Reduce Embodied Carbon Emissions

Minimize Hardscape and Structures	Plant more, pave less	Aim for 70% planting and 30% paving, depending on the project type.
	Minimize underground construction	Minimize sub-slabs and footings. Sand-set pavers and minimize thicknesses of paving and base courses. Seek alternatives to slurries, concrete infrastructural encasements, and cementitious geotechnical soil reinforcement. Choose geotechnical construction methods with lower embodied energy, such as mechanically stabilized earth and geopiers, or rammed aggregate piers.
	Reduce concrete, steel and aluminum	Use alternative materials wherever possible. The greenhouse gas (GHG) emissions of aluminum can be over 10 times higher than steel, and over 50 times higher than concrete, per kg. Concrete and steel, however, are the most-used construction materials, and their production generates about 15% of global energy and process-related CO2 emissions. See below for best practices for reducing the use and embodied carbon of concrete and steel.
Utilize Low-Carbon Materials	Wood and wood products	**Sustainable forestry:** Deforestation is responsible for about 20% of GHG emissions, with increasing reporting of illegally harvested timber products in global trade. Specify reclaimed wood products. For virgin wood products, specify wood from new-growth, climate-smart forests that promote responsible forest stewardship and conservation through long rotation periods and limited average harvest sizes, and address non-carbon considerations including biodiversity, water quality, habitat protection, health, and local and indigenous communities. Specify wood that is not harvested from primary forests. If not local to your project, do not specify tropical hardwoods. Require timber stamped by a third-party sustainable forestry organization, with a documented Chain-of-Custody (CoC), sourced from a certified managed forest or stand. **Reduce carbon emissions and maximize carbon storage:** Specify locally harvested and manufactured wood products from energy-efficient manufacturers. Specify air-dried lumber and products manufactured with carbon-free renewable energy. Design, detail, and maintain wood for longevity, durability, and reuse. Design for efficiency, using the right wood for the right application. For example, though an engineered wood product has greater embodied carbon, it may last longer and require fewer members for the same application. Use sustainably-sourced engineered wood fiber in place of rubber surfacing where possible. Ask for EPDs, and conduct a whole project LCA to maximize efficiency and reduce emissions. Following these guidelines, sustainably grown, harvested and processed wood products can maintain the carbon stored in the wood for decades to come.
	Decomposed granite, aggregate, chip seal	Replace concrete and asphalt paving where possible. Specify local or recycled aggregate for base and top coat.

Reduce Embodied Carbon Emissions

Utilize Low-Carbon Materials	Lightweight fill on structure	Use recycled materials such as foamed glass aggregate, or lightweight fill such as expanded shale, in lieu of synthetic materials (foamed concrete, geotechnical polyurethane, or expanded polystyrene) or cellular concrete. Ensure a local or regional source of the lightweight fill exists.
	Green concrete and concrete reduction	Concrete production is responsible for about 8% of global energy and process CO2 emissions, mainly due to the high heat and chemical process emissions involved in turning limestone into clinker, the primary component of cement. Reduce the use of concrete by designing with alternative materials, and by designing and managing the project to minimize waste. Where necessary, design, specify and build with low-carbon concrete. **Collaborate** with the client, contractors, and cement and concrete manufacturers to achieve low-carbon concrete with locally available materials and project requirements. Set overall project emissions targets, or a max global warming potential (GWP) on A1-A3 emissions, to allow flexibility. Require product-specific environmental product declaration (EPD) submittals to keep track of the GWP of each mix. **Reduce waste:** Make a waste avoidance plan with volumetric calculations and program optimization to avoid over-ordering. Avoid temporary construction works, or use reusable materials, or the lowest appropriate strength concrete. **Increase material efficiency and reduce use:** Replace concrete with voids, coffers, and fill where possible, ensuring the coffer or fill material is low-carbon. Avoid over-designing concrete; design for appropriate strength. Rationalize testing requirements to reduce overuse of cement onsite. **Optimize cure times:** Longer cure times may be required for some supplemental cementitious materials (SCMs) and alternate binders. Specify strengths at 56, 72, 90, or 120 days where possible. **Low-emissions concrete:** Write **performance specifications**, outlining characteristics of fresh and hardened concrete (i.e. strength, modulus of elasticity, durability-resistivity, permeability, and volume change, or potential for cracking), rather than prescriptive specs, which can limit contractor and manufacturer flexibility. Prescribing minimum cement, maximum SCM quantity, or certain water to cement ratios or air content can result in concrete with higher GWP. **Mixing methods** such as aggregate scattering-filling can reduce cement usage by 10-30%. Consider recycled **aggregates**, where appropriate, which have lower EC than new aggregates, though they may require more water and cement. Strong aggregates can reduce cement requirements. Recent techniques can create **mineralized carbon aggregates**, thereby storing carbon in concrete. Industrial **carbon capture and storage** through injection into concrete is a developing technology that can also reduce the GWP of concrete mixes.

Reduce Embodied Carbon Emissions

climatepositive design

Carbon Drawdown

Utilize Low-Carbon Materials	Green concrete and concrete reduction	**Reduce and replace clinker:** Reducing the clinker-binder ratio to an average of 0.52 can reduce costs by 5-15% and emissions up to 13%, without substantial impact on performance. **SCMs:** supplementary cementitious materials can replace some of the clinker in portland cement. SCMs come from a range of naturally-occuring materials and industrial byproducts, and vary in local availability. SCMs can improve the strength of concrete, reduce the cost of cement by up to 15% and reduce emissions by up to 18% by 2050. Current SCMs include ground granulated blast-furnace slag (GGBS), fly ash, limestone, alkali-activated cementitious materials such as calcined clay, kaolin clay, metakaolin from clay deposits, tropical soils, and industrial byproducts, biomass ashes such as rice husk ash and palm kernel ash, burnt shale, silica fume, and recycled glass pozzolans. A promising mix currently being produced in some countries is called LC3: a combination of cement, calcined kaolinitic clay, and gypsum. **Reduce cement with alternative binders**, such as biomineralization, alkali-activated materials and geopolymers, and wollastonite. Consider **admixtures** when SCMs or alternate binders increase cure time or reduce workability. **Abate heat-related emissions** by sourcing cement from lower energy-intensive kilns, such as kilns fueled by renewable electricity, bio waste or industrial waste. Kilns for heating limestone, in increasing order of energy intensity, are: dry with preheater and precalciner, dry with preheater, long dry, and wet. **Reinforcement:** Where appropriate, eliminate steel reinforcement or use welded wire mesh or thinner rebar to reduce unnecessary steel. Consider alternatives for shrinkage cracking control, such as synthetic fiber reinforcing. Ensure the embodied carbon (EC) of removed reinforcement is not counteracted by the EC of a thicker concrete slab or wall, or other modifications.
	Green steel and steel reduction	In 2020, steel production was responsible for approximately 7% of global energy and process-related GHG emissions. Steel is made from a mix of raw primary materials (ore) and recycled materials (scrap steel). Use **recycled steel** or **steel with a high percentage of recycled material**. Specify steel from **electric arc furnaces (EAFs)**, which use scrap steel. Steel products with the lowest embodied carbon come from EAFs running on renewable electricity, that use 100% scrap steel and sponge iron from direct-reduced iron (DRI) plants. Design to use steel products that typically come from EAFs, including wide-flange members, angles, channel shapes, and rebar. Be cautious of hollow structural sections (HSS) and metal deck, which tend come from blast furnaces (BF) or basic oxygen furnaces (BOF), which use less recycled content. Contact steel producers to inquire about the specific production methods used to produce structural steel for the project. **Design with salvaged or reclaimed steel.** Pipes decommissioned from oil and gas facilities can be used for pipe piles or column. Contact the demolition companies of upcoming demolition projects in your region. Check your area for salvage yards.

