Creating a cooler, greener, wilder school environment

What is climate change?

Climate change refers to a long-term change to global or regional climate patterns due to increased levels of greenhouse gases in the atmosphere. It is agreed by 97% of climate scientists that climate change is being induced by human activities, including the burning of fossil fuels.

Clearly define key words phrases (e.g. greenhouse gases, adaptation, mitigation)

- **Greenhouse gases** - Gases that absorb heat in the Earth's atmosphere. There are around 30 greenhouse gases, some are human induced (anthropogenic), and some occur naturally but have increased significantly in atmospheric concentration due to human activities.
  Some of the most significant greenhouse gases include carbon dioxide, methane, and nitrous oxide, as they are chemically stable and persist in the atmosphere over decades or centuries, meaning they have a long-term influence on the climate.
- **Greenhouse effect** - The greenhouse effect is a natural process that occurs where greenhouse gases in the Earth's atmosphere trap some of the Sun's energy. The greenhouse effect makes Earth much warmer than it would be otherwise, keeping Earth a comfortable temperature for us to live.
- **Enhanced greenhouse effect** - The phenomenon by which the natural greenhouse effect is magnified due to human activities which increase greenhouse gas emissions. The greenhouse effect is natural and, the climate has always been changing. However, the rapid increase of carbon dioxide in the atmosphere since the industrial revolution is significantly greater than it has ever been before.
- **Mitigation** - the action of reducing the severity, seriousness, or painfulness of something. Climate change mitigation refers to action that reduces the severity of climate change in the future by reducing greenhouse gas emissions.
- **Adaptation** - An adaptation is a characteristic of an organism that improves its chances of surviving and/or reproducing. Climate change adaptation refers to actions that help us to prepare for or respond to the impacts of climate change.

Impacts of climate change

- **Increasing average temperature** - The planet's average surface temperature has risen about 0.9°C since the late 19th century (NASA).
- **Warming oceans** - Sea-surface temperatures in the Australian region have warmed by 0.9°C since 1900. This has also contributed to significant coral bleaching events on the Great Barrier Reef in 1998, 2002, 2006, 2016, 2017 and 2020 (AIMS).
- **Shrinking ice sheets** - The Greenland and Antarctic ice sheets have decreased in mass. Greenland lost an average of 286 billion tons of ice per year between 1993 and 2016, while Antarctica lost about 127 billion tons of ice per year during the same period. The rate of Antarctica ice mass loss has tripled in the last decade (NASA).
- **Shrinking glaciers** - Glaciers all around the world are shrinking. https://climate.nasa.gov/climate_resources/4/graphic-dramatic-glacier-melt/
- **Sea level rise** - Global mean sea level increased throughout the 20th century and in 2012 was 225 mm higher than in 1880 (climate change in Australia).
- **Decreased snow cover** - Snow depths at four alpine sites in Australia declined from the 1950s to 2001. Maximum snow depth is decreasing and the snow season ending earlier.
- **Arctic Ocean ice decreasing** - The annual mean ice extent in the Arctic decreased over the period 1979 to 2012 with a rate that was very likely in the range 3.5 to 4.1% per decade.

Additional resources about climate change:

- **Climate Change Basic Guide** – A very useful go-to guide which includes definitions of key concepts, metaphors, impacts in our region, effective communication and framing strategies. (www.naturalresources.sa.gov.au/files/sharedassets/adelaide_and_mt_lofty_ranges/corporate/climate-change-guide-april-2019.pdf)
- **Climate Change - What you can do** – Australian Psychological Society. (www.psychology.org.au/for-the-public/Psychology-Topics/Climate-change-psychology)
- **Climate Action Tracker** - Tracks countries' climate change mitigation commitments. (https://climateactiontracker.org/)
- **Heat mapping resource** - http://spatialwebapps.environment.sa.gov.au/urbanheat/?viewer=urbanheat

Activities and actions for students:

The actions and activities around climate change can generally be broken into two categories, Adaptation and Mitigation. Adaptation actions help us to prepare for or respond to climate change impacts. Mitigation actions reduce the amount of greenhouse gases.

Adaptation activities you can do at school:

Climate

Have a look at the heat mapping for your school. Have students identify the hotter and cooler areas of the school grounds.

Use some infrared thermometers to measure the temperature of surfaces around the school ground to find which are hotter and cooler.

Have the students brainstorm actions they or the school could take to adapt to a hotter climate in the future. For example:

1. Heat tolerant, native plants are used for the new gardens.
2. Install extra shade structures in the school yard.
3. Plan to ensure the school gardens are watered more thoroughly before and during heatwaves.
4. Install heat-resilient grass on the school oval.
5. Change the school uniform to cooler materials.
6. Adjust the school day to cooler hours (for example, start earlier in the morning).

Water

Climate change predicts that South Australia is going to become drier. Have the students brainstorm how they and the school can adapt to be more efficient with water use. For example:

1. Research how much water we use in our everyday lives. How can the choices we make influence how much water we use?
2. Heat tolerant, native plants are used for the new gardens.
3. Install water efficient taps and irrigation.

Wildlife

Climate change is going to make the environment harsher for our native wildlife too. Hotter climate, with more heatwaves and less rainfall will create challenges for our wildlife.

Have students think about how they could adapt to make their school environment an oasis for local native wildlife. For example:

1. Plant more native plants for animals to use as food and shelter.
2. Create a wildlife friendly garden with cool places for animals to rest, hide and feed (for example a frog pond).
3. Have watering stations for native animals to find water on hot days.

4. Install nesting boxes to create safe shelter for native wildlife.

Mitigation activities for school:

Energy

Using less energy or harnessing the energy from nature creates less greenhouse gases. Have the students look at how much energy they use and then think about activities they could do at school and home to use less energy. For example:

1. Turn off lights and power points when not in use.
2. Install solar panels on the school.
3. Install energy efficient lightbulbs and appliances.
4. Walk or cycle to school instead of driving. Carpool or take public transport.

Waste

Waste in landfill creates methane which is a potent greenhouse gas. Putting waste into the correct bins can divert waste from landfill and also reduce the energy created in making all-new materials. Have the students measure how much waste they are creating every day and then brainstorm ways they could reduce the waste the school creates. For example:

1. Teach the students about recycling correctly.
2. Learn about how much energy is saved when recycling common items.
3. Start a compost system to divert food waste from landfill.
4. Challenge the school to bring less packaging waste in their lunches.

Water and climate change

What is climate change?

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What is the greenhouse effect?

A group of gasses known as 'greenhouse gases' naturally traps some of the sun's energy within the Earth's atmosphere, while allowing some of it to be reflected back into space. This phenomenon, known as the 'greenhouse effect', helps maintain the earth's temperature at a balanced state suitable for life as we know it.

The **enhanced greenhouse effect** occurs when human activities (such as deforestation and the burning of fossil fuels) add large amounts of GHGs to the atmosphere, upsetting this natural balance and causing the earth to gradually heat. This gradual heating and its many resulting climatic impacts (such as sea level rise, increasing occurrence of heatwaves and reduced rainfall) are widely known as 'climate change'.

The enhanced greenhouse effect is a bit like a doona keeping the Earth warm, where the GHGs act as the doona's stuffing. With intensive GHG emitting activities, more stuffing is added to the doona making it thicker and better at trapping heat, causing the Earth to overheat.

