Climate Ready School Grounds
Technical Area: Heat Stress

As we see our average global temperatures rise, there is a need to adapt to adapt our existing school buildings and grounds. Our schools will face higher peak summer temperatures and longer periods of time each summer over 25ºC.

We know that many of our school grounds and buildings are prone to overheating. This is for a variety of reasons – from issues such as too much glass through to predominately hard surface around a building, or construction unsuitable for the peak temperatures. As our climate changes we will see hotter peak temperatures and more intense and numerous heatwave events. Therefore, overheating buildings and hot outdoor spaces will be a priority for many schools.

Research suggests that 'nature-based solutions' can go a long way to mitigate or reduce the amount of heat our school grounds absorb and radiate back. Nature based solutions (or 'blue green infrastructure' as it can sometimes be called) seek to provide shade and insulation from the heat. At a simple level, shade and green will reduce the heat build-up and temperature peaks compared to tarmac and unshaded buildings.

These benefits are for the outdoor spaces used at break, for PE and for outdoor learning, as well as the indoor spaces through sheltering the buildings. It is important to understand that most existing guides focus on the building in isolation. In doing so, they omit the benefit that green infrastructure can bring to a whole site and building.

Why would you prioritise overheating?

It is important to understand how much of an issue overheating is in your school. Consider the site, the building, and how many days per year you would consider the school 'too hot'.

What type of site do you have?

There is no such thing as a 'typical' school site, even across the three building groups. What we can easily understand is the amount of hard surfacing (typically asphalt), the number of trees, shrubs, and green planting and where that planting is relative to the building.

Any site with over 60% hard surface, with a lack of shade to the south, and without planting close to the building is at increased risk of overheating. If you have significant hard walls and hard surfacing all around the outdoor space, then the build-up of heat can be significant. If your hard tarmac or concrete surfaces come right up to building walls and doors, this increases heat radiation into the building.

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What type of buildings do you have?

Most school buildings can be grouped into three main categories:

Old – over 80 years old, these buildings are often stone with large windows. They have high ceilings and solid walls, pitched roofs and a could have a lot of ventilation. These buildings respond well to keeping heat out with trees, shrubs, green walls, blinds/shades, and good use of the window ventilation.

Mid-century – between 30 and 80 years old. Many are of 'lightweight' construction, flat roofs, large windows, and large facades, often facing south. They typically would have had single glazed windows, less ventilation, and lower ceilings. These are the most vulnerable buildings from an overheating point of view.

Modern – less than 30 years old. These typically are designed to a much higher standard of insulation and air tightness. They can have issues with too much glazing, lack of ventilation and lightweight construction. Without good ventilation or shading many of these buildings can really suffer from overheating in specific areas.

How many days is the school too hot?

Remember that we are looking at the outdoor space as well as indoor. Consider how many days and what sections of the outdoor space is too hot, leading to issues of use. Alongside this, also consider how many days and where the indoor space is too hot.

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Solutions

The solutions to heat also offer many co-benefits within the six technical areas of climate change in school grounds. The solutions below focus on the outdoor space and nature-based solutions, and so we have omitted some solutions focussed on the building or use of technology alone.

For example images to inspire changes in your own school grounds, visit our technical areas page.

	Cost	Benefit
Planting trees: Mature trees can be excellent for seasonal shading large areas of space and buildings. Smaller trees can also help, and of course over time they become mature trees. This can of course be in the ground or in raised planters. Consider seasonal change, allowing more sun and warmth in during winter, but having heavy leaf cover in summer.	£	*****
Planting shrubs and hedges: Both shrubs and hedges can create pools of shade and cover significant areas of space. Well planned, they can also allow access to play and learn, or can be close to buildings to create shade and heat buffers for walls and windows. This can of course be in the ground or in raised planters.	£	*****
Planting flowers, herbs, and long grass: We know that areas of rough, varied planting retain less heat than mown grass and certainly more than asphalt. This can of course be in the ground or in raised planters.	£	***
Amenity grass (mown): While not as good as the longer grass, typical sports field mown grass is still significantly better than asphalt.	£	*
Canopies, sails, and solar shades: These can provide both very targeted shade and be built close or even onto to buildings. They can be very effective around windows and in areas of high use such as outdoor gathering areas.	£££	****
Green roofs: Can benefit the building and in some cases can be added to roof-top play or outdoor classroom areas.	£££££	***