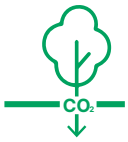
Reduce Embodied Carbon Emissions

Utilize Low-Carbon Materials	Green steel and steel reduction	**Reduce steel quantities:** Engineers should consider using **braced frames** instead of moment resisting frames, and **joists and trussed members** rather than rolled shapes, to reduce overall quantities of steel and therefore the carbon impact of the structure. **Right-size** each steel member to reduce excess material. Consider using **higher-grade steel**, which can accomplish the same structural task using less material. However, ensure that the increased strength of the material does not result in additional carbon emissions. **Design for adaptability, deconstruction and reuse.** Steel framing with metal fasteners is well suited to reuse. **Collaborate:** Work with contractors and steel fabricators to increase the efficiency of your design, explaining your objective to lower carbon emissions by reducing steel quantities, increasing the use of recycled steel, using higher grade steel, and designing for reuse.
	Recycled materials	Maximize recycled content and reuse in paving, aggregate base, wood, structures, mulch etc.
	Low carbon walls and structures	Gabions, rammed earth, mud walls, cobb, straw bale, wattle and daub, mud and stud, compressed earth blocks, adobe, air-dried bricks, earth mortar and other earth-based building materials, site boulders, reused concrete, bamboo, and bio-based materials such as live willow revetments, are low-carbon alternatives to concrete and steel. Consider transportation distances and requirements when specifying.
	Natural drainage swales and biotreatment areas	Follow the existing drainage patterns of the site, and minimize piping and concrete channels through natural drainage and infiltration strategies. Avoid High Density Polyethylene (HDPE), plastic and concrete liners where possible.

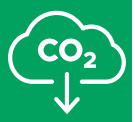
Reduce Embodied Carbon Emissions

Reduce, Reuse, Recycle	Reduce and recycle	Reuse site concrete and asphalt as aggregate or pavers. Fallen site trees can be repurposed as furnishings, site elements, boardwalks, and interior use. Utilize boulders and stone as site elements, retaining structures, or aggregate. Specify materials that can be reused at the end of the project's life.
	Minimize demolition and offhaul	Minimize and balance cut and fill.
	Reduce transportation and offsite emissions	Source local materials and plants. Reuse on-site material to the extent possible. Reduce materials needed, for example minimize base course and pavement thicknesses as possible. Specify small stock size trees, plants, plugs and seed, from local nurseries that propagate and grow plants and trees to size, preferably using organic inputs and integrated pest management. Field-grown, bare-root trees have a lower carbon footprint than container-grown.
Conserve and Protect Topsoil and Soil Biodiversity	Minimize grading and till	Grading and till release carbon into the atmosphere, disturbing soil ecologies and sequestration capacity. Biodiverse, biologically structured soils sequester carbon. Tilling is not necessary to incorporate amendments if soil has a robust ecosystem and is uncompacted. Amendments can be surface-applied, with mulch on top. If soil is compacted, deep tilling may be necessary to reestablish a healthy soil ecosystem.
	Minimize compaction and construction impacts	Protect as much of the site as possible from construction traffic, restricting compaction to dedicated areas. Protect stockpiled soil, and keep covered with cover crops or mulch.
	Design strategies that minimally impact soil	Minimizing soil disturbance keeps carbon in the soil and protects sequestration capacity. Design boardwalks, elevated paths, and minimal, permeable paving. Avoid planting annuals that need to be replanted, which disturbs the soil. Choose self-seeding or spreading annuals and perennials.
	Existing soil amended in place	Avoid amending soil unless testing shows significant deficiencies. Design planting for existing soils. Avoid importing soil, which releases carbon dioxide through soil disturbance and transportation, and degrades ecosystems and farmland.

Increase Carbon Sequestration through Nature-based Solutions



Protect Nature	Do not specify sphagnum peat moss, virgin topsoil, or river gravel	Avoid landscape materials mined from natural ecosystems that provide climate resilience and valuable ecosystem functions, including carbon sequestration and biodiversity.
Design Carbon-Smart Planting	Maximize planting	Aim for 70% planting and 30% paving, depending on the project type.
	Minimize lawn	Meadow, no-mow grasses, native and adaptive planting provide sequestration, habitat and healthy soil ecology. Lawn diminishes biodiversity and is a net GHG emitter due to fertilizer and chemical inputs, maintenance equipment operations, and high water use. Reduce lawn areas as much as possible. Where used, best practices include: **Strategies for reducing emissions:** Choose species and cultivars adapted to the site, to reduce input requirements. Specify seed or hydroseed rather than sod. Use electric maintenance equipment, especially charged by renewables. Do not use quick-release nitrogen fertilizer, which can result in nitrous oxide releases to the atmosphere, a GHG 300 times more heat-trapping than CO2. Fertilize with organic, slow-release amendments when grass is young, to encourage healthy root systems, then taper to minimal fertilization. Cease fertilization before heavy precipitation or irrigation, or during warm periods. Reduce irrigation, which can increase N2O releases, in addition to the embodied energy in the water. Reduce the quantity of top-dressing sand. **Strategies for increasing sequestration and biodiversity:** Maintain healthy, actively growing perennial turfgrass. Avoid tilling or renovating turf under 30 years of age, as turf sequesters more carbon in the first 30 years of its life, on average. Leave grass clippings in the turf. Increase grass mowing height, which may promote deeper root development. Avoid chemical pesticides, using IPM. Include flowering forbs or bulbs in turf planting to support pollinators.
	Plant native species	Native plants support biodiversity through relationships with native fungi, microbes, pollinators, and other flora and fauna, and thus are able to develop mycorrhizal networks and robust ecologies above and below ground, enabling carbon sequestration. Choose genetically local plant sources, planning ahead to collect endemic seed and propagate.



Increase Carbon Sequestration through Nature-based Solutions

Design Carbon-Smart Planting

Select species and design planting to maximize sequestration

Maximize plant cover. Plant a mix of long-lived, large, and fast-growing native and adaptive trees, shrubs and plants. Include both annual and perennial plants, with a larger proportion of perennials. Select species with longer growing seasons to maximize sequestration potential. Match plant cultural requirements to the site. Avoid plants that are too aggressive or competitive.

Tiny forests: Use tree plant spacing that exists in natural forests rather than typical plant spacing guidelines. Using techniques such as the Miyawaki Method, up to 57 trees can be planted in an area the size of a parking spot!

Bamboo rapidly sequesters carbon, grows easily on degraded land, prevents erosion, and can be used as a regenerative building and product material. Avoid where invasive, or contain roots.

Increase diversity of plant species and plant types

Multi-layered planting above and below ground, with plants of different heights, forms and root structures, results in complex, adaptive, healthy ecologies that can maximize sequestration, resilience, and biodiversity.

Afforestation, the introduction of trees to urban, rural and natural areas that have never or not recently had trees, can sequester significant carbon and provide a variety co-benefits. Afforestation should only be attempted where it is ecologically appropriate, the new trees harmonize with native flora and fauna, and monoculture is avoided. Indigenous peoples and local communities must be deeply involved in projects. (See also Climate Resilience)

Woody shrubs: Select species that have longer growing seasons to maximize sequestration potential.

Meadow and No-mow grasses: Specify native, drought tolerant, low water use grasses and meadow species in place of high-maintenance lawn.

Spreading groundcovers: Maximize photosynthesizing plant cover in place of mulch or bare ground.

Vines can increase sequestration in areas with limited horizontal space.

Constructed wetlands should be implemented only in appropriate climates and locations. Wetlands sequester significant amounts of carbon, in addition to providing shoreline resilience and habitat.

Certify Carbon Sinks

Emerging carbon credit markets

Consider partnering with third-party organizations to certify project sites as carbon market sinks.

