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Stormwater Runoff, Combined Sewer Overflow, and Environmental Justice in the Bronx

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Environmental Studies Minor Internship Paper

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The Bronx River Alliance is a grassroots organization dedicated to improving the quality of water and "ecological health" of the Bronx River, as well making the Bronx River resources available to all urban residents along the river. The Bronx River Alliance, or BxRA, has teamed up with many other organizations, such as the Bronx Parks and Recreation Department, Youth Ministries, EPA, as well as the SWIM Coalition to obtain these various goals. The SWIM (Storm Water Infrastructure Matters) Coalition is a close partner to the BxRA, and is dedicated to making the Bronx River swimmable through sustainable and retrofit infrastructure, it is also the organization in which I worked most closely with. It is with both the BxRA and the SWIM coalition that I worked to improve the quality of the Bronx River (as well as the Long Island Sound) through storm water collection and management during my internship.

Before I can address the organizations in which I interned for, and the various ways in which my actions as well as the actions of these organizations benefited the Bronx River, I feel that it is important to first address, what is the Bronx River? The Bronx River is an urban fresh water river that is 23 miles long and extends from the Bronx into Westchester County. The watershed area of this river is over 56 square miles, and has been severely and negatively impacted due to urban development. "Over 100

years of industrial pollution and urban sewer discharges have caused debris jams, flooding, excessive storm water runoff, sedimentation, erosion, habitat loss and sewage overflows".[1] Even as recent as ten years ago, the river was totally unusable, declared a dead river, and even remarked as "an open sewer" by the Bronx Valley Sewer Commission.[2]

Even after vast improvements had been made (within only ten years the river went from being a complete wreck, to a river capable of recreational canoe trips) there was still plenty of speculation about how great a recovery the river could make. It was reported that since so much damage had been done to it, there was no way that a full restoration could ever be managed. Yet, many river based organizations (including the BxRA's predecessor) restored an abundance of fish populations (trout, once plentiful in the river, now cannot survive within the river's too warm ecosystem) including alewife herring and oysters, and even more surprisingly, after there being no sightings for almost two centuries, a beaver even migrated into the Bronx River area in 2007. The beaver is now named Jose, after Jose Serrano a congressman who dedicated close to 30 million dollars to the restoration of the Bronx River, and continues to live along the River within the Bronx Botanical Gardens (recent speculation feared that Jose was deceased, but there have been sightings as recent as April 2008).[3] If all of the proposals that the SWIM

[1] http://water.usgs.gov/owq/cleanwater/success/bronx.html
[2] http://www.vanityfair.com/culture/features/2008/04/bronxriver200804
[3] http://www.nydailynews.com/ny_local/bronx/2008/05/07/2008-05-07_bronx_river_beaver_alive_and_well.html

Coalition has made are enacted, 90% of lower New York's waterways (including the Bronx River and East and Hudson Rivers) could be swimmable.[4]

The BxRA is comprised of five different "teams" which address different aspects and needs of the river. The first team is named the Greenway Team, and they are a group of people who work on the planning, designing, and implementing of the Bronx River Greenway. The Greenway is a perfect example of the BxRA's commitment to environmental justice, an aspect of their campaign which I will address later in this paper. The Greenway will be a pedestrian and bike path which will extend along the river from the Bronx all the way into Westchester County (the length of the river). This path will make the river, and the parks created around the river, available to the residents within this urban area.

The ecology team is comprised of scientists, local representatives, as well as city, state, and even federal officials, who work on restoring and maintaining the "ecological health" and integrity of the Bronx River.[5] They also work to restore watershed areas that have been ruined due to the urbanization of this area. Not only do these people work on the planning and legal aspects of cleaning the river, but this team also deals with the manual labor, or fieldwork, of keeping the river clean. It is through the ecological team's Conservation Crew, a group of full-time employees whose sole task is to clean the river and banks, that debris and other hazardous materials are cleaned out of the river.