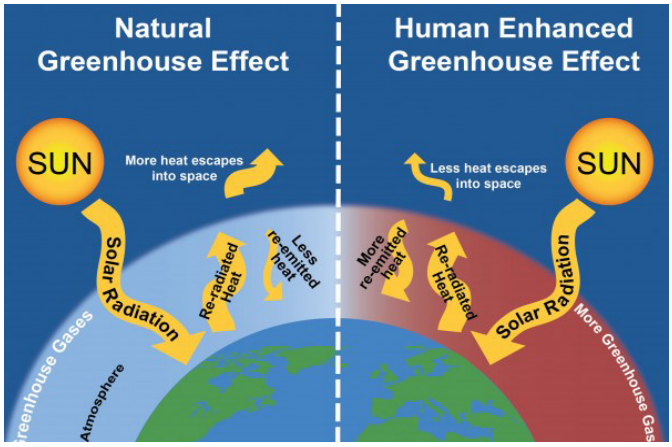

Figure 1: An illustration of the enhanced greenhouse effect
University of Michigan, Climate change: css.umich.edu

Climate change responses

Society's two main responses to climate change are mitigation and adaptation, with some activities having aspects of both. Climate change mitigation includes actions that reduce emissions in a wide range of industrial, agricultural and personal activities, such as car-pooling to work. Mitigation also includes the active removal of carbon dioxide from the atmosphere into carbon sinks, such as saltwater aquifers, where injected CO_2 reacts with the saltwater to create solids which can no longer be released to the atmosphere.

The second response type, climate change adaptation, involves activities to prepare for and reduce the severity of key climate-related risks at a local level, such as building a raised house on stilts in areas prone to coastal inundation.

Australia is one of the largest per capita emitting countries[1], and hence has a moral obligation to "do its share" and implement significant mitigation measures.

In 2014, Australia contributed 1.4% of total global anthropogenic GHG emissions, with South Australia accounting for 5.6% of Australia's emissions[3]. As Australia is a relatively small contributor to overall global GHG emissions, no amount of national mitigation measures will prevent Australia from experiencing climate change impacts well into the future, hence the need for strong adaptation measures.

How does water relate to climate change?

South Australia is the driest state on the driest inhabited continent on Earth[2], and climate change is increasing the frequency and intensity of droughts and heatwaves, as well as impacting the amount, distribution and timing of rainfall. These changes can increase human and environmental demand for water, as well as impact productivity and human health.

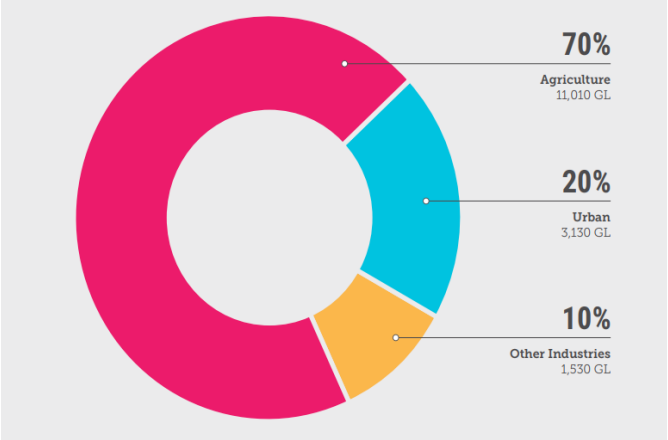

Figure 2: Bulk water abstractions in Australia 2016-17
BoM, Water in australia 2016-17: bom.gov.au

Sustainable solutions

Efficient water use

In the financial year 2004-05, the volume of distributed water supplied in South Australia decreased 11% from the 517GL supplied in the financial year 2000-01[4]. This reduction, largely attributable to the state's water restrictions, demonstrates the capacity of households to significantly reduce their water consumption when required to do so, thereby lowering GHG emissions from treatment and transportation of water, as well as decreasing water and energy bills.

Alternative water sources

South Australia's water supply comprises surface water, ground water and desalinated sea water, with one third supplied by the Murray Darling Basin[5]. Diversifying our water sources enables us to make better use of all the available water, saves high quality water for when it is needed, and helps secure our water supply system against climate change-related drying.

Some alternative water sources include:

- Recycled water from wastewater treatment plants for non-drinking purposes such as agriculture, public space and garden irrigation, toilet flushing and laundry.
- Stormwater harvesting schemes which collect and treat water from drains through mechanical water treatment plants or through natural systems such as wetlands.
- Desalination which removes salt and other minerals from sea water to make it suitable for human consumption and/or industrial use. This process is energy intensive and therefore emits large amounts of GHGs.

Water storage

As climate change is impacting rainfall and water availability, capturing and storing water close to its source can reduce our use of, and reliance on, mains water supply.

Installing a rainwater tank in your home or school allows capture and storage of rainwater runoff, typically from rooftops via pipes, which can be used for laundry, watering gardens, flushing toilets and washing cars. Additionally, rainwater use can reduce water bills, provide an alternative supply during water restrictions and help decrease stormwater runoff and associated flooding risks.

Managed aquifer recharge (MAR) is the intentional storage of water in underground aquifers for later use. When needed, the water stored in aquifers can be extracted and used for irrigation or industrial purposes[6].

Since 1989, 58 MAR schemes have been constructed in the Adelaide Metropolitan Area, totalling over 10,000 ML in annual estimated harvest capacity[7].

Did you know?

A 2005 study found that the average Australian uses 341,000L of water per year – equivalent to around 8 backyard swimming pools[8].

What can we do?

There are many ways to increase water efficiency in homes and schools including:

- fixing dripping taps and leaky toilets – a leaking tap can waste up to 20,000 L of water a year
- installing water efficient showers, taps, toilets and appliances
- installing cold water diverters to recycle cold water (while waiting for hot water to arrive via hot water pipes) which would otherwise go down the drain
- utilising household greywater (from showers, washing machines and dishwashers) for garden irrigation, toilet flushing and laundry use
- planting indigenous or low-water use grasses and plants
- increasing permeable paving in outdoor areas to maximise rainfall infiltration into plants' root zones and decrease irrigation requirements.

Linking to Education activities

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www.environment.sa.gov.au/topics/green-adelaide/for-educators

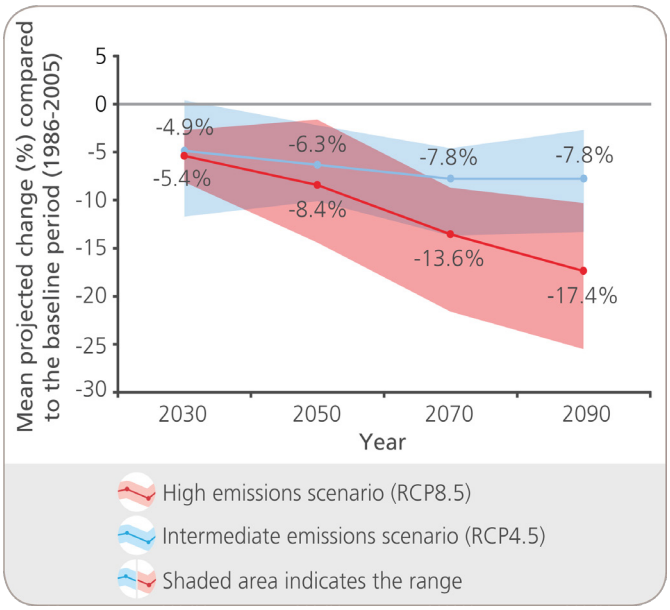

Figure 3: Projected percent change in the greater Adelaide area's average seasonal rainfall from 2030 to 2090
Goyder Institute, SA Climate Ready Report: goyderinstitute.org

Other important concepts:

Virtual/embedded water – the total volume of water used in the production of a consumer product, including during processing, packaging and transporting.