Design Walking, Biking, Public Transit-Centric Communities

Compact Neighborhoods	Compact neighborhood design	Design cities and neighborhoods so that most daily necessities and services, such as work, shopping, education, healthcare, and leisure, can be easily reached by a 15- or 20-minute walk or bike ride from any point in the city. Compact neighborhood design requires a multi-disciplinary approach, involving transportation planning, urban design, and policymaking, to create well-designed public spaces, pedestrian-friendly streets, and mixed-use developments.
	District centers	Densities in transit-oriented districts are normally greatest in the district center – the 400-meter (¼ mile) radius surrounding a transit station. At least 40% of a mixed-use district center has ground floor retail, restaurant, commercial and/or personal services.
	Residential densities	Mixed-use development, combined with higher residential densities, encourages transit ridership and walking. District cores should have the highest residential density as well as bus and rail service, with somewhat lower density in villages.
Street Networks	Complete streets	Complete streets allow pedestrians, cyclists, motorists and public transit to move comfortably and safely. Complete streets balance competing needs, including: wide sidewalks with amenity zone of trees and furniture, traffic lanes, bike lanes, and optional on-street parking lanes.
	Shared streets	Shared streets combine cycling, pedestrians, social activities, parking, and local car traffic to create a shared space, without traditional lane segregation. Conventional devices such as curbs, signs and signals are replaced with an integrated, people-oriented public space that encourages distinctiveness, social interaction, walking, cycling, universal accessibility, and reduced traffic speeds through such interventions as street trees, planting, tactile paving, and color changes.
	Street width and orientation	Street patterns influence the microclimate around buildings and affect access to light, sun and wind. Ideal orientation and width depends on the temperature and humidity of the urban area. Avoid the use of cul-de-sacs and increase intersections in the street network to provide better connectivity.
	Bikeways	Bikeways facilitate safe efficient travel and promote physical activity while reducing energy use, carbon emissions, and noise pollution. Well-designed bikeways establish unbroken routes linking residential areas, neighborhoods, district and employment centers, and public transit. Bikeway modes include bike lanes, cycle tracks, cycling boulevards, and off-road routes.

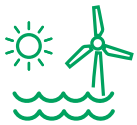
Design Walking, Biking, Public Transit-Centric Communities

Street Networks	Micromobility	Plan for small and lightweight vehicles, including human- and electric-powered scooters, bicycles, cargo bikes, skateboards, and rickshaws. Micromobility can improve last-mile connectivity to other forms of transit, while reducing congestion, pollution, and emissions, and improving street life and health outcomes.
	Break down barriers to walkability	Major roads, under- and over-passes, topography and excessive heat or cold can discourage walking. Explore ways to minimize barriers, such as shortening crosswalks, building pedestrian bridges and planting shade trees.
Public Transit Communities	Transit-oriented design	Transit-Oriented Developments (TODs) are established within 400 – 800 meters (¼ – ½ mile) walking distance of public transit with areas near transit increasing in density. TODs conserve land, encourage walking and bicycling, and reduce infrastructure costs and energy consumption.
	Provide direct, convenient, safe pedestrian and cycle routes to transit	Connect to multi-modal transit networks, with stations at appropriate distances. For example, bus stops at frequent intervals, light rail stops at greater distances, and heavy rail stops less frequently.
	Incorporate health and wellness facilities	Provide appropriate facilities such as shelters, restrooms, and safety features, including lighting at public transport stations, bus stops and bike parking areas, and shade trees where appropriate.
	Remove parking minimums	Dense urban projects frequently design parking underground. Underground construction is the most emissions-intensive. Incentivize more sustainable transit and activate the site by removing parking minimums.

Reduce Operational Emissions and Support Renewables

Design with Water	Manage stormwater and wastewater within the landscape	**Circular water systems** that reuse stormwater, greywater and blackwater for irrigation and other purposes can minimize offsite piping, potable water usage, and energy-intensive stormwater and wastewater treatment. Planted infiltrating bioswales, bioretention, and engineered wastewater treatment wetlands can sequester carbon, provide habitat, support biodiversity, return nutrients to the soil, and provide amenities for people.
	Irrigate minimally with passive, gravity irrigation	Potable water treatment and distribution and wastewater treatment account for 4-5% of total energy use in the US and other countries. Minimizing water use therefore yields carbon savings in addition to conserving this precious resource. Design irrigation zones for native, adaptive, and drought-tolerant planting where appropriate. Passive irrigation systems reduce piping.

Reduce Operational Emissions and Support Renewables

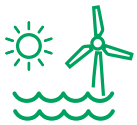


Manage Site to Reduce Carbon Emissions and Increase Sequestration	Minimize high-maintenance lawn	High-maintenance lawn is an unsustainable net carbon emitter that degrades ecosystems, due to chemical fertilizers and inputs, maintenance emissions, and high water use.
	Specify electric and hand-powered equipment	Electric and hand-powered equipment emit less fossil fuel than gas-powered equipment, such as mowers, blowers, chainsaws and trimmers.
	Design low-maintenance landscapes	Allow the landscape and species composition to evolve over time, improving resilience and reducing maintenance and replacement emissions. Avoid hedges and planting designs that rely on regular trimming or pruning. Choose plants that need only occasional (once or twice-yearly) pruning or mowing. Give larger shrubs space to grow to full size, and underplant with self-spreading annuals and perennials to maximize photosynthesis and prevent weeds.
	Minimize pruning and retain woody material	Improve the lifecycle management of trees. Wood chip mulch decomposition releases as much as 80% of the stored carbon. Keep logs and pruned woody material onsite as woody debris, perpetuating a healthy regenerative ecosystem that can cycle carbon into soil and reduce carbon release.
	Compost on-site	Compost site clippings and surface-spread compost instead of chemical fertilizers, to retain carbon onsite and reduce trucking and emissions. Tilling is unnecessary if the soil ecology is robust.
	Integrated pest management (IPM)	**Probiotic organic fertilizers:** Avoid chemical fertilizers, especially those with nitrous oxide (N2O), which are made from fossil fuels, release N2O into the atmosphere, damage ecosystems, and degrade soil life. **Organic pesticides:** Do not use glyphosate herbicides, or other chemical herbicides and pesticides, including the neonicotinoid (neonic) class of pesticides. Chemical herbicides and pesticides devastate soil life.
	Build soil carbon	**Organic soil amendments:** Compost (especially on-site compost), compost tea, probiotic inoculants, and vermiculture build soil ecologies and capacity for carbon sequestration. Biochar is also an excellent way to capture carbon and store it in the soil, while improving the nutrient uptake of plants. Monitor planting and fill in gaps with seed and **underplanting**, to maximize carbon sequestration through photosynthesis. Use **mulch** appropriate to the site. A variety of mulch material (leaf litter, wood, bark, straw) provides more nutrients that can be cycled into the soil by microbes. Wood-based mulches have a lower carbon footprint than gravel mulches. In sandy or desert environments, use local sand or rock-based mulches, to avoid introducing inappropriate organic material. **Retain woody debris, snags, brush piles,** and **leaf litter** for a healthy, productive ecosystem of increased soil carbon.

