Environmental Impact, Successes, and Challenges of a Statewide Green Schools Program

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Abstract

This paper evaluates the affect that Green School programs have on their local environment. The design of this study includes the assumption that Green School programs not only benefit students and teachers—while developing their environmental literacy and environmental stewardship—but that the program also provides essential ecological improvements. To perform this assessment, data excel sheets submitted by Maryland Green Schools (MDGS) from 2014-2019 were assessed to quantify environmental parameters and to demonstrate environmental advantages produced by this Green School program. Additionally, representatives from exemplar Greens Schools and random Green Schools across the state of Maryland were interviewed in order to identify factors contributing to the success of the Green Schools program as well as any challenges or barriers green schools are facing.

Key words: Green Schools programs, environmental literacy, environmental stewardship,

Introduction and Literature Review

This paper evaluates the affect that Maryland Green Schools have on Maryland's environment. A Green School is defined as a school consisting of a healthy, safe environment conducive to learning, while simultaneously conserving energy, money, and environmental resources (Boston Public Schools, 2013). Green Schools are designed with the future in mind—providing a scholastic environment for students while teaching them sustainable practices and preparing them to be supporters and leaders towards a healthier, cleaner, more eco-conscious future (Heming, 2017).

Green School programs offer an array of benefits to the individuals involved. Students exposed to Green School programs demonstrate increased confidence, development of problem-solving skills, improved test scores, and improved attention spans when compared to pre-green school program exposure (Heming, 2017). Research indicates that academic performance increases when students are

given outdoor learning opportunities (Bartosh et al., 209; Coyle, 2010; Khan et al., 2019; Kuo et al., 2018; Richmond et al., 2017)). Several studies have documented increased standardized test scores (Ghent et al., 2014; Kweon et al., 2017; Lieberman et al., 2000; Lieberman et al., 2005; Lopez et al., 2008), enhanced attitudes towards school (Arikan, 2021; Fagerstam & Blom, 2013;Shay-Margalit & Rubin, 2016; Waliczek et. al., 2001), improved in-school behavior (Lieberman & Hoody, 1998; Shay-Margalit & Rubin, 2016), and attendance (Price, 2013) in schools that integrate outdoor learning experiences into their curricula versus those that do not. Many researchers believe that these observed performance increases can be attributed to the immersive experience of outdoor learning (Benefield et al., 2006; Gill, 2014; Kuo et al., 2019; Lloyd, et al, 2018; Waite, et al., 2017; Wells et al., 2015; Wells, 2000). One study evaluating the influence of Green School certification found that educational gains and improved environmental performance are exhibited by students in schools accredited as ongoing green (Goldman et al., 2018). An evaluative review on Green School programs involving school gardens assessed 12 different studies and found that 9 of the 12 studies displayed a positive difference in test scores between gardening students and non-gardening students. The review reported that in all the studies, school gardening increased science scores (Blair, 2009).

Similarly, teachers also benefit from training, experience, and exposure to these green programs. Teachers reported that becoming acclimated to Green School programs by leading environmental education programs or by incorporating environmental literacy into their curriculum increased their self-confidence and self-efficacy (Ayaz & Sarikaya, 2021; Haines et al., 2019; Smll et al., 2012).

Natural environments emulate restorative qualities that stimulate children's adaptive developmental processes such as motor fitness, self-confidence, creativity, and learning (Blair, 2009). Students and teachers alike have reported decreases in stress levels after exposure to nature and outdoor learning (Alvarsson et al., 2010; Bratman et al., 2012; Vella-Brodrick & Gilowska, 2022). Outdoor learning offers students an outlet to be active while increasing their physical, social, and mental health. In 2010, the National Wildlife Federation surveyed 1,878 educators on their professional opinions on outdoor learning—75% of the educators interviewed agreed that students who are exposed to regularly scheduled time outdoors exhibit a higher level of creativity and problem-solving skills (Coyle, 2010). As a direct result of outdoor learning exposure, Green School students suffering from ADHD have displayed decreased symptoms (Kuo & Taylor, 2004). The majority of parents with children experiencing ADHD reported a greater reduction in ADHD symptoms exhibited by their children after green outdoor activities when compared to activities involving other settings (Kuo & Taylor, 2004). Aside from promoting independence, confidence, decision-making, and problem-solving skills, outdoor learning also develops students' empathy towards others and develops their self-discipline and initiative. Immersive experiences in nature incite a student's desire to comprehend and cognitively digest ecological concepts and processes (Blair, 2009).

Many researchers support the claim that childhood experiences in green, outdoor environments cultivate lifelong positive attitudes toward nature and sustainability (Louv, 2008). One study conducted by Duerden & Witt (2010) synthesized that environmental programs involving direct ecological experiences catalyzed

environmental knowledge into a stronger motivating force for pro-sustainability, eco-responsibility, and positive environmental attitudes. When students are given the opportunity to participate in environmental projects, they can see the direct progressive effects of their efforts toward sustainability and environmental betterment (Duerden & Witt, 2010). Researchers evaluating environmental education in Turkey observed that these programs contributed to students' gaining an understanding of ecological processes and concepts, developed students' perception of nature, and increased students' eco-responsible tendencies and behaviors (Erdogan et al., 2013). These opportunities provided by Green School programs allow students to feel a part of something larger than themselves. As a result of involvement in environmental projects and programs, students exhibit improved eco-attitudes (Bergman, 2015; Robina-Ramirez & Medina-Merodio, 2019). The demonstrated increase in eco-attitudes epitomizes the significance and value of Green Schools and Green School programs (MacLeod, 2012).

Maryland Green School Program

The Maryland Green Schools Award Program (MDGS) is the primary Green School program for the state of Maryland. MDGS is designed as an opportunity for schools and their surrounding communities to investigate the positive and negative ecological impacts their school is having on the surrounding environment (Maryland Association for Environmental and Outdoor Education (MAEOE, 2019). By implementing the MDGS program, students are empowered to make real changes by advocating and employing sustainable practices thereby fostering environmental literacy while also reducing the school's environmental impact (MAEOE, 2019). The MAEOE designed this program to provide eco-educational opportunities for students ranging from pre-K through 12th grade in hopes of increasing environmental awareness and stewardship across all age groups. The MDGS program is aligned with the Chesapeake Bay Watershed Agreement goals (Chesapeake Bay Program, 2022) while also supporting the Maryland State Department of Education environmental literacy standards and environmental literacy graduation requirement (State of Maryland, 2020).