Rainfall variability –the degree to which rainfall varies across an area or over time, an important characteristic of climate.

Water sensitive urban design – engineering and planning features, such as raingardens, swales and green roofs, which improve stormwater quality, decrease runoff and improve urban amenity using rain water.

Did you know?

The drying across southern Australia in 2016 was the strongest recorded large scale rainfall change since 1900[9]. Typically, a 1% reduction in rainfall leads to approximately a 2-3.5% reduction in streamflow, which across the Murray Darling Basin has declined by 41% since the mid-1990s[10].

References:

[1]United Nations Framework Convention on Climate Change

[2]Government of South Australia

[3]The Climate Institute 2014

[4]Australian Bureau of Statistics

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[6]Government of South Australia

[7]DEWNR Technical Report

[8]Water footprints of nations

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[10]Climate Council Water Security report

Waste and climate change

What is climate change?

The term 'climate change' refers to the long-term changes in global or regional climate patterns due to increased atmospheric greenhouse gas (GHG) levels; a phenomenon also occasionally referred to as 'global warming'.

What is the greenhouse effect?

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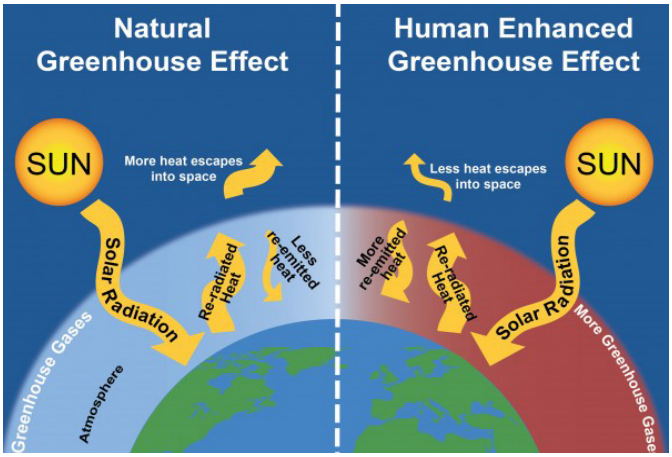

Figure 1: An illustration of the enhanced greenhouse effect
University of Michigan, Climate change: css.umich.edu

Climate change responses

Society's two main responses to climate change are mitigation and adaptation, with some activities having aspects of both.

Climate change **mitigation** includes actions that reduce emissions in a wide range of industrial, agricultural and personal activities; such as car-pooling to work. Mitigation also includes the active removal of carbon dioxide (CO_2) from the atmosphere into carbon sinks, such as saltwater aquifers, where injected CO_2 reacts with the saltwater to create solids which can no longer be released to the atmosphere.

The second response type, climate change **adaptation**, involves activities to prepare for and reduce the severity of key climate-related risks at a local level, such as building a raised house on stilts in areas prone to coastal inundation.

How does waste relate to climate change?

Waste transport and treatment activities emit large amounts of CO_2, while the decomposition of organic waste in anaerobic conditions (in landfill) releases the potent GHG, methane. Waste related emissions are responsible for 2% of Australia's GHG emissions, contributing the equivalent of 12.6 million tonnes of CO_2 (CO_2-e) in 2017[1]. While recycling prevents raw material extraction and transport-related GHG emissions, reducing unnecessary consumption and preventing waste generation at the source are the most effective waste reduction strategies.

Australia is one of the largest per capita emitting countries[2], and therefore has a moral obligation to "do its share" and implement significant mitigation measures.

In 2014, Australia contributed 1.4% of total global anthropogenic GHG emissions, with South Australia accounting for 5.6% of Australia's emissions[3]. As Australia is a relatively small contributor to overall global GHG emissions, no amount of national mitigation measures will prevent Australia from experiencing climate change impacts well into the future, hence the need for strong adaptation measures.

Sustainable solutions

Methane capture is an important GHG reduction strategy, given it is a gas 21 times more potent than CO_2. In fact, between 1990 and 2017, national waste emissions declined by 37%, mostly due to higher rates of methane capture during solid waste disposal[1].

Recycling and 'urban mining' (reclaiming raw materials from existing resources) reduce GHG emissions by decreasing the need for energy-intensive industrial processing of virgin materials.

South Australia is a leader in construction and demolition recycling, as well as in composting household and commercial food waste, with one of the highest recycling rates in Australia.[4] The state's estimated GHG savings from recycling in 2016-17 were around 1.25 million tonnes of CO_2-e (39% from metals, 34% from organics, 13% from masonry and 7% from cardboard and paper products). These savings are equivalent to the amount of CO_2 absorbed by 1.9 million trees, or the GHGs produced by 288,500 cars in a single year[4].

Did you know?

In 2009, South Australia was the first state to ban single use plastic bags, and following overwhelming public support for a 2019 Government discussion paper, legislation is being drafted to begin the banning of some other single-use plastic items.

Figure 2: The buyerarchy of needs
Adapated from Long Live Irony, Sarah Lazarovic: longliveirony.com/

What can we do?

Rethink consumption and disposal practices

Conduct bin audits at home/work/school to assess and improve bin use.

Embrace Nude or Waste Less food: wow.sa.gov.au/nude-food.html

Apply the 'buyerarchy of needs' to purchasing choices or acquisitions.

Purchase second-hand items where possible, or buy durable long-lasting products.

Reduce consumption of unnecessary or short life span items

Have a classroom/office/neighbourhood challenge to see how long it takes to fill a landfill bin (the current South Australian record is two years)[5].

Avoid unnecessary products and those with short life spans or excess packaging.

Repair items that can still be functional before purchasing new products.

Reuse items as much as possible

Hold a Clothes Swap event to swap rarely-used items and help reduce more than 500,000 tonnes of clothing sent to landfill in Australia each year[6].

Use up fridge and pantry items with recipe finders: foodwise.com.au/recipe-room/our-recipe-finder/

Take your own reusable utensils, cups and bags.

Support companies with a reuse policy in their supply chain.

Recycle and compost products

Use council kerbside collection for organic materials, including all food scraps.

Locate and use local free drop-off sites to recycle florescent lighting, electrical products and other items banned from household waste disposal: whichbin.sa.gov.au/

Collect and return 10 cent drink containers.

Recycle soft plastics at REDcycle: redcycle.net.au

Purchase recycled-content products for school/home/work to ensure there is an end market for recycled products. For example, stationery, outdoor furniture, decking, concrete, gravel and bricks.

Other important concepts:

Circular economy – An economic system that minimises waste and maximises the use and value of materials, in contrast to the traditional linear economy's 'take, make, dispose' production model[7].

