# Project Firestorm

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## Introduction

Project Firestorm is a STEM unit of work developed by Stage 3 teachers at St Ives North Public School. This integrated study addresses an authentic problem for the school surrounded by bush land, directly adjoining the Ku-ring-gai National Park. This unit is the final learning sequence in a Stage 3 geography study focusing on [Factors that shape places](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/learning-areas/hsie/geography-k-10/content/1183) – How can the impact of bushfires on people and places be reduced?

## **Unit overview**

Project Firestorm develops student understanding of the management of environments and how people influence the places in which they live. It focuses upon bushfires in their local area. Students are challenged to generate solutions to preparation, survival and recovery from a catastrophic bushfire event. They learn design thinking processes and develop scientific and mathematical thinking skills whilst developing a solution for their driving question, ‘How can our community prepare for, survive or recover from a catastrophic bushfire event?’.

Students connect the concepts and activities developed in ‘Factors that shape places’ with a study of the impact of bushfire hazard in NSW. Students investigate the ways people and bushfires have changed the natural environment.

Students may have a basic understanding of coding, robotics, 3D modelling and electrical circuitry, although these understandings are not essential.

This learning unit of study aligns with the RFS interactive[Project Firestorm](https://www.projectfirestorm.com.au/) (2019) program developed to support the implementation of Project Firestorm.

## Outcomes

|  |  |  |
| --- | --- | --- |
| Science and technology | Outcomes | Content |
| **Working scientifically** – ST3-1WS-S | plans and conducts scientific investigations to answer testable questions, and collects and summarises data to communicate conclusions | plan and apply the elements of scientific investigations to answer problems |
| **Design and production –**  ST3-2DP-T | plans and uses materials, tools and equipment to develop solutions for a need or opportunity | research, identify and define design ideas and processes for an audience |
| **Material world –**  ST3-6MW-S | explains the effect of heat on the properties and behaviour of materials | identify and evaluate the functional and structural properties of materials, |
| **Material world –**  ST3-7MW-T | explains how the properties of materials determines their use for a range of purposes | select appropriate materials, components, tools, equipment and techniques and apply safe procedures to produce designed solutions |

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| --- | --- | --- |
| Mathematics | Outcomes | Content |
| **Working mathematically** – MA3-1WM | describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions. | describe and interpret different data sets in context |
| **Statistics and probability** – MA3-18SP | uses appropriate methods to collect data and constructs, interprets and evaluates data displays, including dot plots, line graphs and two-way tables | tabulate collected data, including numerical data, with and without the use of digital technologies |

|  |  |  |
| --- | --- | --- |
| HSIE – geography | Outcomes | Content |
| **Geography-**  GE3-2 | explains interactions and connections between people, places and environments | investigate the impact of ONE contemporary bushfire hazard in Australia |
| **Geography-**  GE3-3 | compares and contrasts influences on the management of places and environments | investigate the ways people change the natural environment in Australia |
| **Geography-**  GE3-4 | acquires, processes and communicates geographical information | investigate how the natural environment influences people and places |

|  |  |  |
| --- | --- | --- |
| English | Outcomes | Content |
| **Speaking and listening** –  EN3-1A | communicates effectively for a variety of audiences and purposes using increasingly challenging topics, ideas, issues and language forms and features | develop criteria to evaluate the effectiveness of spoken texts; identify and summarise key ideas and information from guest speakers, eg note-taking or using digital technologies |
| **Reflecting on learning** –  EN3-9E | recognises, reflects on and assesses their strengths as a learner | discuss and reflect on the roles and responsibilities when working as a member of a group and evaluate the benefits of working collaboratively with peers to achieve a goal |

|  |  |  |
| --- | --- | --- |
| Creative arts | Outcomes | Content |
| **Visual arts -**  ****VAS3-1**** | **investigates subject matter in an attempt to represent likenesses of things in the world** | Organise and assemble materials in various ways on the making of artworks suited to a particular purpose and think about the meaning of their decisions. |

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| --- | --- | --- |
| **PDHPE** | Outcomes | ****Content**** |
| Healthy, Safe and Active Lifestyles  ****PD3-2**** | investigates information, community resources and strategies to demonstrate resilience and seek help for themselves and others | recommend appropriate actions to improve health, safety, wellbeing or physical activity issues within the school or wider community, for example: – suggest and practise action plans for emergency situations to ensure the safety of themselves and others. |

