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Title:

Nature-Based Solutions for Climate-Neutral Neighborhoods: Scenarios for **Ali Demi**

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1. Introduction

The Ali Demi neighborhood in Tirana is a post-communist urban area that has been investigated for its possible transition to net-zero energy buildings. Its fragmented urban morphology, which includes villas, medium-density, and high-density apartment complexes, results in small pockets that provide natural shade and cooling effects while also contributing to high humidity retention.
Despite these characteristics, the neighborhood confronts numerous obstacles. Energy efficiency is a significant issue, since many buildings have poor insulation, obsolete HVAC systems, and inefficient windows, with the majority of structures classed as D or E, resulting in high energy use. The area's environmental performance is particularly worrying, as the urban layout and construction materials contribute to heat retention and worsening air quality. There are some green spaces, but they are insufficient to mitigate the urban heat island (UHI) effect. Furthermore, air pollution poses a serious threat to public health, leading to significant health-related costs. Water management is another obstacle, as inadequate infrastructure exacerbates problems with urban runoff and resource sustainability.
Ali Demi's environmental and urban challenges make it an ideal candidate for Nature-Based Solutions (NBS) to improve energy efficiency and lessen the consequences of climate change. This report offers an analysis of the neighborhood's existing situation, investigates design scenarios for adopting NBS solutions, and evaluates their potential impact on the community and environment.

2. Area Profile & Observations

2.1 Neighborhood Overview

The Ali Demi neighbourhood is located close to the heart of Tirana, about 1km from the city centre and right next to the Lana river. The block is made of 9 linear mid-rise (4 storey) residential buildings from the post-communist era which house about 500 residents. The buildings are in a poor condition due to lack of maintenance, which is common in the country. The poor maintenance includes all buildings (facades, corridors), pavements and open areas. The area covers 13.687 m2 in the perimeter of 815m and focuses around the250m long section of Ali Demi road which serves as the main artery for that part of the city. The road itself has a tree alley on each side of the road, therefore, the area is pretty lush with the greenery, alongside with window and garden plants.
The area has a high social potential with many spots that could be improved and brought to the people with small interventions. Next to the perimeter, or in a close vicinity, exist 3 elementary schools, a post office and plenty of cafés. There is a big problem with parking, especially due to unregulated parking areas which could be better used without removing the parking space. Relatively large number of bikes have been observed, alongside poor bike, wheelchair and baby stroller accessibility. There is also a significant lack of proper water, rainwater and cable infrastructure, common for the city.
In the provided survey data obtained in the area, it is important to mention the low response rate collected in the area, which could be connected to many of the social infrastructure problems in the area. The area is served with one bus line with poorly marked bus stops.

2.2 Existing Conditions

Studying the existing data provided during the workshop, few spikes in the particle concentrations have been noticed:

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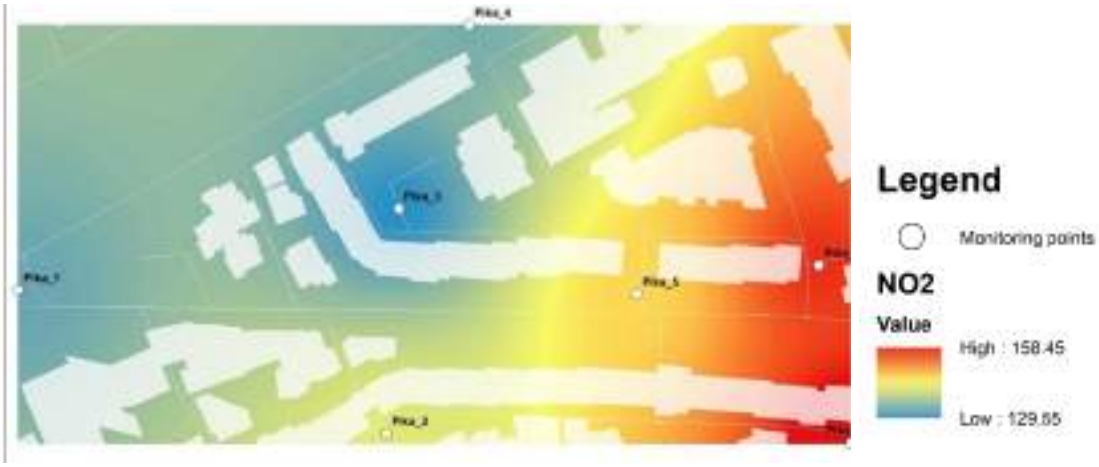
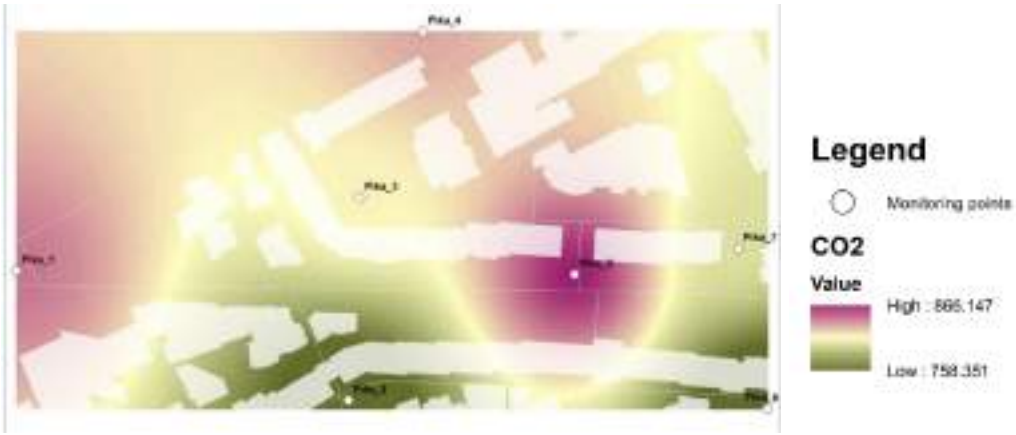
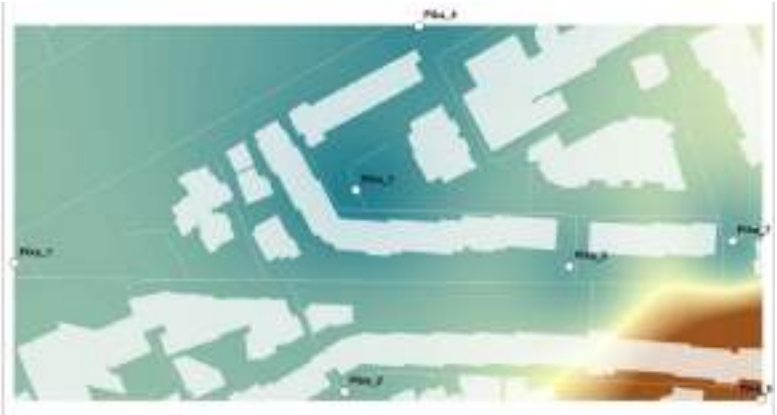
- Increase of NO_2 particles in the eastern part of the area (probably due to traffic congestion)
- Slight increase of CO_2 particles at the intersections
- A spike of PM2.5 and PM10 particles in the southeast of the area (source unknown)







