



SCHOOL GARDENS AS A GATEWAY TO TRANSFORMATIVE ADAPTATION

A knowledge co-creation approach
in Split-Dalmatia County, Croatia

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School gardens serve as low-risk entry points for education-driven climate adaptation

Embedded within public education infrastructure, school gardens support awareness-raising, institutional learning, and local engagement with Nature-based Solutions (NbS). While limited in scale and impact, school gardens act as practical testing grounds, exposing governance, coordination, and financing challenges that must be addressed if NbS are to move from isolated pilots to mainstreamed solutions.

Climate risks in Split-Dalmatia County (SDC) are cumulative and interconnected, especially in urban coastal areas, requiring **integrated adaptation strategies that incorporate Nature-based Solutions (NbS)**.



NbS address multiple environmental and societal challenges most effectively when embedded in spatial planning, governance and education systems, rather than implemented as standalone projects.

School gardens represent a low-risk form of education-based NbS and provide practical **entry points for transformative adaptation** by building institutional capacity, social awareness, and local ownership of NbS.



By **linking adaptation objectives to education policy and everyday school practices, school gardens help normalise NbS** within communities. Because schools are widely distributed and socially trusted public institutions, they also act as community-level “multipliers” of NbS values, though continuous communication and engagement remain essential to maintain momentum.

In SDC, stronger coordination across administrative levels, integration of NbS into binding planning frameworks, and sustained financing are needed to **leverage school gardens and other early-stage NbS for systemic and scalable impact**.



KEY MESSAGES

Multi-hazard risks in coastal Mediterranean cities and the role of NbS

Coastal Mediterranean cities face interacting climate hazards that reinforce one another across space and time. At the land–sea interface, sea-level rise, storm surges, coastal flooding, and erosion coincide with heatwaves, droughts, river flooding, and wildfires (Škunca et al., 2021; Margeta et al., 2019).

Urbanisation and extensive impermeable surfaces intensify the urban heat island effect, increase runoff and flood risk, and simultaneously threaten biodiversity and ecosystem services (Labib et al., 2022; Croatian Waters, 2025; PAP/RAC, 2015; Tzavella et al., 2026). Across the region, an emerging “seesaw effect” alternates extreme hydrological and thermal events, compounding stress on dense urban fabrics and critical infrastructure (Duplančić Leder et al., 2025; Rico-Bordera et al., 2026).



The extreme storms in Dalmatia in February 2026 serve as a contemporary validation of earlier projections regarding the rising costs of sea-level rise and the necessity for integrated adaptation - PAP/RAC

In this context, Nature-based Solutions (NbS) offer multifunctional benefits that address interlinked risks: improving water retention,

reducing runoff, moderating heat through shading and evapotranspiration, restoring soil structure, and enhancing biodiversity (Margeta et al., 2019; Bačić et al., 2025). Their long-term effectiveness, however, depends on institutional capacity, governance coordination, public acceptance, and sustained maintenance.

Education-based NbS as a mainstreaming and scaling pathway

Across Europe, NbS adoption commonly progresses through:



However, many Mediterranean regions struggle to progress beyond the pilot stage due to limited capacity, fragmented governance, and insufficient social legitimacy. Education-based NbS such as school gardens strengthen the enabling conditions required for scaling by embedding NbS principles directly within public institutions that have continuity, legitimacy, and deep community reach.

Education-based NbS:

- cultivate routine stewardship and maintenance skills;
- build long-term behavioural and cultural familiarity with NbS;
- foster trust and “social licence” for larger interventions;
- provide replicable governance micro-models that inform local planning.

These qualities correspond to several approaches to transformative change identified in the IPBES Transformative Change Assessment (Bennett, 2024):

- Systems approach, by linking governance, education, and ecological processes;
- Knowledge co-creation, by enabling collaboration among schools, NGOs, and communities;

- Inner transformation, by shaping values, worldviews, and emotional connections to nature among children and educators.

As trusted public institutions, schools also function as community multipliers, diffusing NbS concepts horizontally across families and communities. As a result, school gardens are not only entry points for NbS but also long-term components of a community’s transformative adaptation pathway.

Building capacity for multi-risk climate adaptation: the role of school gardens

In SDC, these regional dynamics manifest acutely in low-lying coastal settlements.



The school of our dreams: planning the school garden with students.

The February 2026 storms produced cyclonic tides and severe flooding, overtopping waterfronts and inundating nearby buildings, with emergency services responding to widespread seawater ingress (Jutarnji list, 2026; Croatian Waters, 2025).

Preliminary analyses within **DesirMED** identify Kaštela Bay as one of the eastern Adriatic's most climate-vulnerable areas (Tzavella et al., 2026). These events validate earlier projections regarding rising costs of sea-level rise and the need for integrated adaptation (PAP/RAC, 2015).