In order to become a certified MDGS, a school must meet the Green School objectives set by MAEOE; these objectives include environmental issue instruction, professional development, altered environmental behavior, celebration of sustainable practices, responsible transportation and reduced emissions/carbon footprint, pollution reduction, water and energy conservation, structures for environmental learning, habitat restoration, solid waste reduction, and community partnerships (MAEOE Green Schools application, 2018). Upon completion of the listed objectives, a school has earned its certification as a Maryland Green School (MDGS).

Currently, there are approximately 681 registered Maryland Green Schools. Maryland Green Schools receive instructional aid from their partnerships with either a Green Center or Green Leader—or from both for some Maryland Green Schools (MAEOE Green Centers Program, 2022; MAEOE Green Leaders, 2022). A Green Center is assigned to a school becoming "green" and is a useful resource even after achieving certification. Green Centers provide valuable information

about the Maryland Green School Program. Green Center staff and volunteers assist schools working towards certification. Green Leaders are the individuals representing the assigned Green Center. They act as MAEOE's navigators for the MDGS program by guiding uncertified schools through the certification process and helping these schools devise green projects to meet the requirements of certification. Again, they are a valuable resource even after receiving this award.

One study evaluating the influence of Maryland Green Schools on student achievement concluded that students enrolled in Green Schools display higher performance levels across all assessed criteria (Ghent et al., 2014). These conclusions were based on a 3-year assessment of pre- and post-Green School designation from exam pass rates in reading and math for 5th and 8th graders and exam pass rates in math, biology, English, and language arts for secondary students. The data showed that the 5th and 8th-grade students' Martland School Assessment performances in reading and math increased significantly from pre- to post-MDGS program instillation. Additionally, 10th-grade students also demonstrated a significant increase in algebra and English from pre- to post-MDGS designation (Ghent et al., 2014).

As previously stated, research confirms that the MDGS program provides various benefits for students, teachers, and leaders involved; however, the environmental impacts of the programs have not yet been thoroughly evaluated. The primary assumption for this research is that Maryland Green Schools not only positively affect all individuals involved but that they also provide positive benefits to the environment. Therefore, the objective of this study is to evaluate all Maryland Green Schools and their impact on the local environment by quantifying several different environmental parameters. The research question is "What are the environmental impacts of Maryland Green Schools?"

Methods & Materials

Quantifying Environmental Impact

This study is an analysis of the environmental impact of Maryland Green Schools (MDGS). Environmental impact was measured by quantifying numerous environmental parameters based on green school project data submitted to the MAEOE by certified MDGS. The environmental parameters quantified include pounds of recycled material; footage of stream bank cleaned; number of trees or shrubs planted; square footage of rain gardens installed; percentage of schools with no idling zones; percentage of schools that compost; volume of rain barrels installed; square footage of gardens installed; number of bird boxes created; square footage of habitat installed; and square footage of invasive species removed. The exact values for all listed environmental parameters for MDGS were determined using data provided by the MAEOE (MAEOE Green Schools Program, 2019) from 2014-2019.

The data supplied by MAEOE was utilized to provide a general statement of how MDGS are performing in all seven categories of the MDGS application which include Water Conservation/Water Pollution Prevention, Energy, Solid Waste Reduction, Habitat Restoration, Structures for Environmental Learning, Responsible Transportation, and Healthy School Environment (MAEOE Green Schools Program, 2019). This study evaluates 635 MDGS that were certified at the time of the

study and analyzes quantitative environmental action project data of these schools.

Environmental Interviews

The second portion of the study consisted of a series of interviews including four exemplar green schools, four random green schools and three non-green schools; one of each was chosen from Southern, Central, Western, and Eastern Maryland. The interview portion was designed to identify perceived barriers as well as elements of the program that have contributed to the success of MDGS programs in these schools. These factors were identified with the goal of improving the MDGS program as well as making these elements known so that schools considering seeking MDGS status or states running similar programs may consider how these barriers and positive attributes may affect them.

An exemplar green school was defined as a certified MDGS that is continuously expanding on its environmental action projects, incorporating environmental literacy into all subjects, and is effectively inspiring the local community to contribute to the school's environmental projects. Non-green Schools were interviewed to measure statewide awareness of the program as well as to determine whether or not Non-green Schools are implementing their own green initiatives outside of the MDGS program. Interviewing Non-green Schools was necessary in order to determine whether these Non-green Schools find the MDGS certification process motivating or meaningful. This helped us to understand why there are still Non-green Schools across the state that have not yet partaken in the MDGS certification process.

In each region, one county was chosen from which one of each type of school (exemplar, green, non-green) was selected. The county chosen in Southern Maryland consisted only of Green Schools, explaining why non-green schools were interviewed in three of the four counties rather than four as initially planned. When reaching out to these schools to ask for their participation in the project, the non-responsiveness of most schools was surprising. This made the process of finding representatives from four schools in each county a bit difficult and rather time-consuming as many schools never replied or declined to participate. As many schools as possible were contacted in each county—in some counties, all schools were contacted. Schools included in the interview portion of the study were those that were willing to participate and offer insight and information. Thus, the sample was based on convenience.

Administrators/teachers from each of these schools were interviewed to determine what facets of the Maryland Green Schools program are most challenging and what facets are most beneficial. Interviewing non-green schools provides insight regarding statewide awareness of the program and provides reasoning as to why some schools have not yet begun the Green School certification process. Determination of these potential barriers revealed what needs are and are not being met and thus, will enable MAEOE to better serve future green school applicants.

The interview questions for exemplar and random Maryland Green Schools included:

- ☐ What kind of relationship does the school have with Green Centers or Green Leaders?

- ☐ What is the community involvement?
- ☐ What green school implementations have worked best? What implementations have not worked?
- ☐ Has administrative consistency made a difference in your success as a Green School?
- ☐ Is there a correlation between administrative consistency and how many grades the school expanded on since first application?
- ☐ What is the overall impact of the Green Schools program on the entire school? Are there more students involved in clubs that are environmentally based since the school achieved Green School status? Are there more teachers involved?
- ☐ How many established partnerships does the school have?
- ☐ What are some barriers your school is facing that have prevented it from expanding since certification?
- ☐ If you had unlimited funding, what would you do next?
- ☐ How can MAEOE help your school further its expansion?

Interview questions for Non-green Schools included:

- ☐ Have you heard of the Maryland Green Schools (MDGS) program?
- ☐ Are you interested in learning about the MDGS program?
- ☐ Does your school have a green initiative?
- ☐ Do you know if your principal is supportive of Green School programs?
- ☐ Does Green School recognition motivate you to become certified?
- ☐ Does your school possess a "green grant"?
- ☐ Does your school have an eco-club, Future Farmers of America, 4H, or participate in a BioBlitz?