Technical Area: Heat Stress

	Cost	Benefit
Green walls: Can be very effective in shading walls and reducing heat flow into the building, or heat reflected into the outdoor space. It is not cheap or appropriate for every wall.	£££££	*****
Ponds or wetlands: Water has an immense ability to moderate heat. Ponds, damp areas, and wetlands can reduce heat retained significantly. Flowing water is even more effective, both in absorbing heat itself and creating air movement.	££££	***
Building colours and surfaces: As in hotter climes around the world, creating lighter coloured or reflective surfaces can reduce heat getting into the buildings and radiating back out into the outdoor spaces.	££	*
Natural soil and mulch: While not significantly better, bare soil is better than asphalt. In the UK, this soil can become mud in the winter. Therefore, use of mulch and maintenance is required. Woodchips and mulch do offer benefits in cooling surfaces.	£	*
Sand and grit: These safe impact surfaces are ideal for heavy trafficked play areas. When considering overheating and surface temperatures, they are significantly better than rubber safety surfacing.	££	*
Mixed grass and paving: These mixed paving surfaces offer a high resistance to wear and an improvement in heat retention. This can be created through patterned slabs or mixing of slabs and planting areas.	££££	**

More resources and information

How London Schools and Early Years Settings can Adapt for Climate Change

Cooling Schools: Experiences from C40's Cool Cities Programme

Oasis Schoolyards: Recommendations Booklet for Transforming Schoolyards

Living walls (The Royal Society)

Climate Ready School Grounds
Technical Area: Cold Stress

With more energy in the environment, it is forecast that although our winters will generally be warmer and wetter, we are predicted more winter storm or extreme cold events. This is related to jet stream changes over the Atlantic.

Therefore, school grounds need to be more resilient to enable play and learning when there is snow and frost on the ground. When well-planned, green infrastructure can allow for more sunshine in winter while also slowing windspeeds and creating more sheltered areas. Built infrastructure can be invaluable in creating specific areas of shelter and seating.

Why would you prioritise cold stress?

If your school expects regular frost or snow most winters, then this is an area which you should consider. Current challenges include areas of the grounds which do not get sunshine and therefore take longer to melt. Some schools also have paths, access routes, or areas which require significant restrictions in use – for example, some safety surfacing or artificial grass remains icy for longer periods of time.

There is also an issue of cold buildings – and good green infrastructure can assist in insulating buildings from extreme cold. You therefore may also consider this topic if you regularly have a cold inside space.

This technical area is also strongly connected to wind stress. Therefore, schools who are exposed to cold prevailing winds may also consider prioritising cold stress as well.

Solutions

The solutions for cold stress are related to those for wind stress, but there is some nuance in the type and species of planting. The solutions focus on the outdoor space, but there can be benefits to the buildings and retaining heat.

For examples to inspire changes in your own school grounds, visit our technical areas page.

Technical Area: Cold Stress

	Cost	Benefit
Plant trees: Broadleaf trees which shed their leaves can be very useful in allowing winter sunshine through, warming spaces. The decision over which trees to plant is therefore important, as well as their siting as part of a shelter belt.	£	****
Planting shrubs and hedges: Both shrubs and hedges should be considered in a way which creates warmer microclimates, warmed by the sun to the south while reducing the wind. Hedges and shrubs can create 'insulation' for school walls and have the added benefit of keeping driven rain off the walls.	£	**
Planting flowers, herbs, and long grass: Longer planting can provide grip through snow and ice, as well as being more robust under high use such as repeated playtimes.	£	**
Walls and fences: These can offer a more compact solution than planted trees, hedges, and shrubs, and can be built to face south and collect any warmth possible from the sun.	££££	**
Sheltered seating areas: Creating cosy seating and gathering spaces out the cold is an important aim. It can increase the use of outdoor spaces for learning and provide social gathering spaces for pupils and parents. Consider sheltered seating that has a 'wall' as well as a roof.	£££	****

More resources and information

How Schools and Early Years Settings can Adapt for Climate Change (Greater London Authority)

Climate Ready School Grounds
Technical Area: Wind Stress

With more energy stored in our warming environment, it is predicted that we will see an increase in average wind speed and more extreme windstorms.

