to 7,300 acres in 2007[5].

Many of the wetlands that remain are in poor condition. For example, the health of streamside wetlands and saltmarshes in the Inland Bays watershed have received a grade of D[6]. Loss and degradation of wetlands have contributed to flooding and poor water quality in Sussex. Better buffers will reduce further degradation and loss of wetlands and their beneficial functions.

Better Buffers will Help with Sussex County's Poor Water Quality

Sussex County has poor water quality. The most recent DNREC assessment of water pollution found that 87% streams, ponds, and bays in Sussex were polluted due to high bacteria levels, high levels of nutrients or low dissolved oxygen levels. Forty-four percent of waters (44%) were polluted by bacteria, 18% had low dissolved oxygen, and 78% had high nutrient levels.

In the Inland Bays Watershed, all assessed waters were found to be polluted by excess nutrients, 50% by bacteria, and 11% had low dissolved oxygen. While improvements to the water quality of the Inland Bays have been realized, measured pollutant loads from the watershed to the Bays have not decreased despite decades of voluntary and regulatory action. Many of the tributaries of the Inland Bays have very high pollutant levels and very poor water quality. The situation is so bad in the Indian River, that dissolved oxygen can fall to zero during the summer months.

Better buffers are an important part of the strategy to protect and restore the water quality of the Inland Bays and other ecologically and economically important waterways of the County.

Better Buffers Will Prevent Flooding in Sussex County

Sussex County is prone to flooding due to its low elevation, high ground water table and proximity to sea level. Flooding of property and infrastructure can have significant costs to individuals, businesses and governments. Just one inch of water in an average home can cost more than $25,000 in damage[7].

Coastal and areal flooding is increasing. Flooding that decades ago usually happened only during a powerful or localized storm can now happen when a steady breeze or a change in coastal current overlaps with a high tide. From 1950-2018, nearly half of all major and moderate flooding events in Lewes occurred since the year 2000. Lewes recorded an average number of 4 flood days in 2000. In 2017, 15 flood days were recorded. In 2030, between 15-30 high tide flood days are projected.

[5] Center for the Inland Bays. 2016. State of Delaware's Inland Bays 2016.
[6] Center for the Inland Bays & DNREC. 2010. Wetland Health Report Card.
[7] Delaware Seagrant. 2019. Homeowner's Handbook To Prepare for Natural Hazards.

Despite increases in flooding, building in Sussex County is happening in floodprone areas. From 2010 to 2017, Sussex County had the third highest number of homes (1,233) built in 10-year flood risk zones of any county in the United States.[8]

Buffers not only provide areas designed to absorb floodwaters, they keep residences out of areas most prone to flooding. By doing so they will reduce the tax-payer burden for addressing community drainage and flooding issues. As of 2018, there were over $28 million worth of unmet needs to resolve community drainage problems in Sussex County[9].

Better Buffers will Protect from Hazards Associated with Climate Change

Sussex County is highly vulnerable to climate-change driven sea-level rise. Sea-level rise increases the average sea level over time, which in turn increases the height of high tides and increases the height of low tides. Sea-level rise also amplifies the risks of flooding from storms that bring heavy rain and waves.

Sea level off Lewes and Ocean City, Maryland has risen at a rate of 1.3 to 2.2 inches per decade since record keeping began[10]. Our coast is a global hotspot for sea level rise and the rate of sea level rise is increasing while the land of Delaware is sinking. Global greenhouse gas emissions are contributing significantly to the rise. Projections for sea level rise off Lewes under continued trends in greenhouse gas emissions are 9 inches by 2030, 1.5 feet by 2050, 3.3 feet by 2080, and 4.7 feet by 2100.

Three to five feet of sea level rise in Sussex County is projected to result in the inundation of 4 to 11% of businesses, 8 to 13% of residences, over half of parkland acreage, 7 to 10% of road miles, 31 to 37% of wastewater pumping stations, and 32 to 36% of sites where hazardous substances have been released[11]. The loss of nearly all saltmarshes due to drowning is projected.

Groundwater tables in coastal Delaware have also been projected to rise significantly in response to sea level rise[12]. This will expand the boundaries of existing freshwater wetlands and create new wetlands in areas that were formerly uplands.