## Notes

* **student STEM learning journal** - every student will keep a STEM learning journal to record their individual and group tasks, notes, ideas, drawings and reviews
* **RFS visit** –request a local RFS brigade to support Project Firestorm: [Program support](https://www.projectfirestorm.com.au/teacher-resources/program-support)

## Teacher resources

* [Bushfires 1 – Understanding bushfires](https://www.science.org.au/curious/bushfires) – Australian Academy of Science
* [Bushfire – an anthology of poems](https://www.abc.net.au/radionational/programs/archived/poetica/2012-07-28/4112790) – ABC National
* [Bushfires – A Geography resource for Australian students](https://www.gtav.asn.au/resources/resources-all-levels/bushfires-a-geography-resource-for-australian-students) – Geography teachers Association of Victoria
* [Design Thinking](https://schoolsequella.det.nsw.edu.au/file/ba43743b-baca-4dd2-9689-2da09ad2ffc7/1/design-thinking-across-the-curriculum.zip/index.html#/)
* [Empathy map](https://www.careinnovations.org/resources/catalyst-method-empathy-mapping/)
* [Project Firestorm](https://www.projectfirestorm.com.au/) – RFS interactive version

## Learning experiences

### Sequence 1 – pre-assessment and RFS visit

**Sequence 1 teacher notes:**

This learning sequence 1 aligns with the ‘Teacher Section’ of RFS interactive[Project Firestorm](https://www.projectfirestorm.com.au/mission/level-1)

#### Opportunity to monitor student prior knowledge

**Assessment 1:** Select one of the following tasks (retain in STEM journal) to demonstrate prior knowledge of the impacts of bushfires on people, places and environments (syllabus outcome GE3-2).

* + record a [concept map](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/577#.YmJkpBiAD8w.link) with ‘bush fires effect the environment’ in the centre
  + complete a [‘Know/Want to know‘](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/562#.YmJkpBwPZVE.link) chart on the effect of bush fires on the environment
  + create [a bush fire survival plan](https://www.rfs.nsw.gov.au/plan-and-prepare) for your household

#### Lesson 1: Project Firestorm launch

* Prior to local RFS visit, students brainstorm the impact of bushfires after watching [Bushfire Season (3:39)](https://www.abc.net.au/btn/classroom/bushfire-season/11505884)
* Local RFS brigade visit to launch the project and give a spoken presentation focusing on role of the RFS; provide time for students to ask the volunteers questions.
* If RFS brigade is unavailable, watch [Volunteering in the NSW Rural Fire Service (3:01)](https://www.youtube.com/watch?v=51tRloDwPko&feature=youtu.be)
* In class, discuss the role of the RFS in preparing for and fighting fires.

#### Lesson 2: launch follow up

To develop background knowledge of bush fires: students watch [Australia Firestorm 1 of 4 - BBC My Country Documentary (10:58)](https://www.youtube.com/watch?v=UMmGE5RNrR4) - Black Friday fires Victoria (2009).

Provide questions to guide notetaking, for example:

* When did the fires happen?
* What were the weather conditions like up in the up to the fires?
* What were the weather conditions like on the day of the fires?
* What safety advice was given to the community?
* Where did the first fire start?
* What fuelled the fire?
* Why are eucalyptus trees so flammable?
* Why couldn't the fire crews stop the fire from spreading?
* What are the factors that influence bushfires mentioned in the video?

Students apply their background knowledge to create a bushfire infographic using an online design tool, for example [Canva](https://www.canva.com/create/infographics/).

Record in STEM learning journal

#### Lesson 3 Geography – NSW maps

**Note:** this lesson is selected from the 4 week, Stage 3 unit of study**,** [Bushfire mitigation](https://education.nsw.gov.au/teaching-and-learning/curriculum/primary/stage-3-resources/bushfire-mitigation). Students examine the location and extent of a bushfire event including the impact on vegetation, animals and people and the role of government agencies in bushfire management for a selected case study.

* Select a recent, contextually appropriate bushfire event. For example, Black Summer (2019-2020) - North Coast, Mid North Coast, Hunter, Hawkesbury, Wollondilly, Blue Mountains, Illawarra, South Coast, Riverina and Snowy Mountains regions.
* Students annotate and label a map of NSW
* Students examine the natural features that make the area fire prone, for example vegetation, slope, aspect, weather, climate. Add to map of NSW
* Students discuss the human features that contributed to the disaster, for example, settlement patterns, roads and services. Summarise discussion in STEM learning journal
* Students compare the annotated map to the [State Vegetation Type Map](https://www.environment.nsw.gov.au/vegetation/state-vegetation-type-map.htm).
* Students label the vegetation types of the fire-affected area, including orientation. Use [SIX maps](https://maps.six.nsw.gov.au/) to support this activity.
* Compare to the natural environment around the school. Discuss and record the factors that have influenced the use of the local area.
* Collate all activities in the STEM learning journal

