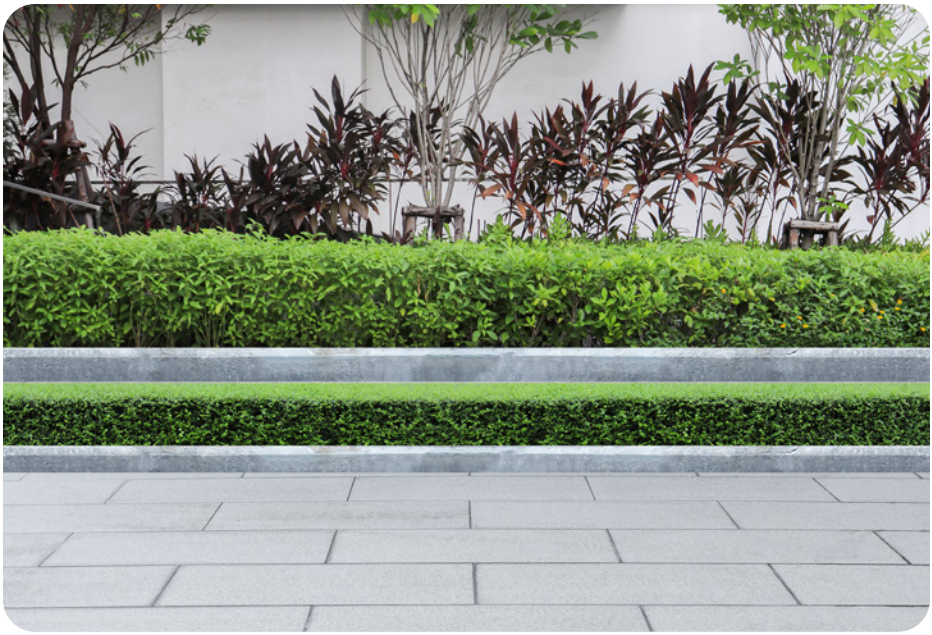
Key Takeaways

1 Choose the right GI for the right place to maximise their positive impacts

- **Match GI/BI to site conditions** consider climate, space, socio-cultural context, water availability and budget.
- **Prioritise GI types** that work for wildlife (parks, gardens, local nature reserves and allotments are biodiversity hotspots) and the environment (trees and shrubs are fundamental for soil retention and carbon capture). The shown matrix (Figure 9) reflects the efficiency of each type of GI/BI in providing different benefits, which helps in selecting the optimum solution for an individual challenge.
- **Consider multifunctionality** to capitalize on win-win opportunities in every project. For instance, planting a hedge or a green wall along a school boundary cuts air pollution, reduces noise, creates wildlife habitat, and provides children daily nature contact - all from one simple intervention (Figure 9).
- But keep in mind that there is no "perfect" solution, and **the decision is always a balance** between positive impacts, plant species requirements - water, air, maintenance, etc. - public support, budgets, and so forth.

A few examples:

- **Hedges along roads**, **green screens** at **schools**, and **green gates** at entrances all help mitigate PM, but also **parks and tree-lined streets** reduce UHI effects.
- **Urban trees and woodlands** are the top carbon capturers. **Street trees** are effective in open spaces but may trap air pollutants in narrow street canyons. Design placement carefully.
- **Green roofs and walls** cool buildings, boost biodiversity, and reduce air pollutants.
- **Shrubs and trees** boost carbon storage in every square meter.



