



Allegheny College Campus Wildlife Habitat Management Plan

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Allegheny College Food Forest. Photo by Anthony Swanson

This report has been endorsed by the National Wildlife Federation.



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Executive Summary

In early 2023 Allegheny College became a Certified Wildlife Habitat, recognized by the National Wildlife Federation. To become certified, the location must adequately meet the standards in five categories: food, water, cover, habitat for raising young, and sustainability practices. To obtain that certification, we conducted this study to determine how well Allegheny’s campus meets the certification criteria. This report includes assets we identified for each criteria along with suggested improvements.

Wildlife needs adequate food sources to survive. The campus has a variety of trees and shrubs that provide food for wildlife throughout the year. The campus wildlife food supply could be improved by planting a greater diversity of trees and shrubs, and ensuring more evenly distributed food sources by reducing empty lawn space. Animals also need adequate water for survival and breeding; the Allegheny campus has water resources in Dick Run, the Ravine, and the rain garden on campus. Improvements to water can focus on improving water quality, increasing pooling, and creating a wildlife pond.

Cover provides animals with shelter from weather and protection from predators. Dick Run, the Ravine, uneven-aged tree stands, and a cedar hedge near College Court provide high value cover. Cover seems especially good near water sources. To improve cover, we recommend planting more pollinator and rain gardens, planting an understory in areas with mature trees, and increasing non-grass ground cover.

Habitat for raising young is determined by cover, food, and water in relatively close proximity to one another. Valuable habitats on campus include tree cavities, snags, fallen logs, and shrubs. Tree cavities are found in most areas on campus. Snags and logs are generally limited to Dick Run. Shrubs are mainly found in hedgerows near buildings and parking lots across campus. The Ravine has a balance of food, cover, and water, as do the hedges near Dick Run and the cedars near College Court. We recommend increasing the number of snags and logs in Dick Run to improve habitat for rearing young.

Sustainability practices enhance the four categories that are essential to Allegheny College’s certification as a Wildlife Habitat. The college already implements many sustainable practices, such as composting, minimizing chemical fertilizers and pesticide use, and installing rain and wildflower gardens.

Recommended Citation

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Endorsement

We are pleased that this report, which served as the basis for Allegheny College's application for a National Wildlife Federation Certified Wildlife Habitat, has been reviewed and endorsed by the National Wildlife Federation. We hope that this report can serve as an example to other colleges and universities conducting campus habitat assessments.



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Introduction

The National Wildlife Federation has created a program that allows landowners to designate their land as Certified Wildlife Habitat, based on meeting requirements for five different criteria. These criteria are food, water, cover, places to raise young, and sustainable practices. Each of these criteria must be met for the land to be considered a certified wildlife habitat. For food, there must be three sources identified across the area, ideally from native plants. For water, there must be at least one source of water for wildlife to use within the area. Cover, which can be classified as any area that provides physical protection for wildlife, and must be present in two locations. Additionally there must be two locations for wildlife to raise young, which may overlap with the cover sources. Finally, for sustainability, the National Wildlife Federation identifies three sustainable practices criteria, two of which must be met to acquire certification.

Our findings determined that Allegheny College qualifies as a Certified Wildlife Habitat. This report details the ways in which Allegheny meets or exceeds the standards of the five criteria for food, water, cover, places to raise young, and sustainability practices. Also discussed are ways that the college might further improve on the criteria standards, with the ultimate goal of improving the quality of wildlife habitat on campus. An additional benefit of this project is that other colleges and institutions can replicate this process to determine if they meet the qualifications to become a Certified Wildlife Habitat.

Food

Resources

Trees and Shrubs

The Allegheny College campus has many species of trees and shrubs, both native and non-native. These plants provide many types of food for an array wildlife, including pollinators and other insects, birds, rodents, and mammals. Available wildlife food on campus includes nectar, berries, fruits, buds, leaves, twigs, nuts, seeds, and bark, depending on the season. The 2000 Hazlett Report of the Allegheny College campus trees gives an overview of the trees on campus, including the scientific names, native status, and counts. The report shows that oaks, maples, pines, and flowering crabapple trees make up a large quantity of the trees on campus.

The most common native oaks include pin oaks, white oaks, and northern red oaks (Hazlett Report, 2000). Turkeys, squirrels, raccoons, white-tail deer, various rodents and other small mammals rely heavily on acorns. Allegheny's native maples include red maples and sugar maples. Both maple species are a strong food source, providing seeds, buds, twigs, and leaves that are popular with birds, deer, and smaller animals. Allegheny has two species of native pines, including the eastern white pine and the hemlock, which provide seeds and bark. Fruit is available from flowering crabapples and an apple orchard. Allegheny's campus has a number of other fruit-producing trees, including serviceberry trees, a few holly bushes, and one mulberry tree.