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Given the date and from the interviews with the residents, we have concluded that air pollution is not a huge problem in the area (in comparison to the city of Tirana). The tree alleys are also making the air quality better, as well as the Lana river and the vegetation around it, therefore even reducing the urban heat island effect. Other than the existing trees, the rest of the green areas are in a poor state, and with a huge potential to be redeveloped and significantly improved. The team has noticed that rainwater could cause problems in the area due to lack of rainwater management, even in the days following the rain.
The social aspect of the area was interesting to observe. Most of the observations were pointing at the lack of maintenance of every part of the area with multiple possible causes for it. The interviewed people have shown a concern over the potential inclusion of the third party (NGOs, municipality)in the (re)development of the area. Lack of public places where people would interact was observed alongside an unusually high number of cafés.

3. Environmental and Ecosystem Services Assessment

3.1 Environmental/Societal Demand

The environmental and societal needs identified in the Ali Demi neighborhood of Tirana highlight a set of urgent priorities closely tied to public health, safety, and quality of life. Based on the results from the neighborhood survey, several infrastructure and environmental services are perceived as inadequate, with residents expressing a strong demand for improvement in areas such as air quality, waste management, greenery, lighting, and public infrastructure. These issues have a direct effect not only on environmental conditions but also on social inclusion and economic sustainability.
One of the most prominent concerns among residents is air quality. A significant majority rated air quality as poor or very poor, with visible dissatisfaction linked to traffic pollution and lack of green infrastructure. This poor perception justifies targeted interventions in air purification through green infrastructure, which could increase the attractiveness of the area and enhance real estate values. Clean air is not only a health need but a factor in creating a livable and economically dynamic urban space.
The lack of green spaces and recreational areas was also strongly emphasized. Residents expressed a strong need for increased greenery, with existing green spaces perceived as insufficient and poorly maintained. This demand is not only aesthetic—green areas contribute significantly to public health, reduce stress, and support biodiversity. Expanding green infrastructure can also create green jobs in landscaping, maintenance, and ecological management. Water management emerged as another critical challenge during the site visit, particularly in reference to broken infrastructure and frequent puddles due to inadequate drainage. Such conditions affect both health and accessibility, especially for vulnerable groups like children and the elderly. Reliable water infrastructure supports business activity and public safety, especially during heavy rains or heatwaves. Urban heat stress is also a growing concern, with citizens reporting discomfort during hot periods. Increasing vegetation coverage and tree canopy would contribute to microclimate regulation. Reducing urban heat islands through nature-based solutions is not only environmentally beneficial but also improves comfort in public spaces, especially for children in recreational areas.
In summary, the environmental and social needs in Ali Demi are multi-dimensional and interrelated. The most critical interventions focus on improving air and water quality, expanding green spaces, enhancing waste and lighting infrastructure, and supporting inclusive access to safe, clean, and attractive public areas. These priorities offer not only health and well-being benefits but also contribute to the broader economic development and social cohesion of the neighborhood.

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Health	Why we need it? How much improvement?	Economic Growth	Why we need it? How much improvement?	Inclusivity	Why we need it? How much improvement?
Improved air quality	From the thematic maps we can see that air purification is needed in particular around buildings 2, 3, 4, 5, 6. The proximity with a school close to building 3 increases this need. 20% better approx	Increased property value	Cleaner air and better urban conditions make residential areas more attractive, potentially increasing property values by 15%.	Sense of community	More public spaces and recreational areas encourage community interactions and social integration.
Heat Islands situation	Heat is lower again among buildings 2, 1, 9, while it gets worst as it goes toward buildings 3, 6, 7.	Green job creation	Expansion of green spaces and infrastructure can create new employment opportunities in urban planning and environmental management.	School children (space for recreational use)	There is a lack of space where children can play, but in the area, there are different schoolyards that are not used after the end of the lecture.
Water management situation	broken tubes, not much soil, lots of puddles	Business sustainability	Improved infrastructure and environmental conditions attract businesses and quality of the shops, ensuring long-term economic growth.	Safety in public areas	Increased lighting, pedestrian-friendly spaces, and improved infrastructure enhance safety for residents, especially women and children.
Waste management issues	Poor waste collection services leading to public health risks. Improvement in waste disposal efficiency by at least 40%.	Public transport efficiency	Reduction in traffic congestion and improved public transport can boost productivity and economic activity.	Affordable housing integration	Environmental improvements should not lead to gentrification but ensure affordable housing remains available.
				Public health equity	Improved environmental conditions should benefit all socio-economic groups equally, reducing disparities in health outcomes.