Brief description	Object type	Object category	Food provision	Air pollution	Noise mitigation	Heat mitigation	Water quality mitigation	Water flow management	Maintaining carbon stocks	Supporting physical activity	Supporting social interactions	Restoring capacities - stress reduction and cognative restoration	Supporting biodiversity
Mainly private space linked to dwellings	Gardens	Balcony	L	N	N	N	N	N	N	N	L	H	L
		Private garden	M	L	L	M	M	M	L	VH	M	VH	H
		Shared common garden area	M	L	L	M	M	M	L	M	H	M	L
Mainly public space, but some access restrictions may apply	Parks	Pocket park	L	L	L	L	H	M	L	M	VH	H	M
		Park	L	H	H	H	H	M	H	VH	VH	VH	H
		Botanical garden	L	H	VH	VH	H	M	H	M	H	VH	VH
		Heritage garden	M	M	H	H	H	M	M	M	H	VH	H
		Nursery garden	M	M	L	L	H	M	M	L	M	M	L
Areas designed primarily for specific amenity uses	Amenity areas	Sports field	N	L	L	L	L	L	L	VH	H	M	N
		School yard	N	N	N	N	N	N	N	VH	VH	M	N
		Playground	N	N	N	N	L	L	N	VH	VH	M	N
		Golf course	N	M	L	L	N	M	L	M	H	H	M
		Shared open space (e.g. square)	N	N	N	N	N	N	N	M	VH	L	N
Areas designed primarily for spceific uses (not leisure); some access restrictions may apply	Other public space	Cemetery	N	M	M	M	M	M	H	L	L	VH	H
		Allotment / other growing space	VH	M	L	L	N	M	N	H	H	VH	H
		City farm	VH	M	L	L	N	M	N	M	M	H	M
		Adopted public space	L	M	L	L	L	L	N	N	L	M	L
Linked to routeways, geographical features and boundaries	Linear features/ routes	Street tree	L	H	L	H	L	L	M	N	L	H	M
		Cycle track (as green/ blue corridor)	L	L	L	L	L	L	L	VH	M	H	L
		Footpath (as green/blue corridor)	L	L	L	L	L	L	L	VH	VH	H	L
		Road verge	L	L	L	L	M	M	L	N	N	L	L
		Railway corridor	N	VH	VH	VH	L	M	H	N	N	L	VH
		Riparian woodland	L	VH	VH	VH	VH	H	VH	H	H	VH	VH
		Hedge	L	M	L	L	H	H	M	N	N	M	M
Contructed green and blue space, added to infastructure	Contructed GI on infrastructure	Green roof	N	L	N	L	L	H	L	N	N	L	L
		Green wall	N	M	M	L	N	L	L	N	N	M	L
		Roof garden	M	M	L	M	L	L	M	L	H	VH	M
		Pergola (with vegetation)	N	M	L	H	L	L	M	N	L	H	L
Infrastucture designed to incorporate some GBS components	Hybrid GI (for water)	Permeable paving	N	N	N	N	H	H	N	L	N	N	N
		Permeable parking/ roadway	N	N	N	N	H	H	L	N	N	N	N
		Attenuation pond	N	L	L	L	VH	VH	M	N	L	M	H
		Flood control channel	N	L	N	L	L	VH	L	N	L	N	L
		Rain garden	L	M	N	L	H	H	M	N	N	H	M
		Bioswale	N	M	L	L	M	VH	M	N	N	L	M
Bluespace features	Water-bodies	Wetland	N	M	L	M	VH	VH	M	L	M	VH	H
		River/stream	L	L	H	H	M	H	L	M	H	VH	H
		Canal	L	L	L	M	L	M	L	M	H	VH	L
		Pond	N	L	L	L	L	H	M	L	H	VH	H
		Lake	M	L	M	H	H	H	M	H	H	VH	VH
		Reservoir	L	L	M	H	H	VH	M	H	H	VH	M
		Estuary/tidal river	H	L	H	H	H	N/A	M	M	H	VH	VH
		Sea (incl. coast)	H	L	H	VH	H	N/A	VH	VH	VH	VH	VH
Other un-sealed features without specified use, often on private land	Other non-sealed urban areas	Woodland (other)	L	VH	VH	VH	H	H	VH	H	H	VH	VH
		Grass (other)	L	L	L	L	M	M	L	VH	H	M	M
		Shrubland (other)	L	M	L	L	H	H	M	M	M	H	H
		Arable agriculture	VH	M	L	L	N	L	N	L	N	L	L
		Sparsely vegetated land	N	N	L	N	L	L	N	M	M	M	L

N Negligible L Low M Medium H High VH Very high

Figure 9: *Matrix for urban GI/GBI to guide multifunctional planning of nature-based solutions (Source: Jones et al., 2022. Nature-Based Solutions, 2, 100041).*

2 Choose the proper plant species

- Use a rich **mix of plant species and layered vegetation** to create varied and thriving habitats and ensure resilience. If possible, prolong flowering/fruit period.
- **Prioritise maintaining existing vegetation** over new planting, for trees in particular. Their benefits grow over time so it takes time to get them replaced.
- Choose species based on **current and future climate**, ensure successional tree planting, and avoid peat. This requires reconsidering notions of "native" and "established" species, among other categories. This can be achieved by including a short list of proven performers for different urban contexts.
- Consider **growth times and cycles** as some have very long growth cycles, whilst others need to be replaced every year. Consider **seasonality** too as some plant species provide different services throughout the year.
- Consider **maintenance requirements** as different species require different levels of labor and resources - this should factor into selection and budgeting.
- Choose species that **tolerate urban stress**.
- **Consult with experts**, such as botanists, nursery managers, community gardeners, local wildlife groups and anyone with local knowledge for advice. Availability, durability and maintenance are important factors to consider.
- Keep in mind that, same as with GB/GI, there is no "perfect" species for a specific location, and **the decision is always a balance** between positive impacts, plant species requirements - water, air, maintenance, etc - maintenance, budgets, and so forth.

A few examples:

- Near schools, hospitals, and playgrounds choose **evergreen**, **non-invasive**, **non-toxic**, and **low-allergen** species.
- For year-round noise protection use **evergreen species**.