These questions were asked with the intention of determining and addressing barriers that Green Schools face after certification which prevent them from further developing sustainable practices.

Quantitative Results

After evaluating the data excel sheets provided by MAEOE, the following quantifications were determined (See table 1; table 2). The MDGS program began in 1999, however, green initiative data was not recorded until 2011. In the early years of data collection and recording, the data was recorded inconsistently. Beginning in 2014, a data record template was created and used consistently; however, there were still a few key differences in documentation style between 2014 and 2015, hence we are presenting the parameters in two separate tables.

Table 1: Table demonstrating quantified environmental parameters from 2014 to 2019.

Environmental Parameters	Number of trees/shrubs planted	Square footage of plants implemented (ft^2)	Square footage of habitat implemented (ft^2)	Square footage of raingardens implemented (ft^2)	Volume of rain barrels implemented (gallons)
2014-2019: Totals	36,674	24,135,066.1	21,722,090.77	600,268.1	65,399

Table 2: Table depicting quantified environmental parameters during 2015 to 2019.

Environmental Parameters	Square footage of garden area implemented (ft^2)	Square footage of Invasive species removal (ft^2)	Number of bird houses created	Stream bank cleaned (feet)	Recycled Material (lbs.)
2015-2019: Totals	71,262.05	1,128,678.13	2,955	202,411.5	14,642,231.79

To generate the percentages in Figure 1 and 2, Excel sheets provided by MAEOE for each year (2015-2019) were utilized to determine, of the Green Schools recorded, how many indicated that they are currently incorporating composting (Figure 1) or a no idle zone at their schools (Figure 2).

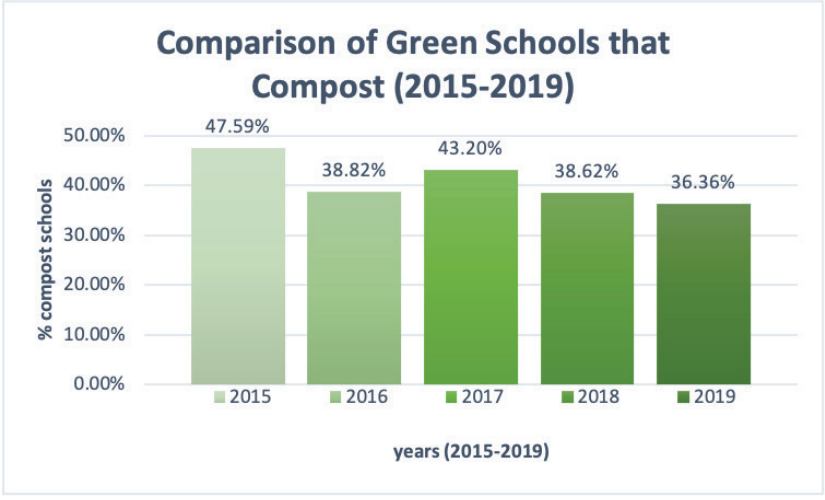

Figure 1: Graph demonstrating the annual percentage of Green Schools that compost from 2015 to 2019

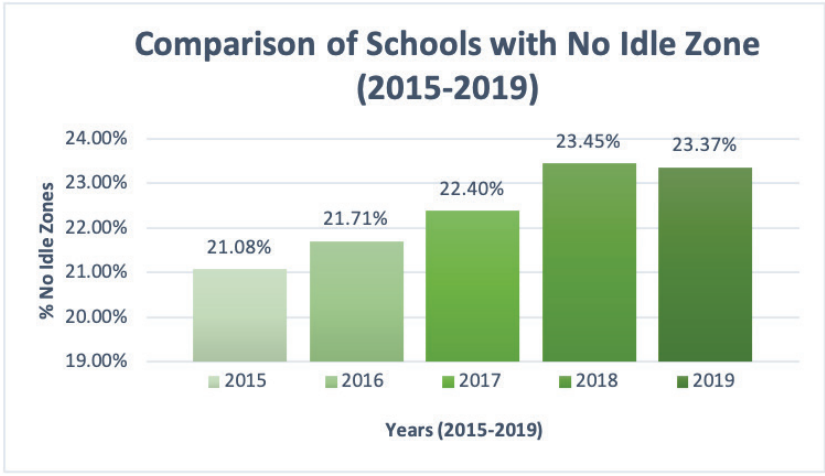

Figure 2: Graph demonstrating the annual percentage of Maryland Green Schools that enforce a no idle zone during student drop-off and pick-up from 2015 to 2019.

Discussion Quantitative Implications

These quantified environmental parameters provide insight as to how well MDGS are performing in all seven categories of the MDGS application. They also indicate the numerous benefits that these implemented initiatives are providing for Maryland's environment. Maryland Green Schools accounted for over 36,000 trees planted within the state. This is a vast environmental achievement. A sapling absorbs about thirteen pounds of carbon dioxide each year (Bordelon, 2019). Being that MDGS planted approximately 36,674 trees (from 2014-2019), that translates to 476,672 pounds of carbon sequestered each year. A mature tree absorbs forty-eight pounds of carbon each year (Keystone 10 Million Trees Partnership, 2022). Once these planted trees reach maturity, they will sequester nearly 1,760,352 pounds of carbon each year, resulting in a positive environmental impact.

Aside from carbon sequestration, these trees can also serve as a tool for flood mitigation and Best Management Practices (BMPs). In both suburban and urban settings, a single deciduous tree has the capacity to capture between 500-760 gallons of rainwater/runoff per year (Keystone 10 Million Trees, 2022). Each year, the 36,674 trees planted intercept 18,337,000 to 27,872,240 gallons—depending on the maturity of the tree.

Additionally, the planted trees provide energy savings via their strategic placement around school buildings. These strategically placed trees can reduce air conditioning by 30% and can save 20-50% in energy used for heating. These trees create a net cooling effect making it so that each tree serves as ten room-size air conditioners operating about twenty hours a day (Keystone 10 Million Trees, 2022). Not only do these strategically placed trees provide energy savings but they also reduce annual heating and cooling cost by eight to twelve percent (Keystone

10 Million Trees, 2022).

Based on the quantified environmental parameters, it was determined that MDGS are performing spectacularly regarding the following categories of the MDGS application: Water Conservation/ Water Pollution Prevention through implementing raingardens and stream bank cleanups; Energy by not only providing energy savings through strategic tree placement but also by implementing energy efficient light bulbs and motion sensing light switches; Habitat Restoration via plant, shrub, habitat, and bird house installation; Structures for Environmental Learning by employing garden and habitat areas, pollinator gardens, and outdoor classrooms; and Healthy School Environment as all of these implemented initiatives grant students access to new and beneficial experiences.