I had the pleasure of briefly working with the Education team during my internship with the BxRA. The Education Team is made up of BxRA employees as well as local teachers and even scientists, who work to educate the public about the Bronx

[4] http://sustainableflatbush.org/2007/04/30/swim-stormwater-infrastructure-matters/
[5] http://www.bronxriver.org/

River, as well as both its benefits and potential benefits. Along with this team, I was able to work on a power point presentation, to be presented to local middle-school teachers, on how to teach about the Bronx River to local school children. This presentation, coupled with an instructional book which was created the year earlier, directed the teachers on how to illustrate the importance of the river, its watershed areas, wetlands, how and why it is important to keep the river clean, and the importance of access to natural habitats, such as the river. Within this plan, we also showed teachers how they could contact us to partake in certain classroom trips to the river, and how they would fit into local school curriculum. My direct task was to create the actual PowerPoint presentation that was used to instruct the teachers.

The Outreach Program works to produce local community support in the form of special events, festivals and fundraisers. It is through the outreach program that public knowledge of the Alliance is made. It is also through the Outreach program that local individuals are able to volunteer through, such as during Clean Up days, and localized restoration projects. One amazing aspect of the BxRA is how many people are both aware of and interested in helping this organization. It is shocking how many people register to volunteer during Clean-Up days; sometimes a waiting list has to be created. During the latest Clean Up, in September 2008, more than 700lbs of garbage was removed and cataloged (types of trash collected was tallied) from the banks along 233rd street. They discovered that the most abundant types of materials that were littered were food wrappers and containers, such as disposable cups and lids, as well as many other plastic based objects. [6]

[6] http://www.bronxriver.org/index.php?pg=content&p=abouttheriver&m1=10.

The Recreational Program is perhaps one of the most interesting aspects of the BxRA teams. This team works in congruence with all of the other programs, and works to sponsor and create bike and canoe trips along the prospective greenway and Bronx River. Many people are unaware that canoe trips are sponsored on the Bronx River, but they are a great way to not only introduce urban residents to the benefits *and fun* of natural resources, but also allow people to see and use a river that they probably never have even seen before (aside from driving over it on the parkway). This group works to have people personally familiarize themselves with the river as opposed to mildly being aware of its existence.

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The canoe trips are an excellent way to both familiarize people with the river, as well as to teach them the importance and interesting aspects of the river. During tidal trips, canoe trips that are done on the river's estuary (where salt and fresh water meet),

[7] Photo taken from the Bronx River Alliance's Historical Photo Collection

boaters get to experience both high and low ties (the river raises and decreases up to eight feet during tides) and they are also able to see different organisms that live in the river, such as crabs.[8]

As I have noted, I worked most closely with the SWIM coalition during my internship. The SWIM coalition works to improve the quality of the Bronx River water through "natural, sustainable, storm water management practices in [local] neighborhoods".[9] Presently, the water of the Bronx River is not fit to be used for drinking or swimming, but, as I have mentioned earlier, the SWIM Coalition projects that the quality of the Bronx River water can be swimmable by 2030. This coalition of local organizations, including the BxRA, strives to improve the water quality by decreasing the amount of Combined Sewer Overflow (CSO) that enters into the River's water. CSO's are caused by storm water runoff and account for 27 billion gallons of sewage, which enters into rivers and waterways every year.[10] SWIM's has five main goals that they prioritize as:

1. "Incorporate natural, sustainable storm water management into CSO Long Term Control Plan"
2. "Involve the Public"
3. "Incentivize private storm water management"
4. Enact "Government Reform"
5. Make NYC Green

As the SWIM coalition states, it would be fiscally responsible to enact these various proposals because they make storm water a resource when previously it was seen as waste. [11]

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[8] http://www.bronxriver.org/index.php?pg=content&p=aboutus&m1=1&m2=5&m3=33
[9] http://swimmablenyc.info/?page_id=2
[10] http://www.bronxbeat.org/cs/ContentServer?childpagename=Bronxbeat/JRN_Content_C/BBArticleDetail&c=JRN_Content_C&p=1165270050524&pagename=JRN/BBWrapper&cid=1175372036408
[11] http://swimmablenyc.info/?page_id=4

What is storm water runoff and why is it so destructive to the Bronx River? Storm water runoff occurs when precipitation occurs and it cannot naturally soak into the ground because of impervious surfaces, such as roadways, sidewalks, and driveways, get

