

NBS Spatial units

This section presents **3 factsheets** related to **NBS Spatial units**, focusing on spatial planning through the integration of **Greenery Elements** and **farming practices**.

GREENERY ELEMENTS

CARDIMED	GREEN CORRIDORS
	Synonyms: Green way; Cycle-pedestrian green paths; Green bypass; Green belt, Carbon sinks, Ecological corridors, Green infrastructure networks. Description: Green corridors repurpose derelict infrastructure areas, such as old railway lines or waterways, into linear parks, revitalising diverse landscapes. These corridors serve as transitional zones enhancing ecological connectivity and facilitating wildlife movement across diverse landscapes. They play a vital role in green infrastructure networks, offering refuge, food, and protection for wildlife, while also serving recreational, ecological, and transportation-related functions. Picture source: Natural Walking Cities.
	Main challenges targeted Biodiversity & Renaturalization, Freshwater and groundwater supply and quality, Societal benefits
	Regulation and Maintenance Services Air quality regulation, Climate regulation, Water regulation, Improve quality of groundwater, Improve quality of surface water, Efficient water treatment (rainwater), Reduce flood risk, Reduce landslides, River flood protection, Coastal flood protection, Permeability restoration, Create or restore habitat, Restore degraded areas, Mitigate desertification, Create or restore fauna, Create or restore flora, Support pollination, Reduce harmful impacts to fauna & flora, Forest creation and/or restoration, Connect green spaces, Connect blue and green spaces, Develop resilience of green spaces, Support free movement of species, Provide nesting and breeding habitat, Refuge for farm and wild animals, Restore natural forest fire regime, Reduce changes on soil characteristics, Stabilise soil / substrate, Improve soil fertility / biodiversity, Improve carbon sequestration, Provide thermal regulation / cooling, Reduction of greenhouses gases emissions, Enhance dry deposition of aerosol particles, Reduce risk of pest and diseases, Increase green areas around urban rivers, Coastal restoration & protection/ Promote resilience against natural disasters
	Cultural Services Recreation and ecotourism, Social relations, Facilitate education, Support environmental awareness, Increase recreational and socialisation value, Increase aesthetic and patrimonial or cultural value, Health and Well-Being improvement, Ensure accessibility to green spaces, Reduce undesired behaviours, activities and vandalism, Support social cohesion and justice, Increase stakeholder engagement, Increase physical health, Promote mental health, Reconnect people with nature, Promote health habits, Reduce risk of pest and diseases

Provisioning Services	Fuel, Promote natural aquifer recharge / preserve groundwater supply, Promote natural surface water recharge / preserve surface water supply, Provide nutrition sources for birds and insects, Production of biomass, Nutrient recovery, Material reuse
Other Services	Contribute to local employment, Increase land/property monetary value, Sustainable food production, Reduced carbon footprint, Increase tourism, Reduced costs in comparison with other solutions, Reduced carbon footprint
Replicability	★ ★ ★
Design & planning	Plants: Tree species with large canopies or species optimised for carbon capture, heat reduction, and providing habitat or food for wildlife. Area: Small (<5 ha), medium (5-10 ha), and large (>10 ha). Tree pit: Minimum depth of 1.5 m and minimum space between street curb or building of 1.8 m.
Operation and maintenance	Operational activities: Watering needs vary based on plant type, soil, and climate. Young trees typically require regular watering until their root systems are established. Maintenance activities: Regular removal of sediment, leaves, or debris that obstruct water flow, as well as pest control and pruning. In high-traffic areas, trees should be pruned to a minimum height of 2.5-3.0 m above ground level to prevent obstruction of car and pedestrian passage. Others: Training to staff and volunteers responsible for the operation and maintenance. Regular documentation of maintenance activities, operational issues, and measurements. Safety protocols and training (to prevent accidents and ensure compliance with safety regulations). Track legal and regulatory compliance. Be prepared to adapt your operation and maintenance practices over time in response to changing environmental conditions, market dynamics, and other factors.
Combinations with other NBS	Vegetated pergola, Urban micro forest, Urban parks, Agroforestry, Pot-based green facade, and Wall-based green facade as elements of green corridors (for maximising thermal regulation and biodiversity enhancement). Bioretention cells (rain gardens), Bioswales and permeable surfaces (for reducing the runoff going to these systems). Compost application and Mulching application (for optimising the maintenance or as end for produced biomass). Existing blue infrastructure such as urban rivers, waterfronts, and lakes for increasing ecological connectivity between green and blue spaces). Riparian buffer, Restoring native vegetation, Invasive alien species control and Techniques for fauna refuge and nesting (for providing habitats for local wildlife, improving structure, composition and function of the ecosystem).
Supportive units & smart tech	Rainwater harvesting systems (for using collected rainwater for irrigation). Smart irrigation systems (for optimising water usage). Smart sensors (to monitor humidity, T and air quality for assessing