Cultivated Food Spaces

There is a small apple orchard, a vegetable and herb garden, and a permaculture food forest on campus. Although their intended use is to provide human food, fruits from the apples often go unharvested and are consumed by animals. The apple orchard (Figure 1), which contains two rows of mature apple trees on the lawn behind Steffee Hall, produces a large crop of apples each fall. Apples that remain on the trees and fall on the ground are consumed by birds, mammals, and insects. Some of the apple trees are in poor health and show signs that they may die within the next few years. The majority, though, are healthy and young. The biggest challenge facing the apples is the need for routine pruning.



Figure 1. Apple orchard behind Steffee Hall.

The food forest (Figure 2) contains five fruit trees and numerous native fruit-bearing shrubs, such as pawpaws and raspberries. It is located in the space between Carr Hall and Brooks Hall, and shares a border with the vegetable garden, also known as the Carrden. The fruit trees are not yet mature, so they will not yet bear fruit. The shrubs will likely begin producing in the next 1-2 years, but will not reach peak production for some time. As with the apples, the fruits of this area are intended for human consumption, but substandard fruits and groundfall will most likely be left for animals.

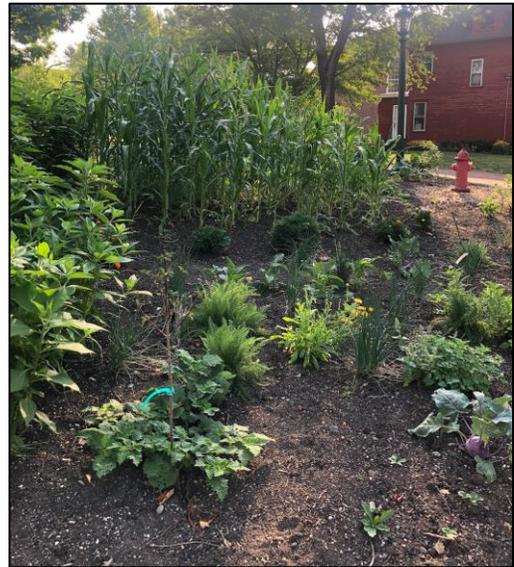


Figure 2. Food forest, designed and planted by the Sustainable Design Team

Carrden

The Carrden (Figure 3) is located next to the food forest between Carr and Brooks Halls. It is made up of wooden raised beds, small plots of unraised tilled soil, a small plot of herbs, a row of shrubs, two pear trees, a grape vine trellis, and a kiwi vine trellis. The vegetables grown vary from year to year, and are intended for human consumption. Waste is generally composted, which feeds insects and decomposers. Pollinators are fed by the blossoms of the herbs, vegetables, trees, and shrubs. Small animals may scavenge unharvested produce. The grapes are eaten by birds. The kiwi vine is not yet producing fruit. The pears often go unharvested and can be eaten by mammals, birds, and insects.

Ravine

There is a ravine, simply called “Ravine” on campus (Figure 4), located approximately between Schultz Hall and Ford Chapel. This is an excellent habitat for wildlife because it has a variety of trees, food, and a stream running through the middle. The primary trees here are eastern white pines and hemlocks, which provide seeds. Rhododendrons cover the banks and provide buds for food. The stream may provide food sources by hosting aquatic organisms.



Figure 3. The Carrden is frequented by several deer who eat the crops.



Figure 4. The Ravine provides excellent habitat.

Dick Run

Dick Run is the stream and ravine on the eastern end of campus, behind the Wise Sport and Fitness Center. Dick Run is another habitat and food source for wildlife, particularly because this area is not as highly managed as the more central campus locations. Because of its edge-of-campus location, dead trees remain on the ground and fallen leaves remain unmanaged. As a result, complete cycles of decomposition take place and provide food for microorganisms and fungi. The presence of these organisms, in turn, provides food for wildlife.

Another advantage of this location is that it has a community of multi-aged trees, which is important for providing a variety of foods for animals. For example, deer can feed on the younger shoots and saplings, while the oldest trees produce numerous seeds and nuts. The stream provides aquatic organisms as additional food sources.

Recommendations

Overstory

There are high numbers of a select few tree species recommended for native landscaping by the Pennsylvania State University, but the diversity of mast-bearing tree species is low. The majority of mast-bearing trees are oaks. We recommend a number of trees and shrubs that have high wildlife food value (Table 1). Oaks are a valuable food source, but there is a lack of other nut trees, such as hickories, native walnuts, and potentially hybrid chestnuts. There is also a lack of fruit-producing trees, such as American persimmons, hackberries, and red mulberries. For a greater diversity of food producing trees, species such as black walnuts, butternuts, black cherries, multiple hickory species, hackberries, persimmons, mulberries, and tupelos should be planted. Hackberries are especially important due to their resilience to a variety of environmental conditions.

Understory

Tall and old trees are found abundantly throughout campus but there is a lack of younger trees and their understories. If during a large windstorm an old tree were to fall, it would either be very expensive or take years for a replacement food source to sufficiently replace the suffered loss. We recommend planting red mulberry trees, pawpaw trees, American plum trees, American persimmons, and other shade tolerant trees as well as younger oak and maple trees (Table 1). Additionally, to further aid the lack of diversity within these understories, fruit-producing shrubs such as the serviceberry, spicebush, red chokeberry, nannyberry, elderberry and silverberry could be planted.