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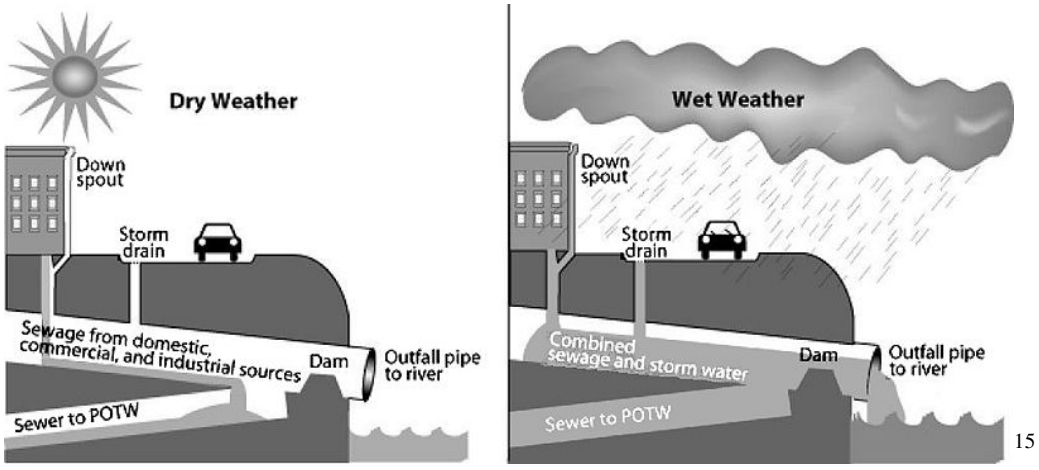
in the way.[13] The urbanization of these areas causes the water to have nowhere to go and therefore it enters into the cities sewage system. These sewers are combined with the cities "rainwater runoff, domestic sewage, and industrial wastewater" and then brought to a water treatment plant.[14] There is apparatus that is installed that allows this excess water to empty directly into rivers and streams. As stated by the EPA, "these overflows…contain not only stormwater but also untreated human and industrial waste, toxic materials, and debris". There are several of these raw sewage-containing CSOs that are designed to run directly into the Bronx River.

As noted, the BxRA as well as the SWIM coalition is dedicated to combating CSO's and the waste that they pour into the Bronx River. There have been expensive

[12] Photo taken from the Bronx River Alliance Historical Photos Collection
[13] http://www.epa.gov/weatherchannel/stormwater.html
[14] http://cfpub.epa.gov/npdes/home.cfm?program_id=5

attempts to ease the effects of CSO's. One of these attempts is called End-of-Pipe technology. End-of-Pipe technology concentrates not on stopping the CSO's from occurring, but rather tries to treat the polluted water before it enters the rivers and water bodies. The BxRA and SWIM Coalition feel that these attempts treat a problem rather than eliminating the problem in the first place. While they may be effective, they are extremely expensive. Instead, the BxRA and SWIM Coalition have tried to implement various natural and sustainable ways to eliminate stormwater runoff in the first place.

Since CSOs are so damaging to the water bodies that they are designed to flow into and pollute, there have been a number of ways in which people have tried to overturn previous ways in which stormwater was viewed. As noted previously, stormwater currently is viewed as a waste and a nuisance. Now, in the name of sustainable resources, people have designed ways in which we can use and benefit from stormwater.



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Many of these designs are retrofit styles in which already established housing could incorporate them into their design. It is one of the goals of the BxRA as well as

[15] http://cfpub.epa.gov/npdes/home.cfm?program_id=5

SWIM for New York City to employ many of the following techniques to turn stormwater into a resource.

Within the projects that I worked on at the BxRA, the following list were the most often used propositions for retrofit adjustments to be made to both commercial and residential architecture and landscaping; the first four are the most commonly used and considered.