We are already experiencing significant increases in the frequency and severity of tidal flooding as well as increased flooding from more intense precipitation events. Many of our saltmarshes are already disappearing. Already underway are expensive adaptation measures including frequent beach replenishment, shoreline stabilization, elevation of homes and roads, and avoidance of areas prone to flooding.

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[8] Climate Central. 2019. Ocean at the Door: New Homes and the Rising Sea, 2019 Edition. *10-year flood risk zone defined as area exposed to at least a ten year flood threat in 2050 under moderate global greenhouse gas emission cuts and corresponding median projections for sea level rise.,*

[9] DNREC. 2018. Resource, Conservation & Development Projects 21st Century Fund Annual Report

[10] Callahan et al. 2017. Recommendation of Sea-Level Rise Planning Scenarios for Delaware.

[11] Delaware Coastal Programs. 2012. Preparing for Tomorrow's High Tide.

[12] McKenna. 2014. Presentation to the Center for the Inland Bays Scientific & Technical Advisory Committee.

Buffers not only provide areas designed to absorb floodwaters, they keep residences out of areas most prone to flooding. Buffers on tidal wetlands also provide wetlands areas to migrate into under conditions of rising sea level.

Better Buffers Protect and Improve Economic Value

Buffers function to directly and indirectly provide benefits to the public including flood control, water quality improvement, recreation, wildlife habitat, and carbon storage. Delaware's wetlands in total have been estimated to provide $1 billion to $3 billion in annual economic value and support to 25,000 jobs with $568 million in wages.[13] Economists estimate buffers in the Delaware River Watershed provide over $10,000 per acre per year of benefits to the public[14]. Because buffers help to keep new residences further from areas more likely to flood, less public expenditures will be needed for drainage issues and disaster relief associated with acute flooding events. For example, east coast wetlands avoided $625 million in direct flood damages during Hurricane Sandy[15].

Better buffers will function as an important part of protected community open space in Sussex County. Open space enhances home values and homeowners are willing to pay a premium to live next to open space. In Chester County PA, there is an average increase of over $11,000 in the value of homes that are located up to a half mile from protected open space. When added together, this proximity to protected open space totals $1.65 billion and increases property and transfer tax revenues a total of $27.4 million per year[16].

Better Buffers are Supported by the Sussex Comprehensive Plan and the Inland Bays Comprehensive Conservation & Management Plan

Better buffers are central to achieving multiple goals, objectives, and strategies of the County's 2018 Comprehensive land use plan, a priority of which is to "better preserve the rural character and natural resources of the County," including "considering larger buffers in sensitive environmental areas." Some Goals, Strategies, and Objectives of the Plan that support better buffers are as follows:

> Conservation Chapter Goal 5.1. Preserve, maintain, and enhance natural resources and natural systems. Objective 5.1.1 Encourage development practices and regulations that support natural resource protection.
>
> Goal 5.2: Encourage protection of farmland and forestland.
>
> Goal 5.3: Ensure the protection of the natural functions and quality of surface waters, groundwater, wetlands, and floodplains. Objective 5.3.1 Protect surface water and drinking water quality.

[13] Kauffman, G.J. 2018. Socioeconomic Value of Delaware Wetlands.
[14] Econorthwest. 2018. The Economic Value of Riparian Buffers in the Delaware River Basin.
[15] Narayan et al. 2017. Scientific Reports.
[16] RETURN ON ENVIRONMENT The Economic Value of Protected Open Space in Chester County, Pennsylvania. 2019.

Strategy 5.3.1.3 Identify an appropriate range of wetlands buffer distances based on location and context. Objective 5.3.5 Reduce flooding and erosion.

And strategy 12.1.3.2 Consider creating an ordinance designed to protect established, mature, healthy trees during the construction of new developments to better preserve existing trees and green spaces.

Better buffers have also been an important action of the Inland Bays Comprehensive Conservation and Management Plan since the original 1995 version to which Sussex County is signatory. This plan is the blue print of actions needed to successfully restore the water quality and habitat of the Bays.

Better Buffers are Supported by the Public

A 2018 online survey of 395 individuals by the Sussex Alliance for Responsible Growth found that Future Land Use and Conservation were the top two priority elements of the Sussex Comprehensive Plan.