Reduce Operational Emissions and Support Renewables

Reduce Building and Infrastructure Energy Usage	Green roofs	Extensive green roofs with minimal or no foam or paving are ideal for insulating and cooling the building below and reducing building energy needs, as well as slowing stormwater and providing habitat and biophilic benefits. Use air conditioning condensate or stormwater to provide passive irrigation. Green roofs can be combined with solar panels to improve outcomes.
	Cool roofs	Light-colored roofs absorb less heat and reduce cooling needs. This can be as simple as painting a dark roof with a light color, using low-volatile organic compounds (VOC) exterior paints.
	High-albedo materials	High-albedo paving and structure materials reduce the heat island effect.
	Shade buildings with trees	Trees and vegetation can reduce building energy use and cool pavement and surrounding temperatures through transpiration, while providing biophilic benefits, encouraging walking, cycling, and transit use. Place trees for maximum shade, generally to the west.
	Constructed wastewater wetlands	Constructed subsurface wastewater treatment wetlands, such as "living machines," can treat blackwater within a building or development. Floating or free water surface wastewater treatment wetlands can prevent the release of greenhouse gases from sewage while sequestering carbon through vegetation. These systems may also reduce pumping, pipes, and energy usage by centralized, mechanized wastewater treatment facilities, and may provide aquaculture and other habitat as well as public landscape amenities.
	Energy-efficient lighting	Choose energy efficient lighting fixtures. Minimize light pollution and habitat disturbance. (See also Climate Resilience)
	Reduce pumping and motor usage	Design passive water and wastewater systems to minimize energy use by pumps and other motors. **Avoid fountains**, which have high energy use. Where required, optimize pump sizes and use variable frequency drives (VFD's) to minimize energy usage.
	Reduce Mechanical Electrical and Plumbing (MEP) energy usage	Right-size equipment and consider life cycle energy use when designing MEP systems for the site. Select more efficient systems where possible.
Support Renewables	Design and plan for renewable energy deployment	**Prioritize shared land uses and multifunctional landscapes**, such as wind farms with pasture and agriculture, and agrivoltaics and solar with pollinator habitat. Cover canals and brownfields with photovoltaics (PV), integrate PV into existing civil infrastructure and rights of way, and install solar shade structures over parking lots and rights-of-way. **Design regionally sensitive, place-based energy deployments** that reflect the scale and feel of nearby scenery and the cultural landscape. Partner with communities and incorporate local aspirations for landscape character.

Reduce Operational Emissions and Support Renewables



Support Renewables	Design and plan for renewable energy deployment	**Early, proactive public engagement in siting process:** Minimize conflicts through least-conflict solar and wind power development mapping and landscape-scale spatial planning. Engage stakeholders, including Indigenous communities, in planning and participatory scenario-building. **Account for ecological impacts proactively:** Balance energy development with habitat connectivity, areas of limited access, and high-quality intact natural communities, while prioritizing preservation of threatened biological resources. Set clear conservation goals and identify low-conflict areas. **Empower local communities** through progressive labor practices and ownership structures. Incorporate the principles of energy democracy to ensure communities benefit financially from nearby projects. Support local public or cooperative ownership whenever possible, with participatory democratic control, and prioritize union labor for new green jobs.
	Plan for development- and neighborhood-scale renewable infrastructure	**Optimize neighborhood design for photovoltaics and passive heating and cooling.** Plan for **microgrids**, localized energy grid systems that reduce reliance on regional grids, improving community disaster resilience and energy democracy. In remote areas, promote opportunities for community energy independence. **Community batteries** can store solar electricity and increase energy democracy. Incorporate space for **electric vehicle charging** stations within streetscapes and parking areas, including two-way vehicle-to-grid charging. Design for **photovoltaics** everywhere possible, and plant underneath.

Reduce the Carbon Footprint of your Business Operations

Measure	Calculate your organization's emissions by preparing a greenhouse gas (GHG) inventory	Set your emissions boundary. Include emissions from Scope 1, Scope 2, and Scope 3. Built project emissions can be excluded, and calculated separately. **Scope 1:** Direct onsite emissions by your organization, such as building emissions, fossil fuels used onsite, company vehicle fuel usage, and hydrofluorocarbon leakage from air conditioning. **Scope 2:** Indirect offsite emissions purchased by your organization, such as purchased electricity, energy used for heating and cooling, and server electricity use. **Scope 3:** Indirect emissions resulting from your organization's activities, including emissions from: Upstream activities: Producing and transporting purchased goods. Downstream activities: Travel, employee commuting, cleaning and waste disposal, subconsultants, and investments made by your organization. Downstream activities include built projects, but project emissions can be calculated separately through Pathfinder, and excluded from the emissions boundary of your organization.

Reduce the Carbon Footprint of your Business Operations

Reduce	Reduce the GHG emissions of your organization	Using your GHG inventory, prepare an Emissions Reduction Strategy (ERS) or Sustainability Action Plan (SAP) with specific actions, quantifiable goals, and a time frame. Target your largest emissions sources, such as heating, ventilation, and air conditioning (HVAC).
Offset	Use carbon offsets only when primary emissions cannot be reduced	Choose offset projects that align with your organization's values, such as restoring degraded land, while providing co-benefits like increased biodiversity, habitat creation, and intergenerational transfer of Indigenous land management practices. Some companies offering rigorously verified carbon offset projects include Verra, Climate Action Reserve, Saving Nature, and City Forest Credits. Revegetation-based carbon sequestration projects often take many years to reap benefits. Combine such projects with more immediate offset credits, such as refrigerant gas destruction, or renewable energy projects. Ensure carbon credit projects actually reduce atmospheric GHGs. Avoid credits that pay for something that was already happening, reward land clearing, or involve revegetation of unsuitable land. Offset credits should align with the UN Sustainable Development Goals. Prioritize tangible reductions at the time of emissions over future reductions. Ensure offset credit projects are monitored and reported over their lifetime.
Publish	Certify and disclose your organization's GHG emissions annually	Carbon neutral certification requires independent validation of data, and a public report every year, including disclosure of the emissions boundary, total emissions and their sources, emissions reduction strategies, and any offsets.

Acknowledgments and sources

We are grateful to the following publications, research, and individuals for their contributions to the ideas of the Climate Positive Design Toolkit (see Resources page for additional sources and resources):

American Society of Landscape Architects: Climate Action Field Guide
Australian Institute of Landscape Architects: Climate Positive Design Guidelines
Architecture 2030: 2030 Palette and Carbon Smart Materials Palette
Carbon Conscience, Chris Hardy and Sasaki: White Paper, Design Guidelines
Steve Engler, PE, LEED AP, Senior Associate at Sasaki
Deanna Lynn, Landscape Design for Carbon Sequestration
Nicholas Pevzner, Yekang Ko, and Kirk Dimond, Power Player: Designing for Just and Multifunctional Energy Landscapes, Landscape Architecture Magazine, 6/8/2021
Regeneration.org
United Nations: Sustainable Development Goals
UN Convention on Biological Diversity: Kunming-Montreal Global Biodiversity Framework

Expand Ecological Services

Incorporate Nature-based Solutions	Coastal adaptation	**Living shorelines and breakwaters:** Preserve, create, or enhance natural systems like marshes, mangroves, beaches, and dunes to protect shorelines from erosion and support habitat. **Design for water table rise and saltwater incursion:** Raise waterfront trees, and select saltwater-tolerant species of trees and plants. **Riparian buffers:** Natural or planted areas adjacent to water bodies can enhance rivers and protect nearby communities.
	Water-resilient cities	Create **sponge cities** with biotreatment water catchment and storage, remove concrete barriers and increase waterway vegetation, plant riparian and shoreline buffers, recharge groundwater with recycled water, and install smart systems for water resilience. Maintain existing flood storage areas. **Circular water systems:** Using treated greywater and blackwater for irrigation and other purposes increases drought resilience. Grey and blackwater can be treated within the landscape, through "living machines" and other nature-based systems, to improve decentralized resilience. (See also Carbon Drawdown) **Plan for flood-prone areas:** Restore floodplain functions. Plan for agriculture, not housing near water bodies. Plan for future impacts, resilience and evacuation. Design creek, river, and coastal infrastructure to adapt to high flows and storms. Build soil carbon and vegetation to hold and slow water. **Managed retreat** from waterfronts and riverfronts: Consider climate justice issues when planning retreat from areas prone to flooding, erosion, and other hazards.
	Re/afforestation of steep slopes	Prevent erosion and landslides by reforesting or afforesting steep slopes.
	Support cool, green public infrastructure	Create a publicly accessible network of connected green and blue areas. Design to mitigate heat islands, soak up stormwater, and provide habitat.
Cultural Burning	Learn from and work with Indigenous communities to incorporate traditional burning into land management practices.	Cultural burning increases biodiversity and brings back the herbaceous shrub layer rather than hot fire species, decreasing the risk and intensity of future fires.