Locations on campus that would benefit from an added understory due to the sole dominance of tall and matured trees are the lawn behind Bentley, and the lawns in front of Quigley Hall and in front of Reis Hall. These locations would greatly benefit from a food production standpoint with the addition of understories from shorter trees and younger trees to replace the inevitable death of the older ones.

Table 1: Suggestions for high wildlife value trees and shrubs

<i>Overstory Trees</i>		
White pine	Tulip poplar	Red maple
Red cedar	Sycamore	Sugar maple
Black walnut	White oak	Black gum
Black cherry	Red oak	Sweet gum
Hemlock	Pin oak	Black willow
Hackberry	Pawpaw	Red mulberry
American persimmons	Hackberry	Hickory
Butternut	Sassafras	Tupelo
<i>Understory Trees/Shrubs</i>		
Red chokeberry	Eastern redbud	Serviceberry
Black chokeberry	Nannyberry	Spicebush
Black elderberry	Red osier dogwood	Buttonbush
American persimmons	Pawpaw	Red mulberry
American plum	American holly	Winterberry

Replacing Non-natives with Native Species

Allegheny's campus has a number of non-native species that have been integrated into the landscape. One example is burning bush, which is a non-native hedge that is commonly used in landscape design. Burning bush hedges on campus are going to be removed in the near future, and we recommend that the locations of previous hedges be planted with native fruit-bearing species, including serviceberries, aronias, elderberries, silverberries, and nannyberries. In the future, wildlife value should be an important consideration when replacing plants that are up for removal.

Water

Resources

Dick Run

Part of Dick Run (Figure 5) is located on the Allegheny College campus. The portion of Dick Run on Allegheny College's property is estimated to be about 830 yards in length. On Allegheny's property, the stream starts on the northern side of campus near Allegheny Commons. The stream then flows southwest behind the Wise Sport and Fitness Center. The stream daylights until it flows under a parking lot and East College Street, and returns to being open after the street. The stream continues flowing south behind Phi Kappa Psi and Delta Tau Delta fraternity housing.

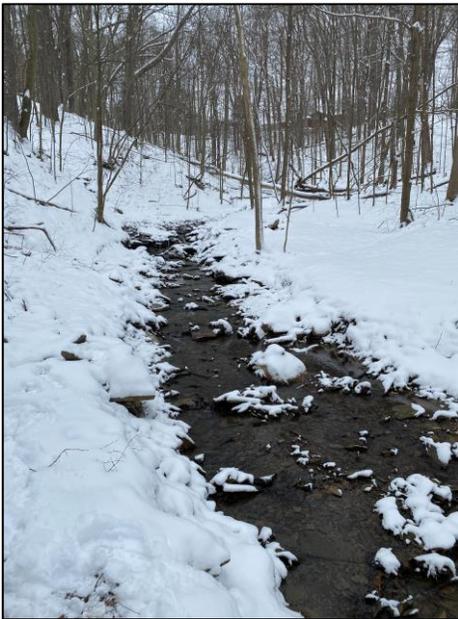


Figure 5. Northward view of Dick Run from the parking lot between Wise Sport and Fitness Center and Ravine Dorm.



Figure 6. Whitetail deer walking along stream bank at Dick Run.

The stream depth ranges between four feet in pools during heavy rainfall, to almost completely dry during summer droughts. The riparian buffer is estimated to be between 40-120 yards wide along the stream until it meets with Parking Lot 4. The riparian buffer zone is predominately made up of mature trees and

some smaller shrubs, which are both beneficial for wildlife (Figure 6). Near Parking Lot 4, there is no riparian zone protecting the stream from parking lot runoff. At the corner of the Wise Center, there is a runoff pipe that contributes to the stream directly. After flowing under the parking lot and street, there are more pools in the stream. The stream contains leaves that are not regularly removed, which is a benefit to wildlife, particularly aquatic macroinvertebrates and small fish. Logs and tree branches in the stream enhance the aquatic habitat.

Ravine

Ravine (Figure 7) is located behind Ford Chapel and the Observatory. The stream contains water runoff from the upper lots of campus, including the rain gardens. The creek is lined with stacked stone to prevent bank erosion. The riparian buffer surrounding the stream is about 15 yards wide on both sides which creates habitat for many different types of mammals (Figures 8, 9).



Figure 7. Looking upstream at Ravine towards the wooden walking bridge.



Figure 8. Cottontail Rabbit hiding in shrubs beside the stream at Ravine.

The riparian buffer consists mainly of rhododendron shrubs, other small shrubs, and some mature trees. The stream is about seven inches at its deepest part but can reach depths of around a foot during periods of flooding. From testing completed in an earlier study, there are virtually no aquatic invertebrates living in the stream. The total length of this stream is roughly 120 yards in length.

Rain Garden

A rain garden is located behind the 454/Admissions House (Figure 10). This area catches rain water, and surrounding areas drain to this point. The rain water collects and filters into the soil at a slow, sustainable rate. This area usually does not have water pooling, but does provide a moist habitat. This rain garden occupies approximately 90 square feet, and consists mostly of oak leaf hydrangea mixed with a few smaller plant species.