In 2019, the Sussex Alliance for Responsible Growth distributed an online petition for the County to increase the extent and width of forested buffers that garnered 508 signers.

A 2014 survey of Delawareans found that 77% support avoiding building new structures in areas at risk from sea level rise, 64% support allowing beaches and wetlands to naturally migrate inland, and 85% support changing building codes and regulations to reduce risk in flood prone areas.

Better Buffers will Help Manage Extraordinary Growth in Sussex

Sussex is Delaware's fastest growing county with a current estimated population of 336,634 people[17]. Over the past decade, an additional 47,705 people are projected to have moved to Sussex. An additional 48,457 to 159,167 people are projected to be living here within 25 years.

From 2008 to 2015 over 13,500 building permits were issued in Sussex. From 2017 to 2019, 66 new subdivisions with 5,827 units were given preliminary approval by Sussex Planning and Zoning. Over the same time period, another 20 developments with a total of 1,294 residential units were approved as conditional uses or changes of zone by County Council.[18] These developments would be grandfathered under a new ordinance and receive minimal buffers relative to science based recommendations.

A significant portion of this development has been in areas at risk of flooding. From 2010 to 2017, Sussex County had the third highest number of homes (1,233) built in 10-year flood risk zones of any county in the United States.[19]

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[17] Sussex County. 2019. Sussex County Comprehensive Plan.
[18] Sussex County 2020. Application data provided Feb. 2020.
[19] Climate Central. 2019. Ocean at the Door: New Homes and the Rising Sea, 2019 Edition. *10-year flood risk zone defined as area exposed to at least a ten year flood threat in 2050 under moderate global greenhouse gas emission cuts and corresponding median projections for sea level rise.,*

The growth drives up impervious surface coverage that contributes to flooding and poor water quality. In 2010, the Inland Bays Watershed surpassed 10% impervious surface coverage, the threshold at which many estuaries begin to express noticeable degradation in response. Better buffers are needed to protect residents and the environment from the effects of rapid population growth in the County.z

What are the Important Characteristics of Better Buffers?

Wider Buffers are Better

The benefits of a buffer are based on its width. Wider buffers ensure that the greatest amount of pollution is kept out of the wetland or waterway buffered to a certain extent. Wider buffers also offer more habitat for wildlife that rely on both the wetland or water buffered and the buffer area itself.

The Center for the Inland Bays recommended adequate and optimum buffer widths for the protection of water quality based on the type of wetland or waterway buffered[20]. Adequate widths were 80 feet for non-tidal streams, 80 to 300 feet for tidal waters and wetlands, 80 feet for streamside wetlands, and 50 feet for other non-tidal wetlands. Optimum widths were 150 feet for non-tidal streams, 150 to 500 feet for tidal waters and wetlands, 150 feet for streamside wetlands, and 100 feet for other non-tidal wetlands. Another recent comprehensive study recommended a minimum of 98 foot forested buffers on small streams[21]. Adequate widths for buffers to protect wildlife habitat can be in the 1000s of feet.

Why Forested Buffers are Essential

Benefits of Native Forested Buffers

Forests are crucial to maintaining the water quality of streams, rivers, and bays. They also are essential habitat for wildlife, they protect public health, they provide recreation opportunities, they increase property values, and they enhance quality of life.

Nowhere are forests more important than where they are close to water. Research has demonstrated that the amount of forest in an estuary's watershed, particularly near the water, has a significant influence on the health of the estuary's baygrasses, crabs, and marsh birds.[22]

Forested buffers are also especially important to a wide variety of bird species. These include raptors such as bald eagles and osprey. Colonial waterbirds such as great blue herons, which often establish groups of nests in mature trees, use the forested buffers for food, cover, and nesting. Numerous species of migratory birds depend on coastal areas to rest and feed during their long flights from Central and South America. A range of mammal, amphibian, and reptile species also use these areas near shore. The number and variety of species are highly dependent on the amount and type of vegetation within the buffer. The more natural the

[20] Center for the Inland Bays. 2008. Recommendations for an Inland Bays Water Quality Buffer System.
[21] Sweeney & Newbold. 2014. Journal of the American Water Resources Association.
[22] Li et al. 2007. Estuaries and Coasts. 30, 840-854; and references therein.

condition of the Buffer is, the greater the number of species that will use it. A fertilized and manicured lawn that leads to a bulkheaded shoreline provides none of the important habitat benefits found in a naturally forested Buffer.