Protect, Conserve and Enhance Biodiversity

Protect Existing Ecosystems	Forests	Protecting carbon-rich, biodiverse forests is critical to maintaining sustainable life on the planet. Do not cut forests for development. Specify only reclaimed wood products, wood from sustainably managed climate-smart forests, and/or locally harvested and manufactured wood products from energy-efficient manufacturers. Do not specify tropical hardwoods.
	Peat bogs, coastal wetlands, mangroves, reed beds, marine kelp and seagrasses	Retain and protect carbon-sequestering ecosystems, which also provide climate resilience and habitat. When disturbed, wetlands release methane, a significant greenhouse gas.
	Grasslands	Grasslands account for 15% of global terrestrial carbon storage, of which 90% is below ground, making the carbon more secure than forests. Grasslands and savannahs are rich habitats, and are threatened worldwide by agriculture and development.
	Avoid incremental habitat loss	Retain indigenous plants and habitat features such as established trees, shrubs and hollows, and collect endemic seed. Minimize habitat disruption during construction, including lighting, noise and dust.
	Avoid plastic	Plastics are detrimental to ecosystems and health. Avoid plastic use where possible, but consider the carbon impacts of alternative materials like stone, concrete, and exotic hardwoods. Where necessary, specify recycled or recyclable plastics.
Restore Disturbed Landscapes	Rewilding	Create wildness in degraded landscapes. Rewilding focuses on natural processes and restores wildness to landscapes of all scales, through natural elements such as native plant and animal species. Rewilding can build connections between people and place, restore biodiversity, and support local communities and nature-based economies.
	Afforestation	Planting trees in areas that have never or not recently had trees can sequester carbon, bolster biodiversity, restore degraded ecosystems and watersheds, prevent erosion and desertification, and support vulnerable communities. Afforestation should only be attempted where it is ecologically appropriate, the new trees harmonize with native flora and fauna, and monoculture is avoided. Indigenous peoples and local communities must be deeply involved in projects. (See also Carbon Drawdown)
	Bodies of water	Restoration of rivers, lakes, streams and freshwater wetlands is critical to human health and well-being, as well as habitat and ecological processes.
	Seaforestation	Restoring and expanding kelp forests and other fast-growing seaweeds in the oceans can provide vital habitat, improve marine health, reverse ocean acidification, prevent coral bleaching, increase fish harvests, and store tremendous amounts of carbon.

Protect, Conserve and Enhance Biodiversity

Support Habitat	Interconnected ecosystems: Avoid fragmentation and ecological islands	Interconnected ecosystems are critical to ecological health and the ability for flora and fauna to adapt to climate change. Use publicly owned land corridors, like highways, roads, and rails to rebuild species diversity. Connect with Indigenous history and culture in the process of restoring and preserving interconnected ecosystems. Evaluate existing and proposed bridges and culverts to prevent fragmentation of stream corridors.
	Wildlife and habitat corridors	Plants and animals are relocating as increasing temperatures and water patterns change the places to which they are adapted. Design wildlife and climate flow corridors that meet the latest corridor science recommendations in addition to creating multi-purpose trails, greenways, and roadsides. Avoid the fragmentation of corridors through culverts, bridges, roads, and other infrastructure.
	Construct diversified ecosystems, and provide food, shelter and nesting places for fauna	Replace lawn monocultures with biodiverse plantings and endemic soils to create self-managing ecosystems, even in overlooked areas such as parkways and medians. Specify maximum 30% of plants per family, 10% per genus, and 2% per species.
	Design planting for succession, not replacement	Designing for succession enables robust landscapes. Rather than trying to plant an apex forest from scratch, start with pioneer species that will shade longer-lived species until they can thrive.
	Minimize light and noise pollution	Minimize light and noise pollution that can distress flora and fauna. Avoid light near fauna resting spots (like ponds, tall trees and shrubs) and avoid white and blue wavelengths. Aim for warm yellow lights closer to 2000 Kelvin.
	Offset habitat loss as a last resort	Off-site habitat restoration should be a last resort. This can be challenging to do given the location-specificity and complexity of ecosystems. See also Carbon Drawdown, Reduce the Carbon Footprint of Your Business Operations, for more information about carbon offsets.
Use Endemic, Native, or Long-term Adapted Species to Enhance Biodiversity and Climate Migration	Consider long-term climatic shifts when selecting species	As areas warm and climate patterns shift, many species of flora and fauna will need to shift toward the poles in order to survive. Research species in climates similar to the projected future climate of your project site, and specify appropriate, non-invasive trees and plants from these sister climates to augment native species.
	Seed collection and propagation	Plan for site and local endemic seed collection well in advance of construction, as it may involve long lead times and seasonal constraints. Propagate and contract-grow seedlings near the site, or in a similar climate.
Specify Manufactured Soils that Mimic Endemic Soils	Design planting for endemic soils.	Where manufactured soils are necessary, mimic endemic soils. Maintaining endemic soils and planting improves native biodiversity and reduces invasive species.

Incorporate Ecologically Sound Land Management Practices

Climate Resilience

Manage the Wild-Urban Interface to Maintain Ecosystem Functions, Biodiversity and Climate Resilience

Development patterns that protect wildlands and reduce risk from wildfire, landslides, and flooding	**New growth areas:** Identify and establish environmentally suitable and transit-viable new growth areas. **Settlement areas:** Clearly defined settlement areas limit sprawl and protect habitat corridors. Prioritize areas of existing development. **Coastal settlements:** Manage settlement growth toward existing communities and away from environmentally sensitive areas, to protect residents and natural habitats. Avoid disturbance of dunes, barrier beaches, mangroves, and other critical environments. Guidelines: - No structures seaward of 10 times the annual erosion rate. - Allow only moveable structures seaward of 60 times the annual erosion rate. - Guide development toward existing communities. - Encourage compact mixed-use development. - Acquire and preserve undeveloped land and critical environments, consider partnering with land trusts. **Mountainside settlements:** Manage mountainside settlement growth toward existing communities. Avoid erosion, development of steep slopes and fire-prone areas. Guidelines: - Prevent unnecessary grading or stripping of vegetation. - Preserve natural drainage patterns. - Require re-vegetation to maintain the natural landscape environment. **Hazard mapping** identifies the potential impacts of flooding, landslides, hurricanes, earthquakes, drought, and wildfires. **Inundation mapping:** Sea level rise and storm surge maps create a detailed picture of community resources and areas exposed or vulnerable to future inundation. Maintain existing flood storage areas.
Wildfires	Establish **firebreaks** through vegetation, including agricultural buffers. **Reduce fuel loads** (consider using animal partners for cost and carbon savings), while striving to maintain healthy ecosystems and carbon in removed wood.
Prevent landslides	Proper site selection is critical to reducing the risk of landslides. Work with the contours of a place, respecting vegetation and root systems that stabilize soil and prevent erosion. Reestablish stormwater corridors that connect natural watersheds, reducing potential mud/land/debris slides.
Manage invasives	Avoid specifying known invasive plants and those that have a high potential for becoming invasive, due to range shifts associated with climate change. Develop an invasive species management plan for sites pre-, during, and post-construction.