Life-cycle assessment/analysis – A technique to assess the environmental impacts associated with all stages of a product's life; from raw material extraction to processing, manufacturing, distribution, use, reuse and disposal.

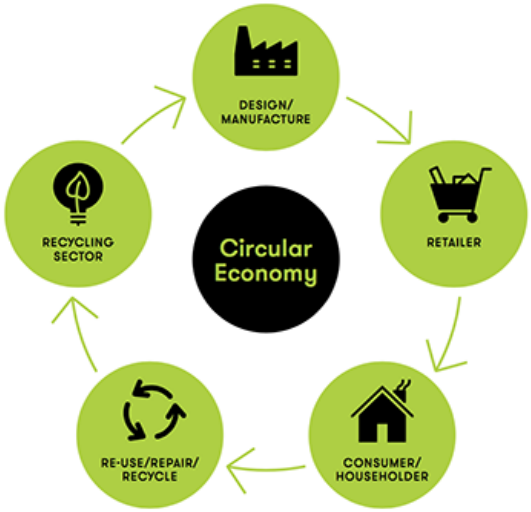

Figure 3: Diagram illustrating the circular economy process
Green Industries, What is circualr economy? greenindustries.sa.gov.au/circular-economy

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www.environment.sa.gov.au/topics/green-adelaide/for-educators

Did you know?

South Australia's Container Deposit Scheme was introduced in 1977. In 2017-18 over 612 million containers (41,372 tonnes) were recycled, returning over $60 million to the community[8].

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[1] Climate Council
[2] United Nations Framework Convention on Climate Change
[3] The Climate Institute 2014
[4] Green Industries
[5] Kids News
[6] ABC News
[7] Ellen MacArthur Foundation
[8] EPA South Australia

Transport and climate change

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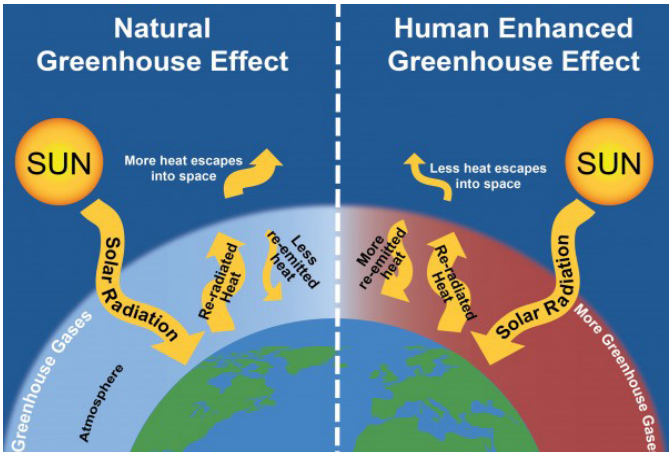

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The second response type, climate change **adaptation**, involves activities to prepare for and reduce the severity of key climate-related risks at a local level, such as building a raised house on stilts in areas prone to coastal inundation.

How does transport relate to climate change?

The transport sector, consisting of road, rail, aviation and shipping, is the third largest source of Australia's GHG emissions, contributing 18% of total emissions in 2015. Nearly 50% higher than the OECD average, Australia's transport emissions are the ninth highest in the world, with almost half of all emissions attributable to cars[1].

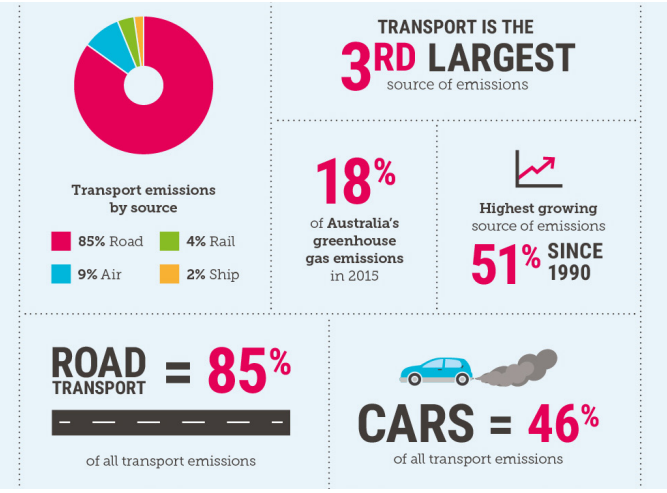

Figure 2: Australia's transport emissions
Adapated from Climate Council, What's the deal with transport emissions?: climatecouncil.org.au

Australia is one of the largest per capita emitting countries[2], and therefore has a moral obligation to "do its share" and implement significant mitigation measures.

In 2014, Australia contributed 1.4% of total global anthropogenic GHG emissions, with South Australia accounting for 5.6% of Australia's emissions[3]. As Australia is a relatively small contributor to overall global GHG emissions, no amount of national mitigation measures will prevent Australia from experiencing climate change impacts well into the future, hence the need for strong adaptation measures.

Sustainable solutions

Encouraging active transport

Active modes of transport (such as cycling and walking) increase daily physical activity levels and lower GHG emissions by avoiding car use. Additionally, those transport modes have low or no financial costs, promote a greater sense of community and create safer neighbourhoods by reducing traffic congestion and air pollution. Despite those benefits, typically only half of Australia's children and young people use active modes of transport at least once per week to travel to and/or from school[4].

Australian governments can encourage active transport uptake by increasing road safety awareness, and by investing in appropriate infrastructure, such as bicycle storing facilities and highly interconnected cycling and walking paths.

Increasing public transport use

Australian public transport use is comparatively low (accounting for approximately 12% of trips), with the country's public transport investment roughly half of its road construction and management expenditure[5].

Travel on all forms of public transport involves fewer GHG emissions per person per kilometre than the average Australian car, and additional benefits include lower costs for individuals (with annual savings of up to $9,400)[2]. Australian governments can encourage higher public transport use by facilitating and promoting access to reliable, comfortable, affordable and safe public transport.

Electrifying transport with renewable energy

Electric vehicle uptake has increased in Australia in recent years, with 2,284 electric vehicles sold in 2016, a 67% increase from the previous year[6]. Despite higher upfront costs, once purchased, electric cars have considerably lower operating and maintenance costs.

Through the use of renewable energy as their charging source, electric vehicle use can deliver large GHG emission reductions, as 100% renewables powered vehicles are considered to emit no GHGs. Governments in Australia could support these reductions by transitioning to a renewables-dominated electricity grid, and by further investing in charging infrastructure.

Adopting mandatory vehicle GHG emissions standards

While mandatory GHG emissions standards for cars now cover over 80% of the global market, Australia is among a small minority of countries lacking a policy to incentivise lower emissions vehicles.

Consumer choice plays a significant role in reducing GHG emissions, and Australians tend to choose larger, less efficient cars. If all Australians who purchased new cars in 2015 had chosen vehicles with lowest-in-class emissions, the average emissions intensity of vehicles sold in that year would have been 55% lower than it was in reality[7].

Did you know?

A return flight from Australia to Europe will emit over 5,000 kg of GHGs[8] - equivalent to an average Australian household's total GHG emissions for 3 months.