Birds are ecological indicators of healthy ecosystems. There are now 432 species of North American birds at risk of extinction, more than a third of all species[23]. Almost all North American terrestrial birds rear their young on insects, and most of those insects are caterpillars. It takes 6,000-9,000 caterpillars to rear one clutch of Carolina chickadees to fledging[24] and many more to bring chicks to independence. So, to have birds, we need to plant the species that make caterpillars (bird food). Essential land stewardship entails reducing lawn area and transitioning from alien ornamental plants to native ornamental plants. Native oaks, cherries, willows, birches, maples, elms, blueberries, alders, and pines produce about 75% of the insect food that drives food webs in Delaware[25].

Forested buffers provide superior water quality, habitat, and flood mitigation benefits than do non-forested buffers. Forested buffers have been shown to retain over 30% more nitrogen pollution than grassed buffers. Forested buffers provide extensive vertical structure to hold precipitation and thus prevent runoff. Non-forested buffers do not provide this structure. Forested buffers provide multiple layers of vertical habitat and food sources for insects, bats, mammals, and particularly birds, that meadows or grassed buffers do not provide. Forests also provide physical structure to stream channels through their roots and contribute to the food web of stream channels through provision of organics such as leaves and sticks. Forested buffers also regulate the temperature of streams. The quality of streamside forests has been cited as the single most important factor altered by humans that affects...water quality of the streams providing water to coastal bays[26].

Disappearing Sussex Forests

Despite these benefits forests are at risk. Forest cover in Delaware is at its lowest level since 1907[27]. It has been estimated that by 2050, 43% of Delaware's remaining forestland will be converted to urban areas. Only four other states are expected to experience a greater degree of forest conversion to expanding urban areas.

Forests are disappearing rapidly from Sussex County due to development. From 1992 to 2012, upland forests decreased by 14 square miles in the Inland Bays watershed. In Sussex County, over half of the forests within proposed developments are intended for clearing.[28] Forested ecosystems are replaced by non-native lawns with little value for native wildlife. In Delaware suburbs, 92% of the area that could be landscaped (not hardscape) is lawn, 79% of the plants are introduced species, and only 10% of the tree biomass that could be in our developments is actually there[29].

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[23] North American Bird Conservation Initiative. 2016. The State of North America's Birds 2016.
[24] Brewer. 1961. The Wilson Bulletin.
[25] Narango et al. 2018. Proceedings of the Natural Academy of Sciences.
[26] Sweeney, B.W. 1992, Water Science and Technology.
[27] Delaware Wildlife Action Plan and references therein.
[28] State of Delaware. 2020. Preliminary Landuse Service Data 2017 to 2019. *accessed* Jan. 2020.
[29] Delaware Statewide Ecological Extinction Task Force. 2017. Final Report.

Public Preference for Forested Buffers

The peer reviewed scientific literature shows that landowners on the rural/urban fringe prefer forested buffers to corridors with little vegetation, and they best preferred more extensive forested buffers.[30]

Another study found residents preferred forested buffers over grassed buffers in both rural and suburban areas.[31] Additionally, in a recent study of nearly 12,000 Americans, seven out of 10 kids surveyed said they "would rather explore woods and trees than play on neat-looking grass."[32]

[30] Sullivan, W.C., et al. 2004. Landscape and Urban Planning. 69, 299–313.
[31] Kenwick, R. a., et al. 2009. Landscape and UrbanPlanning, 91, 88–96.
[32] Kellert, S. and DJ Case and Associates. 2017. The Nature of Americans National Report: Disconnection and Recommendations for Reconnection.

Benefits of Native Forested Buffers

Forests are crucial to maintaining the water quality of streams, rivers, and bays. They also are essential habitat for wildlife, they protect public health, they provide recreation opportunities, they increase property values, and they enhance quality of life.