- Green roofs
- Blue roofs
- Rain Barrels
- Porous pavement
- Rain gardens
- Depressed tree pits
- Water Conservation fixtures
- Underground Storm Chambers

Green roofs are a retrofit form of architecture that can be applied to pre-existing, pitched or flat rooftops. First the roofs have to be waterproofed, as most roofs generally are, and then soil and vegetation is then placed on top. There are many benefits, beside the capture and reduction of stormwater, such as further insulating the house and reducing heating bills, as well as increasing the life of the roofs by protecting them from destructive UV rays, and help to further soundproof the houses. Green roofs also can provide shelter for wildlife and increase the amount of "urban wilderness"; they provide a habitat for wildlife, which has been misplaced due to urbanization. It has been recorded that green roofs are able to absorb between 60-100%

of the rainwater that falls upon them.[16] The water is then used by the vegetation to grow or absorbed back into the atmosphere. The vegetation itself decreases the amount of Carbon Dioxide in the air, and reduces some of the carbon footprint that is produced by urban industrial areas.

While the main purpose of green roofs is to irrigate plants and allow for the water to be absorbed back into the atmosphere, blue roofs are designed to store and collect that water for later use, or they can also be used in unison with green roofs and can be used to irrigate the vegetation along with rainfall. Some of the uses of this collected rainwater can be recreational or aesthetic uses as well, such as outdoor "ecoshowers" or waterfalls. Of course, the main purpose of these roofs, such as with green roofs, are to collect stormwater so that it does not end up within the combined sewers.[17]

Rain Barrels are perhaps the most easily installed stormwater collecting fixture and can be easily adopted by residential homeowners; they are even sold in home depot and other home improvement stores. These barrels, or rain tanks, can be placed upon rooftops, or placed under rain gutters on pitched houses. The water collected in these barrels is considered grey water and is of a good enough quality for many household purposes, including washing dishes, clothes, and flushing toilets (afterwards becoming black water) and irrigating vegetation. There are three different types of water quality, white water, which is the cleanest and is of drinking quality, grey water, which contributes to 50-80% of residential wastewater (it is the result of common household practices, such as washing dishes, clothes, etc.[18] While in the past grey water was considered a waste and sent, along with black water (the worst quality water which

[16] http://www.hrt.msu.edu/greenroof/
[17] http://en.wikipedia.org/wiki/Blue_roof
[18] http://en.wikipedia.org/wiki/Blue_roof

contains feces, toxic chemicals, and other harmful contaminants) to water treatment plants. Within recent years, through devices such as rain barrels, this grey water is collected and used as a resource.

[19] Since impervious surfaces cover over 60% of the Bronx River's watershed, various techniques have been implemented to expand the amount of pervious surfaces that are available.[20] One of these techniques is the creation of porous pavement (also called permeable or pervious pavement). There are several different types of porous pavement, including porous asphalt and porous concrete. Both of these porous surfaces are extremely convenient and cost effective due to the fact that they are both laid down the same way that their impermeable counterparts are; new techniques and equipment would not be needed for this changeover.[21]

Raingardens and depressed tree pits are two more ways in which stormwater is collected. Raingardens are areas of planted land that usually surround asphalt, concrete or other impervious surfaces. For similar reasons listed above, such as the vegetations need for irrigation as well as soil being pervious, these raingardens are able to reduce the amount of stormwater runoff up to 30%.[22] Depressed tree pits are used in areas such as parking lots and other areas with impervious surfaces. Again, the depression as well as the vegetation serves as a way to collect and put to use rain water. Also, planting these

[19] http://en.wikipedia.org/wiki/Rainwater_tank
[20] Bronx River Alliance 2006
[21] http://www.toolbase.org/Technology-Inventory/Sitework/permeable-pavement
[22] http://en.wikipedia.org/wiki/Rain_gardens

trees restores oxygen into urban areas as well as provides shelter within areas where wildlife is being pushed out, such as birds and squirrels.[23]

I became familiar with these various storm water collecting techniques through my work with the BxRA Montalto Project to which I was assigned to for the duration of my internship. The Montalto Project was started by a group of professors from Drexel University in Philadelphia. They examined CSO within the Bronx area and determined that one particular area within the Bronx, called Bronx River (due to the confusion of both the community and the river having the same name, I will refer to this area as the BR Community) that created the most storm water runoff and contributed the most pollution into the Bronx River. These professors at Drexel University measured the amount of storm water runoff that occurred for a two-year period of time. Now, combined with the BxRA, SWIM Coalition, and the EPA, Drexel University plans to make the BR Community into an experimental area where retrofit storm water collection techniques will be applied to the residential neighborhood and then Drexel University will continue to spend another two years measuring how much storm water is collected (and thus dumped into the Bronx River) after these water collection techniques are employed.