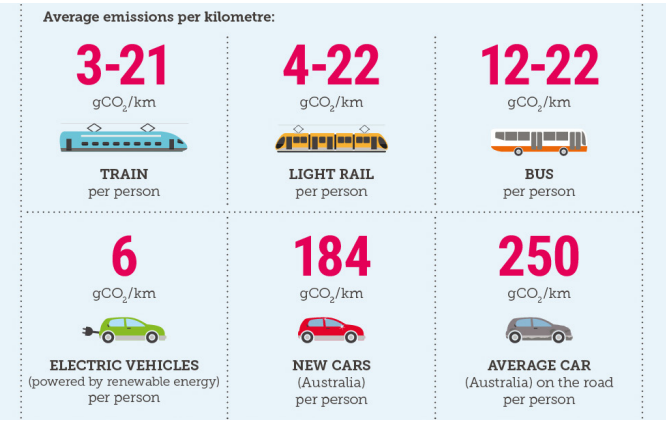

Figure 3: Average emissions by mode of transport
Adapated from Climate Council, What's the deal with transport emissions?: climatecouncil.org.au

Did you know?

Australia's transport emissions have the highest growth rate, having increased 51% between 1990 and 2016[9], with 1990 levels projected to double by 2035.

Other important concepts:

Urban form - the physical characteristics such as shape, size and density, which define built-up areas and which play a crucial role in commuters' transport choices and associated GHG emissions. Australia's high per capita transport emissions are strongly linked to the long commuting distances of our sprawling capital cities.

Walkable neighbourhoods – areas that are conducive to walking, for example those with good-quality footpaths, schools and workplaces located near affordable housing and access to regular public transport.

What can we do?

- Walk, cycle or use public transport as an alternative to driving whenever possible
- If purchasing a new car, investigate and select a low GHG emitting vehicle: greenvehicleguide.gov.au
- Maximise car travel efficiency by car-pooling with others, or consider other options for sharing transport with those going to the same destination, such as Share Your Ride
- Choose local holidays to reduce car and air transport emissions
- If travelling by air, investigate options to offset your emissions
- Survey your school community to identify its current travel patterns to and from school, and encourage more sustainable commuting options.

Did you know?

Adelaide City Council's electric solar bus is the first in the world to be recharged using 100% solar energy[10].

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The enhanced greenhouse effect is a bit like a doona keeping the Earth warm, with the GHGs acting as the doona's stuffing. With intensive GHG emitting activities, more stuffing is added to the doona; making it thicker and better at trapping heat, causing the Earth to overheat.

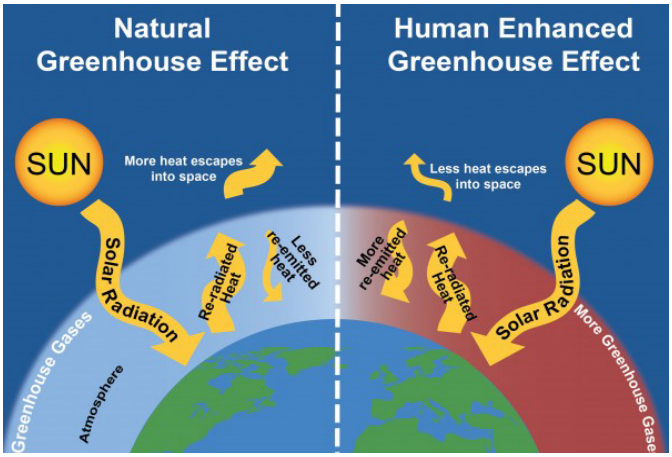

Figure 1: An illustration of the enhanced greenhouse effect
University of Michigan, Climate change: css.umich.edu

Climate change responses

Society's two main responses to climate change are mitigation and adaptation, with some activities having aspects of both.

Climate change **mitigation** includes actions that reduce emissions in a wide range of industrial, agricultural and personal activities; such as car-pooling to work. Mitigation also includes the active removal of carbon dioxide (CO_2) from the atmosphere into carbon sinks, such as saltwater aquifers, where injected CO_2 reacts with the saltwater to create solids which can no longer be released to the atmosphere.

The second response type, climate change **adaptation**, involves activities to prepare for and reduce the severity of key climate-related risks at a local level, such as building a raised house on stilts in areas prone to coastal inundation.

How does food relate to climate change?

Long distance food transportation emits CO_2, while red meat production results in large methane emissions, as does the anaerobic decomposition of food scraps in landfill conditions. Additionally, shifting weather patterns caused by climate change can significantly affect food production viability in certain areas, as well as the cost and availability of some food items.

Australia is one of the largest per capita emitting countries[1], and therefore has a moral obligation to "do its share" and implement significant mitigation measures.

In 2014, Australia contributed 1.4% of total global anthropogenic GHG emissions, with South Australia accounting for 5.6% of Australia's emissions[2]. As Australia is a relatively small contributor to overall global GHG emissions, no amount of national mitigation measures will prevent Australia from experiencing climate change impacts well into the future, hence the need for strong adaptation measures.

Sustainable solutions

Buy local, seasonal produce

In 2008 an average Victorian shopping basket of 29 common food items was found to have travelled a combined total of over 70,000 kilometres – nearly twice the Earth's circumference[3]. While agricultural practices differ greatly in environmental impact, locally produced food items tend to have lower associated GHG emissions.

Similarly, while 'out-of-season' produce is often available for purchase at any time of year, seasonal alternatives tend to travel much shorter distances (so are said to have lower 'food miles') and generally have much lower associated GHG emissions than imported food. They also tend to be much fresher and tastier.

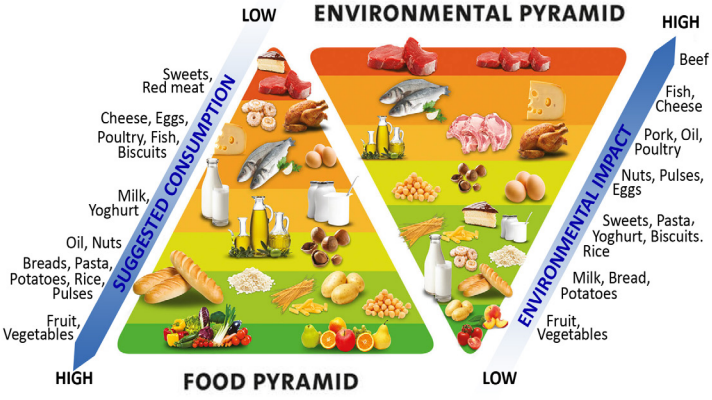

Figure 2: Nutritionally recommended foods and their environmental impacts (as measured by associated GHG emissions as well as water and land use).
Adapted from Barilla Center for Foood and Nutrition, Double pyramid: barillacfn.com

Reduce consumption of animal products

In Australia average annual meat consumption is around 92 kg per person, triple the amount recommended by the Australian Health Guidelines. Meat production at this scale has significant environmental impacts, most importantly methane emissions from livestock's natural digestive processes. A 2015 study concluded that a twice weekly meat eating diet is 45% less GHG intensive than a daily meat eating diet[4].

While red meat production is GHG intensive, pig and poultry are the most 'climate-friendly' meats, contributing much larger amounts of meat globally, while respectively accounting for only 9% and 10% of total livestock emissions[5]

Did you know?