	the impact of environmental conditions, detecting anomalies and optimising maintenance).
CAPEX	<i>not available</i> . Main types of costs: Design and development infrastructure, Permits, fees and administrative (land acquisition, environmental impact assessment and other permits); Equipment and materials (planting and landscaping materials, irrigation and drainage system, signage and wayfinding infrastructure); Labour (irrigation system installation, pathway construction, lighting installation, soil preparation and amendment, and drainage system installation).
OPEX	<i>not available</i> . Main types of costs: Utilities (water and electricity -if applicable-); Labour (pruning, watering, fertilisation, irrigation system maintenance, pest and disease management for plants, cleaning of pathways and surrounding areas, inspection and repair of infrastructure, landscape design updates or enhancements); Permits, fees and administrative (insurance premiums for liability coverage); Community engagement and educational programs (if applicable).
By-product(s):	Organic biomass from trimming, pruning, clippings and fallen leaves (for mulching, soil amendments, composting, organic fertilisers, energy production and biofuel). Potential generation of carbon credits.

CARDIMED	URBAN MICRO FOREST
	Synonyms: Urban/City forestry; Urban vegetation; Urban woodland; Arboreal areas around urban areas; Arboreal urban parks; Arboretum; Urban tree cover; Urban greenery. Description: Urban micro forests are green spaces designed to replicate the appearance and structure of natural forests within urban environments. They encompass various elements such as woodlands, tree clusters, individual trees, street trees, park trees. Typically, urban forests are actively managed and provide opportunities for foraging. Picture source: Regreen project
Main challenges targeted	Biodiversity & Renaturalization, Rainwater management & flood protection and Societal benefits
Regulation and Maintenance Services	Air quality regulation, Climate regulation, Water regulation, Create or restore habitat, Create or restore fauna, Create or restore flora, Support pollination, Reduce harmful impacts to fauna & flora, Forest creation and/or restoration, Connect green spaces, Develop resilience of green spaces, Support free movement of species, Provide nesting and breeding habitat, Refuge for farm and wild animals, Stabilise soil / substrate, Improve soil fertility / biodiversity, Enhance and stabilise water retention, Improve carbon sequestration, Reduction of greenhouses gases emissions, Enhance dry deposition of aerosol particles, Provide thermal regulation / cooling, Provide thermal isolation
Cultural Services	Recreation and ecotourism, Social relations, Health and Well-Being