Nowhere are forests more important than where they are close to water. Research has demonstrated that the amount of forest in an estuary's watershed, particularly near the water, has a significant influence on the health of the estuary's baygrasses, crabs, and marsh birds.[33]

Forested buffers are also especially important to a wide variety of bird species. These include raptors such as bald eagles and osprey. Colonial waterbirds such as great blue herons, which often establish groups of nests in mature trees, use the forested buffers for food, cover, and nesting. Numerous species of migratory birds depend on coastal areas to rest and feed during their long flights from Central and South America. A range of mammal, amphibian, and reptile species also use these areas near shore. The number and variety of species are highly dependent on the amount and type of vegetation within the buffer. The more natural the condition of the Buffer is, the greater the number of species that will use it. A fertilized and manicured lawn that leads to a bulkheaded shoreline provides none of the important habitat benefits found in a naturally forested Buffer.

Birds are ecological indicators of healthy ecosystems. There are now 432 species of North American birds at risk of extinction, more than a third of all species[34]. Almost all North American terrestrial birds rear their young on insects, and most of those insects are caterpillars. It takes 6,000-9,000 caterpillars to rear one clutch of Carolina chickadees to fledging[35] and many more to bring chicks to independence. So, to have birds, we need to plant the species that make caterpillars (bird food). Essential land stewardship entails reducing lawn area and transitioning from alien ornamental plants to native ornamental plants. Native oaks, cherries, willows, birches, maples, elms, blueberries, alders, and pines produce about 75% of the insect food that drives food webs in Delaware[36].

Forested buffers provide superior water quality, habitat, and flood mitigation benefits than do non-forested buffers. Forested buffers have been shown to retain over 30% more nitrogen pollution than grassed buffers. Forested buffers provide extensive vertical structure to hold precipitation and thus prevent runoff. Non-forested buffers do not provide this structure. Forested buffers provide multiple layers of vertical habitat and food sources for insects, bats, mammals, and particularly birds, that meadows or grassed buffers do not provide. Forests also provide physical structure to stream channels through their roots and contribute to the food web of stream channels through provision of organics such as leaves and sticks. Forested buffers also regulate the temperature of streams. The quality of streamside forests has been

[33] Li et al. 2007. Estuaries and Coasts. 30, 840-854; and references therein.
[34] North American Bird Conservation Initiative. 2016. The State of North America's Birds 2016.
[35] Brewer. 1961. The Wilson Bulletin.
[36] Narango et al. 2018. Proceedings of the Natural Academy of Sciences.

cited as the single most important factor altered by humans that affects...water quality of the streams providing water to coastal bays[37].

Disappearing Sussex Forests

Despite these benefits forests are at risk. Forest cover in Delaware is at its lowest level since 1907[38]. It has been estimated that by 2050, 43% of Delaware's remaining forestland will be converted to urban areas. Only four other states are expected to experience a greater degree of forest conversion to expanding urban areas.

Forests are disappearing rapidly from Sussex County due to development. From 1992 to 2012, upland forests decreased by 14 square miles in the Inland Bays watershed. In Sussex County, over half of the forests within proposed developments are intended for clearing.[39] Forested ecosystems are replaced by non-native lawns with little value for native wildlife. In Delaware suburbs, 92% of the area that could be landscaped (not hardscape) is lawn, 79% of the plants are introduced species, and only 10% of the tree biomass that could be in our developments is actually there[40].

Public Preference for Forested Buffers

The peer reviewed scientific literature shows that landowners on the rural/urban fringe prefer forested buffers to corridors with little vegetation, and they best preferred more extensive forested buffers.[41]

Another study found residents preferred forested buffers over grassed buffers in both rural and suburban areas.[42] Additionally, in a recent study of nearly 12,000 Americans, seven out of 10 kids surveyed said they "would rather explore woods and trees than play on neat-looking grass."[43]

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[37] Sweeney, B.W. 1992, Water Science and Technology.
[38] Delaware Wildlife Action Plan and references therein.
[39] State of Delaware. 2020. Preliminary Landuse Service Data 2017 to 2019. *accessed* Jan. 2020.
[40] Delaware Statewide Ecological Extinction Task Force. 2017. Final Report.
[41] Sullivan, W.C., et al. 2004. Landscape and Urban Planning. 69, 299–313.
[42] Kenwick, R. a., et al. 2009. Landscape and UrbanPlanning, 91, 88–96.
[43] Kellert, S. and DJ Case and Associates. 2017. The Nature of Americans National Report: Disconnection and Recommendations for Reconnection.