Incorporate Ecologically Sound Land Management Practices

Manage the Wild-Urban Interface to Maintain Ecosystem Functions, Biodiversity and Climate Resilience	Include risk and emergency management in community planning	Work with communities and government agencies to develop local and regional climate resilience and recovery plans, anticipating potential climate disruption. Promote wise management of the wildland-urban interface, and encourage resilient rebuilding in appropriate locations to avoid repeated losses.
	Support self-reliant ecosystems	Build **circular economies** and **circular systems** for water, food, nutrients, waste and energy. Plan and design to reduce reliance on outside systems, including capturing rainwater where it falls, and repurposing and recycling waste locally.
	Urban infill	Grow within the existing bounds of your community, to preserve surrounding rural and natural spaces.
	Urban retrofit	Repurpose or redevelop low-density contaminated, abandoned, or underused areas and buildings that are within walking distance to transit and/or district centers, to reduce sprawl.
Mitigate Heat Islands	Create urban forest canopies	Maximize shallower (1 meter deep) **horizontal soil volume** for tree roots. Use structural soils or cell systems as necessary to allow tree roots to grown beneath paved areas. See Carbon Drawdown for additional soil information. Prioritize high-quality **ground preparation** over tree stock size. **Maximize soil interconnectedness.** See Carbon Drawdown for additional soil information. Use **passive irrigation** to maximize the soil moisture growing capacity of trees. Select tree species and **smaller stock sizes** for future climate changes. **Prioritize trees over utilities.** Re-think street cross-sections and challenge utility provider rules that restrict opportunities for street trees. Provide passively irrigated **shade trees in parking lots** and zones. Use structural soils or cell systems to extend soil zones under pavements.
	Design parks to cool communities	**Prioritize underserved areas** with limited existing canopy cover for new tree planting. **Protect large, mature trees.** **Plant underused spaces in parks**, maximizing carbon sequestration through biodiverse afforestation techniques. (See also Carbon Drawdown) Use **passive irrigation** and **wicking beds** to irrigate lawns and maximize soil moisture. Design **climate-appropriate playgrounds.** Avoid materials that can become excessively hot under the sun.
Prioritize Health and Well-Being	Include passive and active spaces for all demographics	Design landscapes to provide for multiple co-benefits. Design for varied experiences: active places to walk, ride and play, experience joy and biophilia, or rest and recuperate.

Support Regenerative Local Agriculture and Increase Food Security

Protect and Restore Agricultural Areas	Peri-urban agriculture protection	Advocate for protecting sustainable peri-urban agricultural areas from development and the expansion of urbanized areas into rural communities. Protection of these lands through agricultural conservation easements, land trusts and other means, can reduce "food miles" by keeping food production and transportation near the city.
	Abandoned farmland restoration	Advocate for bringing abandoned farmlands back into productive uses such as regenerative agriculture, reforestation or native vegetation. Abandoned farmlands are lands that have been 'farmed out' through extractive agricultural practices or were not suitable for agriculture (ie. steep slopes). The exposed soils of these lands can be a carbon source. Restoring productivity can transition these lands to carbon sinks, improve ecological health and/or increase food production.
	Farmland planning	Work with farmland owners, conservation biologists and restoration ecologists and planners to incorporate landscape planning alongside practices of conservation agriculture and ecological restoration on existing and historic farmland to support continued farming and ecological diversification.
	Agrivoltaics and wind power	Promote windmills and agrivoltaics, or solar panel arrays installed over arable farmlands, where compatible with crop types and climate. Shade provided by panels can help to retain soil moisture and protect crops from severe weather, while income from solar energy helps to offset the unpredictable income stream of farming, thus retaining farmland. (See also Carbon Drawdown)
Support Local Food Supplies	Urban food forests	Support the use of food forests where appropriate, to increase food availability and reduce urban heat, while diversifying regional agricultural systems. Food forests are layered diverse planting of edible plants that seek to mimic ecosystems. Commonly managed by community groups, they can also generate social connection and enhance abandoned or underutilized urban lands. Tree crops also sequester significant carbon.
	Microgardens	Incorporate small community food gardens into any appropriate available space. Microgardens provide opportunity for social connection and enhanced biodiversity on abandoned or underutilized urban lands.
	Rooftop agriculture	Incorporate rooftop gardening into projects wherever appropriate, considering the carbon footprint of additional concrete and steel that may be required within the building to support the green roof. Most building roofs have very high solar incidence, making them ideal places for crop production. Rooftop farms combine opportunities for community building and economic benefit with reduction of heating and cooling requirements (resulting in reduced emissions), improved biodiversity, water capture, aesthetic value and air quality.

Support Regenerative Local Agriculture and Increase Food Security

Support Local Food Supplies	Aquaculture	Safeguard and improve aquatic food contributions to nutrition and just economies. When properly managed, these resources can recycle food waste nutrients, supply alternatives to red meat that have lower carbon footprints and promote local, affordable food options.
	Rainwater harvesting	Plan for and implement water catchment systems, especially in arid or drought-prone environments. Water catchment systems are designed to collect and store water and vary based on climate, soils and topography. They can be designed to provide water for domestic animals, wildlife and/or household usage.
	Improved irrigation infrastructure	Promote water conservation through improved irrigation systems. Drip and sprinkler irrigation systems can reduce water usage as well as carbon emissions through reduced energy demands, improve crop yields and reduce soil erosion. Fields become less humid and therefore less friendly to many pests. These systems are made even more efficient when paired with rainwater harvesting.
	Community food hubs and farmers markets	Design and build community food hubs and integrate space for farmers markets and local food trucks into publicly accessible open space. Food hubs can be generators of local economy, jobs, and increased awareness of food resources within a community. Farmers markets and food trucks offer direct-to-consumer opportunities for small farmers and food businesses, increasing outlets for sales for small farmers and providing consumers with healthy food options. Both food hubs and farmers markets can offer locations for community gathering and improved social connection.
	Indigenous foodways	Plan for, implement, and support opportunities for inclusion of Indigenous foodways on agricultural, peri-urban and urban lands. Developed over time by communities living on the land, Indigenous foodways include land stewardship methods that reconnect biological and cultural diversity. Inclusion of these practices and the associated plant species can support improved physical, cultural and spiritual health of Indigenous communities while revitalizing native plant species, rare and heirloom seeds, and practices associated with their cultivation that support long-term ecosystem health.
	Regional foodways	Plan for, implement, and support opportunities for inclusion of regional foodways on agricultural, peri-urban and urban lands. Regional foodways connect people to a specific geographic region, climate, ethnic or religious group and/or family. Their continued practice can promote community bonds and stronger bonds between people and the land through sharing of long-held traditions of cultivation and land stewardship.
	Land ownership and access	Promote and advocate for local, state, and national policy and programs that support land ownership and/or access to arable public lands for small farmers, and historically marginalized communities.