The purpose of this experiment is not simply to see if these methods of rainwater collection work, which is certainly one aspect, but also to prove to the city and other large urban areas, that these methods are *cost effective.* In order to provide initiative for the residents of this community to want to take part in this experiment, a reverse auction has

[23] http://www.ext.vt.edu/pubs/trees/430-028/430-028.html

been put into place (in other words, the residents are offered money in exchange for us installing water collection equipment on their house). This was one of my particular

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tasks. I took part in organizing a town meeting by using OASIS maps to gather information about the residents of the BR Community.[25] After I gathered information, such as their addresses and telephone numbers, I wrote a personalized letter to all of the residents briefly informing then about the intent of the BxRA and Drexel University and extending an invitation for them to attend a meeting where further information would be discussed. While the town meeting did not occur during my internship, I also prepared supplies in order to gather further information, regarding the reverse auction, from the residents during the town meeting. For example, I created a questionnaire for the residents to fill out regarding:

1. Their contact information

[24] http://www.oasisnyc.net/, Aerial view of BR Community
[25] http://www.oasisnyc.net/oasismap.htm

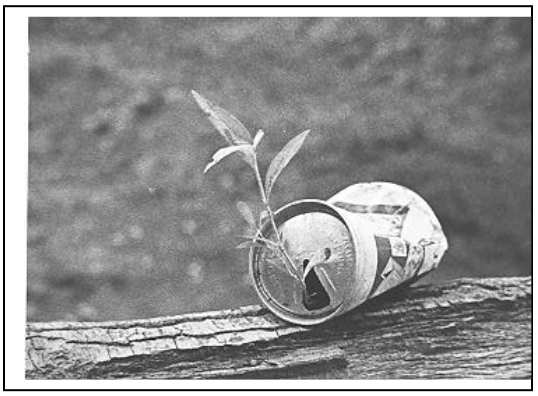
2. Whether they were homeowners themselves or if they rented the apartment in which they lived in
3. If they were interested in installing water collecting equipment on their houses for free
4. If they were interested in being paid to install water collecting equipment on their houses
    a. If so, how much would they have to be paid in order to do so

After that information is collected, the BxRA and Drexel University will be able to come up with an adequate way of creating a reverse auction for the members of the BR Community and they would find out which households were optimal for installing water-collecting equipment.

Anther one of my tasks as an intern was corresponding with other people involved with the project, especially community leaders within the BR Community. Within my correspondence, I assured the leaders of our intentions, as well as educated them on the damage caused by storm water runoff and CSOs. I also read and edited several extremely detailed, jargon-riddled, lengthy proposals written by the BxRA alliance's Teresa Crimmens, and which were to be submitted to the City.

When I was not working on the Montalto project, I was also working with historical photos and documents from the organization in which the BxRA took over: Bronx River Restoration. After the BxRA took over, many documents and photos were placed into storage. It was my task to go through these documents and photographs and to scan them into the computer for future preservation. While this took hours of time to complete, I found it extremely rewarding to see Bronx Community residents, from as far back as the 70's, working together to better their community; I was able to see visual evidence of the work that the BxRA, and its former organization, were able to complete through their efforts. It was through this task that I learned the most about environmental

justice, and the importance of urban community residents to be able to have adequate access to nature.



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What is environmental justice how is the BxRA involved in it, and how will it benefit the people of the Bronx? Environmental justice, according to the EPA is "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies."[27] There have been many complaints, from people of all urban areas, that unsightly, or even unhealthy, treatment plants, waste incinerators, landfills, etc. have been designated in their neighborhoods. As stated by Julie Sze, in her book Noxious New York, the communities where these polluting facilities are usually located are in neighborhoods with "high rates of despair [such as] high levels of unemployment, disease, exposure to environmental pollutants, as well as low levels of income home ownership and education" (Sze, 1). Also, along with these health-impairing facilities, people within these areas also have limited access to nature and "environmental benefits such as open space" (Sze, 1). This sort of discrimination can even be seen within the Bronx, and the results of which are illustrated through the residents of the Bronx' health. For example, the Bronx holds the highest cases of children born with asthma in New York (Sze, 1). It is through lack of access to clean natural environments that many

