5th edition of the School Contest

RAin gardens: rethinking our Neighborhood

2nd High School Cholargos

2025-01-31

#### A sustainability issue in our community

We live in Cholargos, a charming suburb of Athens, located on the foothills of the mountain Ymittos. Bordering to the mountain our suburb has a distinctive slope. Our school is located at an altitude of 240 meters and the main road, Mesogeion Avenue at 190 meters.

Εικόνα που περιέχει εξωτερικός χώρος/ύπαιθρος, αυτοκίνητο, χερσαίο όχημα, όχημα

Το περιεχόμενο που δημιουργείται από τεχνολογία AI ενδέχεται να είναι εσφαλμένο.Although it is relatively green, rapid urbanization has led to the construction of blocks of flats which are replacing detached houses with yards, so green spaces are lost and replaced by concrete. Due to climate change, rainfall is infrequent, but when it does occur, it might be heavy or last for few days.

This difference in elevation creates aν inclination, and during heavy rainfall, water flows torrentially down to Mesogeion Avenue. Considering these factors, along with some blocked storm drains, and the lack of a sustainable drainage system, the risk of flooding events is very high.

Figure 1 Flooding in Mesogeion Avenue 2018

The above mentioned are the main causes of poor retention of rainwater in the ground and increased surface runoff so that the natural water cycle is significantly disrupted. Water ends up in aquatic ecosystems without any treatment, carrying solids, pollutants, harmful chemicals and microbial loads (originated from roads, vehicles, pet waste). Studies reveal that 58% of coral reefs and 88% of seagrass beds are exposed to nitrogen inputs from wastewater and stormwater runoff. Coastal marine ecosystems are under threat.

Another issue arising is the Urban Heat Island (UHI) effect which causes urban areas to be hotter than rural ones due to heat-absorbing materials like concrete and asphalt, in combination with lack of vegetation. This leads to higher temperatures, increased energy use, poor air quality, and health risks for residents.

#### **Rain gardens: an innovative solution**

To tackle these challenges, we chose a smart and low-cost solution: Rain Gardens! These bio-retention basins, planted with water-friendly plants, collect and store rainwater until it infiltrates the soil. They reduce runoff,10 m2 can manage up to 3,000 liters of stormwater! Thus, they prevent flooding as they delay peak runoff by 40-60 minutes! The water is captured by the roots so soil and air humidity is enhanced through plant transpiration. Beyond managing stormwater, they recharge groundwater, allowing up to 40% to infiltrate in contrast to 5-10% of absorbance on impermeable surfaces. This way water cycle is restored and wetlands preserved. Apart from water quantity, they also play a key role in controlling water quality. Various particles and pollutants can be filtered (thanks to soil filtration and plant uptake) and removed before ending to the aquatic ecosystem, reducing water pollution and maintaining the balance of the biogeochemical cycles. Studies support that an 80% of heavy metals and 70% of nitrogen and phosphorus can be filtered.

A well-designed network of rain gardens will transform our city into a green, eco-friendly neighborhood, rethinking its infrastructure, boosting the landscape's attractiveness and value and supporting urban biodiversity by providing new habitats for birds and butterflies helping with pollination. Rain gardens are a sustainable project that works all year round with low construction and maintenance costs, encouraging homeowners and communities to transform even small, shared spaces, like apartment courtyards, into rain gardens. With our work however, rain gardens will promote collectivityand teamwork from the whole community of Cholargos.

The more gardens we make the greater their impact will be. We came up with 4 ideal locations, but we proceed to a detailed implantation plan for one of them- the closest square to our school. This one,17 Noemvri fountain square, is decorated today with an enormous out of order water fountain, which we are planning to deconstruct and replace it with a rain garden, repurposing and reusing the area! Our rain garden could also be a small park decorated with benches, made of recycled materials (or materials the local authorities planned to be recycled, as old broken benches or plastic, that could be converted into bird feeders), providing motivation to remanufacture. Also, to attract young people at night, we will use old recycled light bulbs, refurbishing them.

Schools, moreover, could help with the construction, and specifically one of our kindergartens, which is sustainable, providing compost to support plant growth, as we refuse the use of artificial fertilizers. This could further strengthen and promote Cholargos ‘s recycling efforts. We also plan to integrate rain gardens into the streetscape median of Cholargos´ main road, Perikleous street, and the sidewalks designs of Anastaseos avenue to capture street water run-off. Regarding the alternative uses in both parts we propose the creation of a bike lane across the rain garden, which will encourage people to stay fit. At the beginning of the bike lane, a bin could be placed where users can leave spare parts from unused bicycles, allowing them to be reused by anyone in need of repairs. Finally, an abandoned skate park near our school, in Ntamari, a former burial site could be transformed into a rain garden. We can be completely sure that our action will benefit our community.