Due to higher temperatures and lower rainfall, up to 70% of Australia's wine-growing regions with a Mediterranean climate (such as the Barossa and the South Australian Riverland) are projected to be less suitable for grape growing by 2050[6].

Agricultural adaptation strategies

The following are examples of climate change adaptation strategies already widely used by farmers in the greater Adelaide region to address higher temperatures, reduced growing season rainfall and other climatic challenges[7]:

- improving shade provision (trees/structures for animals, nets for vines and fruit trees)
- selecting more drought tolerant varieties and rootstocks
- using weather forecasts to trigger pre-heatwave irrigation
- monitoring soil moisture to optimise irrigation timing
- reducing dam water loss through the use of liners and covers.

What can we do?

Eat local produce

Calculate the food miles of your imported food: foodmiles.com
Purchase local produce or grow your own.

Eat less animal products

Reduce your weekly meat and dairy intake and/or choose climate-friendlier meats.

Reduce food waste

Install a compost bin at your school or home to divert food waste from landfill.
Encourage local businesses to donate left-over food items: foodwise.com.au/food-donation-tool-kit

Other important concepts:

Food security: The physical and economic access to a sufficient quantity of affordable and nutritious food at all times.
Goyder line: An east-west line running from Ceduna across the Spencer Gulf, north to Orroroo and across to Pinnaroo by the Victorian border, indicating the northern boundary of South Australia's viable agricultural land. A drying, warming trend would most likely shift the Goyder line further south, endangering the viability of nearby agricultural enterprises.

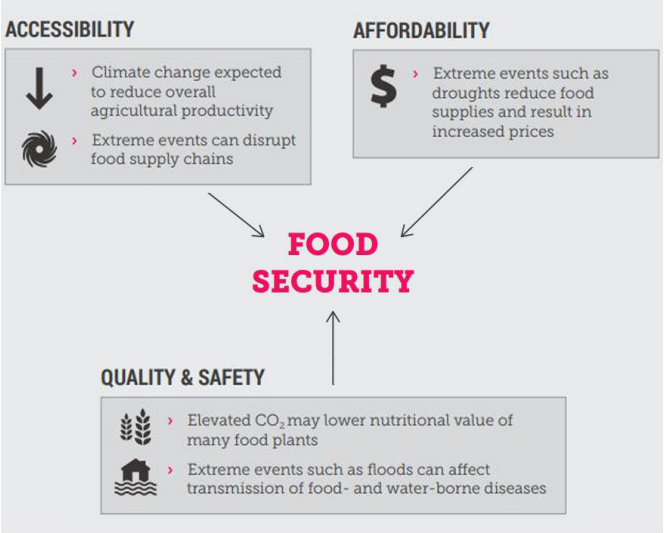

Figure 3: Food security
Climate Council, Feeding a hungry nation: climate change, food and farming in Australia: climatecouncil.org.au

Did you know?

In 2006, Cyclone Larry destroyed 90% of North Queensland's $300 million banana crop, leaving up to 4000 people out of work[8] and causing banana prices to soar from $2-3 a kilogram to $15 a kilogram[9].

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www.environment.sa.gov.au/topics/green-adelaide/for-educators

Did you know?

Converting organic matter into compost is an important practice for reducing household emissions. In 2011 Australians' food waste generated methane equivalent to 6.8 million tonnes of CO_2 emissions[10], more than South Australia's combined transport and waste emissions for the financial year 2015-16[11].

References:

[1] UN Framework Convention on Climate Change
[2] The Climate Institute
[3] CERES
[4] Sustainable Table
[5] UN Food and Agricultural Organisation
[6] Climate Council
[7] AMLR NRM Board
[8] Sydney Morning Herald
[9] NewsComAu
[10] Energy360
[11] Government of South Australia

Energy and climate change

What is climate change?

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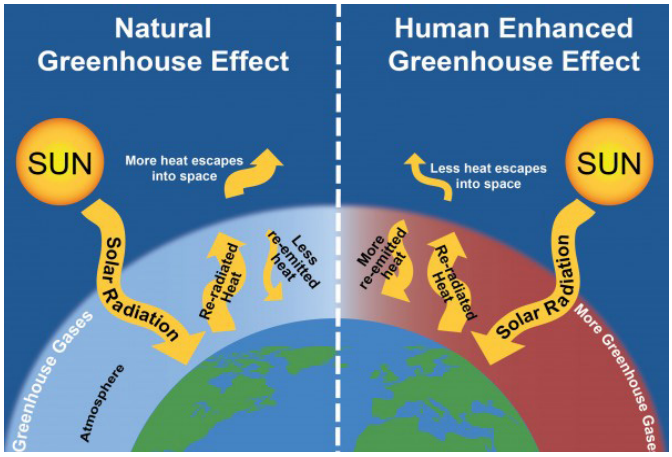

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The second response type, climate change **adaptation**, involves activities to prepare for and reduce the severity of key climate-related risks at a local level, such as building a raised house on stilts in areas prone to coastal inundation.

How does energy use relate to climate change?

Around 85% of Australia's energy comes from non-renewable sources (coal, oil and gas), which emit large amounts of GHGs contributing to climate change[1]. Energy production and use (comprising mostly fuel combustion and electricity) is the largest source of national GHG emissions, accounting for around 75% of net emissions[2].

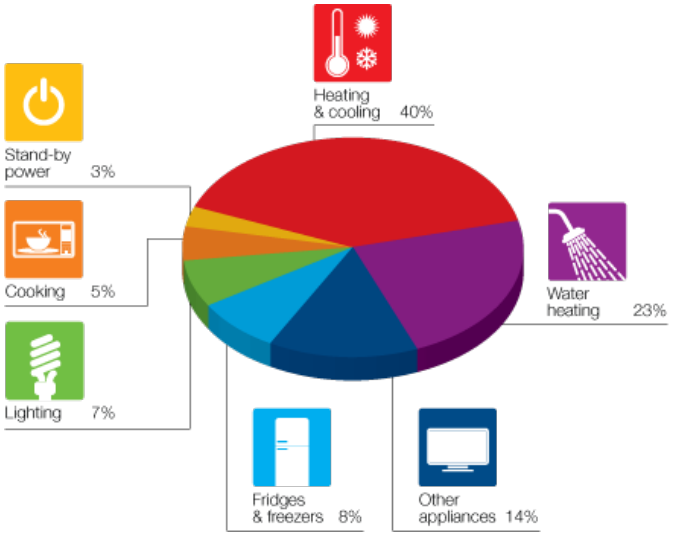

Figure 2: Average energy use in an Australian home
Government of South Australia, Home energy use: sa.gov.au

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Sustainable solutions

Reducing energy consumption

As the majority of Australia's energy is currently obtained from non-renewable sources, reducing energy consumption will decrease the amount of GHGs being emitted. 'Energy efficiency' involves using less energy to provide the same service, for example installing LED lighting which uses around 85% less energy than halogen globes, or upgrading insulation to reduce the amount of electricity used to heat or cool your home. As lighting and heating/cooling represent 8-15% and 40%[5] of the average household energy use respectively, such energy efficiency measures can significantly lower the associated GHG emissions.