#### Opportunity to monitor student progress

**Assessment 2:**

**Geography GE3.2, GE3.3, GE 3.4. –** review work samples collated in STEM learning journal

#### Lesson 4: Visual arts inspired by fire

**Students will explore events, shapes, movement, colours and patterns of fire as inspiration to create artworks and build empathy.**

**Students will have opportunities to express their creative ideas and thinking, and deepen their understanding**

* **Observe Van Gogh –** [Starry Night - interactive animation (04:30)](https://vimeo.com/36466564) **and link movement of clouds to demonstrate the ‘Movement of fire’.** 
  + **using chalk pastels, students translate the night scene to a bushfire scene.**
  + **discuss and select colours of fire: red, orange, yellow, black.**
  + **draw a landscape from 00:06, creating a horizon line, and a flame effect using the colours of the fiery night sky**
  + **reflect on the composition, line and movement in their artwork; record in STEM learning journal**

##### Opportunity to monitor student progress

**Assessment task 3**

**Visual arts – AS3-1: Movement of fire: Observe students as they organise and assemble materials for their artworks: collect work samples and journal entries as students reflect on their artwork.**

Alternative lesson options

* **Display and discuss flame-shaped images focusing on lines and colours. Students sketch the shapes then use the sketches to model a flame shaped clay vase.**
  + **science links - water in the clay converts to steam at 100°C**
  + **mathematics links - clay fired in a kiln to a temperature of 1100°C**
* **Observe work by Aboriginal artists such as Clifford Possum Tjapaltjarri and Ronnie Tjampitjinpa and create an artwork in their style.**

**Note: artworks may be displayed in the classroom and photographed for inclusion in the student’s STEM learning journal.**

### Sequence 2 – Developing empathy

**Sequence 2 teacher notes:**

This learning sequence aligns with Mission 1 in the RFS interactive [Project Firestorm](https://www.projectfirestorm.com.au/mission/level-3).

**About design thinking:** ‘Schools use different elements of design thinking in the classroom, whether implicitly or explicitly. It is a creative way to get to the answer to a problem, and to understand how you learn.

Design thinking is often used in the school planning process. It allows schools to empathise with students, teachers and the community to understand their needs, putting the student at the centre of planning at the school level.

Design thinking also offers a good way to combine quantitative and qualitative data in school plans and profiles. It helps make sense of statistics, giving them a context.’ [Design thinking and the curriculum](https://education.nsw.gov.au/public-schools/game-changer-challenge/teacher-information)

**Teacher preparation**: Copy or create a poster for design thinking that displays the key elements of empathise, define, ideate, prototype, test and share (a quick internet search provides many appropriate examples)

Create an enlarged empathy map - divide a large sheet of butcher’s paper into 4 quadrants. Label the quadrants say, do, think, feel

Review resources listed below, as well as teacher-identified resources, prior to the lessons to select those suitable to the context of the school and student experiences. Write sample sticky notes

#### Lesson 1: introduction to design thinking

Introduce Design thinking by watching the [Design Thinking video](https://schoolsequella.det.nsw.edu.au/file/ba43743b-baca-4dd2-9689-2da09ad2ffc7/1/design-thinking-across-the-curriculum.zip/index.html#/id/5dce5dea534d6d1276d8dbf3)

Display teacher-prepared poster and explicitly introduce the 6 key phases of design thinking used within this unit:

* + empathise
  + define
  + ideate
  + prototype
  + test
  + share.

Discuss students’ knowledge of bushfires and how this has grown over the previous lessons:

* review understanding of how bushfires impact on people and their lives.
* the importance of building empathy and understanding when designing solutions for another person’s problems.

##### **Video resource list**

* [When the Fire Comes (1:04:19)](https://www.youtube.com/watch?v=XbYI5dDlMeg) (2009 Victorian – Black Saturday fires), people interviewed after a fire.
* [Return to Dunalley - a family's survival story, six months on (6:08)](https://www.abc.net.au/7.30/return-to-dunalley---a-familys-survival-story-six/4766826) children huddled under a bridge with their grandparents in the Tasmanian bushfire
* [Bushfire recovery (4:26)](https://www.abc.net.au/btn/classroom/bushfire-recovery/10525352), review of children’s needs after a bushfire
* [ABC Black Saturday mosaic](https://www.abc.net.au/innovation/blacksaturday/#/stories/mosaic), hundreds of people share their stories and experiences of the fires.
* [BTN: Australia’s Black Summer Bushfires (Ep 1)](https://www.abc.net.au/btn/classroom/20200204-ep1-btn/11911010) (24:30)

#### Lesson 2: create an empathy map identifying needs and wants

**Empathy map:** a collaboratively developed visual display that captures the thoughts (think), emotions (feel), expressions (say) and actions (do) of the focus people involved in the design topic.