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3.2 Ecosystem Services Supply Assessment

The assessment of ecosystem services in the Ali Demi neighborhood is essential for understanding how nature-based solutions can contribute to addressing the environmental and social challenges identified in the area. The ecosystem services selected for monitoring are those most aligned with the concerns raised by residents in the recent survey, particularly in relation to air quality, urban heat, lack of greenery, and water management. The goal is to not only evaluate the current supply of these services but also to create a baseline that can guide future interventions and measure their effectiveness over time.

Green infrastructure plays a crucial role in regulating the urban microclimate, especially in areas affected by heat stress and limited tree coverage. By increasing vegetation, we can reduce ambient temperatures and improve overall thermal comfort in public spaces. This contributes directly to better living conditions, particularly for vulnerable populations such as children and the elderly. Similarly, improvements in vegetation and soil permeability help manage stormwater runoff, reduce the risk of flooding, and alleviate the strain on aging water infrastructure—another key issue highlighted by residents.

Air purification and carbon sequestration are also vital components of the ecosystem services provided by urban greenery. In an area where many respondents rated air quality as poor, the capacity of trees and green spaces to remove particulate matter (PM_{10}) from the air and capture CO_2 emissions represents both an environmental and a public health benefit. These processes not only improve local conditions but also contribute to broader climate resilience objectives.

Access to recreational areas and green public spaces is a service that intersects environmental health with social inclusion. In Ali Demi, the lack of green areas is one of the most strongly perceived issues, with many residents expressing dissatisfaction with the availability and condition of parks, playgrounds, and open spaces. Measuring the number of recreational areas per 1,000 residents will help quantify this gap and support the planning of inclusive, accessible green infrastructure that enhances quality of life.

Other ecosystem services such as noise mitigation, habitat provision, and soil quality improvement are also considered, as they support the long-term ecological health and livability of the neighborhood. While some of these services may not be the highest priority according to the survey, they contribute to a holistic approach that values biodiversity, environmental justice, and sustainable urban development.

To evaluate these services, a combination of quantitative and spatial methods will be used, including biodiversity assessments, infiltration rate measurements, GIS-based canopy mapping, and models for pollutant capture and water retention. Each indicator has been selected for its relevance to the local context and its potential to inform decision-making. Ultimately, this supply assessment aims to create a data-driven foundation for greening strategies that are not only environmentally effective but also socially equitable and responsive to community needs.

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Urban ecosystem service	Supply indicator	Method and calculation	Value per unit	Is it relevant for the area? 1-not relevant – 5 very relevant
Microclimate regulation (cooling)	Cooling capacity of green infrastructure	Temperature reduction per m² of vegetation cover	°C/m²	4
Habitat provision	Relative richness of focal species	Biodiversity assessment	number of species	3
Recreation	Recreation Opportunity Spectrum	Number of recreational areas per 1,000 residents	number/1000 residents	5
Noise mitigation	Reduction of traffic noise at selected receivers (residential buildings)	Noise reduction in dB per m² of green infrastructure	dB/m²	3
Air purification	PM10 deposition	Particulate matter removed per m² of green infrastructure	µg/m²	4
	CO_2 sequestration	Carbon absorbed per year per tree	kg CO_2/tree/yea	4
Runoff mitigation	Runoff avoided due to infiltration	Volume of water retained per m² of permeable surface	L/m²	4
Soil quality improvement	Increase in soil permeability	Measurement of soil infiltration rates after interventions	mm	4
Urban forest benefits	Tree canopy coverage	Percentage of land covered by trees in the area	% of area	4

4. Scenario Design Process

General description of scenario 1 and 2

In the scenarios, the group wanted to tackle the most obvious problems in the area that are possible to fix with low investments and disruption of the existent life in the area, and also to improve the quality of life significantly

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through direct and indirect effects of the interventions. The team has also focused on trying to bring the implemented features back to the residents, so they can have the feeling of ownership and community over the area and features in their neighbourhood. By detailed observation of the area and the review of existing and innovative practices in other neighborhoods and cities, the two problems the team decided to tackle were lack of communal and green spaces, alongside the accessibility and functionality, and rainwater collection and management. These two problems are even relying on one another, tackling many of the other problems the area has. As mentioned before, the practices in the scenarios were chosen by reviewing their effect, cost, feasibility, disruption to the existing situation, collaboration and potential care by the residents, and mainly - the impact on the ecological side and bringing nature back to the urban area.

4.1 Scenario 1 – Green and Community-Centered Revitalization

Concept Description and Guiding Vision

Scenario 1 focuses on addressing the primary challenges in the neighborhood by enhancing public and green spaces while maintaining affordability and minimizing disruption. The key interventions are aimed at improving community interaction, increasing ecological benefits, and enhancing the visual and functional quality of the area. The goal is to reintegrate nature into the urban fabric and promote a stronger sense of ownership and engagement among residents.
By incorporating small-scale, high-impact changes, the neighborhood becomes a more livable and attractive environment. The interventions also contribute to climate resilience, better rainwater management, and improved accessibility. This scenario provides a balance between practicality and sustainability while ensuring the community benefits directly from these transformations.