Renewable energy sources

In contrast to fossil fuels, energy sources such as sunlight (solar), geothermal heat, water (hydro) and wind are renewable and therefore sustainable. Renewable energy comprises around 15% of Australia's electricity supply, including both large generators and small systems owned by families and businesses[3]. Rapid technology improvements in the renewable energy sector, government-funded clean energy incentive programs and climate change awareness are accelerating the implementation of renewable energy.
In 2016-17, South Australia generated 48.9% of its electricity from renewable sources[6]. At the rate of new solar and wind power being installed nationally in 2018 and 2019, Australia could reach 50% renewable energy in 2025[7].

Other important concepts:

Energy storage – involves technology to capture and store the energy produced so that it can be used at a later time.

Passive design – The use of techniques such as northerly building orientation, shading, sealing and double glazing to take advantage of natural sources of heating (e.g. the sun) and cooling (e.g. breezes) and minimise the need for artificial heating and cooling use, and hence the associated costs and GHG emissions.

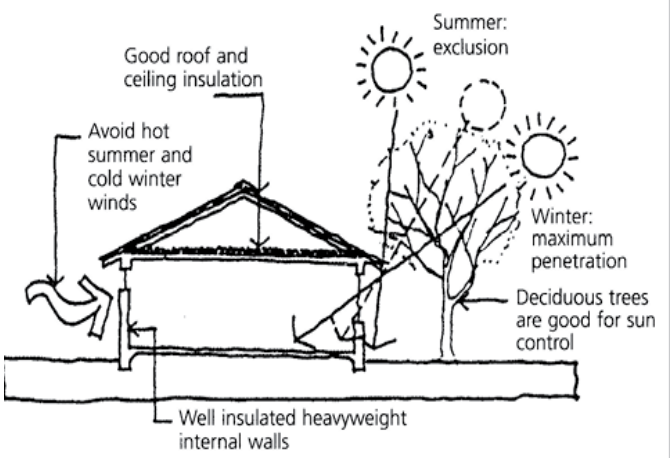

Figure 3: An illustration of pasive design principles
YourHome, Passive design: yourhome.gov.au

Did you know?

South Australia has the second highest proportion of solar PV households at 32.3%. Queensland is highest at 32.9%[8].

What can we do?

Use renewable energy sources

Generate renewable energy by installing solar panels at your home or school.

Switch to an environmentally ethical energy provider – investigate local providers here: greenelectricityguide.org.au

Reduce energy consumption

Install energy efficient LED lighting.

Investigate and select energy efficient appliances: energyrating.gov.au

Adjust your thermostat for winter and summer – every degree you raise your thermostat by in summer, and lower it in winter, will decrease your GHG emissions, and can save up to 10% of your heating and cooling costs.[9]

Insulate and draught-proof your home to reduce winter heating costs by up to 70%.[5]

Implement passive design strategies, such as installing external shading on buildings or planting deciduous trees to shade windows in summer but let winter light in.

Borrow a Home Energy Toolkit to assess how energy is used in your home and identify energy and cost saving actions.[10]

Use 'Smart' energy saving power boards which automatically switch appliances off to reduce the amount of energy use in standby mode.

Did you know?

In 2017 the world's largest lithium battery was installed in South Australia. It is recharged using renewable energy from a nearby windfarm and has an energy storage capacity of 129MWh[11], is enough electricity to power 8,000 homes for a full day[11].

Linking to Education activities

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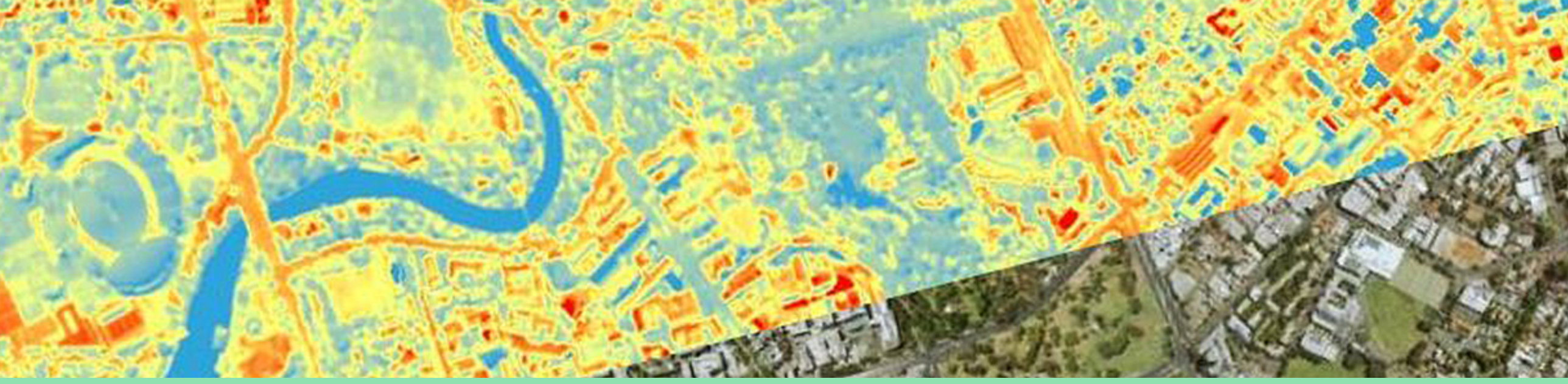
www.environment.sa.gov.au/topics/green-adelaide/for-educators

Did you know?

South Australian emissions per capita fell by around 30% between 1990 and 2016 and remain substantially lower than the national average[12].

References:

[1]Department of Environment and Energy
[2]State of the Environment Report 2016
[3] United Nations Framework Convention on Climate Change
[4]The Climate Institute 2014
[3]Department of Environment and Energy
[5]Australian Government
[6]AEMO
[7]The Conversation 2018
[8]Climate Council
[9]Energy Smart SA 2018
[10]Home energy toolkit
[11]Clean Energy Australia Report 2018
[12]State of the Environment Report 2018



RESILIENT EAST

Climate Ready Eastern Adelaide

COOLING OFF

Temperatures above 35°C are uncomfortable for our thermal regulation. The more days we experience this heat, the greater risk it has on our health.

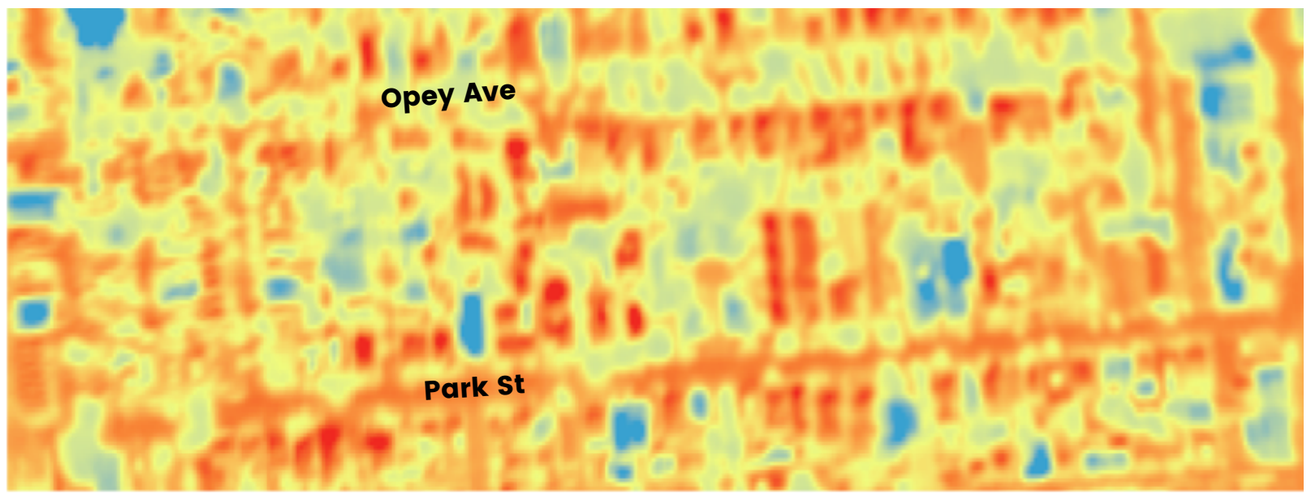
Typically, artificial surfaces (such as roads, footpaths and buildings) store heat and prevent water infiltration. On the other hand, surfaces with grass, gardens beds or trees assist in cooling by absorbing and releasing water (transpiration) or by shading surrounding surfaces.