#### **Benefits and impact on our community**

The construction of rain gardens is very important for our community in Cholargos and will help in many ways. Some of the environmental impacts such as the creation of new habitats, groundwater recharge and water quality improvement are previously mentioned. One of the biggest benefits of using these gardens is their ability to manage rainwater sustainability, reducing or delaying the peak flows in the sewage system, helping prevent overloading in our municipality's sewage network. Reducing flood risk to properties in our area and improving the ability to handle heavy rainfall in short periods can have an economic impact helping prevent financial losses caused by floods.

But benefits of rain gardens go beyond just helping the sewage system and saving money for property owners as rain gardens will help mitigate the impacts of climate change in our community. We have already experienced some of the hottest summers (combined to extended fires close to Athens metropolitan area). Green infrastructure will help cool our area as they increase soil and air humidity (through evapotranspiration), lowering the temperature and thus reducing the urban heat island effect. Urban gardens, including rain gardens, can lower temperatures by an average of 0.94°C during the day and 1.15°C at night but also improve air quality absorbing and storing carbon dioxide.

The benefits of using rain gardens in our town can also be seen from other perspectives. As community projects, they will bring our neighborhoods together. Volunteering opportunities, could engage local communities in the development and management of the gardens offering simple and effective way to connect people with their local environment promoting a sense of pride, responsibility and care for the green zones. Maintaining the garden will raise awareness about organic waste recycling, as compost will be directly utilized in each small garden. This will strongly encourage families to dispose of organic materials in the brown garbage bins available throughout our city, which often remain underutilized and reduce waste. By selecting plants for bioretention, our community could even grow food from the rain gardens. So, if young and elderly people of Cholargos get involved in in the creation of green spaces there will be a collective action. This involvement strengthens community ties and fosters long-term support for sustainable practices.

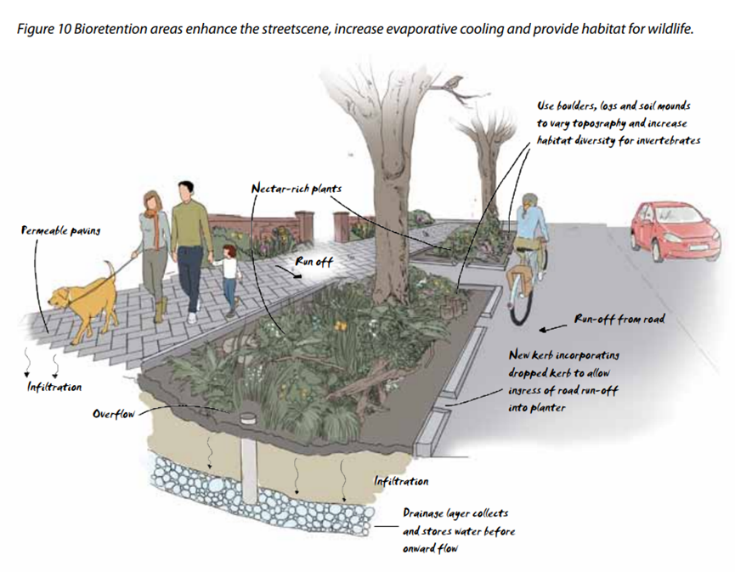
The green spaces and water features will improve our area and help human health. The rain park adds an aesthetic value to the urban landscape of Cholargos- firstly, because it will provide a sense of connection with the nearby mountain of Ymittos. On the other hand, the aforementioned alternative uses for our neighborhood's rain garden, with benches and the construction of bike lanes, will contribute to the creation of green spaces and recreational areas for the citizens.

Figure 2: Rain garden into the sιdewalks of a main street

#### **Implementation plan**

Regarding the revitalization of 17 Noemvri square (the closest to our school) and its transformation into a rain garden, we must get in touch with the Municipality and the green manager in order to obtain the approvals and permissions that are needed. We will work with city officials to secure permissions and apply for grants or funding, if available, for green infrastructure projects. With the Municipality’s help, we will get in touch with urban planning service (POLEODOMIA) and EYDAP (the responsible company in the water supply, sewerage and wastewater treatment) and check for utility lines or underground infrastructure before digging.