Design Features and Proposed Nature-Based Solutions (NBS)

One of the major interventions in this scenario is the enhancement of private and public facades with greenery. By encouraging residents to integrate plants and flower pots into their balconies and windows, the neighborhood gains a fresh and vibrant appearance. Additionally, facade-integrated planters help improve air quality and reduce urban heat, making the environment healthier and more visually appealing.
Another significant transformation involves repurposing the schoolyard as a shared public space during afternoons and weekends. Since the neighborhood lacks sufficient public gathering areas, opening up the school courtyard outside of school hours provides a much-needed communal space. The addition of modular seating, shaded areas, and greenery ensures that the space is inviting and functional. This intervention strengthens social ties within the community, offering a venue for outdoor learning, local events, and recreational activities.
To further enhance the public experience, two small green pockets are introduced in underutilized areas of the neighborhood. These spaces provide pleasant gathering spots with urban furniture, shaded seating, and natural landscaping. Drought-resistant vegetation and rain gardens are incorporated to aid in stormwater management, improving the area's resilience to heavy rainfall. The green pockets not only serve as places for relaxation but also contribute to the overall ecological well-being of the neighborhood.
Parking and pedestrian areas are also restructured to optimize land use while incorporating sustainable design elements. A larger parking lot is developed using a hexagonal concrete pattern with green spaces in between, allowing for better rainwater infiltration and reducing heat accumulation. Pedestrian-friendly pathways and safer

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crossings are introduced to improve accessibility and encourage walking. These changes make the streets more welcoming and functional while enhancing urban mobility.

Visual Elements

To illustrate the proposed interventions, sketches and diagrams will be included to showcase the planned green facade installations and schoolyard transformation. Additionally, reference photos from similar urban greening projects will provide a clear vision of the expected outcomes. Maps and overlays will demonstrate the before-and-after impact of the green pockets and parking rearrangement, helping to visualize the improvements and their benefits to the community.
This scenario demonstrates that with modest investments, the neighborhood can significantly improve its quality of life by fostering a greener, more communal, and accessible urban environment.

4.2 Scenario 2 – Rainwater management

The proposed rainwater management scenario for the Ali Demi area in Tirana aims to enhance the permeability of the urban environment while integrating greenery to improve both functionality and aesthetics. By utilizing rainwater as a resource rather than allowing it to be wasted through runoff, our approach fosters sustainability and urban resilience. Key aspects of our plan include optimizing the use of rainwater for irrigation, increasing green infrastructure, and improving spatial organization to create a healthier and more visually appealing neighborhood.

The guiding vision for this project is to establish a more sustainable and livable urban environment through thoughtful rainwater management. Our approach prioritizes ecological balance, community engagement and spatial efficiency. We sought to transform the Ali Demi area into a model for green urban planning, where natural elements and urban infrastructure coexist harmoniously. To achieve this, we propose the following interventions:

- Rainwater utilization for the vegetation
    - Redirecting rainwater from the main road toward existing tree alleys
    - Expanding greenery by introducing lush bushes and low vegetation between trees to enhance biodiversity and improve the microclimate
    - Providing residents with flower pots and plants for window installations, leveraging the observed community practice of personal greenery to further enhance the area

- Enhancing urban permeability
    - Removing unnecessary concrete surfaces and replacing them with green infrastructure such as bushes, grass and permeable surfaces to facilitate natural rainwater absorption
    - Creating breathing space around tree roots to improve their longevity and maximize rainwater infiltration
    - Regulating and greenifying parking areas
    - Organizing parking along smaller roads and implementing permeable green blocks to allow rainwater to seep into the ground.
    - Addressing unregulated parking in the western part of the area by introducing a structured parking solution, with the potential for an underground garage topped with a park to maximize land use efficiency.

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- Pilot Project: Rainwater Collection for a Community Garden
    - Implementing a rainwater collection system on the rooftop of an elementary school to irrigate a community garden within the school's yard. Using this pilot project to assess feasibility and scalability, with the long-term goal of expanding the initiative to other buildings in the neighborhood.

Through these interventions, the Ali Demi area will not only manage rainwater more effectively but also improve its aesthetic appeal, environmental resilience, and overall quality of life for its residents. This vision aligns with sustainable urban development principles, fostering a greener, more community-oriented neighborhood.

5. Environmental Performance & Ecosystem Service Outcomes

5.1 Assessment of Ecosystem Services – Scenario 1

Scenario 1 was focused on the creation of communal green spaces, including the following interventions:

- Closing the road in front of the elementary school in the area: closing roads in front of schools has been proven to reduce traffic and average speed in roads in the area, which is related to a decrease in collisions of around 6% (Transport for London. (2022). *Getting to know School Streets: Case studies 2022*. Transport for London. https://content.tfl.gov.uk/getting-to-know-school-streets-case-studies-2022.pdf). Knowing Tirana's estimate of accidents per year (Qirjako, G., Burazeri, G., Hysa, B., & Roshi, E. (2008). Road traffic injuries in an urban setting in transitional Albania. Scandinavian Journal of Public Health, 36(5), 512–519. https://doi.org/10.1177/1403494808089562) a reduction of collisions by 6%, could amount to hundreds of euros of savings, resulting in around 20 less accidents a year. In fact, medical treatment needed after an accident can be very costly , for instance surgery can range from 80€ to 2000€ (OpenAI. (2025, March 23). *Estimated price for surgery in public hospitals in Tirana*. Personal communication.), and physical therapy can be estimated around 45€ per treatment (Lemon Breeze Hostel. (n.d.). *Services*. Lemon Breeze Hostel. Retrieved March 23, 2025, from https://www.lemonbreezehostel.com/en/services-3).
- Creation of a pocket park (buildings 2 and 3): estimating that a tree can absorb around 25 kg of CO_2 per year (Ecotree. (n.d.). *How much CO_2 does a tree absorb?* Ecotree. Retrieved March 23, 2025, from https://ecotree.green/en/how-much-co2-does-a-tree-absorb) and that our proposition would include approximately 8 trees in this pocket park, yearly the amount of CO_2 absorbed would be around 200 kg. Current technologies for CO_2 air absorption cost between 123 and 316 € per ton of CO_2 (International Energy Agency (IEA). (n.d.). *Current cost of CO_2 capture for carbon removal technologies by sector*. International Energy Agency. Retrieved March 23, 2025, from https://www.iea.org/data-and-statistics/charts/current-cost-of-co2-capture-for-carbon-removal-technologies-by-sector). This pocket park would save approximately 50€ per year.
- Creation of a pocket park (buildings 4 and 8): this park could contain around 15 trees, thus saving approximately 100€ a year absorbing CO_2.
- Wooden containers for waste bins: wooden containers for waste bins might help in keeping the streets cleaner, allowing for less frequent need of cleaning services. Since currently in Tirana many neighborhoods are unhappy with the way waste is managed and waste taxes are thought to be too expensive, this solution could eventually end up in lower taxes, resulting in a possible saving of around 24 € per family per year if taxes were to be cut by 50% (Citizens.al. (2023, December 22). *Fatura e pastrimit në Tiranë rritet, inceneratori djeg vetëm paratë e buxhetit*. Citizens.al. Retrieved March 23, 2025, from https://citizens.al/en/2023/12/22/fatura-e-pastrimit-ne-tirane-rritet-inceneratori-djeg-vetem-parate-e-buxhetit/).
- Ramps: ramps make accessibility higher and reduce changes of injuries, resulting in cost savings similar

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to the first intervention. Each avoided accident would make people save hundreds if not thousands of euros for surgery and, if needed, physiotherapy visits.

- Bike parking boxes and a bench (building 5): increase the use of the bike instead of the car for short trips would result in gas savings. If fuel costs 1.7€/L (Cargopedia. (2025, March 17). *Prezzi dei carburanti in Europa*. Cargopedia. Retrieved March 23, 2025, from https://www.cargopedia.it/prezzi-dei-carburanti-in-europa), using the bike instead of the car would make people save approximately 1€ each 5 km (considering a fuel efficiency of 10L/100km).
- Creating a leisure area in front of shops that have space outside (buildings 2 and 4): this space could bring more profits to the shops in the area, providing more customers, and, at the same time, it could allow people in the area to save on leisure and mobility expenses, having a meeting point close to home. Profits could be calculated imagining an increase of 6% in revenues (U.S. Environmental Protection Agency. (n.d.). Economic benefits of green infrastructure. U.S. Environmental Protection Agency. Retrieved March 23, 2025, from https://www.epa.gov/green-infrastructure/economic-benefits-green-infrastructure). For savings, we know that people would save 1€ for every 5 km they decide not to drive because they have a leisure space within walking distance.
- Open school yard for playground/urban garden: this initiative could foster healthier lifestyles among participants, lowering medical expenses and grocery expenses. Moreover, it could create job opportunities for kids, enhancing their experiences in growing their own food. Savings could be estimated around 5€ for probiotics per 3 months (assuming a person with an unhealthy diet needs a box of probiotics every 3 months), 0.50 € per week in garden produces (knowing that vegetables cost around 0.50 euros/kg in Tirana), resulting in 46€ per year per person. Making kids learn food growing skills might empower them to grow their own food through their whole life, increasing savings.

5.2 Assessment of Ecosystem Services – Scenario 2

- Scenario 2 focuses on rainwater management interventions that aim to improve urban permeability and enhance green infrastructure. The following assessments provide estimates of environmental and financial benefits:
- **Rainwater utilization for vegetation:** Redirecting rainwater from the main road toward tree alleys and expanding greenery increases water retention and reduces runoff. Studies indicate that urban tree canopies can intercept up to 60% of rainfall (Xiao & McPherson, 2016). Given an estimated annual rainfall of 1200mm in Tirana and an average tree interception rate of 50%, the initiative could prevent approximately 240,000 liters of runoff per year if implemented across 400m² of tree canopy.
- **Expanding greenery with bushes and low vegetation:** Vegetation plays a crucial role in carbon sequestration and microclimate regulation. An average bush absorbs around 5kg of CO_2 per year (Ecotree, n.d.), and planting 100 bushes in the area would sequester approximately 500kg of CO_2 annually, equivalent to the emissions from driving a car for about 4,000km.
- **Removal of unnecessary concrete surfaces:** Converting 500m² of impermeable pavement into permeable green infrastructure can increase rainwater infiltration by up to 90% (Ferguson, 2005). This measure can significantly reduce the strain on stormwater drainage systems and lower flood risks in the neighborhood, potentially saving up to 10,000€ in flood damage repairs annually.
- **Breathing space around tree roots:** Allowing trees to absorb more rainwater can extend their lifespan by reducing stress on their root systems. Studies show that trees in compacted urban soils have a lifespan of only 10-20 years, while those with adequate water infiltration can live up to 50 years longer (Jim, 1998). This could result in long-term savings by reducing the need for frequent tree replacement and maintenance costs, which range from 200€ to 500€ per tree.