Analysis of the quantified values indicated that the two categories in which MDGS are performing very well but could still stand to improve are Solid Waste Reduction and Responsible Transportation (Figure 1 and 2). As demonstrated by Figure 1, each year (from 2015-2019), less than fifty percent of Maryland Green Schools compost. Although Maryland Green Schools have significantly contributed to Maryland's Solid Waste Reduction by recycling over fourteen million pounds of materials since 2015, increasing the percentage of Green Schools that compost is the key to improving MDGS performance in Solid Waste Reduction. By encouraging more MDGS to compost, we can reduce materials deposited at landfills and can reduce greenhouse gas (GHG) emissions (Environmental Protection Agency, 2022). In addition, composting provides various benefits including soil enrichment by increasing moisture retention and suppressing plant pests and diseases. Composting reduces the need for chemical fertilizers that can be harmful to students and the environment. Food and yard waste composition promotes production of beneficial bacteria and fungi that aid in degrading organic matter into humus which provides rich nutrients for local plants (Environmental Protection Agency, 2022). Several teachers and administrators at different Green Schools across the state were interviewed to provide insight as to why so few MDGS implement composting.

From these interviews, it was determined that the most common reasons contributing to the lack of composting at MDGS include lack of administrative support, spatial limitations and restrictions, and safety concerns. Many teachers expressed that their school was unable to implement composting due to administrative pushback out of concern that composting bins and barrels might attract wildlife and become a safety hazard for their students. Across the state, many counties require schools to have their composting bins a specific distance from the school building, numerous MDGS are incapable of meeting this requirement due to school grounds' spatial limitations. If we can find a way to address these composting concerns and limitations, not only will MDGS improve their Solid Waste Reduction performance, but the state of Maryland will benefit as a whole by reducing its carbon footprint.

Regarding Responsible Transportation, from 2015 to 2019, less than twenty-five percent of MDGS enforced a "no idle zone" during student drop-off and pick-up (Figure 2). Responsible Transportation is the most complicated category to record and to implement. The primary methods that schools employ for Responsible Transportation are carpooling, no idle zone, school bus system, public transportation, and walk/bike to school days. Other methods to implement Re-

sponsible Transportation include showing students biking safety videos, installing bike racks, carpool training, etc. This category proves challenging for MAEOE to record being that schools have to try to report their estimated percentages of students and teachers that carpool, take public transportation, utilize school transportation, and students/teachers that participate in walk/bike to school events. This data can be difficult to gauge and even more difficult to implement based on location and responsiveness of student, parent, and teacher body. All of these implemented methods can only be suggestions, they are not designated projects, thus, there is no obligatory participation or guarantee that they will make an impact. Additionally, location significantly contributes to the success of these Responsible Transportation implementations. In submitted MDGS applications, teachers expressed that location affected the effectiveness of implemented transportation efforts. Several stated that because the community was near the school, the majority of students utilized the school bus system and the remaining student body either walked or rode their bikes to school or carpooled. Some schools even employed a "walking school bus" which was led by a group of teachers that would safely walk a group of students to school each day.

There were several schools that expressed that public transport was too far from their school for students, making it so most students utilized the school bus system; only one family walked to school due to the area being too rural for students to safely walk there. Although these are challenging obstacles to address, they are crucial to the successful reduction of Maryland's carbon footprint. Not only would implementing a "no idling zone" at all Maryland Green Schools provide various benefits to the environment, but also to students, teachers, and parents. We must consider the detriment we are inflicting upon students walking to designated vehicles as well as the teachers guiding them as they are all subjected to dangerous fumes emitted by the idling vehicles they walk past (Minos, 2022). Inclusion of no idle zones is crucial to protecting students and teachers who can suffer stunted lung growth and can experience lung disorders such as asthma (Minos, 2022). Additionally, idling vehicles release harmful GHGs (greenhouse gases) and consume copious amounts of petroleum which negatively impacts the environment by contributing to carbon pollution and atmospheric (global) warming (ibid). If we can convince MDGS to enforce obligatory protocols that must be followed, such as an enforced "no idle zone" for bus drivers and parents/guardians, this would be a major step in the direction of carbon emission reduction.

Qualitative Results

From interviewing non-green schools, random Green schools and exemplar Green schools, the following observations were made:

- ☐ All non-green schools reported that they do not find green school certification to be a motivating or meaningful title
- ☐ All three non-green schools interviewed stated that they were aware of the Maryland Green School program
- ☐ Two of the non-green Schools specified that they were not interested in learning more about the MDGS program
- ☐ Two of the non-green schools have an environmental club/host ecological

seminars
- ☐ All non-green schools implemented green projects at their school despite not being certified
- ☐ All principals interviewed stated that they support the program although their school is not currently a MDGS
- ☐ Administrative support is completely crucial to success as a green school
- ☐ Having enough teachers involved in a school's Green School program determines the school's ability to maintain or expand green initiatives
- ☐ The more partnerships a school can generate, the more resources they have access to and ultimately the better they perform as a Green School
- ☐ Exemplar Green Schools incorporate green initiatives and projects into all scholastic subjects
- ☐ Exemplar Green Schools choose directly applicable projects that serve a purpose
- ☐ Exemplar Green Schools efficiently involve most of—if not all—staff members
- ☐ Teacher trainings are important for growth
- ☐ Some of the biggest barriers are that Green Schools face are pushback from grounds grew and administrators on outdoor projects and change of staff with no successor to continue the program

Discussion Qualitative Implications

It was reassuring that all non-green schools interviewed stated that they were aware of the Maryland Green School program as this indicates that the program is being properly advertised across the state. Two of the Non-green Schools articulated that they were not interested in receiving more information about the MDGS program, giving reason that certification was an undertaking that their school is not yet equipped for. One of the principals expressed that "as a small school and working as a Teaching Principal in a Title I School, the focus is on our students. Our staff work diligently to implement the Maryland State Curriculum in a way that engages our students in active hands-on learning." Although the school is focused on hands-on learning, it is not yet prepared to meet the requirements of Green School certification. The other principal that declined further information on the program explained that she had previously been employed at a MDGS and was aware of all that it entails and felt that her school was not yet ready for the work necessary to obtain certification. In comparison, the third school interviewed expressed interest in learning more about the program as they are in the midst of achieving certification and felt as though the more informed they are, the better implementations they can employ.