Recommendations

Wildlife Pond

We recommend adding a small pond on campus to increase wildlife. By adding a wildlife pond we will be increasing biodiversity on campus by hopefully introducing a few new species to campus, specifically reptiles and amphibians. A possible location of the pond could be in the lawn next to Murray Hall. This area is already at a low elevation and contains drains. One method to creating the pond would be to raise the drains and allow water to flood naturally. A fountain could be added to the pond to increase oxygen levels in the water. The fountain would also decrease mosquitoes during the warmer months. A misting feature could be added to the pond to benefit some species of birds, specifically hummingbirds. The pond should be relatively shallow, 1-2 feet in depth. The edges of the pond should be gradual slopes to allow for easy access by wildlife. Native aquatic plants would also be added to these ponds to provide cover to the aquatic wildlife living in these ponds. A potential native plant to be added is the fragrant water lily (*Nymphaea odorata*). This plant produces lily pads and beautiful flowers that are commonly pollinated by different species of bees and flies. Planting a native garden surrounding the pond will also increase biodiversity and attract various species to the pond.

Bird Baths

Placement of bird baths would be beneficial as a temporary or intermittent water source for birds, insects, and some small mammals. The bird baths could be coupled in areas where birdhouses are established to best benefit their users. The bird baths would need to be filled during dry months, which could be completed by student/staff volunteers. Recruiting volunteers is a barrier to this solution's implementation; automated-filling bird baths are available, but are considerably more expensive compared to traditional freestanding bird baths. To save on money bird baths could be constructed from various materials, such as old flower pots.



Figure 9. Cottontail Rabbit tracks crossing stream banks at Ravine.



Figure 10. Rain garden behind 454 House.

Alterations to Existing Water Features

Dick Run

To improve the effectiveness of Dick Run as a water source for wildlife, Allegheny College could take several steps to decrease inputs into the creek. First, the college may consider adding a more expansive riparian buffer zone to the area between the stream and the parking lot/road. This is an area where runoff is entering the stream, which can cause problems for habitat downstream of the campus, such as Mill Run. Dick Run is a tributary to Mill Run, the stream that flows through Meadville, PA and into French Creek. During water sampling, chloride levels of Dick Run were extremely high, ~400 ppm, which is almost double the 230 ppm threshold established by the EPA (Jaramillo, 2018). In addition to decreasing the runoff that is entering our stream, Allegheny College can be more conscious of the amounts of salt being used on its parking lots. Responsible and appropriate application of these products will decrease the amount that is entering the stream immediately, without having to wait until the establishment of a riparian buffer zone. Because that the existing riparian buffer zone is located on a very steep slope, runoff from campus can quickly make its way to the stream.

Additionally, Allegheny College can continue wildlife practices that they are unconsciously doing. By leaving leaves and branches and coarse woody debris in the stream, the college is protecting species that need shelter and nourishing species that use the nutrients in leaves as a source of food.

Ravine

An improvement that could be made to Ravine to encourage more wildlife is to create more pools. Stacking rocks will create low-level dams in the stream, thus aiding those species who need areas of slower flowing water, and will help to maintain areas of water when the stream is dry during summer months.

Cover

Resources

Dick Run

Dick Run is a primary source of cover on campus for multiple species due to its water source, leaf litter, and surrounding vegetation. Leaf litter on the banks are a source of cover for small mammals and rodents that can hide from predators as they forage as well as collect any materials needed for nests. Leaf litter also provides nesting materials for many different species of birds. Along with leaf litter there is also a large number of fallen branches, fallen logs, and dead standing trees that provide cover to smaller mammals like chipmunks or squirrels and many different species of birds. Another source for cover in the understory are younger trees. Dick Run does not have many younger trees and plants other than the mature trees, but it does have a few saplings and low growing plants, such as ferns (Figure 11). The main reason that there is such a thin understory is because of the large deer population as well as the thick upper canopy that limits light at ground level in the spring and summer. The area also provides shelter for amphibious species, such as the yellow spotted salamander (Figure 12). These elements all provide a safe understory for the species dwelling in the lower section of the canopy. The upper canopy is filled with a large amount of mature trees, including sycamore, maple, oak, and some deciduous tree species as well. This dense upper canopy provides a large space for tree dwelling species, including small mammals and bird species. Its lower elevation also helps keep the area secluded from the rest of the campus as the ravine's steep banks and plant life protects the ecosystem from human disturbance.



Figure 11. A fern located at the base of tree in Dick Run.



Figure 12. A yellow spotted salamander that can be found in Dick Run.

Ravine

The Ravine (Figure 13) is another source of cover for species living in the campus forest. It provides many of the same features as Dick Run, including a water source, a large upper canopy, and cover along the streambank. Unlike Dick Run, Ravine has a large amount of rhododendron growing along the ravine sides that provide cover to species like rabbits and chipmunks. Ravine has understory cover from other plant species besides the rhododendron that creep all the way to the water's edge. This provides protection and cover to smaller species trying to drink from the creeks and amphibians that may be inhabiting the area. The large canopy above provides cover and a habitat for birds and other canopy dwelling species.