As heatwaves become hotter and more frequent, urban density increases, backyards become smaller and less space is available for trees, it becomes vital that we act now to keep our cities cool.

By identifying hotspots we can prioritise on ground action to cool areas so our homes and communities continue to be healthy and resilient. We can also check to see if hotspots are located near our most vulnerable members of the community, or around heavily used public spaces.

URBAN HEAT MAPPING

As our climate becomes hotter and drier, it is important to understand high-risk areas and identify opportunities to better plan for the future. Urban Heat Mapping is a tool that can help us do this by highlighting where heat builds and why. The tool shows a snapshot of surface temperatures in hot weather so we can compare different land uses, designs, materials and colours. For example, imagine how a dense community of houses would compare with one that is more spacious. How about a bitumen road compared with irrigated grass? Or, a house with a white roof compared to one with a grey roof? Which surfaces do you think would be hotter or cooler?



An aerial map (bottom) and a heat map (top) of Opey Aveneue and Park Street, Hyde Park. Compare the two. Which surfaces are cool (blue) and which are hotter (red). Can you guess why?

ABOUT THE DATA

Heat maps of the Resilient East region were captured on 23 March 2018. On this day, the temperature was above average for summer, with a maximum of 33.8°C and a minimum of 21.3°C. An aeroplane was used to capture thermal infrared imagery during a series of flyovers. The maps show daytime and nighttime data with a colour scale from blue (coolest) to red (hottest).

WORKING TOGETHER

This tool was developed in partnership with the Department for Environment and Water, Resilient South, Adapt West and Adapting Northern Adelaide.

Zoom in to your backyard to see how cool your home is!

resilienteast.com

CITY OF ADELAIDE · City of Burnside · CAMPBELLTOWN CITY COUNCIL · City of Norwood Payneham & St Peters · CITY OF PROSPECT · CITY OF TEA TREE GULLY Naturally Better · THE CITY of Unley · TOWN OF WALKERVILLE · Government of South Australia

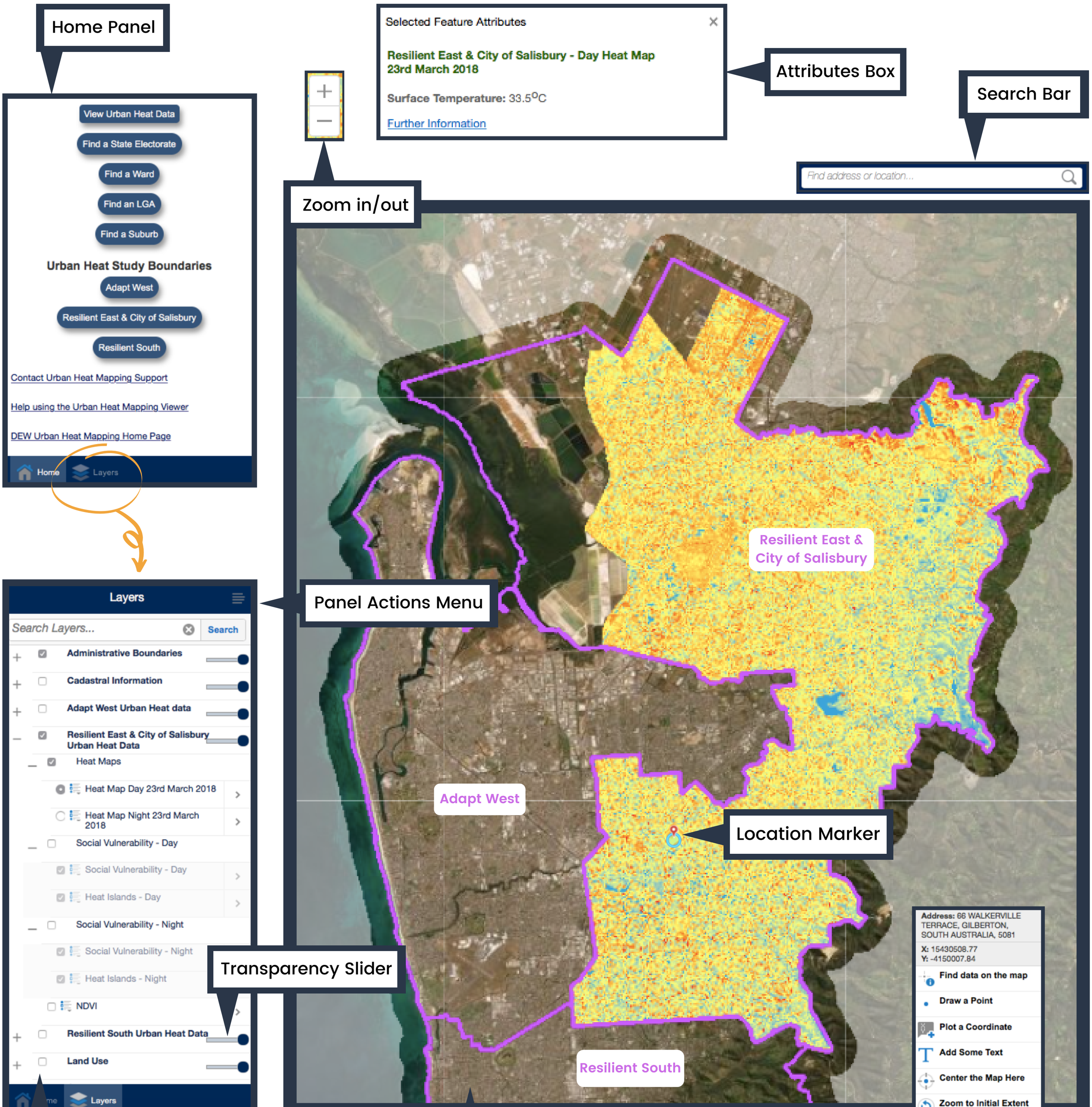
RESILIENT EAST

HEAT MAP QUICK GUIDE

Access heat mapping online at **resilienteast.com**

Climate Ready Eastern Adelaide

A quick guide to help you easily find your way around the **Urban Heat and Tree Mapping Viewer** online platform. Use this to help navigate the map, access the layers and discover information available for the Adelaide region.



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