Although these non-green schools are not certified, they still delegate efforts toward including green practices such as outdoor classrooms and stream banks cleanups. A couple of the schools interviewed had several excellent projects in place including a trout raise and release program as well as allowing students to explore the local watershed and complete water quality testing to learn how water quality affects the local trout population. Additionally, this non-green school was engaging in a partnership with the Maryland Department of Natural Resources (DNR) by which the school monitored American Chestnut trees for DNR scien-

tists. The school also tapped trees in a maple grove located on school property, created a pollinator garden, and planted an apple orchard. These outdoor structures were utilized as tools to provide hands-on, outdoor learning experiences for their students. This year, the school plans to implement more initiatives including a greenhouse project and a rain garden that will collect run-off from the parking lot.

One of the most surprising discoveries made was that all the non-green Schools reported that they did not find the Maryland Green School title to be meaningful. This indicates that more work needs to be done marketing the program to show people the positive benefits that this program offers for its students and staff. These non-green schools need assurance that achieving certification is not about the award itself but is about incorporating practice that will strengthen the spirit of their school's community.

When asked if they found the MDGS award to be meaningful, one of the principals stated that "our focus is on providing quality education through the most motivating and engaging activities for our students. The banner is motivating to some schools but…the recognition we seek is through our students not the [MDGS] flag." Another principal plainly stated that that title does not prove to be meaningful. As mentioned, one of the schools interviewed is currently in the process of obtaining Green School certification—the green team leader at this school explained that after convening with her green team of high school students, they collectively decided that they wanted to become certified, not for the sake of having that title, but because they want to create a green community within their school and certification was the best method for holding themselves accountable in reaching this goal.

Practically all the interviewed non-green schools possess an environmental club or incorporate ecological seminars. One of the schools had both an environmental club and a climate action team that students could attend after school. An elementary school interviewed hosted voluntarily eco-seminars for each grade level where students from a neighboring high school would come and administer presentations to the elementary students.

Thorough interviewing of random and exemplar Green Schools across the state of Maryland allowed for the identification of key factors and differences regarding characteristics that comprise a successful Green School versus an exemplar green school. A successful Green School is a school that has met all objectives set by the MDGS application and is continuously working on progressing initiatives at their school. In comparison, an exemplar Green School is a school that has gone above and beyond the requirements of the MDGS application and is constantly employing new and innovative ways to incorporate sustainability. Becoming an exemplar green school requires time, patience, and effort—it is not something that is achieved during the initial certification process but rather is something that a school must work on achieving and perfecting.

Both successful and exemplar Green Schools demonstrate the value of administrative support. All schools reported that administrative support was essential to their growth as a Green School—many green team members articulated that it is impossible to accomplish anything without the support of your administrators. Several interviewees stated that oftentimes, projects flow more smoothly when your administrators back your projects or are involved in some way as, sometimes, there are necessary approvals that can only be obtained or are easier to obtain as

an administrator.

At these successful and exemplar Green Schools, the green team members were always established principals, teachers, or staff that had been at the school for several years—anywhere between five to twenty-two years. Having these long-standing employees and relationships allowed these schools to continuously progress and innovate new initiatives being that all members were aware of and endorsed the school's green projects. Successful Green Schools always have at least three green team members—when a school has one or two people responsible for all sustainable developments, it is overwhelming and difficult to maintain and advance initiatives.

Exemplar Green Schools discussed the importance of incorporating shared responsibility by having most, if not all staff, involved in green initiative implementation and development. They explained that having most or all staff involved makes sustainable incorporation much easier and more achievable. Although many schools struggle with getting most or all staff involved, shared responsibility is the best method for progressing your program within your school. Teachers have a lot on their plates, oftentimes making it challenging to convince teachers to participate in their school's green team; however, as explained by one the exemplar Green School principals, schools must focus on incorporating the Maryland Green School program into every subject before they can effectively get more teachers onboard. This principal mentioned that at her school, they utilize green projects and green project data to teach all subjects. For example, the school conducted a green project with students by which they recorded data, they used this data and incorporated it into math class to teach decimals. They created a school garden and had their elementary students plant the seeds, they used this as an opportunity for a math lesson on how to use a ruler to measure the distance between seeds as well as a reading and comprehension lesson by having the students read and comprehend the instructions on the back on the seed packets. This method of incorporation makes it feasible for teachers to participate without increasing their workload while simultaneously promoting sustainable practices and environmental literacy.

The story of Crellin elementary school

Crellin Elementary School (CES) is located in Oakland, Maryland within Garrett County. The town of Oakland is the west-central part of Garrett County. Crellin Elementary is a near perfect example of a successful Green School. CES is the true embodiment of MAEOE's intended purpose of the MDGS program. This school has worked diligently with its Green Centers such as Hickory Environmental Center to meet the needs of their Green School and to provide more opportunities for their students. Crellin has gone beyond working with their assigned Green Centers and has developed partnerships with key organizations such as the Chesapeake Bay Foundation and Smith Island to supply their students with new immersive eco-educational opportunities as well as to provide staff with inspiration for new environmental action projects.

CES has the complete support of their community; community members are the muscle behind many of their implemented projects. Their principal expressed that it took time to evoke communal involvement, but she began with asking parents and community organizations for help and was able to convince these members to volunteer.

In regard to initiative implementation, Crellin's principal stressed the importance of incorporating initiatives into what is a current need or problem at their school. This allows students to witness issues that are affecting their school and become actively engaged in solving these issues. Crellin's motto is to teach students to take care of their own space because they must first learn how to tend issues in their own backyards before they can solve issues in distant places.

Principal Dana McCauly also expressed the importance of learning from unsuccessful implementations. She stated that she did not see any unsuccessful initiatives as failures but rather used them as an opportunity to convene with staff, discuss why they did not work, and find a new approach. For example, students at Crellin Elementary planted different plants in an area on campus, but none of the plants grew. Rather than perceiving this as a failed attempt, they used this as an opportunity for students to study the soil area to determine exactly why the plants did not grow. As projects are incorporated—whether successful or not—the more everything builds off of each other and continues to expand.

Overall, the main attributes of Crellin that have contributed to its success as a Green School are reaching out for assistance from organizations and community members, actively engaging students, trying new things, and making the best out of any situation.