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- **Greenifying parking areas with permeable surfaces:** Implementing permeable parking solutions covering 1000m² could allow up to 1,000,000 liters of rainwater to infiltrate into the soil annually. This intervention mitigates heat island effects and reduces surface water runoff, improving the overall resilience of the urban environment.
- **Pilot rainwater collection for a community garden:** Collecting rainwater from a 200m² school rooftop with a retention system could provide up to 240,000 liters of water per year, assuming a 60% collection efficiency. This would be enough to irrigate a 500m² community garden, reducing the need for municipal water and potentially saving up to 1,500€ in water costs annually.

By integrating these ecosystem services, Scenario 2 enhances environmental sustainability, mitigates climate change impacts, and provides long-term financial savings for the community.

5.3 Comparison Table – Ecosystem Services Achieved

Exemplary services:

Urban ecosystem service	Scenario 1 contribution	Scenario 2 contribution
Cooling Effect	Pocket parks contribute by adding green spaces that help mitigate heat	Expanding greenery, removing concrete, and greenifying parking areas reduce urban heat islands
CO_2 Sequestration	150€ per year	500 kg of CO_2 per year (from bushes and low vegetation)
Air Quality Improvement	More trees and vegetation absorb pollutants, improving air quality	Increased greenery and rainwater-fed vegetation improve air filtration
Flood Mitigation	Indirectly reduced by increased green spaces which contribute to water absorption	1,000,000 liters of water infiltrated, 10,000€ savings in flood repairs, improved permeability
Biodiversity Enhancement	46€ per year per person	Expanded greenery and habitat creation for urban wildlife
Recreational Value	Leisure areas and open school yard provide social spaces	Community gardens and green public spaces enhance recreational opportunities
Sustainable Mobility	1€ every 5 km per person	Permeable surfaces and green areas improve pedestrian and cycling comfort
Health improvement	approx. 1085€ per avoided accident per person	Improved urban environment reduces respiratory illnesses and heat-related health issues
Waste management	24€ per year per family	Indirect improvement through better stormwater management and green spaces reducing litter

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6. Social and Economic Impact Assessment

6.1 Health Benefits

Scenario 1 (Communal Green Spaces):
The creation of communal green spaces will provide various health benefits. The proposed interventions, such as the closure of roads to make room for playgrounds and pocket parks, will improve air quality by introducing more greenery to the area and reduce traffic, thus lowering the risk of accidents. Plants, trees, and shrubs absorb air pollutants and enhance the surrounding microclimate, reducing the effects of the urban heat island (UHI) effect. This will lower ambient temperatures, making the area more comfortable, especially for children and elderly residents. Mental health benefits will also be significant, as green spaces are known to reduce stress and anxiety, together with fostering spaces for community meetings. The availability of recreational spaces will improve the overall well-being of the community, providing a safe and engaging environment for children to play and for families to socialize.

Scenario 2 (Rainwater Management):
In Scenario 2, the introduction of rainwater management systems such as lush vegetation, hexagonal green grid parking lots, and rainwater canals will help reduce the UHI effect. Vegetation will absorb water and filter pollutants, creating a healthier space for the local population. The ability to manage rainwater will also enhance the local environment by preventing waterlogging and controlling runoff, which can contribute to flooding and air pollution. The visual and physical improvements made by these green interventions will contribute to a more positive atmosphere for the residents, reducing stress and increasing overall happiness.

6.2 Economic Benefits and Costs

Scenario 1 (Communal Green Spaces):
The interventions in Scenario 1 offer significant cost savings. Closing the road in front of the elementary school could reduce accidents by 6%, saving hundreds of euros annually on medical expenses, including surgeries (80€-2000€) and physiotherapy (45€ per treatment). Creating pocket parks with trees could save around 50€ per year in CO_2 absorption, with the second park saving 100€ annually. Wooden containers for waste bins could reduce waste management costs, potentially saving 24€ per family. Ramps improve accessibility, preventing injuries and reducing medical costs. Bike parking and benches would encourage cycling and walking over driving, saving 1€ per 5 km. A leisure area in front of shops could boost retail profits by 6%, while reducing transport costs for residents. Finally, the school yard urban garden could save 46€ per person per year on food expenses by growing produce.

Scenario 2 (Rainwater Management):
Scenario 2 will generate economic benefits primarily by reducing water-related costs. The introduction of rainwater systems and water-absorbing greenery will help conserve water and reduce municipal water treatment expenses. Additionally, the green infrastructure will decrease the need for air conditioning during the summer months, leading to energy cost savings. By managing rainwater more efficiently and promoting sustainability, the neighborhood will also see a reduction in potential flood-related costs. There are also opportunities for economic growth through the establishment of green jobs related to the maintenance and management of these systems. Although the installation of rainwater systems and green grids requires investment, the long-term cost savings and improvements to property value are expected to offset the initial expenses.

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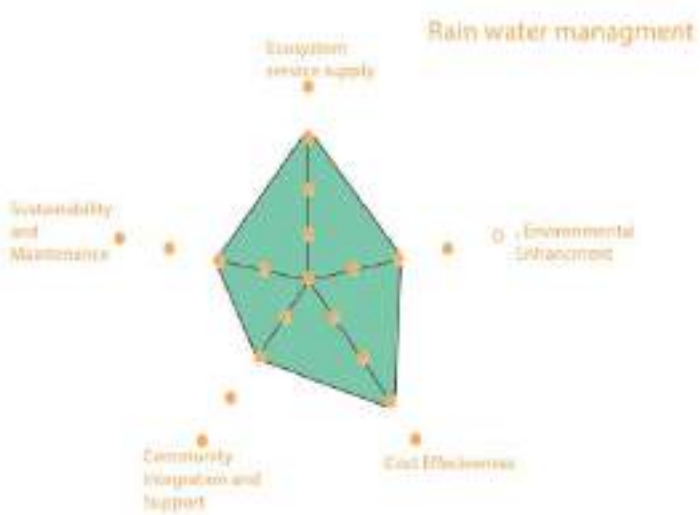
6.3 Inclusivity Benefits

Scenario 1 (Communal Green Spaces):
The introduction of communal green spaces will significantly enhance accessibility for various community members. The planned installation of ramps for wheelchair users, strollers, and cyclists will ensure that these public spaces are usable by all, regardless of mobility. Furthermore, the creation of playgrounds and recreational areas will provide children and families with safe and inclusive spaces to interact. These spaces will also serve as venues for community-building activities, fostering social cohesion and community engagement. People will have the opportunity to come together, share experiences, and participate in local events or leisure activities. These interventions will encourage greater social interaction among people from different backgrounds and ages, promoting a stronger sense of community.