Bentley Lawn

Bentley Lawn is an example of a mature forest on Allegheny's campus (Figure 14). There is a large amount of large trees, including the massive and famous sycamore growing adjacent to Bentley Hall. However, there are very few young trees. This can pose a problem as there are no replacement trees should any of the mature ones become damaged or die. The upper canopy is adequate as it still provides cover for species that nest in the upper branches of the canopy, but greater structure is needed in the understory. With the renovation of Bentley Hall, the lawn located at the front of the building was stripped of plant life during construction, but soon after the renovations were complete a few saplings were planted in front of the building. This will provide cover in the future and currently is providing a small amount of cover on an otherwise open lawn. The Bentley lawn contains very little ground cover; strategic placement of low-growing plants will provide cover to small mammals.



Figure 13. A small creek running through Ravine.



Figure 14. Bentley lawn mature tree growth.

College Court

College Court is a group of dormitory buildings located near the center of campus just to the south of the Campus Center. There is not a great amount of ground cover, but there are a few mature cedars along with some other trees that provide some cover. This is a location where Allegheny has the opportunity to make improvements similar to those at Bentley Lawn. A large upper canopy can provide some cover, but there are no smaller trees, and little leaf litter or low growing plant species.

Murray Lawn

Another location that requires an improvement of ground cover and canopy cover is Murray Lawn (Figure 15). It is a centrally located lawn space with a small amount of foot traffic aside from a few events held by the campus. The lawn is primarily grass with a few patches of clover. This provides relatively no cover for wildlife. Another issue with this area is that the only trees and shrubbery in the area are located on the edges with no other source of cover across the main lawn space.

Recommendations

Pollinator Gardens

There are already a few pollinator gardens around campus and more are planned. These gardens provide cover for a large number of different species. Some of these gardens have been planted near Carr Hall, Bentley Hall, and Steffee Hall. It is important that these pollinator gardens have a variety of native plant species. Along with cover, pollinator gardens can provide a number of benefits to native wildlife, including a source of food and nesting material. They can be planted in small grass plots with low traffic or around the bases of trees. There are multiple dead zones, which are zones with little to no cover, on campus and they can be converted into pollinator gardens to address this issue.

Rain Gardens

Rain gardens give similar benefits as pollinator gardens by providing cover for species living close to the ground, which is greatly needed on Allegheny's campus. Rain gardens can provide a water source and even create vernal pools for amphibious species, a benefit to creating those over pollinator gardens. There is a rain garden on the west side of the Admissions building. Another potential location for a rain garden is on Murray lawn (Figure 16). It has already seen some flooding issues in the past due to the slopes on the side and the low level of the lawn which makes it a viable candidate for a rain garden.



Figure 15. Murray Lawn.



Figure 16. Shrubs and low-growing plants at the bases of trees near Murray Lawn.

Hillside Thistle Problem

To the east of Steffee Hall there is a parking lot with a large hillside that was once a pollinator hill. It was an excellent example of what can be done to help benefit wildlife on campus, but it had some issues occur in the past that led to thistle overgrowing the hill and a large portion of the pollinator plants dying. There was an issue with communication that led to a misunderstanding on how the hill should be maintained during off months. This issue has been addressed and is being dealt with, but it is highly suggested that all pollinator gardens have a strict maintenance policy with clear guidelines on how the gardens should be maintained so that this does not occur again.

Planting In Mulch

Bentley Lawn is typically used for graduation ceremonies and other events, so the lawn traffic is quite high at times. Keeping a large portion of the lawn clear is important. To still provide some cover in these spaces, plants or mulch could be placed around the bases of the mature trees. This will help protect them from mower blades while also providing some cover to species living in the area. Examples of these plantings can be seen being executed near Murray Lawn (Figure 15) and the Observatory (Figure 17).

Understory

An important issue on Allegheny's campus is the lack of an understory across large portions of campus. There is a great amount of mature growth even in high traffic spaces like Bentley Lawn, but there

is no young growth to one day replace the mature growth when it eventually dies. This also poses an issue for cover as there is little cover in these spaces for species that live in the lower canopy and the understory of the campus forest. One way to fix this issue would be to plant more of an understory across all of campus. To do this more saplings can be planted along with shrubbery and a wide variety of flowering plants. This has been implemented across campus in some spots already, including the pollinator garden near Carr Hall, a tulip tree planted near Steffee Hall, and a variety of saplings planted on the front lawn of Bentley Hall.

Ground Cover

Ground cover is lacking on campus. Aside from Ravine, Dick Run, and some other small examples there really is not much ground cover. Grass lawns provide no wildlife cover. To address this problem, low-growing plants can be planted in lawn spaces with low levels of traffic. A starting point would be to identify plots that are rarely used by students, faculty, and for campus events, and convert them into clover lawns, yarrow lawns, or plant low-growing flowers (Figure 18).