Several of the schools reported having involved Green Centers or Leaders as well as community members provided them with crucial resources. For example, a green team at one of the schools planned to attend a teacher training at their Green Center that would provide their teachers with information on how to incorporate environmental literacy; however, the training was going to cost twenty-five dollars per participant and the school was unable fund the training so their Green Center graciously waved the fee so all the teachers could attend. Green Centers also provided outstanding site visits such as animal shows for students, or even Green Center employees hosting educational discussions for teachers to attend. Exemplar and successful Green Schools expressed the criticality of their community partnerships. Examples include partnerships with a local nursery that was able to provide the school with discounted plant prices, with the community beekeeper that would come and speak to the students on the importance and purpose of pollinators, or simply parents within the school stepping up and assisting with green initiatives such as garden maintenance. Exemplar Green Schools always possess between five to ten or more partnership thereby exemplifying the influence and contribution that these partnerships have on the growth and development of a school's sustainable practices.

As previously mentioned, exemplar Green Schools emphasized the purpose of incorporating the program into every subject as well as picking projects with purpose. Picking a project with purpose involves integrating green initiatives that meet a need or address an issue on the school's campus or surrounding community. For instance, one exemplar school decided to plant a pumpkin patch because they wanted pumpkins; however, this project did not last being that it served no purpose. The school learned from this experience, decided to replant the pumpkin patch with the intent of using the pumpkin seeds to discuss plant growth and reproduction and used the harvested pumpkins to cook with during home economics class.

The exemplar Green Schools also emphasized the cruciality of reaching out and asking for assistance. Many expressed that if they had been apprehensive about contacting MAEOE, Green Centers, or community members for access to resources, their school would not have progressed as fluidly and exceptionally as it has.

Interviews of MDGS determined specific factors that have contributed to the success of these green schools including administrative support, partnerships, and incorporation of purposeful, applicable projects. Another factor that has contributed to Green School success is teacher trainings. These trainings expose teachers to information that better prepares them as environmental educators and equips them with knowledge of innovative sustainable practices. A primary contributing factor to Green School achievement is effectively involving your surrounding community. Successful Green Schools efficiently create a green culture at their school by engaging parents and community members. By engaging parents and giving the opportunity to participate in green projects, parents observe the positive impact that the program is having on their children and are encouraged to become involved themselves by assisting on projects and project maintenance.

Success can also be achieved via collaboration with neighboring schools. Several green team leaders conveyed that some of their most successful projects had been in collaboration with neighboring schools—some of the projects were long-standing and had been going on for more than two years. Even simple collaborative efforts such as having upperclassman at high schools teach lessons or administer readings to students at neighboring elementary or middle schools is a great opportunity for partnership extension as well as a meaningful experience for all students involved.

Lastly, a primary contributing factor to success can be staff and administrative consistency. Staff and administrative consistency allow for uninterrupted development and progression of projects. When staff is constantly changing, it is difficult to maintain an established green team, responsibility is always shifting, and incoming staff require training on current operations—these all prove to be hindrances to green growth. Staff and administrative consistency can be increasingly difficult, depending on the population density of the school's location. In western Maryland, the counties are generally more rural, and people tend to remain employed at the same school for an extended time, allowing these schools to maintain an established green team and projects. This issue highlights the importance of incorporating the program into all subjects as a means to get all teachers involved in some way. If a school is able to do this—involve most or all staff—then there is less concern when a staff member leaves as there will be staff remaining that

can continue established projects. Without this incorporation, schools run the risk of not recertifying being that once it is time to recertify, there may be no staff remaining to carry the projects or fill the application. There were Green Schools contacted to fill out the Green School survey; however, these schools were unable to do so as they no longer employed any staff that were involved in the initial certification process. This is a pertinent issue for the statewide expansion of the MDGS program, as well as achieving the goal of fifty percent of Maryland schools being Green Schools by 2024.

Conclusion

Common Barriers to Expansion

Interviewing Maryland Green Schools granted these schools the opportunity to voice obstacles they are facing, thus demonstrating common barriers to green expansion experienced by Green Schools. One of the most commonly reported issues was receiving pushback from grounds crew when trying to install outdoor projects such as gardens or habitat areas. Green team members reported that grounds crew were in opposition of outdoor project installations due to creating additional work for crew members that now have to mow around and avoid these designated project areas. Because of receiving continuous pushback, many green team leaders were unable to install their desired outdoor projects and were limited to only maintaining their current outdoor projects. A green team leader from an elementary school had been caring for her school's garden for over eight years—this past summer, the grounds crew mowed down the garden. This pushback is extremely demoralizing for those wanting to install or for those caring for installed garden and habitat areas. It is understandable that grounds crew feel frustrated and feel as though their workload is being increased; however, for the sake of green expansion amongst Green Schools, discussions between grounds crew and green teams must occur in order to find common ground and to move forward. Several teachers also mentioned receiving administrative backlash via constant emailing involving keeping gardens and other outdoor projects looking satisfactory, thereby, setting a precedence of continuous pressure on teachers.

County pushback is also a major hindrance that Green Schools across the state are facing. Numerous counties require special permission for projects such as raised beds or rain gardens. Although the county does not directly fund the project in any way, counties require submission of extensive paperwork fully describing project details and cost analysis. The additional effort required to obtain special permission for these simple projects deters teachers from pursing and installing these projects.

Practically all Green School staff mentioned time restricting them in some capacity. There are instances when projects take more time than anticipated, which can cause projects to never reach completion. For Green High Schools, where students often design their own projects, these projects can take a long time—if students, do not complete the project before graduating, the project dissipates when the student leaves. A green team leader from a school in Wicomico County

expressed that she feels the need to pursue freshman for student-led projects making it so she will have a full four years to work on projects since she has so many juniors and seniors that devise amazing projects that do not come to fruition due to time constraints.

Inadequate funding for environmental initiatives or for teachers and staff to attend more environmental education conferences and trainings can be extremely limiting. In order to progress sustainable development, Green Schools require sufficient funding for planned projects. Attending conferences and trainings are essential for equipping green teams with the necessary knowledge and inspiration to expand environmental literacy within their schools.

For various reasons, garden upkeep and maintenance were frequently described barriers. Some teachers reported having underestimated the effort required for garden installation and conservation and were not properly equipped to nurture their garden. Others reported that they were solely responsible for tending their school's garden—without assistance from students, parents, and other staff, this is often not sustainable long term. Those who were exclusively accountable for their school's garden and were able to maintain it reported struggling to preserve it during the summertime when their availability was much more limited. Additionally, teachers who were the sole caretakers of their school gardens expressed concern that once they leave their school, they have no staff that will take over garden maintenance. To ensure school garden success, schools must incorporate garden care into the school day, incorporate garden duties into environmental clubs, or ensure that several staff, parents, or students are involved in garden care.