Support Regenerative Local Agriculture and Increase Food Security

Encourage Alternative Farming Techniques	Regenerative agriculture	Regenerative agriculture focuses on restoring and maintaining biologically healthy soil through a variety of farming techniques, and is the foundation of Indigenous and traditional food systems worldwide. Regenerative agriculture can restore degraded land and recarbonize soils, while producing healthy food, protecting watersheds, and strengthening ecological and cultural diversity and economic resilience.
	Conservation agriculture	Conservation agriculture is a no-till system that protects soil and improves drought resistance, thus reducing the need for irrigation. Increased fertility and greater yield with reduced need for fertilization are common results.
	Agroforestry	Promote integration of agroforestry into agricultural systems and urban parklands as appropriate. Inspired by natural ecosystems, agroforestry combines trees, shrubs, and vines with animal and crop farming systems. Mixing annual crops and perennial trees and plants, agroforestry is used by millions of people around the world as a traditional, ecologically and financially sustainable source of food, fiber and wood. Common forms of agroforestry include Silvopasture, Windbreaks, Riparian Forest Buffers, Tree Intercropping, Alley Cropping and Forest Farming.
	Silvopasture	Silvopasture is the intentional combination of trees, pasture, and livestock (including cattle, sheep, goats, deer and ducks) in ways that mimic natural ecosystems. These practices increase diversification of products including nuts, fruits, mushrooms and tree saps that allow for multiple harvest timelines and reduced financial risk.
	Windbreaks	Plant biodiverse windbreaks to reduce soil erosion and provide habitat and wildlife corridors.
	Riparian forest buffers	Plant riparian forest buffers in agricultural, rangeland, suburban and urban conditions. Riparian forest buffers consist of trees, shrubs and/or other perennial plants grown at the riparian edge. These buffers support nutrient, pesticide and waste filtration from agricultural or urban runoff, stabilize banks to protect against erosion, and provide terrestrial wildlife corridors and critical habitat and food for aquatic species. Plantings can include harvestable and productive crops, such as food or wood products to support additional family income.
	Forest farming	Protect managed forest lands and promote forest farming practices where appropriate. Forest farming includes cultivation of (typically) high-value crops beneath a managed forest understory. Woodland crops, or non-timber forest products, include ginseng, mushrooms and other medicinal or ornamental herbs. These are commonly grown within tree canopy grown for wood or other tree-based food products. Forest farming can benefit lower income communities as a supplemental income and support continued cultivation of rare understory plants.

Support Regenerative Local Agriculture and Increase Food Security

Encourage Alternative Farming Techniques	Alley cropping / Tree intercropping	Tree intercropping involves the use of trees or hedges interspersed with agricultural crops either in closely spaced rows (alley cropping) or in a scattered manner. Leaves dropped from trees and shrubs, and inclusion of nitrogen fixing species such as acacia, provide additional nutrients while shading plants, reducing erosion and improving habitat.
	Municipal and regional composting	Support composting at the local and municipal level. Organic waste, including food waste, contributes significantly to methane production when left to decay in landfills. Composting converts organic material into nutrient rich soil which is both a valuable fertilizer and can aid in moisture retention and soil carbon sequestration. Municipal composting operations reduce landfilling and generate material to support urban forests, farms and gardens.
	Staple foods	Plant culturally relevant staple trees, shrubs and vines. Staple foods are perennials that have been harvested for millennia as significant components of local food supplies (ie. avocado, breadfruit, moringa). Planting these species in windbreaks, intercropping systems, forest farms and parklands can provide a culturally relevant, ecologically resilient foodsource.
	Managed grazing	Managed grazing shifts from typical overgrazing practices that deplete soils toward rotational grazing practices that mimic the grazing behavior of migratory herds of herbivores that evolved with plains landscapes. These herbivore-grazed soils are carbon rich and nutrient dense, and can sequester carbon at much higher rates than depleted soils.

Acknowledgments and sources

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American Society of Landscape Architects: Climate Action Field Guide
Australian Institute of Landscape Architects: Climate Positive Design Guidelines
Architecture 2030: 2030 Palette and Carbon Smart Materials Palette
Carbon Conscience, Chris Hardy, Sasaki: Carbon Conscience White Paper, Design Guidelines
Steve Engler, PE, LEED AP, Senior Associate at Sasaki
Deanna Lynn, Landscape Design for Carbon Sequestration
Amy Whitesides, Design Critic, Landscape Architecture, Harvard University Graduate School of Design
Regeneration.org
United Nations: Sustainable Development Goals
UN Convention on Biological Diversity: Kunming-Montreal Global Biodiversity Framework

Advocate for Equity and Social Well-Being

Build Community	Recognize past injustices	Depending on the project location, understand the Indigenous communities from which the land was forcefully taken, along with the contemporary issues facing these communities. Learn about past and present environmental injustices related to all communities of the area.
	Know yourself	Get to know your own motivations, attitudes, and biases prior to working with communities, in order to be open to both information and the lived experience of the community with whom you will work.
	Start by listening, then share	Listening openly without judgement is essential to understanding what community members are sharing. Immerse yourself in the community setting. Practice humility and curiosity.
	Focus on what matters most	Craft and facilitate engagements that illuminate what matter most to communities, using techniques such as photo documentation, sketch exercises, pop-up events, and walking workshops that happen in locations and times convenient to community members.
Understand Climate Injustices	Unearth community knowledge	Build relationships with local knowledge experts in the community to understand the deep history of a place and its culture. Consider interviewing local community members to understand their stories and identity. Work with community-led and -based organizations to learn more about a community prior to engaging.
	Identify issues	Identify issues that might inform how best to climate-proof communities. Document data and stories that may include inequities in accessibility, distribution of public resources and hazards, decision makers, and past harms to a community.
	Go to the people	Consider meeting people in their own neighborhoods and homes for work sessions to break down barriers and encourage open and honest conversation, as well as engaging with those who might not be able to attend events in other venues. Be mindful of the value of community members' time.

Get the Word Out

Use Communication Tools and Techniques	Develop a plan for community collaboration	Work with the community to map out a plan that gives them agency in collecting data to identify community concerns, vulnerabilities, and assets.
	Gather data	Use available data mapping from municipal sources and free online sources.
	Support community involvement through analytical tools	Analytical tools can include large-format maps, spatial design exercises, visualizations, and activities. Consider using geospatial asset mapping with mobile technology, to encourage citizen documentation of community assets, threats and opportunities. Consider mobile information forums to reach a broad range of community constituents. Incorporate the Environmental Protection Agency's Community and Citizen Science Programs into projects. Compensate community members for their time and expertise, and pace the process based on what is comfortable to them.
	Organize and synthesize	Organize the information collected, and present it in an understandable way. Identify potential solutions and set priorities for action.
	Implement and evaluate	Pilot or prototype portions of a project, to unearth potential future complications that can be addressed before large-scale implementation occurs. This can save on overall project cost, time and complexities. Evaluate results and support future community resilience.

Explore Pathways to Financial Stability with Communities

Development-driven	Tax-Increment Financing	Tax Increment Financing allows cities to capture newly generated property taxes from construction and reinvest those funds, often through revenue bonds, to make eligible public improvements. Tax Increment Financing is a potent redevelopment tool used by cities in North America, and is being adopted by other nations.
	Impact fees	Impact Fees are charged to a new development to help offset impacts of the development on a community. These fees may fund transportation, open space improvements, and affordable housing.
Fees, Assessments, and Taxes	Business / City / Special / Local Improvement Districts	Business / City / Special / Local Improvement Districts are usually voluntarily established in neighborhoods to help pay for infrastructure improvements. These improvement districts place an assessment on business and/or property owners over a period of time to pay back tax-exempt bonds used to cover the costs of community improvements.
	Taxing energy use	Taxing energy use: Carbon pricing, including fossil fuel subsidy reform, is a powerful tool to encourage and raise funds for low-carbon sustainable development. Carbon pricing co-benefits can include reduced fossil fuel emissions and air pollution.

Explore Pathways to Financial Stability with Communities

International and Domestic Public and Private Funds	International institutions	International institutions such as the United Nations and World Bank, as well as national and local governments, are supporting public and private funding efforts for development aligned with the UN Sustainable Development Goals. Much of the funding is dedicated to sustainable infrastructure development.
	Innovative financing	Innovative financing for sustainable development leverages established finance mechanisms, such as Green Bonds, as well as new market-based instruments to deliver positive social and environmental outcomes through public and private collaboration. Bonds and guarantees are the largest innovative financing mechanisms.
Foundations	Private and institutional funding	Many cities have corporations, institutions, or individuals who have established foundations that allocate resources to causes, sometimes including community redevelopment and revitalization. Redevelopment and economic development tools need to be part of a portfolio that incorporates a consensus-based vision for the future of a neighborhood, capable, dedicated leadership, and effective, supported strategies to make productive investments for community benefit.

