



PART 1

Read the text below and answer questions 1–13.

THE GREEN ROOF REVOLUTION IN URBAN AREAS

A

Cities are frequently warmer than their surrounding countryside, a pattern known as the urban heat island effect. One reason is albedo: dark roof membranes and asphalt surfaces reflect little sunlight and instead absorb solar radiation, converting it into heat that is released back into the air. Another reason is urban form. Dense building clusters restrict airflow, store heat in concrete and brick, and reduce nighttime cooling. In this context, green roofs—engineered layers of growing medium and vegetation installed on rooftops—have moved from architectural curiosity to a practical policy tool. By turning previously “unused” roof area into living surface, they can cool buildings, slow stormwater runoff, and provide small pockets of habitat. The approach is not a single solution to urban warming, but it offers a way to modify the physics of rooftops at scale, especially in districts where ground-level space for new parks is limited.

B

Not all green roofs are built for the same purpose, and the design differences have consequences. Extensive roofs typically use a shallow substrate, often only a few centimetres deep, and support hardy, drought-tolerant plants such as sedum, mosses, and certain grasses. Because they are relatively light and need minimal maintenance, they can be installed on many existing buildings with limited structural reinforcement. Intensive roofs, by contrast, use deeper soil layers that can sustain shrubs and sometimes small trees, creating spaces that resemble elevated gardens. These systems are heavier and require stronger structural support, as well as more irrigation and regular upkeep. Designers also consider local climate, wind exposure, drainage layers, and intended use. A roof meant mainly for insulation and runoff control may prioritise resilient plants and low weight, while a roof intended for recreation may prioritise aesthetics, accessibility, and biodiversity.

C

The best-documented benefit of green roofs is thermal regulation. Vegetation shades the roof surface, lowering the temperature of materials that would otherwise heat rapidly in direct sun. More importantly, plants cool the surrounding air through evapotranspiration, a process in which water is transported from the substrate through plant tissues and released as vapour. This phase change requires energy, so heat is absorbed as latent heat flux rather than remaining as sensible heat that warms the roof and indoor spaces. In



summer, this can reduce heat entering the building, lowering demand for air conditioning. If adoption is widespread, it can also reduce the overall heat island intensity by decreasing the amount of heat stored and re-radiated by roofs. However, performance depends on moisture and plant health. In prolonged drought, a dry roof provides less evaporative cooling, and stressed vegetation can reduce coverage, limiting the benefits that planners often assume in ideal conditions.

D

Stormwater management is another major motivation, particularly in cities where drainage systems are strained by intense rainfall. Conventional roofs shed water quickly into gutters and pipes, contributing to flash flooding and, in some older systems, sewage overflows. Green roofs can alter this pattern by storing rainwater temporarily in their substrate and vegetation. Some of the water is retained and later returned to the atmosphere through evaporation and plant transpiration, while some is detained—released more slowly as delayed drainage. This reduction in peak flow can relieve pressure on urban infrastructure, a benefit sometimes described as “peak shaving.” Yet the limits are important. During saturated conditions, when the substrate has already absorbed as much water as it can hold, additional rainfall produces more runoff. Extreme storms can therefore overwhelm the storage capacity, meaning that green roofs reduce—but do not eliminate—flood risk.

E

Biodiversity gains are possible, but they are not automatic. Many green roofs use a narrow palette of drought-tolerant species and create relatively simple habitats that support fewer insects and birds. More diverse plantings, combined with microhabitats such as varied soil depths, stones, or small logs, can provide resources for pollinators and offer nesting or shelter opportunities. In well-planned networks, roofs can act as “stepping stones” that help species move between parks and other green spaces, partially offsetting habitat fragmentation at street level. Even so, ecological success depends on roof height, isolation, and local air pollution, as well as on long-term maintenance. Some roofs become ecological “islands,” supporting limited communities that cannot easily connect to other habitats. As a result, biodiversity benefits tend to be highest where roof design is deliberately tailored to local species and where green roofs are treated as part of an urban ecological system rather than decorative landscaping.