As previously discussed, many teachers yearn to incorporate composting into their Green School program but are met with many obstacles including administrative pushback out of concern of composting bins attracting wildlife or spatial limitations making them unable to meet county requirements to have bins a specific distance from school building.

Additionally, county regulations prevent some schools from incorporating recycling programs at their schools. Certain counties refuse to pick up recycling at their local schools based on the school's location or other factors making it impossible for these schools to recycle; thus, hindering Maryland Green School recycling performance. Several teachers mentioned that for years, they have taken materials such as juice pouches, crayons, and glue sticks to be recycled at facilities that are now no longer accepting these materials, forcing these teachers to discontinue this specific recycling program.

Another primary barrier to green expansion is administrative pushback on implementation of more extensive environmental projects such as green wall or green house installation. Many schools are unable to execute such projects due to absence of funding. Green Schools that are able to financially afford these projects are often met with lack of support from their schools and are impeded by their administration.

It was repeatedly cited that many found maintaining enthusiasm and momentum to be challenging—inability to do so impedes advancement. After achieving initial certification through employed initiatives, schools face the possibility to entering a stagnant state in which they are complying enough to maintain certification but not expanding their program any further. It is vital to Green School development to continuously devise innovative means of captivating the attention

of all students, teachers, and staff, not only for the sake of ecological expansion across the school's campus, but also Maryland's local environment.

Failed Initiatives

Extensive interview analysis demonstrated frequently failed initiatives as well as why these initiatives were unsuccessful. Professional Development (PD) such as teacher trainings and conferences are crucial to providing inventive insight for environmental literacy and green initiative installment. Most schools do not have funding available to give their teachers these PD opportunities. Several schools struggled with ineffective student-led projects due to students' lack of interest to lead their own projects, students leaving their school, or students graduating before project completion. School gardens failed due to improper garden care or lack of support from other staff, parents, and students. As previously mentioned, school recycling programs failed due to their respective counties putting an end to recycled material pickup as well as many facilities that recycled materials such as crayons, juice pouches, and glue sticks no longer accepting those types of waste.

Successful Initiatives

Certain Maryland counties do not pick-up recycling at local schools; in response, many schools have launched their own recycling programs. Schools have introduced student-run recycling programs where their students are responsible for ensuring that the recycling is placed in the correct bins—teachers and parents then take these materials home to recycle themselves. One Green High School we interviewed has a completely student-run recycling program. These high school students were so dissatisfied that their county no longer offers recycling pick-up that, at the end of each week, students volunteer to take these materials home and recycle them.

Many teachers expressed that outdoor classroom installation has been an incredibly beneficial tool for outdoor education, learning, and exposure for students. Teachers reportedly enjoyed teaching their students in these outdoor settings and stated that students also enjoyed utilizing the outdoor classroom, making this initiative a great structure for captivating students' attention.

In relation to outdoor classroom installation, birdhouse installation and maintenance is another excellent tool for outdoor education and stimulating student's excitement and interest in nature. Many Green Schools with installed birdhouses had their students periodically clean out these birdhouses and perform any necessary maintenance. This hands-on experience grants student's direct exposure to nature, provides them with the opportunity to observe nest structure and nesting behavior, acts as a learning opportunity for bird reproduction and incubation, and ultimately teaches students eco-responsibility. Teachers stated that this direct exposure empowers students as they are able to first-hand witness the positive contribution they can make.

To fund environmental action projects, many schools hosted events to raise money for any materials needed for environmental action projects. To fund their initiatives, some schools hosted yard sales of unwanted clothing and items donated by students. One elementary school in Howard County sold T- shirts with turtles

on them to promote plastic use reduction and used the T-shirt sale revenue to fund installation of a refillable water station. Hosting funding events is not only a great tactic for raising project money but also for reaching out to the community to raise awareness of the program, educate the public on sustainable practice, and discuss what they can do to contribute to the betterment of their local environment.

Although there are schools that are unable to recycle due to extenuating circumstances, overall, MDGS have efficiently incorporated recycling into their programs including paper and ink cartridge recycling. In North America, approximately forty thousand tons of plastic and metal are spared from landfills annually as a direct result of recycling ink cartridges (Graphique Creative, 2021). By recycling ink cartridges, MDGS prevented these cartridges from being discraded at landfills where they would take more than one thousand years to decompose. Additionally, ink cartridge recycling reduces air and water pollution caused by landfilling and incineration; conserves natural resources such as timber, water, minerals, and petroleum; saves energy; and reduces GHG emissions (Graphique Creative, 2021). Paper recycling also reduces GHG emissions that contribute to climate change via methane emissions, extends supply of fiber, contributes to carbon sequestration, saves landfill space, saves energy and water, and decreases carbon dioxide emissions via reducing paper incineration (Environmental Protection Agency, 2016).

Maryland Green Schools have efficiently employed energy monitoring via installation of light switches that automatically turn off; installation of energy efficient bulbs; low-flush, dual-flush, or composting toilets that provide water savings; solar panel installation; as well as strategically planting trees along school buildings in order to provide shade and energy savings. A few schools interviewed shared that their school buildings were previously rebuilt or were being rebuilt; in these new buildings, eco-friendly architecture was incorporated such as pressed wood, high efficiency windows, and green roofs.

Pollinator gardens have proven to be a great resource for Green School teachers and students. Pollinator gardens serve as an excellent means for teaching students about pollinators and the importance of pollination. Students also help tend these gardens, providing additional first-hand experiences as well as teaching them environmental stewardship. Pollinator gardens also grant students with the opportunity to express creativity and to develop their critical thinking skills. An elementary school teacher assigned her fifth-grade students a research project by which the students were instructed to devise a product that assist pollinators in some way—she left this project open-ended so that students could employ their creative thinking skills. After completion of the research project, this teacher then had her fifth-grade students teach the second graders all about pollinators. The fifth-grade students thoroughly enjoyed this assignment; they became very invested, excited, and overall, proud of themselves and all their hard work.

Many schools hosted periodic seminars where students would voluntarily attend and learn about different environmental topics such as decomposers, the food chain, and the role of the food chain. Some schools have continued hosting seminars virtually during COVID-19 and students have still attended. This is incredibly impressive considering that students attend school virtually each day yet, they are interested enough in these seminars to attend them after an entire online school day.