Scenario 2 (Rainwater Management):
In Scenario 2, the inclusion of rainwater management systems and green infrastructure will also support inclusivity by improving the overall environment for all residents. The lush vegetation and greenery along the streets and near commercial areas will make public spaces more inviting and accessible. These improvements will not only benefit people who are passing through the area but will also provide spaces for local residents to gather and enjoy the outdoors. Rainwater management systems that incorporate green spaces will make the streets more pedestrian-friendly, reducing the risk of flooding and making it safer for everyone. These changes will encourage greater use of public spaces, improve social interactions, and increase community engagement through collaborative efforts such as maintaining the greenery and participating in sustainability programs.

7. Star Tool Evaluation

The star tool for the first scenario, communal green spaces, ranked high in environmental enhancement, ecosystem service supply and community integration and support. However, when it came to sustainability and maintenance as well as cost effectiveness it scored lower as it was anticipated that shifts in demographic composition and/or atmospheric conditions over time could impact both the community and the health and viability of selected plant species.



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The star tool for the second scenario, rainwater management, ranked high in ecosystem service supply and cost effectiveness. Whereas in regards to community integration and support, environmental enhancement and sustainability and maintenance, it kept a medium scoring of 3.

Considering this slight difference in ranking, the second scenario was valued as the most desirable one.

8. Community Simulation Game Outcomes

During the community simulation game, responses to both scenarios varied based on residents' intentions to stay in the neighborhood.

In Scenario 1, which proposed **communal green spaces**, residents who owned homes and were raising children tended to support the proposed changes. They viewed it as a worthwhile investment for the future and were more willing to commit to the maintenance efforts required. In contrast, more transient residents, such as renters or those looking to sell, were less supportive of this scenario. Additionally, the potential costs of implementing communal green spaces led some hesitant community members to become even more reluctant, given the required investment of money, time, and effort involved.

In Scenario 2, which focused on **rainwater management**, homeowners planning to stay in the neighborhood were also generally in favor of the proposed changes. While there was initial hesitation, the relatively low upfront costs and the absence of ongoing maintenance costs over time helped shift opinions. The cost-effectiveness of this approach made it more appealing, even to those who were initially unsure about the investment.

In both scenarios, potential investors looking to develop the area were opposed to the proposed changes, as were more transient residents.

Ultimately, Scenario 2 was more favorably received in the community simulation game, with the primary factor being its cost-effectiveness compared to the communal green spaces scenario, which was seen as slightly less financially viable.

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9. Conclusion & Recommendations

After on and off-field research of the area and the city, and exchanging and finding ways to implement our ideas and tackle noticed problems, we have realised that bringing the nature back to the cities and enhancing the life in older parts of the urban areas does not have to be extremely expensive and kept only for wealthier people and communities. All around the world people keep finding ways to enhance their lives with very simple concepts and solutions and law-makers should try better to get to know them for the good of everyone in our societies. During the scenario-making process, we kept finding multiple ways to bring the residents to the new ideas therefore lowering the maintenance cost and enhancing the social aspect of the neighbourhoods therefore bringing nature and social interactions back to the urban areas, known for the lack of it. The team also had a problem of differentiating the ideas by tackling solutions, given the fact that urban areas are a vibrant mix of strongly connected systems that depend on one another which can be a problem in some situations, where we had to find a way to remove or reduce the side effects of some ideas. In the end, we have all agreed that the biggest problem is in the governance of the area, especially smaller units (neighbourhoods) where the lack of community-feeling is observed, stopping the further improvements that would have been initiated by the residents.