3 Design for the environment and human health, not just aesthetics

- Consider that many landscaping traditions were based on **aesthetic principles**, which are **not necessarily aligned with environmental and human benefits**. For instance, rewilded fields increase biodiversity with low maintenance, and yet they are disliked aesthetically by some people. It is primordial to expand what counts as a beautiful green-blue space.
- **Emphasise size consideration** where larger or connected green-blue spaces host richer ecosystems and provide greater benefits. But every corner counts! Even small wildflower patches on roadsides can support a surprising variety of insects.
- **Assess local baselines and needs**, including accessibility, types of users, functions - play, health, leisure, cultural, spiritual, etc - maintenance, safety, etc.
- **Improve connectivity** and **access** by linking public spaces to homes for daily nature contact and active lifestyles. Everyone should have green/blue spaces within a 15-minute walk from home, ensuring at least 3 hectares of accessible green space per 1,000 residents.
- Prioritise **GI that boost both mental and physical** well-being and focus efforts where residents are **most at risk** (elderly, low-income, or health-compromised populations).
- **Strengthen equity, inclusion and community** through designing for diverse users across ages, abilities, genders and economic and cultural backgrounds.
- **Include community co-design principles** by conducting stakeholder consultations ahead of large-scale projects to include their feedback and concerns in proposals, then consult again on the draft proposals and refine (if needed).
- **Add monitoring frameworks** to assess effectiveness post-implementation (species surveys/transects, surveys/people counters/mobile phone info on whether have increased visitors/usage, sensors for temperature/pollution etc, surveys/consultations for people's feedback).

A few examples:

- Plant **hedges close to the road**, between traffic and pedestrians or cyclists.
- Use **compact, dense plants** in deep urban canyons, and **porous canopy trees** in shallow ones to improve air quality.
- **Avoid paving/artificial turf** over gardens and minimise in public lands to preserve vegetation and soil function.
- Combine **Blue + Green Infrastructure** for both sound masking and mental wellbeing.

4 Implement effective management and maintenance strategies

- Develop **long-term maintenance plans** that include budget considerations, responsibilities, and schedules.
- Adopt **adaptive** management approaches to monitor performance and adjust maintenance as needed.
- Consider **seasonality** in maintenance regimes to accommodate different maintenance needs across seasons.
- Engage **communities in stewardship** through programs for volunteer maintenance can increase sustainability and community ownership.
- Address **potential disservices** by managing for potential negatives like allergens, fallen branches, or pest habitats.

5 Invest and support local research

- Invest in **local research** to understand what works best for your city's specific climate, pollution patterns, and built form.
- Specify research **priorities** by identifying key knowledge gaps (particularly around blue infrastructure which remains understudied).
- Consider **citizen science opportunities** through community monitoring can generate valuable data while building engagement.
- Embed **impact assessment methods** to include before/after measurements of air quality, temperature, biodiversity, etc.

6 Integrate urban greening into broader planning frameworks

- **Align with existing policies** so as to connect urban greening to climate action plans, biodiversity strategies, and public health initiatives.
- **Advocate for GI standards in planning policies and design codes** to recommend minimum requirements for new developments.
- **Develop cross-departmental collaboration** to encourage coordination between planning, parks, transportation, and health departments.
- **Create comprehensive urban greening strategies** to recommend city-wide approaches rather than piecemeal projects.
- **Consider lifecycle costs and benefits** that emphasise long-term economic benefits of urban greening.
- **Encourage private GI/BI** such as private gardens, rooftops, green walls and any other GB/GI in private property that contribute to the overall urban green-blue infrastructure.

Recognise GI's multiple benefits — air pollution mitigation, carbon storage, cooling, biodiversity, flood and noise control and human wellbeing — all in one space (Figure 10).

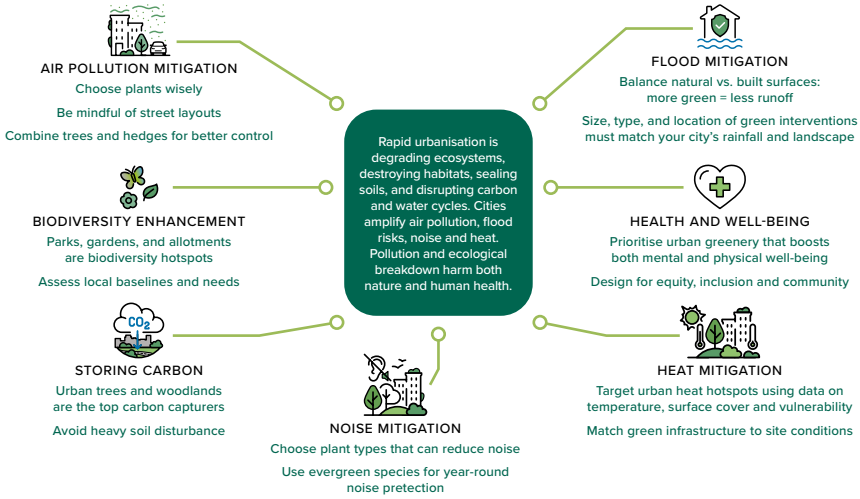


Figure 10: *Overview of the seven environmental and social challenges addressed through urban greening in the toolkit. For each challenge, the figure highlights recommended actions, and key considerations for successful implementation.*

Disclaimer

The content of this document reflects solely the views and experiences of the authors. It does not necessarily represent the positions of the funding agencies, supporters, reviewers, or their affiliated institutions. The recommendations in this document are based on evidence from peer-reviewed scientific literature. While the proposed interventions are valuable, they are not exhaustive. Due to limited research on certain topics, some conclusions remain provisional. As such, these recommendations should be viewed as general guidance rather than definitive or prescriptive. Ongoing research will continue to refine and enhance this resource over time.