Places to Raise Young

Resources

Tree Cavities

We identified several trees that have cavities of different sizes within them. Tree cavities provide crucial habitat to small mammals and many bird species. Cavities may be large enough for birds to create nests, and they might also be big enough to only provide an entry point for smaller bird species to dig into (Remm et al., 2011). For example the Downy Woodpecker, which is the smallest species of woodpecker, could utilize the smaller cavities as they could fit into the smaller holes and then excavate a larger area to live in (Basile et al., 2020).

Shrubs and Ivy

The Allegheny College campus has a lot of English Ivy, which can be seen growing along buildings, walls, and trees. English ivy can be useful for birds as roosting sites as well as a home for insects (The Wildlife Trusts, n.d.), although it should be noted that this ivy is an invasive species. We also observed

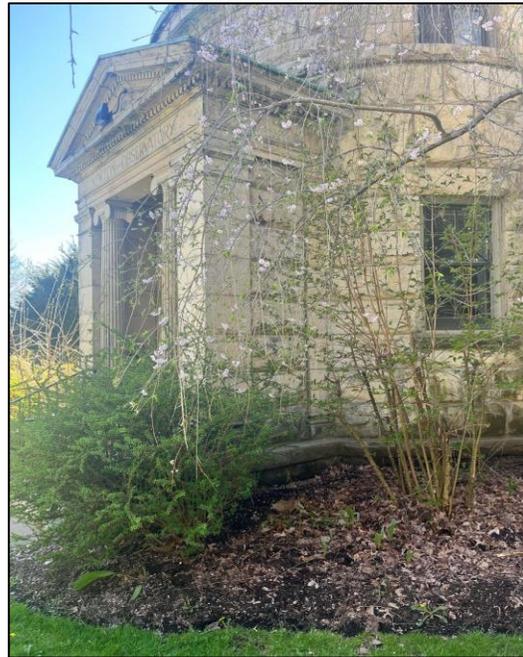


Figure 17. Shrubs and low-growing plants at the bases of trees growing near the Observatory.



Figure 18. A hillside near Montgomery Gym covered in flowers.

different types of shrubs around campus (Figure 19). Shrubs provide shelter to smaller animals. The branches in the shrubs provide birds with shelter as well material for nesting. Shrubs also provide food with blossoms and berries.

Snags and Fallen Logs

The main location where snags and fallen logs are located is near Dick Run behind the Wise Center (Figure 20, 21). These snags (dead standing trees) and fallen logs provide key habitat for animals to raise their young. Many species of birds and small mammals are able to utilize the snags, which typically have tree cavities, to burrow and create dens (Ram et al., 2011). The fallen logs provide benefits to salamanders, newts, and insects as they typically benefit from the moisture located under the logs and can use this area as habitat and to lay eggs (Davis, 2007). These are both valuable assets in this area and allows for animals to support their young.



Figure 19. Large rhododendron located near Reis Hall.



Figure 20. Single Fallen Log near Dick Run.



Figure 21. Multitude of Fallen Logs over Dick Run.

Recommendations

Bat Houses

One suggestion is to add bat houses (Figures 22, 23) to the side of Brooks Hall, because the building has had issues in the past with bats entering dormitory hallways. Figure 24 shows the location that is well-suited for bat houses because these sections of wall receive sunlight during the day, which bats prefer. To ensure that these bat houses are successful, they should have full sun during the day and could also be painted to blend in with the brick wall.

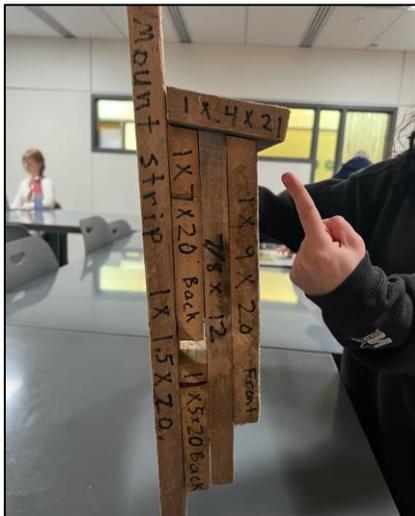


Figure 22. Side of bat house.
 Dimensions (inches)
 Front: 1x9x20; Roof: 1x4x21
 Mount strip: 1x1.5x20
 Back: 1x7x20; Back (2): 1x5x20



Figure 23. Front of bat house.

Bird Houses

Bird houses provide shelter and an area to nest. Birds have a tendency to avoid areas that have a lot of human foot traffic. We found several locations that may be suitable locations to install bird houses. These areas include Murray Hall, College Court, the area near the wooden walking bridge, the student garden, and by Ravine Hall (Ravine is optional as there are tree cavities and other habitats for the birds). If Allegheny College agrees to add these birdhouses, the project could become a collaboration with the art department as well, allowing students to come together and use different knowledge to make bird houses.



Figure 24. Side of Brooks Hall where bat houses could be placed.