Introduce the empathy stage by watching the [Empathise](https://schoolsequella.det.nsw.edu.au/file/ba43743b-baca-4dd2-9689-2da09ad2ffc7/1/design-thinking-across-the-curriculum.zip/index.html#/id/5dce5dea534d6d1276d8dbf4) video.

Display the enlarged empathy map. Explain that students will watch a video about bushfires and take notes about what is

* + said – direct quotes and key phrases or words that resonate
  + done – drawings/diagrams or details of what actions the families took
  + thought –direct quotes from the families that begin with ‘I think…’ or ‘I believe’ and also inferred thoughts and beliefs
  + felt – specific feelings and emotions observed or heard throughout the families’ stories.

Students watch selected videos from the [Video resource list](#_Video_resource_list) (above); use sticky notes to record notes.

Model categorising the notes by reading teacher-made notes and placing in the appropriate quadrant/s on the empathy map.

Students share their notes with the class and stick in the appropriate quadrant/s on the empathy map.

As a class, discuss the stories and the decisions the families made. As appropriate, compare the reactions.

Suggested questions:

* + Why did people decide to leave or stay?
  + Why did the reasons differ? consider stage of life; potential loss; preparation
  + What might your actions have been?
  + How might you have felt?
  + What is your reaction to the videos?

Display empathy map for reference and continual updating.

#### Lesson 3: interview a community member

Invite a community member who has experienced a bushfire to visit the classroom and tell their story.

Students

* listen courteously
* ask questions with respect
* record information to add to the empathy map in the areas of think, feel, say and do.
* reflect on the personal experience and record in STEM learning journal.

#### Lesson 4: Science and technology – adapting to our land

Students study bush fire fuels and fuel types:

* display a map of the school and ask students to locate vegetation including trees, gardens, grasslands.
* conduct a school walk to identify trees on the school site
* focus on eucalyptus trees and their leaf litter. Students collect a sample of the litter.
* conduct a ‘scrunch test’ to explore the flammability of the fuel load: Scrunch or grind a leaf in your hand. If the leaf is
  + dry and crumbly, and leaves your hand dusty, this indicates low moisture content and high flammability/
  + flexible and moist leaving your hand feeling a bit wet or dirty, this indicates a higher moisture level and lower flammability
* Discuss the fuel moisture content. Link the moisture level and flammability to bush fire behaviour.
* View video [Fuel and fuel types](https://youtu.be/kEHspanF_G0) (1:08)

Focus on Aboriginal and Torres Strait Islander peoples’ management of the land.

* discuss eucalyptus plants and the evolution of the arid land
* explore the Aboriginal use of cultural or cool burn to appreciate first peoples’ management of the land
* view [Indigenous fire methods](https://youtu.be/RM72NtXxyLs) (10:58) using cultural knowledge
* understand management strategies of prescribed burning, fuel and fuel types, evidence of prescribed burn in Western Australia
* view the video [A Burning Question – Fire and control methods](https://www.abc.net.au/gardening/how-to/a-burning-question-fire/12395700?utm_campaign=abc_gardening&utm_content=link&utm_medium=content_shared&utm_source=abc_gardening) (02: 28)
* Discuss the advantages and record in STEM learning journal.

#### Lesson 5: Mathematics – In the cold light of day, analyse the aftermath

* review students’ prior knowledge of data sets including tables, column and line graphs
* discuss source of data and validity, noting the use of trusted sites
* provide students with the sample table: [Resource 1: Cold light of day](#_Resource_1:_In)
* individually or in groups, students research data use criteria to complete a table on the impacts of significant Australian bushfires: [example table](#_Resource_1:_In) provided
* students tabulate collected data on a spreadsheet, such as Google Sheets or Office 365 (or using grid books)
* students determine the appropriate display such as column graphs, line graphs or dot points

##### Opportunity to monitor student progress

**Assessment 4**

**MA3-18SP**: students construct the data display for the impact of significant Australian bushfires and record in STEM learning journal

**MA3-1WM**: students describe and interpret the data display, comparing and analysing the relative impacts of significant bushfire events.