	improvement, Increase recreational and socialisation value, Increase aesthetic and patrimonial or cultural value, Ensure accessibility to green spaces, Preserve cultural and historic heritage, Facilitate education, Support environmental awareness, Increase stakeholder engagement, Enhance acoustic comfort, Increase physical health, Promote mental health, Reconnect people with nature, Promote health habits
Provisioning Services	Fuel, Production of biomass, Provide raw material, aromatic plants, biochemical, natural medicines, pharmaceuticals, Promote natural aquifer recharge / preserve groundwater supply, Harvest, store and treat rainwater, Provide nutrition sources for birds and insects, Nutrient recovery, Sustainable food production
Other Services	Contribute to local employment, Increase land/property monetary value, Reduced costs in comparison with other solutions, Favour green economy (reuse of local by-products), Reduced carbon footprint
Replicability	★ ★ ☆
Design & planning	Plants: trees, bush and shrub species. The species are chosen in accordance with local characteristics (climate, soil conditions, pollution levels, spatial needs and management capability). Area: <0.5 ha
Operation and maintenance	Operational activities: Depending on the local weather, plantation watering will be necessary. Maintenance activities: Occasionally, depending on the species, it will be necessary to apply pruning or cleaning treatments. It might also be necessary to apply treatments to fight against pests and weeds. Others: Training to staff and volunteers responsible for the operation and maintenance. Regular documentation of maintenance activities, operational issues, and measurements. Safety protocols and training (to prevent accidents and ensure compliance with safety regulations). Track legal and regulatory compliance. Be prepared to adapt your operation and maintenance practices over time in response to changing environmental conditions, market dynamics, and other factors.
Combinations with other NBS	Vegetated pergola and Urban parks as an element of urban micro forests (for maximising shading effect, thermoregulation and biodiversity enhancement. Pot-based green facade , and Wall-based green facade (for enhancing aesthetic appeal and additional habitats for flora and fauna). Green corridors (for increasing ecological connectivity). Bioretention cells (rain gardens) , bioswales and permeable surfaces (for reducing the runoff going to these systems). Compost application and Mulching application (for optimising the maintenance or as end for produced biomass). Existing blue infrastructure such as urban rivers, waterfronts, and lakes for increasing ecological connectivity between green and blue spaces).
Supportive units & smart tech	Rainwater harvesting systems (for using collected rainwater for irrigation). Smart irrigation systems (for optimising water usage). Smart sensors (to monitor humidity, T and air quality for assessing the impact

	of environmental conditions, detecting anomalies and optimising maintenance).
CAPEX	50 - 400 €/m ² . Main types of costs: Permits, fees and administrative (land acquisition, environmental impact assessment and other permits); Equipment and materials (tree saplings/planting stock and tree shelter); Labour (soil preparation and amendment, planting, irrigation system installation, pathway construction, fencing or boundary establishment and tree shelter installation); Design and development infrastructure (engineering services).
OPEX	20 - 50 €/m ² y. Main types of costs: Labour (watering, irrigation, soil enrichment, pruning, trimming, pest and disease control, soil fertility management, pathway maintenance and fence repair); Community engagement and educational programs (if applicable).
By-product(s)	Organic biomass from trimming, pruning, clippings and fallen leaves (for mulching, soil amendments, composting, organic fertilisers, energy production and biofuel).

CARDIMED	URBAN PARKS
	Synonyms: Large urban park; Pocket park; Public park; Park; Residential park; City park; Large urban public park; Green park; Greened recreation areas/regional parks; Green resting areas. Description: Urban parks refer to green areas within a city with a variety of active and passive recreational facilities that meet the recreational and social needs of the residents and of visitors to the city. They are open to wide-range communities. Urban parks can serve all the city or part of the city, and they are open to a wide range of communities. Picture source: Urbinat
Main challenges targeted	Biodiversity & Renaturalization, Rainwater management & flood protection and Societal benefits
Regulation and Maintenance Services	Improve quality of groundwater, Efficient water treatment (urban runoff), Reduce flood risk, Reduce combined sewer overflows, Reduce urban runoff, Reduce agricultural runoff, Coastal flood protection, Stormwater source control, Permeability restoration, Create or restore habitat, Restore degraded areas, Mitigate desertification, Create or restore fauna, Create or restore flora, Support pollination, Reduce harmful impacts to fauna & flora, Wetland creation and/or restoration, Forest creation and/or restoration, Connect green spaces, Connect blue and green spaces, Develop resilience of green spaces, Support free movement of species, Refuge for farm and wild animals, Restore natural forest fire regime, Reduce changes on soil characteristics, Stabilize soil / substrate, Improve soil fertility / biodiversity, Enhance and stabilize water retention, Improve carbon sequestration, Reduce greenhouses gases emissions, Reduce particles (PM10), Enhance dry deposition of aerosol