Management Plan for Snags and Fallen Logs

Snags and fallen logs in the Dick Run ravine pose minimal risk to students, as there is limited foot traffic there compared to the main campus. For wildlife to utilize snags and fallen logs, there needs to be a distinct management plan in place. It is understandable that on the main campus, the college would not want to keep the snags, as they can be unstable in the face of a storm and pose a threat to students. However in the area around Dick Run, they are valuable to the overall ecosystem and more specifically, for raising young. A policy could be enacted that states that if the snag or fallen log is not a risk to the students then it can remain where it is. Having this written in a management plan would make campus practices universal and would allow for procedures to be consistent throughout campus.

Leaves on Ground

Uncollected leaf litter provides ecological benefits to the ecosystem. Not only does it recycle nutrients back into the system once it decays, it also helps promote insect species. It provides benefits to invertebrates such as butterflies, bumblebees, beetles, snails, and others (Leaf and Limb, nd). These decaying leaves are critical in providing protection to themselves and their young. For example swallowtail butterflies will use leaf litter to camouflage their chrysalises (Wheeler, 2017). On campus there is already an example of uncollected leaf litter, in the food garden located near the Carrden. The leaf litter here will provide some great nutrients into the area and protect a multitude of insect species. Presently, Allegheny mulches fallen leaves as the lawns are being mowed.

Moving Towards More Native Plants

At Allegheny College there are a variety of non-native plant species. For instance, located near the Campus Center there is a large patch of English Ivy (Figure 25). Although this plant does provide some benefits for insects and smaller mammals, such as creating an area for nests and dens, there are also some negatives to the English Ivy. This plant is non-native to the area and is an invasive species. The plant has the ability to spread rapidly and can easily overpopulate and out compete other plants in the area (Anderson et al., 2018). As Figure 25 shows, it has become the dominant plant and does not allow for other plants to be successful in the area. It also is not beneficial to younger trees as it could easily outcompete young saplings if they were to be planted in that area (Municipality of Princeton, nd). In the future the campus avoid non-native species like the English Ivy. Instead, choosing native perennial species should be prioritized for new trees and plants.

Sustainability Practices

Sustainable practices are essential to having a healthy on campus environment for wildlife. Having sustainable practices on campus improves the overall environmental quality of campus, promotes clean air, abundant natural resources, and a nontoxic environment while also increasing the biodiversity of campus.

Current Sustainable Practices on Campus

Allegheny College has been carbon neutral since 2020, and is currently working towards becoming carbon negative in the forthcoming years. The college became the first carbon neutral campus in the state of Pennsylvania and the eighth college in the nation. It first reduced its operational carbon footprint and then balanced the remaining emissions by investing in projects that continue to remove an equal amount of carbon from the atmosphere.

There are numerous ongoing sustainable practices on campus. These include the student-run garden next to Carr Hall, commonly known as the Carrden, a 40% reduction in water consumption, a 42% reduction in greenhouse gas emissions, a 30% reduction in paper consumption, installing solar panels on the Steffee Hall of Life Sciences, and the Creek Connections program. All of these programs and efforts have helped to make Allegheny College's campus a better habitat for our wildlife.

Along with all of the sustainable practices that take place on campus, there are also numerous clubs and organizations that promote sustainability. A few of these include the Allegheny College Food Rescue, the Bike Share, Green Students of Color Society (Green SOCS), Grounds for Change (GFC), the Inclusion, Diversity, Equity, Access, and Social Justice (IDEAS) Cultural Garden, the Outing Club, and Students for Environmental Action (SEA). These clubs promote sustainability in unique ways and are able to share their ideas with each other and the campus community.

Recommendations

Water Conservation

Conserving water on a college campus that houses more than a thousand students for nine months out of the year can prove to be a challenge. However, the college has done so by promoting the use of reusable water bottles and adding numerous water refill stations around the campus. These stations provide students with pre-filtered water as well as providing the number of plastic bottles that have been saved at the top of the machine. Even though we have many of these refill stations already, we do suggest that the college should invest in more, especially in dorms and heavy foot traffic areas. For example, there is only one of refill stations in Ravine-Nervi Hall, located on the edge of campus. Students who live in the part of the hall without the refill station may be less inclined to use refillable bottles and continue to buy and waste plastic water bottles.

Another way that the college continues to conserve water is the use of the rain garden on campus near the Admissions building. Rain gardens should be planted in depressed areas of the landscape and collect rainwater from roofs, driveways, and/or streets and allow it to soak into the ground (EPA, 2023). Rain gardens can be cost effective and an aesthetically pleasing way to reduce runoff. They also help filter out pollutants and provide shelter for butterflies, song birds, and other wildlife (EPA, 2023). Having a rain



Figure 25. English Ivy located by the Campus Center.

garden on campus provides all of these benefits, and increasing the number of rain gardens would further enhance groundwater recharge and reduce excessive runoff. Meadville receives quite a bit of rain each year, so having multiple rain gardens would allow low elevation areas to stay saturated for a longer periods.