### Sequence 3 – Define the driving question

**Sequence 3 teacher notes:**

This learning sequence aligns with Mission 2 in the RFS interactive[Project Firestorm](https://www.projectfirestorm.com.au/mission/level-3)

**Teacher preparation:**

**Create a large classroom display of the driving question: How can our community prepare for, survive or recover from a catastrophic bushfire event?**

Create a retrieval chart – divide a large sheet of butcher’s paper into 3 columns; label the columns Prepare, Survive, Recover.

#### Lesson 1: the define phase and the driving question

Review the design thinking phases and focus on define. **Introduce the define phase by watching the video:** [Define](https://schoolsequella.det.nsw.edu.au/file/ba43743b-baca-4dd2-9689-2da09ad2ffc7/1/design-thinking-across-the-curriculum.zip/index.html#/id/5dce5dea534d6d1276d8dbf5)

**Focus on the driving question classroom display: How can our community prepare for, survive or recover from a catastrophic bushfire event?**

Use a dictionary to define the literal meaning of the key words: community, prepare, survive, recover, catastrophic.

Discuss and define the noun group: catastrophic bushfire event.

Watch [Behind the News – Black Summer Aftermath (3:15)](https://www.abc.net.au/btn/classroom/black-summer-aftermath/12295732?jwsource=cl); compare to the local area and discuss the issues presented.

Students brainstorm practical issues related to the local area:

* + Prepare – equipment, buildings, plants, back burning, clearing
  + Survive – exit route, preparation, access to services
  + Recover – access to services, resilience, rebuild, repair.

Display the teacher-prepared retrieval chart. Students in pairs, write their ideas and understandings on sticky notes and place them under the matching column – prepare, survive, recover.

#### Lesson 2: challenge student assumptions - 5 Whys strategy

Display and review the retrieval chart from Lesson 1.

Ask the students to explain their ideas. As they occur, challenge their assumptions using the 5 whys strategy. For example, the stated problem may be – People died in a bushfire because the RFS did not come quickly enough.

1. Ask ‘Why’? Why didn’t the RFS come quickly enough?

Answer – Because they could not get through the traffic.

1. Ask ‘Why’? Why couldn’t they get through the traffic?

Answer – Because too many other people were on the road.

1. Ask ‘Why’? Why were too many other people on the road?

Answer – Because they left just as the fire arrived.

1. Ask ‘Why’? Why did so many leave just as the fire arrived?

Answer – Because they became frightened and panicked.

1. Ask ‘Why’? Why did they become frightened and panic?

Answer – Because they did not prepare their properties or have a fire plan.

Students understand that a totally different solution is required to the original assumed problem.

Students create a problem statement: Identify

* + the current situation, for example, some people are remaining in bushfire prone areas on Catastrophic fire danger days.
  + why it is a problem, for example, if a fire starts on a Catastrophic fire danger day, it will spread very quickly and their lives will be at risk
  + where the problem is occurring, for example, the problem is occurring in our community.
  + who is affected by the problem, for example, the people who stay are affected as their lives could be at risk; their family and friends may be affected if something bad happens; the local fire brigade and emergency services are affected as they risk their lives to save people who get trapped
  + the desired future state.

#### Lesson 3: PDHPE: Australian fire danger rating system

Brainstorm students’ prior knowledge of the relationship between weather and bushfire. Ask: What kind of weather leads to dangerous bushfires?

Watch video: [BTN Bushfire Recap](https://www.abc.net.au/btn/classroom/bushfire-recap/11910336) (03:44) Discuss the influence of weather on the level of bushfire danger, noting the influence of temperature and rainfall on the dryness of fuel.

Watch video: [Understanding Fire Weather (0:41-1:37)](https://www.youtube.com/watch?v=Jt1PCnSiqQI&t=41s) Discuss the influence of humidity on fuel dryness and the influence of wind speed on bushfire spread.

Display and discuss [Resource 2a: Australian Fire Danger Rating System - poster](#_Resource_2a:_Australian)

Provide background information about the development of the AFDRS.

* + ‘Fire Danger Ratings are based on predicted weather conditions such as temperature, humidity, rainfall and wind.’
  + calculated using the weather data

Discuss the 4 levels of fire danger rating scale and note the key message for each level. Discuss the importance of the key messages as a memorable action-based activity that can be associated with each level.