	particles, Provide thermal regulation / cooling, Reduce risk of pest and diseases
Cultural Services	Health and Well-Being improvement, Increase recreational and socialisation value, Increase aesthetic and patrimonial or cultural value, Ensure accessibility to green spaces, Preserve cultural and historic heritage, Facilitate education, Support environmental awareness, Increase stakeholder engagement, Increase physical health, Promote mental health, Reconnect people with nature, Promote health habits
Provisioning Services	Promote natural aquifer recharge / preserve groundwater supply, Harvest, store and treat rainwater, Provide nutrition sources for birds and insects, Production of biomass, Provide raw material, Nutrient recovery, Sustainable food production
Other Services	Reduced carbon footprint, Contribute to local employment, Increase land/property monetary value, Increase tourism, Reduced costs in comparison with other solutions
Replicability	★ ★ ☆
Design & planning	Plants: trees, bush and shrub species. The species are chosen in accordance with local characteristics (climate, soil conditions, pollution levels, spatial needs and management capability). Area: <0.5 ha (pocket urban park) or >0.5 (large urban park).
Operation and maintenance	Maintenance of vegetation and landscape: Landscaping, mowing, flower and tree planting, grooming, pesticide and herbicide applications, weeding, hoe work, irrigation, raising of saplings, pruning, cutting branches, removing trees and shrubs, processing fallen and dehydrated trees, removing leaf litter, suppressing invasive plants, automatic irrigation systems. Maintenance of recreational facilities: Establishment, maintenance or removal of playgrounds, benches, sport courts, fountains, drinking fountains, etc. Others: Training to staff and volunteers responsible for the operation and maintenance. Regular documentation of maintenance activities, operational issues, and measurements. Safety protocols and training (to prevent accidents and ensure compliance with safety regulations). Track legal and regulatory compliance. Be prepared to adapt your operation and maintenance practices over time in response to changing environmental conditions, market dynamics, and other factor.
Combinations with other NBS	Vegetated pergola , Urban micro forest and Green corridor (for maximising shading effect, thermoregulation and biodiversity enhancement and increasing ecological connectivity). Pot-based green facade and Wall-based green facade (for enhancing aesthetic appeal and additional habitats for flora and fauna). Bioretention cells (rain gardens) , bioswales and permeable surfaces (for reducing the runoff going to these systems). Compost application and Mulching application (for optimising the maintenance or as end for produced biomass).

Supportive units & smart tech	Rainwater harvesting systems (for using collected rainwater for irrigation). Smart irrigation systems (for optimising water usage). Smart sensors (to monitor humidity, T and air quality for assessing the impact of environmental conditions, detecting anomalies and optimising maintenance).
CAPEX	80 - 1000 €/m ² . Main types of costs: Permits, fees and administrative (land acquisition, environmental impact assessment and other permits); Equipment and materials (tree saplings/planting stock and tree shelter, landscaping materials and wayfinding infrastructure); Labour (soil preparation and amendment, planting, lighting installation, irrigation system installation, pathway construction and fencing or boundary establishment); Design and development infrastructure (engineering services).
OPEX	3 - 45 €/m ² y. Main types of costs: Utilities (water and electricity -if applicable-); Labour (pruning, watering, fertilisation, irrigation system maintenance, pest and disease management for plants, cleaning of pathways and surrounding areas, inspection and repair of infrastructure, landscape design updates or enhancements); Permits, fees and administrative (insurance premiums for liability coverage); Community engagement and educational programs (if applicable).
By-product(s)	Organic biomass from trimming, pruning, clippings and fallen leaves (for mulching, soil amendments, composting, organic fertilisers, energy production and biofuel).

FARMING PRACTICES

CARDIMED	AGROFORESTRY
	Synonyms: Alley Cropping; Agroecology practices; Ecoagriculture; Permaculture; Forest farming; Food forests; Forest gardens; Integrated farming; Sustainable farming practices; Conservation and sustainable use of forests. Description: Agroforestry is the combination of trees and crops cultivation. Agroforestry provides a different land use option, compared with separated traditional arable and forestry systems and optimises the benefits from the biological interactions created when trees and crops are combined. The complementarity between trees and crops allows a more effective exploitation of the available resources. Agroforestry helps to better control soil erosion and increases the sustainability and resilience of agriculture. Additionally, agroforestry contributes to biodiversity by providing diverse habitats and supports a wider range of wildlife. Trees modify the microclimate, which can reduce T extremes and stress on crops during extreme weather, enhancing crop growth. By capturing CO₂, agroforestry also plays a role in climate change mitigation and supports water management by improving water infiltration and reducing irrigation needs. Socio-economically, agroforestry can stabilise farm income through the production of non-timber forest products like fruits, nuts, and medicines, alongside traditional crop yields. Furthermore, by enhancing floral diversity, agroforestry systems support pollinators crucial for the pollination of many crops. Over time, agroforestry farms can become less dependent on crop subsidies, and less susceptible to crop price variations, as timber and non-timber forest products generate a significant part of their income. Picture source: Wikimedia Commons