Controlling Non-Native Species

Controlling non-native and invasive species is essential to having healthy wildlife habitat. Exotic and non-native species can overrun an area and provide limited environmental benefit. We do have non-native and invasive species on campus, including non-native honeysuckle, Japanese knotweed, and oakleaf hydrangeas. The non-native honeysuckle is located behind the Delta Tau Delta house on the south end of campus near Ravine. The Japanese knotweed is located by the Phi Kappa Psi house and the oakleaf hydrangea is a part of the rain garden. Thus far, these species have not created major issues on campus.

Our recommendations for these species would be to remove them from the campus and replace them with species that are native and similar in form and function. For example, the oakleaf hydrangeas could be replaced by red twig dogwood. This species is native to the area and would not require any extra maintenance. Red twig dogwood should be planted in an area that receives full sun or partial shade with well-amended soil. The area where the rain garden is located would be a good option for this native species because it reflects the necessary characteristics that red twig dogwoods need to thrive. The Japanese knotweed has also proven to become invasive in the area that it is planted. From our observations, it has overtaken the area and blocks any other species that is around it to grow and fully bloom. Taking this into consideration, the species should be removed and replaced with a native, non-invasive species.

Reduce Lawn Areas

Our third, and final, recommendation for making sure the college is a sustainable campus is to reduce the amount of lawn areas on the main campus. Having dominance of manicured lawn across campus does not promote the natural environment. The constant mowing in the growing season months also requires a large amount of human, economically-intensive labor, as well as consumption of fossil fuels. Encouraging the growth of wildflowers by reducing lawn areas would increase biodiversity on the main part of campus. Wildflower areas bring more animals to campus due to the ability for pollinators to thrive there and providing shelter for small species like rabbits and squirrels. Colleges around the country have begun to encourage the growth of their lawn areas instead of constantly mowing, and it has provided a healthy habitat and an aesthetic campus. Areas on campus are already starting to see wildflower growth include Bentley Hall, Oddfellows, and Carr Hall. These wildflower gardens are somewhat hidden, but having them on campus is benefiting the environment and wildlife without disturbing students and college employees.

Conclusion

We found that Allegheny College met the criteria for recognition as a National Wildlife Federation Certified Campus Wildlife Habitat. Allegheny College does indeed have cover, food, water, places to raise young and active sustainability practices. We can improve these assets by planting more diverse native species around campus, installing bat and bird houses, leaving snags and fallen trees, and enhancing water availability. Continued removal of invasive species must continue. By doing these restorative practices, we can create more natural, beneficial, and healthy wildlife habitat on campus. Working with the Allegheny College Office of Sustainability, Physical Plant Department, and the Department of Environmental Science and Sustainability, Allegheny College will be able to improve its campus as a home for all species.

Literature Cited

- Anderson, M. and Crosby, M. K. (2018). An assessment of invasive plants on Shorter University's campus. *Mathematical and Computational Forestry & Natural Resource Sciences* 10: 24-29.
- Arbor Day Foundation. (2023). Browse the Tree Database. Arbor Day Foundation. Retrieved April 12, 2023, from <https://shop.arborday.org/treeguide>.
- Basile, M., Asbeck, T., Pacioni, C., Mikusiński, G., and Storch, I. (2020). Woodpecker cavity establishment in managed forests: Relative rather than absolute tree size matters. *Wildlife Biology*, 2020(1): 1-9.
- Brittingham, M. (2017, March 21). Landscaping for wildlife: Trees, shrubs, and vines. Penn State Extension. Retrieved April 12, 2023, from <https://extension.psu.edu/landscaping-for-wildlife-trees-shrubs-and-vines>.
- Davis, A. K. (2007). Walking trails in a nature preserve alter terrestrial salamander distributions. *Natural Areas Journal*, 27(4): 385-389.
- Jaramillo, C. (2018, May 16). De-icing salt boosts safety during storms, but it poses a threat to fresh water. NPR. Retrieved March 27, 2023. <https://stateimpact.npr.org/pennsylvania/2018/03/07/de-icing-salt-boosts-safety-during-storms-but-it-poses-a-threat-to-fresh-water/>.
- Municipality of Princeton. (n.d.). Negative effects of English ivy. Municipality of Princeton. Retrieved April 9, 2023. <https://www.princetonnj.gov/1151/Negative-Effects-of-English-Ivy>.
- PA Enflowered. (2023). Nymphaea [water lilies]. PA Enflowered. Retrieved March 22, 2023, from <https://www.paenflowered.org/apgii/nymphaeales/nymphaeaceae/nymphaea>.
- Remm, J., and Löhmus, A. (2011). Tree cavities in forests—the broad distribution pattern of a keystone structure for biodiversity. *Forest Ecology and Management* 262(4): 579-585.
- The Wildlife Trusts. (n.d.). Ivy. Retrieved April 9, 2023, from <https://www.wildlifetrusts.org/wildlife-explorer/wildflowers/ivy>.
- Wheeler, J. (2017, October 6). Leave the leaves! The Xerces Society. Retrieved October 31, 2023, from <https://xerces.org/blog/leave-the-leaves>.