[26] Photo taken from the BxRA Historical Photo Collection
[27] http://www.epa.gov/environmentaljustice/

people feel is impacting the quality of life, and even health of urban residents. Many people believe that it is everyone's right to be able to enjoy access to a clean natural environment, and it is through this theory that the BxRA exists. As discussed earlier, the BxRA works to improve the quality of the Bronx River. This work is done in the name of environmental justice, and the notion that the residents around this river should be able to enjoy the environmental benefits that a clean healthy river and surrounding habitat allows. As stated in the BxRA mission statement, they aim to make the Bronx River not only an economical resource, but also most importantly, a recreational and educational resource for the residents of the Bronx and lower Westchester.[28] If the Bronx River were to be cleaned and restored to how both the BxRA and SWIM Coalition see fit, it would provide an endless amount of resources for residents of the Bronx. We previously viewed how these two foundations host canoe trips down the Bronx River. This is one representation of a recreational resource that this river serves as. Other options, such as the ability for children and adults to be able to leisurely swim in the river, as well as fishing from the river would also be plausible.

The Greenway is perhaps the most visible example of the BxRA efforts for environmental justice in the Bronx. The greenway is a pedestrian and bike path the BxRA has worked to put in place along 23 miles of the Bronx River. While 15 miles already exist, it is their objective to complete the remaining miles within 10 years. This path will "develop new open space in neighborhoods severely lacking it and restore [already] existing parks".[29] As we can see, access to a clean environment not benefits the residents of the Bronx' health, but also increases their quality of life.

[28] http://www.bronxriver.org/
[29] http://www.bronxriver.org/?pg=content&p=aboutus&m1=1&m2=3

Before I conclude this paper I would like to first admit that I had never heard of storm water runoff or CSO before I began my internship at the Bronx River Restoration. Most of the information that I have presented I have learned and dealt with at my internship, rather than through preparation for this paper. I have found that the knowledge and experience that I have attained working with the BxRA is undoubtedly essential to my character, not only as a university student, but also as a New York resident and environmental advocate. I have passed my newfound knowledge onto many other people and have even convinced members of my family to take storm water runoff into consideration when they were building their new home; that new home has a rainbarrel as well as a rain garden. Storm water runoff, CSO's, and most importantly, environmental justice are all aspects of everyday life that need to be put at the forefront of peoples minds. It is unfortunate that not enough people are aware of the environmental impact that they create.

Environmental justice is an extremely important aspect of urban life that the BxRA and many other local organizations have worked to uphold. There have been an increasing number of cases where people living within urban areas are forced to deal with the waste and trash of the middle and upper classes. These urban residents are unable to benefit from the innate right of every person to be able to enjoy access to clean and natural resources. Through efforts, such as improving the quality of the Bronx River, as well as creating parks, and the greenway, nature is being brought back into a starved urban environment.

Community members of the Bronx are no longer ignoring the importance of the Bronx River. This evidence is found within the vast improvements that have already

been made to the river as well as the proposed objectives that will hopefully be enacted upon the river. If the estimates of the SWIM Coalition are correct, the Bronx River will be swimmable within 15 years, this is something that I am looking forward to very much. Not only are humans benefiting from the improvements made from the Bronx River, but as we have seen, even wildlife is benefiting from it. Do to urban development; wildlife has been forced out of their natural habitats. As we have seen with the repopulation of fish into the river, as well as the arrival of Jose the Bronx River's beaver, animals are now being able to enjoy the benefits of this urban river.

Storm water runoff, as well as CSOs, has severely impacted our environment. We need to stop looking at storm water as a waste product and begin looking at as a usable resource. As we have seen though this paper, there are many alternatives, such as green roofs and rain barrels, that homeowners can consider. We need to stop relying on the government and other officials to make our environment a better place, and we need to start acting for ourselves. The more we learn and familiarize ourselves with the environmental problems of our residences, the more changes we can make.

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