They also support soil health and ecological regeneration, directly contributing to climate resilience at the school and neighbourhood scale.

The implementation of school gardens in SDC required close cooperation among a range of local actors including the schools, municipalities, civil society organizations, and technical bodies. Teachers and students played active roles in design, planting and maintenance, helping build environmental literacy and emotional connections to nature.



Education-based NbS, such as school gardens, are targeted, low-risk interventions that enable institutions to engage with NbS practice, while generating learning relevant for policy development - Maja Jurić, SUNCE NGO

Within the DesirMED project, NbS implementation in SDC focused on developing school garden activities in selected primary schools, including the creation of school gardens at the “Brda” and “Dobri” schools in the city of Split, in Skalice, and in the village of Kamešnica.

Designed using indigenous and seasonal plant species adapted to local climatic conditions, the gardens deliver multiple benefits, including urban greening, shading, water infiltration, micro-climate cooling, and biodiversity enhancement, while serving as outdoor learning environments.

This aligns with the “inner transformation” approach outlined in the IPBES assessment, which emphasises shifts in values, mind-sets, and relationships with nature as essential elements of transformative change (Bennett et al., 2024).

The gardens' visibility within school communities positioned them as demonstration sites for NbS, extending learning to parents, local residents, and municipal actors.

Schools were selected as pilot sites because they are stable public institutional structures with strong community ties and the capacity to integrate NbS into everyday routines.





Students at school in Skalice working with Representatives from NGO Permaculture Dalmatia.

This made schools ideal settings for embedding NbS within public institutions.

Their relatively modest financial and administrative requirements allow them to demonstrate how adaptation objectives intersect with education policy and local governance.

Their role as hubs of knowledge co-creation and adaptive, intergenerational knowledge (highlighted by IPBES as essential for navigating complex transformative processes) supports long-term resilience.

Although modest in scale, the school garden activities provided tangible evidence of how NbS operate in institutional settings.

They facilitated dialogue between schools and municipalities, clarified maintenance responsibilities, revealed practical implementation constraints, and generated early-stage institutional learning valuable for future NbS planning.

Governance landscape for integrated responses

The governance landscape for implementing NbS in SDC reflects a broader pattern seen in many European regions: high-level recognition of NbS has not yet resulted in systematic local uptake.

Instead their translation into operational action often relies on local initiative and stakeholder engagement (Martin et al., 2025).

Croatia currently lacks a national mandate to integrate NbS into spatial planning or to recognise schools as adaptation entry points.

Consequently, the school garden initiative depended on bottom-up leadership from the **NGO SUNCE**. The school gardens build on Sunce's broader efforts to introduce students and educators to permaculture principles, and to raise awareness about sustainable management of green spaces.

In the absence of formal policy mandates, the success of these initiatives depends on the engagement of local actors, particularly teachers, whose motivation and commitment make it possible to

integrate the gardens into school activities and maintain them over time. The experience illustrates how community-driven initiatives and education-based NbS can function as practical entry points for adaptation, helping build awareness, institutional capacity, and local ownership, even in the absence of strong top-down frameworks, while demonstrating the potential for broader integration into governance systems.

Implementation challenges and lessons learned

The implementation of school gardens revealed a set of challenges that reflect broader constraints affecting NbS uptake in SDC.



School garden's Lab.



Governance Fragmentation

spreads responsibilities relevant to NbS implementation (e.g., education, spatial planning, environment, water management, and local development) across multiple administrative levels and institutions, complicating the potential to link pilots to wider planning and investment processes.



Limited Technical Capacity

constrains the integration of NbS into planning and maintenance frameworks, particularly at the municipal and island level. While schools and local actors showed high levels of engagement, municipalities often lacked the technical expertise, staffing, or procedural clarity needed to integrate NbS into longer-term planning frameworks or maintenance budgets.



Lack of long-term financing

for NbS undermines continuity and replication of school garden pilots. School gardens required relatively modest resources, yet questions around long-term funding for maintenance and potential replication were not always clearly resolved. This reflects a broader reliance on short-term, project-based funding for NbS, with limited access to stable financing mechanisms.

Weak integration into binding spatial planning



Although NbS are recognised as beneficial adaptation measures in strategic governance documents, they are not incorporated in spatial or sectoral plans as enforceable requirements. This reduces their ability to compete with ad hoc pressures coming from construction, particularly in tourism-intensive areas.

These challenges do not prevent NbS implementation at the county level, but they constrain the extent to which the pilots could be leveraged as part of a more systemic adaptation approach.



The opening of the outdoor classroom symbolises the achievement of the project's main goal – creating a school space that connects children with nature and shows that change begins in outdoor classrooms - SUNCE NGO

Several lessons can be drawn from the use of school gardens as NbS entry points.