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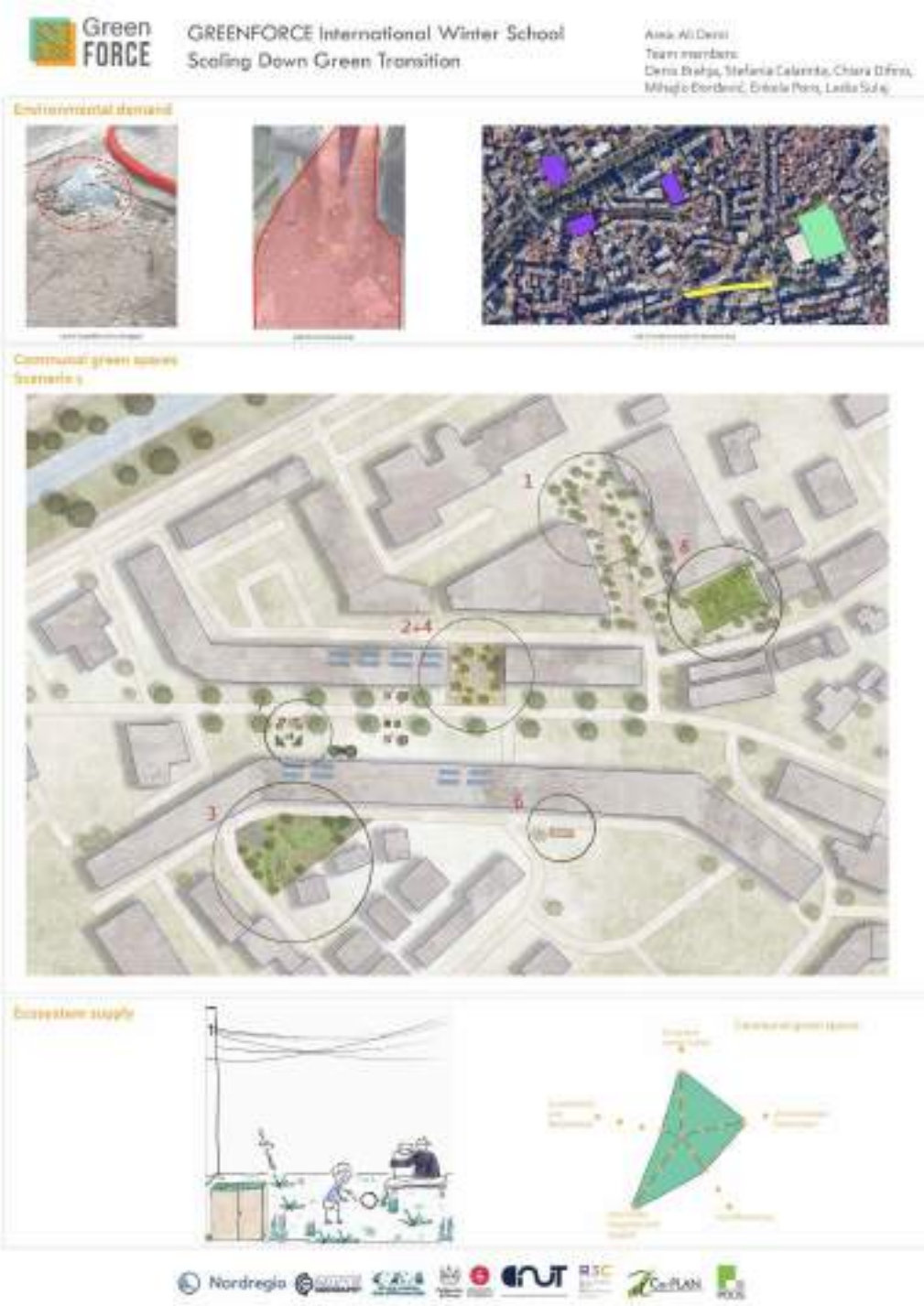
10. Annexes

Scenario 1 poster



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Scenario 2 poster

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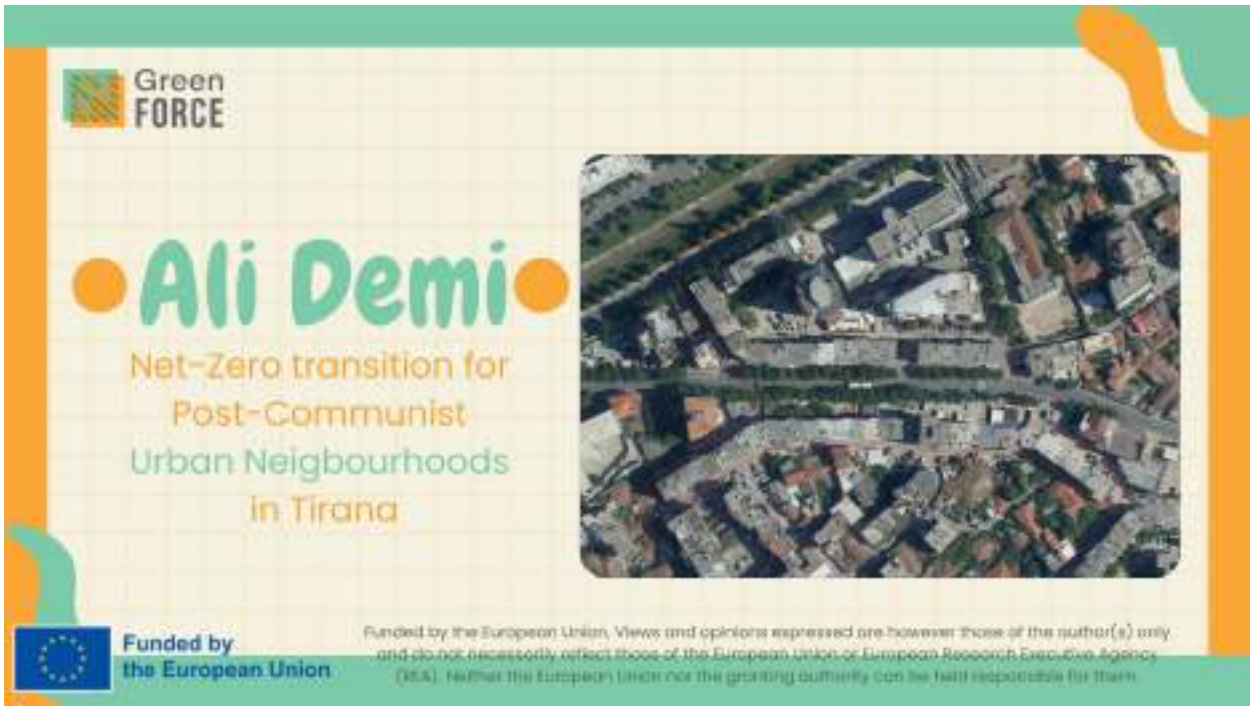
Presentation



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