To build our rain garden we first need to excavate and remove soil material so as to make overflow basin. The ideal depth for a rain garden is around 15-30 cm. After the necessary amount of soil has been removed to create the desired depth, we will add gravel -to slow down and direct water flow into the garden. Above gravel needs to be placed a perforated pipe for drainage and over a filter to reduce swelling of the gravel zone. A levee should be built using the excavated soil to retain water during heavy rain. Pre-existing soil is then placed over the filter, and the excavated soil is mixed with compost to enhance drainage and fertility. The 2nd Sustainable Kindergarden of Cholargos could provide us compost for the construction if needed. Chopped hardwood is added to prevent weeds, retain moisture, and reduce soil compaction, while the top layer holds water.

Then, we will get in touch with a landscape architect and a plant nursery for the exact design of our rain garden. It needs to be divided into zones based on water tolerance and place the suitable, for every zone, plants: the ones that tolerate standing water at the bottom zone, those that tolerate occasional water at the slope zone and drought-tolerant plants at the edge. We could opt for grasses and sedges (as juncus effusus) flowering perennials (as Echinacea purpurea or Asclepias incarnata) that can attract pollinators and shrubs (like sage).

Εικόνα που περιέχει φυτό, χορτάρι, εξωτερικός χώρος/ύπαιθρος, Sweet grass (χορτάρι)

Το περιεχόμενο που δημιουργείται από τεχνολογία AI ενδέχεται να είναι εσφαλμένο. Εικόνα που περιέχει λουλούδι, φυτό, εχινάκεια, πέταλο

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The last step is to start planting. We will ask other schools of our community for volunteers to help us revitalize the rain garden by either digging or planting. The existing adjacent pavement could be replaced and enlarged using permeable material which could help water runoff.

The cost per square meter of this project will be calculated based on the following:

|  |  |
| --- | --- |
| Cost for planting | 40€ |
| Cost for irrigation | 8€ |
| Cost for soil | 25€ |
| Plants | 3€ |
| **Total cost / m2** | **74€** |

The prices were determined after market research, inquiries at the plant nursery, and consultations with technical companies for gardening works.

The surface area of the applicable rain garden is 330m2 and already contains three trees whereas benches and bird feeders (both from recycled materials) are planned to be placed. Consequently, the area to be planted is about 250-270m2. In conclusion, the cost will be around 18.500€. Surprisingly, a rain garden of 250 m2 can manage up to 75tn of stormwater per rainfall! Approximately, a single rainfall of 75,000 liters of floodwater / flood event, a relatively small scale urban flooding, could reach an overall cost (calculating houses, roads, and businesses) of 150.000 € - 400.000 € !

Our involvement with the idea has excited us, and we aim to move forward with the planning and planting of a rain garden in our school yard.

#### **Strategies to promote the creation of rain gardens**

Promoting our idea as a sustainable drainage solution in our town made us set one goal: to raise awareness among citizens about the creation of rain gardens- not only seen as an anti- flooding system but also underline the aesthetic value of green spaces in our municipality. We came up with various ideas to promote this project to people of any age or familiarization with new technologies. If the municipality proceeds with the construction of the rain garden in 17i Noemvriou square we will automatically have a live advertisement, a demonstration in visible public space of their function and aesthetic appeal.

Using social media, we can create short videos with hashtags campaigns such as ***#makeitaraingarden*** that could urge young people to make their own videο with their very own rain garden. We can also collaborate with famous influencers to spread our idea. The creation of digital guides for the young and brochures for the elderly people explaining how to build their own rain gardens could be very helpful.

As school we could host an event as a seminar where a professional (landscape architect) will talk about flooding phenomena and inform about sustainable solutions. With the help of our Informatic’ s teacher we can create a blog that pretty much summarizes our work and efforts regarding this project. Collaboration with other schools in Cholargos and the exchange of best practices in environmental education and sustainability would also help spread our ideas. Additionally, partnering with the Polytechnic University and organizing an open competition for architecture students to design a rain park and explore its alternative uses could further promote our concept.

Planting a rain garden could be an open call and people of Cholargos can participate. Collaboration with the municipality, the green development sector, and even the KAPI (elderly care center) can provide us with valuable support. With municipal funding for the green campaign and including elderly residents in a hands-on role (as sewing T-shirts or hats with a Rain Garden logo), our project can foster engagement across generations.

If citizens become more aware and participate in collective actions—such as planting rain gardens, even in small spaces the impact will be greater. This will also lead to increased awareness of organic waste recycling because compost will be directly used in every small garden. The amount of waste will be significantly reduced. Households that practice composting could pay a reduced waste collection fee. This way the municipality could also offer financial incentives to homeowners who compost and install rain gardens on their properties.

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