Learn from Cultural Knowledge Systems and Practices of Care

Learn from Indigenous Communities through Collaboration	Enrich discovery	Indigenous and traditional local knowledge systems enrich problem-solving and result in more effective and holistic decision making and reciprocity. Sharing of Indigenous traditional and contemporary science with current research enriches discovery of more sustainable futures.
	Inspire a new future	Indigenous ways of knowing and being can evoke and inspire new narratives and visions of living in balance with nature.
	Develop long-term collaborative, meaningful relationships	By respecting and understanding local Indigenous approaches and culture, we can support ongoing trust and respect that can support two-way support for projects, and ensure reciprocity to give as well as receive. Seek guidance to understand and respect local protocols. Local, state, and federal government agencies typically have tribal affairs liaisons responsible for managing relationships with tribal leaders.
	Listen first	Engage with Indigenous community leaders early and often. Practice humility and curiosity. Understand colonial history to avoid negative stereotypes. Be generous with your time and compensate Indigenous people for their time and emotional labor.
	Recognize, respect and identify	Recognize the rights and traditional territory of Indigenous peoples, while respecting and protecting Indigenous intellectual property. Identify and respect Indigenous governance and authority structures. Teach and demonstrate the work of landscape architects to encourage diversity in the profession.

Learn from Cultural Knowledge Systems and Practices of Care

Show Respect through Land Acknowledgments	Start with humility and self-reflection	Land acknowledgements are one step toward offering recognition, reverence and respect, and supporting reconciliation. You can also support Indigenous communities by taking action. Research and learn about the Indigenous people to whom the land belongs, and the history of the land and treaties.
	Understand and acknowledge	Be clear and upfront about displacement, genocide, ethnic cleansing, assimilation, and forced removal.
	Show respect	Use Indigenous place names and languages as appropriate. Use correct pronunciation. Use past, present, and future tenses.
Plan and Design Project Work with Indigenous Peoples	Co-plan and co-design	Climate solutions can be co-created with Indigenous communities, based upon their cultural land management practices and knowledge systems.
	Adopt Indigenous science	Strategies can include planting, food sources, and ecological land management practices to solve climate-related challenges. Seek advice on potential for cultural burning to restore biodiversity and reduce fire risk on your projects.
	Follow guidance: Refer to the International Indigenous Design Charter	Respect and protect Indigenous Intellectual Property. Refer to the International Indigenous Design charter when working on projects involving the representation of Indigenous culture.
	Sustainable future engagement opportunities	Provide **ongoing employment** opportunities through the life of the project, such as seed collection, propagation, and maintenance. Ensure program flexibility and sustainable resources to support innovation and long-term monitoring and evaluation. **Ensure Indigenous people benefit** from the use of their cultural knowledge, especially where it is being commercially applied.

Equity

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Support Climate Leadership

Engage the Public	Engage the media	Prepare **talking points.** Reach out to **local reporters** who have written about climate, infrastructure, or topics related to landscape architecture. Build relationships and send media kits. Write **op-ed pieces** highlighting Nature-based Solutions in response to climate-related articles that omit them.
	Get out there	Attend conferences and events, including the United Nations Framework Convention on Climate Change.
Work with Elected Officials and Public Servants	Who to reach	Engage your local mayors, state representatives, and city councilpersons. Reach out to the heads and key staff of municipal Environmental Quality and Safety departments, Public Works Departments, Planning, and Transportation departments.
	Craft your message	Ask yourself, "why would this person care?" and craft your message to their concerns. Consider including information about how built environment professionals are confronting the climate and biodiversity crises, and climate equity.
	Share case studies	Choose built environment case studies related to the officials' region, platform priorities, or community concerns.
	Invite others	Host **site tours** to show local, state, and federal public officials how built environment professionals use design to create well-planned communities, parks, and green streets, to manage stormwater runoff, and plan state-of-the-art transportation corridors. Link your work to jobs and economic benefits, using data to explain the positive economic impact of your climate work on communities.
	End with an ask	End your email or outreach with an action request to increase the likelihood of a response and the beginning of a relationship.
	Follow up	Share on social media and send thank you letters and social media posts to officials.
	Hire a lobbyist to advance climate policies	Coordinate with a local professional organization or allied coalition to hire a lobbyist to advocate for legislation that supports climate goals as well as practice.
Guide Policies	Nature-based systems	Provide guidance for developing and advocating for policies inspired by nature-based systems.
	Community planning and design	Compact, walkable, transit-oriented development with networks of green space and tree canopy foster human health and social connection, while reducing energy use. Combined with nature-based systems, these communities are resilient and adaptable.

Support Climate Leadership

Guide Policies	Underserved communities	Pay particular attention to communities that are at increased risk from the impacts of the climate and biodiversity crises.
	Transportation	Promote resilience through thoughtful transportation systems. Consider transportation through multiple lenses: as critical connectivity between homes, jobs, schools, recreation, retail, and essential services; as a major source of greenhouse gas emissions; and as a contributor to or detractor from a community's appearance and function.
	Agriculture	Current and future impacts on food production and security, including equitable access to healthy food options and climate- and biodiversity-friendly farming, must be addressed. Farmland is being lost to expanding development, and agricultural systems are being stressed by the effects of changing climate and unsustainable farming practices.
	Greenhouse gas emissions	Greenhouse gas emissions are the driving factor in global heat increases and the resulting climate and biodiversity crises. Policies that encourage net zero and, better yet, climate positive buildings, infrastructure, and landscapes, are critical.

Build Climate Coalitions

Identify and reach out to key collaborators		Potential groups include: Climate-focused nonprofits, university researchers and institutes focused on climate in your state and region, architecture engineering and construction (AEC) professional organizations, climate-focused member organizations, equity and justice organizations, government agencies, product manufacturers, and sustainability and climate rating program coordinators.
Determine targeted items for collaboration		Opportunities may include: Major conferences and events, educational resource development, outreach and communications, development of codes, standards, regulations and policies, and fundraising and grant application collaboration.
Build local climate coalitions		Build a team of allied professionals and experts across disciplines who are dedicated to addressing climate change in your city or state. Discuss climate-smart solutions and tackle barriers to local implementation with architects, engineers, scientists, local government, community advocates, and equity-focused organizations.
Organize roundtable discussions		Organize topic-based roundtables to bring together decision-makers who might not otherwise connect, such as government regulators, AEC professionals, equity organizations, and diverse stakeholders involved in climate issues, such as flood control, fire suppression, and transportation planning.

Nurture Future Climate Leaders

Support Employee Health and Well-Being	Evaluate	Evaluate your organization through a social justice and equity lens. The JUST Certification program encourages policies that improve social equity and enhance employee engagement by increasing transparency. Your firm can also become a B Corporation.
	Support health and well-being	Individuals can cope with climate change distress through the following: 1. Take action 2. Take a break 3. Have fun 4. Move your body 5. Focus on the solutions 6. Talk it out
Encourage Employee Involvement in Climate Action	Start where you are, use what you have, do what you can.	Formalize programs and dedicate time for employees to devote to climate-positive action and volunteer efforts.

Promote Global Alliances

Embody the United Nations Sustainable Development Goals (UN SDGs) and Convention on Biological Diversity Global Biodiversity Framework	Embed the UN SDGs and Global Biodiversity Framework into business plans and daily actions	Work to sustain and create places that contribute to health and well-being by increasing green networks with a diversity of plants in cities and towns. Design systems to absorb and clean water and recharge groundwater resources. Plan multi-modal green streets and public transit, bicycle networks, and safe pedestrian walks and paths. Support biodiversity through conservation, restoration, healthy soils and appropriate plantings. Establish local food sources and distribution in cities and regions to provide healthy food.
Go Global	Expand international and interdisciplinary relationships	Collaborate with other design professionals, scientists, community groups, and equity and environmental organizations to address multiple sustainability goals. This includes involvement in developing policies.

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