Main challenges targeted	Biodiversity & renaturalization, Societal benefits, Local Development & Economic Enhancement
Regulation and Maintenance Services	Air quality regulation, Climate regulation, Water regulation, Improve quality of groundwater, Avoid / reduce salinity in groundwater, Reduce flood risk, Reduce landslides, Reduce urban runoff, Reduce agricultural runoff, Stormwater source control, Create or restore habitat, Create or restore fauna, Create or restore flora, Support pollination, Reduce harmful impacts to fauna & flora, Forest creation and/or restoration, Connect green spaces, Develop resilience of green spaces, Support free movement of species, Provide nesting and breeding habitat, Increase green areas around urban rivers, Reduce changes on soil characteristics, Stabilise soil / substrate, Improve soil fertility / biodiversity, Enhance and stabilise water retention, Improve carbon sequestration, Reduction of greenhouses gases emissions, Provide thermal regulation / cooling, Reduce risk of pest and diseases
Cultural Services	Recreation and ecotourism, Supporting traditional knowledge, Spiritual and ritualistic uses, Sense of place and identity, Health and Well-Being improvement, Increase recreational and socialisation value, Increase aesthetic and patrimonial or cultural value, Ensure accessibility to green spaces, Preserve cultural and historic heritage, Enhance acoustic comfort, Increase physical health, Promote mental health, Reconnect people with nature, Promote health habits
Provisioning Services	Timber, Fuel (e.g., firewood), Forage & fodder, other products for the bioeconomy like essential oils, resins, fibres, colours, compound materials, etc. Promote natural aquifer recharge / preserve groundwater supply, Promote artificial aquifer recharge / preserve groundwater supply, Provide nutrition sources for birds and insects, Provide raw material, Nutrient recovery, Produce energy / Reduce energy demand, Material reuse, Sustainable food production
Other Services	Contribute to local employment, Increase land/property monetary value, Increase tourism, Contribute to new or existing business, Reduced costs in comparison with other solutions, Favour green economy (reuse of local by-products)
Replicability	★ ★ ☆

Design & planning

Clearly define your goals and objectives: What do you hope to achieve with your agroforestry system? Increased food production? Improved soil health? Habitat creation for wildlife? Once you know your goals, you can start to make informed decisions about the specific types of plants to include in your system. **Assess your site characteristics:** Carefully evaluate your land's characteristics, including soil type, drainage, sunlight availability, and slope. This information will help you choose appropriate plant species that will thrive in your specific conditions. **Select appropriate plant species:** Incorporate a minimum of ten distinct species to create a diverse and resilient agroforestry system. Common plant choices include acacia species, eucalyptus species, pine species (for specific climates), coffee plants, cocoa trees, various fruit trees (like mango, avocado, citrus, apple), nut trees (walnut, almond), leguminous trees (leucaena, calliandra), timber trees (depending on your goals, teak, mahogany could be options), medicinal plants (neem, moringa), and aromatics (sage, oregano, lavender). Remember, selection should be based on compatibility with crops, soil preferences, climate suitability, and your specific objectives. **Design the layout of your system:** Consider the spatial arrangement of trees, crops, and other elements in your agroforestry system. Factors like light availability, root competition, and access for management should all be taken into account. **Establish the system:** This involves planting trees, crops, and other vegetation according to your design plan. Consider installing a drip irrigation system to increase irrigation efficiency, especially in drier climates or for high-value crops. **Long-term management:** Agroforestry systems require ongoing care and management to ensure their success. This may include pruning trees, controlling weeds, and monitoring for pests and diseases. The highest yields are expected only after 15 years, if planted as a new system.