F

Economic and policy considerations largely determine whether green roofs spread beyond pilot projects. Installation costs can be substantial, particularly for intensive roofs that require reinforced structures, irrigation systems, and public access measures. Maintenance is also commonly underestimated, since living systems need monitoring,



replanting, and drainage checks. On the other hand, green roofs can protect roof membranes by shielding them from ultraviolet radiation and large temperature swings, potentially extending the roof's service life and reducing replacement costs. Energy savings may offset expenses in some building types and climates, but outcomes depend on local energy prices and the quality of design. Policy has accelerated adoption in several cities through mandates for new developments or through incentives such as tax rebates, density bonuses, and grants. However, critics argue that rigid requirements can encourage minimal “tick-box” installations that meet the letter of the rule while delivering limited performance. Supporters respond that well-written standards and inspection regimes can improve quality over time by pushing the market toward skilled design and reliable installation.

G

Practical constraints mean that green roofs are rarely a universal solution. Water use is a sensitive issue in dry climates: irrigation may conflict with conservation goals unless drought-tolerant planting and recycled water are used. Added weight can be a barrier for older buildings, and poor drainage design can increase leak risk or create maintenance problems if water pools where it should not. Safety and access requirements can raise costs, particularly if roofs are intended for public use, and building owners may be reluctant to accept new liabilities. For these reasons, the “revolution” in green roofs is less about a single technology than about integrated planning and long-term stewardship. Cities that treat roofs as living infrastructure—monitored, upgraded, and connected to broader heat, water, and biodiversity strategies—are more likely to achieve durable benefits than those that treat green roofs as cosmetic additions. In that sense, green roofs are most effective when targeted to suitable buildings and when supported by design expertise, maintenance capacity, and realistic policy goals.

Questions 1–5

Choose the correct heading for each paragraph.

List of Headings

- i When rooftop habitats succeed—and when they do not
- ii Two main roof types and the trade-offs they involve
- iii Using rooftops as a new urban surface
- iv Why water retention benefits have clear limits
- v How vegetation cools buildings and cities
- vi The costs, savings, and policy measures influencing adoption
- vii Practical constraints and the need for long-term stewardship



viii How vegetation may extend the service life of a roof

ix Irrigation and structural barriers affecting unsuitable buildings

1 Paragraph **A**

2 Paragraph **B**

3 Paragraph **C**

4 Paragraph **D**

5 Paragraph **E**

Questions 6–9

Choose **TRUE** if the statement agrees with the information given in the text, choose **FALSE** if the statement contradicts the information, or choose **NOT GIVEN** if there is no information on this.

6 The passage suggests that extensive green roofs are usually heavier and require more structural support than intensive roofs.

7 The passage indicates that green-roof cooling can decline when the roof is dry and plant health is poor.

8 During saturated conditions or extreme storms, green roofs may still produce substantial runoff.

9 The passage states that regulations requiring green roofs apply only to residential buildings.

Questions 10–13

Complete the table below. Choose **NO MORE THAN TWO WORDS** from the text for each answer.

Green roofs: design, performance and delivery

Dimension	Feature or mechanism	Practical result	Dependency, limit or safeguard
Roof design	Extensive roofs: shallow and light; intensive roofs: deeper and heavier	Different designs suit different purposes	Choice depends on structure, climate and intended use



Dimension	Feature or mechanism	Practical result	Dependency, limit or safeguard
Thermal regulation	Cooling through shade and 10	Lower roof temperatures and reduced demand for air conditioning	Performance depends on moisture and plant health
Stormwater control	Temporary storage and delayed drainage	Reduced peak flow into urban drainage systems	Under 11, additional rain produces more runoff
Whole-life economics	Vegetation shields 12 from ultraviolet radiation and temperature swings	Longer service life and potentially lower replacement costs	Installation and maintenance costs may be substantial
Policy delivery	Mandates and financial incentives encourage adoption	Green roofs can spread beyond pilot projects	Standards and 13 can prevent poor-quality “tick-box” installations

Answer Key

1. iii
2. ii
3. v
4. iv
5. i
6. FALSE
7. TRUE
8. TRUE
9. NOT GIVEN
10. evapotranspiration
11. saturated conditions



12. roof membranes

13. inspection regimes