Using green infrastructure can be immensely beneficial. Natural trees, shrubs, and hedges can flex with the wind, are permeable enough to allow some wind through without causing eddies or funnels of wind, and of course can be chosen to vary (or not) by the season. Built infrastructure also has its place, such as walls and fences.

Why would you prioritise wind stress?

Many schools have very open sites, particularly those built from the 1930s onwards. While offering better views and a lot of amenity grassland for sports, these sites can be very prone to wind.

In outdoor spaces, the constant cold wind of winter can really reduce the appeal of playing and learning outdoors. This constant wind can also wick heat from the buildings in the winter.

You may also consider your site at risk if you have had wind damage to fences, walls, or buildings at ground level recently, or if you have areas of your site that regularly funnel wind that is strong enough to buffet pupils and adults as they walk.

You would choose this technical area if overall you think creating a sheltered microclimate in some or all of your grounds is beneficial.

What type of site do you have?

There is no such thing as a 'typical' school site, particularly when it comes to wind. Some smaller urban sites can have significant issues with storms and funnelling, while rural and open sites further north in the UK can have a much higher average wind speed. It is worth taking time to survey your site, work out the prevailing wind, and understand where the issues are.

On how many days is it too windy?

It can be worth tracking the number of days that wind has prevented breaktime or learning out of doors. The assessment of wind, however, also needs to take account of 'uncomfortable' days due to wind.

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Technical Area: Wind Stress

Solutions

The solutions to wind stress also offer many co-benefits within the six technical areas of climate change in school grounds. The solutions below focus on the outdoor space and nature-based solutions benefitting mainly the outdoor space with, of course, some sheltering of the buildings in extreme wind events.

For example images to inspire changes in your own school grounds, visit our technical areas page.

	Cost	Benefit
Plant trees: Both mature and young trees can interrupt the wind, creating significant areas of shelter behind them. Trees should be planted at a distance of five to six times their mature height from a building and offer some benefit upwind as well as significant benefit downwind. Evergreen trees can work better at reducing windspeeds year-round and all trees should be combined with shrubs, hedges, and plants for maximum benefit as a shelterbelt.	£	*****
Planting shrubs and hedges: Both shrubs and hedges can create permeable barriers. You may plan more permeable barriers around the edge of the school, and significantly less permeable as you get closer to seating, play areas, and the buildings. Shrubs and hedges should be combined with trees and can cover larger areas, with access through and around for pupils. Hedges and shrubs can create 'insulation' for school walls and have the added benefit of keeping driven rain off the walls.	££	*****
Planting flowers, herbs, and long grass: While less effective, longer grasses and plants can add benefit to reducing windspeed. They can, however, offer good lines of sight to assist with pupil supervision and security.	£	**

Technical Area: Wind Stress

	Cost	Benefit
Walls and fences: These can offer a more compact solution than planted trees, hedges, and shrubs. It can be easy to retrofit wind-fabrics to existing fencing, but you may need to check if the fence is sure enough to resist the added forces. Walls or solid fences can create as many issues as they solve, but are appropriate in some situations such as behind seating.	£££	**
Sheltered seating areas: Creating cosy seating and gathering spaces out the wind is an important aim. It can increase the use of outdoor spaces for learning and provide social gathering spaces for pupils and parents. Consider sheltered seating that has a 'wall' as well as a roof.	£££	****
Berms and mounds: Can work well to create spaces out of the wind, as well as a richer play environment.	££	*

More resources and information

Creating Shelterbelts for Gardens (RHS)