Operation and maintenance

Operational activities: (Irrigation) Manage irrigation effectively, especially during dry periods. Consider installing a drip irrigation system to increase irrigation efficiency, especially in drier climates or for high-value crops. Regularly inspect irrigation systems (pumps, tanks, piping, soil moisture sensors, etc.) and perform necessary maintenance to ensure proper functioning. **(Fertilisation)** Provide nutrients to your plants to promote healthy growth and productivity. Whenever possible, prioritise organic fertilisers and nutrient sources derived from within the system, such as compost or composted manure. **(Harvesting)** Harvest crops, fruits, nuts, timber, or other products according to your system's design and maturity of the plants. Implement sustainable harvesting practices to ensure the long-term health and productivity of the system. **(Monitoring)** Regularly monitor the health and productivity of your agroforestry system. **Maintenance activities: (Pruning)** Regularly prune trees to maintain desired size and shape, improve light penetration for understory crops, and promote healthy growth. **(Weed control)** Implement strategies to manage weeds, which can compete with crops for water and nutrients. This could involve manual weeding, mulching, or using cover crops. **(Pest and disease management)** Monitor your agroforestry system for pests and diseases, and implement control

	measures using Integrated Pest Management (IPM) techniques whenever possible. This emphasises preventive methods and minimises reliance on chemical controls. (Infrastructure) Maintain any fences, trellises, or other infrastructure associated with your agroforestry system to ensure its functionality and protect your plants. Pruning, Weed control, Irrigation, Pest and disease management. Others: Training to staff and volunteers responsible for the operation and maintenance. Regular documentation of maintenance activities, operational issues, and measurements. Safety protocols and training (to prevent accidents and ensure compliance with safety regulations). Track legal and regulatory compliance. Be prepared to adapt your operation and maintenance practices over time in response to changing environmental conditions, market dynamics, and other factor
Combinations with other NBS	Crop rotation, Mulching application, Compost application, Cover crop (to improve soil quality), Advanced ecological treatments (for treating and reusing wastewater for irrigation). Riparian buffers (to filter runoff and provide habitat). Urban micro forest (to cool and improve air quality). Subsurface flow constructed wetland, Electroactive constructed wetland and Sludge treatment wetland (for irrigation of treated water).
Supportive units and smart tech	Building levees, floodwalls, or floodgates (to protect agricultural land from flooding events). Smart irrigation systems (supply and optimization of irrigation). Advanced water treatments (to ensure safe reuse of treated wastewater). Remote sensing (to assess crop health, monitor vegetation dynamics, and identify areas of stress or water deficiency). Decision support systems (DSS) (to integrate various data sources and provide informed recommendations for managing the agroforestry system). Unmanned aerial vehicles (UAVs) or drones (for high-resolution aerial imagery and data collection on crop health, soil conditions, and other parameters). Drones can provide valuable data for monitoring large areas of land quickly and efficiently. Precision agriculture techniques (for targeted application of fertilisers, pesticides, and irrigation water). Internet of Things (IoT) sensors (for monitoring a wide range of environmental parameters, such as T, humidity, light intensity, and soil moisture). Blockchain technology (for secure record-keeping and traceability of products from agroforestry systems).
CAPEX	1,000.00 - 100,000.00 € ha. Main types of costs: Permits, fees and administrative (land acquisition); Site preparation; Equipment and materials (seedlings and planting materials, fencing, irrigation infrastructure, shelterbelts and windbreaks); Labour (planting and other tasks).
OPEX	5,000.00 - 200,000.00 € y. Main types of costs: Utilities (water); Labour (water management, fertilisers and soil amendments application, pest and disease management, pruning and maintenance, harvesting and processing); Permits, fees and administrative (insurance and taxes); Community engagement and educational programs.
Revenues	5,000 - 50,000 € ha y. Revenue depends on product types (fruits, nuts, timber, etc.); Market prices and management practices; Intensive systems with high-value products can generate more income; Research

	local markets and choose profitable species for your system).
By-product(s):	Mulch and woody biomass (for energy production, biofuel, soil amendments, composting and organic fertiliser). Forage and fodder (for livestock or other animals). Wood pellets or charcoal (for biofuel). Potential generation for carbon credits. Honey from beekeeping (for blooming trees and shrubs). Mushrooms from mushroom cultivation (certain types of mushrooms can be cultivated in the shaded areas created by trees). Medicinal plants for herbal products (processable into herbal teas, tinctures, and other products). Nitrogen fixation from legumes for improved soil fertility (after fixation, the nitrogen is then released into the soil, making it available for other plants to use).