- *Education-based NbS are effective at building awareness, acceptance, and basic institutional familiarity, even when their direct contribution to risk reduction is limited. By embedding NbS into everyday school routines, the gardens helped normalise nature-based approaches and supported learning-by-doing among students and educators.*

- *Small-scale interventions can also serve as learning laboratories, revealing barriers that are relevant to the wider scaling of NbS, including coordination, financing, and institutional continuity.*

- *The experience showed that the success of NbS depends at least as much on governance and ownership arrangements as on technical design. Clearly defined roles and responsibilities, together with the early involvement of local actors, proved essential to effective implementation and long-term maintenance.*

- *Without systemic follow-up, however, school-garden pilots are likely to remain localised and dependent on individual champions.*



Students developing a school garden in Dobri.

Conclusions

The school gardens implemented in SDC demonstrate that **education-based NbS can serve as strategic entry points for transformative climate adaptation.**

The school-garden approach to transformative change represents a good example of a structure that can condition and delineate inclusive and just societal practices, fostering alterations within institutions and governance arrangements.

The success of such an approach builds upon entry points that enable stakeholders to co-create socially grounded knowledge, shared visions and strategies to pursue transformative actions.

Indeed, education-based NbS in SDC aimed to reframe conventional approaches and perspectives to adaptation by engaging students in collaborative actions to increase awareness among citizens and policymakers.

Furthermore, they can catalyse systemic change by building local capacity and simultaneously identifying the governance, planning, and financial constraints that hinder the broader uptake of NbS.

However, to move beyond isolated pilot actions and to foster wider institutional and policy changes, enabling conditions must be strengthened at regional and local levels through shared and coordinated actions.

SDC should prioritise



Improved coordination across sectors and administrative levels;

Integration of NbS into legally binding spatial and sectoral planning instruments;



Sustained access to financing and technical expertise;

Continuous community engagement and communication.



With these enabling conditions in place, school gardens can serve as both entry points and long-term pillars in the region's adaptation trajectory, supporting the wider deployment and normalization of NbS across SDC.



References

- Bačić S., Baučić M., Jajac N., Gilić F., 2025. DesirMED – Analiza ranjivosti obalnog područja Kaštelanskog zaljeva [\[PDF\]](#)
- Bennett E., Biggs, R., Calderón-Contreras, R., Golden Kroner R., et al. 2024. IPBES Transformative Change Assessment: Chapter 3. How transformative change occurs. IPBES Secretariat, Bonn, Germany [\[LINK\]](#)
- Croatian Waters, 2025. Flood Hazard and Risk Maps [\[LINK\]](#)
- Duplančić Leder T., Bačić S., Peroš J., Baučić M., 2025. Multiscale Modeling Framework for Urban Climate Heat Resilience—A Case Study of the City of Split. *Climate*, 13(4), 79 [\[LINK\]](#)
- Labib M.S., Wibowo A., Shidiq I.P.A., 2022. LST-based threshold method for detecting UHI in a complex urban landscape. *IOP Conf. Ser.: Earth Environ. Sci.* 986 012072 [\[LINK\]](#)
- Margeta J., Baučić M., Vilibić I., Jakl Z., et al., 2019. Plan upravljanja obalnim područjem Grada Kaštela. University of Split, Faculty of Civil Engineering, Architecture and Geodesy [\[PDF\]](#)
- Martin J.G.C., Scolobig A., Linnerooth-Bayer J., Irshaid J., et al., 2025. The nature-based solution implementation gap: a review of nature-based solution governance barriers and enablers. *Journal of Environmental Management*, 388, 126007 [\[LINK\]](#)
- PAP/RAC, 2015. Assessment of Costs of Sea-Level Rise in the Republic of Croatia Including Costs and Benefits of Adaptation [\[PDF\]](#)
- Rico-Bordera B., Beneto P., Khodayar S., 2026. Emerging links between droughts, heatwaves and extreme precipitation in a western Mediterranean hotspot: evidence of intensifying compound and sequential hazards. *Earth Syst Environ* [\[LINK\]](#)
- Škunca et al., 2021. Plan upravljanja morskim okolišem i obalnim područjem Splitsko dalmatinske županije (Obalni plan SDŽ). Coastal Plan of SDC. Splitsko-dalmatinska županija. [\[PDF\]](#)
- Tzavella K., Tai Y., Pham V., Bianconi A., et al. 2026. D4.1 Landscapes Characterisation on Climate Resilience, Resources and Ecosystem Services. Deltares, CMCC, UNIST, DUTH. Funded under the Horizon Europe Programme, DesirMED, Grant Agreement No. 101112972, HORIZON-MISS-2022-CLIMA-01-06, HORIZON-IA [\[under review\]](#)





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