Agency visits effectively capture students' attention and excitement by pro-

viding enthralling learning opportunities and immersive experiences. Such opportunities include animal show programs performed by the Nature Conservancy where Conservancy employees bring snakes, rabbits and other animals and teach students all about these creatures. These up-close encounters are extremely meaningful being that they may be the only first-hand exposure some students have ever had with wildlife. Another school partnered with the Chesapeake Bay Foundation (CBF) and would have CBF employees come and perform environmental education programs and would periodically take their students on trips to visit the CBF to participate in nature hikes or fish and crab seining. As the principal described the purpose of these agency visits, she said that these programs "'trick' the students into learning." When students are placed in hands-on, nontraditional educational settings, they are unknowingly gaining essential information and skills that will not only make them better students but better environmental stewards.

Habitat implementation is another great tool for teaching students the importance of caring for and protecting the environment as well as exhibiting to students the crucial role they play in contributing to a greener, more eco-friendly future. Several factors contributed to the success of these various implementations including legislation passed that altered Maryland's environmental literacy standards to ensure that students at each school level are subjected to a meaningful Watershed Educational Experience (MWEE). One high school teacher reported that this alteration in Maryland E-lit standards made it easier for her to incorporate new information and experiences into her curriculum being that every incoming freshman has already had an environmental education experience.

Collaboration with Green Center, Green Leaders, and community members and organizations tremendously improved the success of these implementations; one could argue that many of these initiatives would not have been possible without these partnerships and the associated resources that they provided. By fostering strong relationships with local agencies, Green Schools have been able to cultivate long lasting project partnerships to impact their school and the surrounding community. Community involvement is very important to effective environmental action project expansion. One exemplar Green School in Garrett County stated that community participation has been key to their own green expansion and achieving sustainable school status. By efficiently engaging their local community, the school has set a precedence so that when new families join their school, they immediately express their desire to become involved in program activities. It is equally as important to encourage parents to become involved in any way they can, not only to have more assistance in project maintenance, but also for parents to observe the benefits their children are receiving as a result of the MDGS program. Many schools expressed that having an engaged Parent Teacher Association (PTA) significantly contributed to successful eco-action projects being that PTA members were willing to contribute to project maintenance such as tending school gardens and habitat areas.

A primary contributing factor to initiative success is administrative support. All productive Green Schools have administrative support endorsing their projects. One aspect that many Green Schools struggle with is applying for and receiving grants. Although, many find this process intimidating, it is important to be unafraid to ask for assistance from MAEOE or Green Centers and Leaders. Grants contribute to green growth by funding environmental action projects; for example,

one school utilized their grant money fund a student-led research project aimed to solve agricultural issues on their school's campus.

Awarding students the freedom of choice encourages student project participation. As exhibited by the pollinator garden project where students were given the creative liberty of constructing a bee friendly garden product, these types of projects evoke interest, excitement, and confidence as students are empowered to make their own decisions regarding environmental application.

Perhaps the most significant feature of a successful initiative is defined purpose. A purposeful project is one that provides a solution or addresses a current issue that your school or community is facing. A principal at a Garrett County Green School epitomized the criticality of this project feature by posing the question, "how can we expect our students to solve bigger issues like saving the rainforest, etc. if they can't solve issues in their backyards' first?" She raises the point that we must first get students to care for and about the space around them before they are fully capable of addressing larger, more distant issues.

Concerns for the Future

MAEOE set the goal to achieve fifty percent Green Schools in the state of Maryland by 2025 (MAEOE, 2019). In order to attain this goal, current limitations and perceived barriers must be addressed. To ensure environmental action project expansion and MDGS recertification, current MDGS must ensure that they have sufficient staff, parents, and community involved in their programs so that when green team members leave, other green team members will maintain these projects and continue the recertification process.

MAEOE, as well as other organizations, has worked diligently to obtain funding to improve the MDGS program. During the 2019 Legislative session, Senate Bill 662 and House Bill 1366, which proposed that the MDGS program is allocated additional funding to strengthen the program and encourage the growth rate of the program across the state in order to meet the fifty percent Green School goal by 2025, were passed (MAEOE, 2019). Assurance of statewide Green School expansion is dependent on continuing evaluation of the program as well as persisting efforts to obtain more funding. Maryland Green Schools can contribute to MDGS program assessments by maintaining accurate green action project records and values. MAEOE can contribute to these assessments by recording and preserving Green School data in a consistent, unchanging manner. The success that MAEOE has had with passing these bills highlights the criticality of these assessments and efforts to obtaining funding, supporting Maryland's environment, and developing the MDGS program.

Regarding funding, many Green Schools desire to implement new projects or participate in conferences and trainings but do not have the funding to do so. To further environmental expansion and ecological benefits, we must devise ways by which Green Schools can bridge the gaps in their funding and make incorporation of these activities and events possible. To try and generate these opportunities, Green Schools can reach out to local organizations for funding purposes or apply to receive grant money.

One of the most vital factors to green project implementation and development is maintaining momentum. After obtaining certification, schools can become sta-

tionary with their current initiatives. Sustaining momentum is essential to Green School recertification and growth and development. Green Schools can work to preserve momentum by implementing new and exciting initiatives and activities for students. It is important to remember that momentum must also be maintained amongst staff—schools can accomplish this by attending free informational sessions hosted by MAEOE as a means to become informed and inspired.

As previously mentioned, there are still several counties across the state that do not offer recycling pick-up to their local schools. To increase Maryland's solid waste reduction, we must address and combat this issue. If Maryland is to reach its goal of increasing the number of Green Schools, our counties must endorse the program by picking up school recycling as means to integrate statewide sustainable practices.

Another conversation that must be had is between MDGS green teams, administration, and grounds crew about implementation of outdoor environmental action projects. Green team and grounds crew members must work to find common ground regarding outdoor implementations. Without coming to an agreement, Green Schools will continue to struggle with expanding their outdoor environmental action projects. Additionally, to remove the pressure that green team members receive from administrators requiring outstanding outdoor project appearance, it must be universally accepted that outdoor projects can look flawed and natural. Administrators must be reminded that these are projects that students help employ and maintain and we want these students to feel proud of their work, no matter what.

This study confirms and demonstrates that Maryland Green Schools do indeed have a positive effect on Maryland's environment. Without the MDGS program, many of these environmental action projects would never have been implemented. Additionally, students involved in this program are gaining knowledge and skills they will shape them into and better equip them as environmental stewards and environmentally responsible citizens. Therefore, it can be said that the Maryland Green Schools program provides both environmental and educational benefits that can be replicated in other states and school districts.

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