As a method to recall the 4 levels of Fire Danger and the Key messages, use body percussion to match the beat of the syllables/words with the key message the word/word groups. For example:

○ (mod/er/ate) with (plan/and/prepare)

○ (high - 3 beats) with (be/readyto/act)

○ (e/x/treme) with (take/action/now), (to protect/life\_and/property)

○ (cat/as/trophic) with (for/your/survival), (leave/bushfire\_risk/areas) Note: rhythm adjustments need to be made for words such as ‘high’, ‘bushfire ‘risk’ Focus student attention to the white level and discuss the ‘no fire danger rating’. Ask: are there any actions that the community could be doing?

Discuss the 4 levels of Fire behaviour focusing on the change in the modality of the vocabulary. For example, controlled, dangerous, extremely dangerous, lives lost

Display [NSW Rural Fire Service - fire danger ratings](https://www.rfs.nsw.gov.au/fire-information/fdr-and-tobans). Review the fire danger rating for the school’s location for the day and tomorrow. Refer to the [Resource 2b: Australian Fire Danger Rating System poster - Community messaging table](#_Resource_2b:_Australian) and discuss the appropriate behavioural responses.

Discuss the importance of being safe as an aspect of study in PDHPE.

Ask:

* + What does ‘being safe’ mean to you?
  + Who is involved when you think about ‘being safe’?
  + When is ‘being safe’ important?
  + Where are places that provide you with safety?
  + Why is safety important?
  + If safety is important, what can you do to improve the safety of yourself and others?

Focus on fire safety and display [Resource 2b:](#_heading=h.lro8o8a7lyfi) [Community messaging table](#_Resource_2:_Community)[.](#_heading=h.lro8o8a7lyfi) Review the Fire Danger, Key Message, Fire Behaviour, and Supporting Messages.

Students create a replica of the Australian fire danger rating in the STEM learning journal.

Students write a bush fire survival plan to ensure the safety of themselves and others for an emergency bush fire situation at home or school in their STEM learning journal.

Students communicate the plan to their family or school.

Students write a summary of their ideas on the effect of the environment in the STEM learning journal.

#### Opportunity to monitor student progress

**Assessment task 5**

**PD3.2:** Collect and review student emergency action plan and summaries on the effect of the environment

#### Lesson 4: Science and Technology - how fires behave

**Note**: the following demonstration is for student observation only.

To understand the behaviour of bushfires under varied conditions, students participate in a guided investigation of the relationship between the topography of the local area (particularly inclines and declines) and environmental conditions such as temperature, fuel density, leaf litter and humidity.

Outline the bush fire investigation activity, [Matchstick bushfire demonstration](https://www.projectfirestorm.com.au/) (log in to Project Firestorm).

Identify the variables of incline, decline, wind speed and time. Ask students to predict the behaviour of the bushfire. Record the predictions in the STEM learning journal.

Students observe a teacher demonstration of bush fire activity, for example [Matchstick bushfire demonstration](https://www.projectfirestorm.com.au/) (log in to Project Firestorm).

Record the demonstration using a mobile device.

Review the recording with the students, focusing on the fire behaviour when the variables of incline, decline, wind speed and time were altered. Discuss the difference in the fire behaviour.

Introduce the variables of temperature, fuel density, leaf litter and humidity. Guide students as they consider the variables and formulate generalisations.

Students write a summary of their ideas on the effect of the environment in the STEM learning journal.

#### Opportunity to monitor student progress

**Assessment task 6**

**ST3-4LW-S:** Review student work sample and summary in STEM leaning journal

### Sequence 4 – Ideate

**Sequence 4 teacher notes:**

This learning sequence 4 aligns with Mission 3 in the RFS interactive[Project Firestorm](https://www.projectfirestorm.com.au/mission/level-3)

#### Lesson 1: design with crazy 8s

Review the design thinking phases and focus on ideate. Introduce the ideate phase by watching the [Ideate](https://schoolsequella.det.nsw.edu.au/file/ba43743b-baca-4dd2-9689-2da09ad2ffc7/1/design-thinking-across-the-curriculum.zip/index.html#/id/5dce5dea534d6d1276d8dbf6) video

Discuss the term ideate and its meaning – to form ideas, to think.

Re-visit the driving question and the initial ideas from Sequences 2 and 3. Focus on the three stages of prepare, survive and recover. Refer also to the needs identified on the empathy map.

Ask the prompting question: what new ideas do you have to meet the needs of our community?

Introduce the Crazy 8 design thinking strategy to prompt creative, innovative ideas that are beyond the obvious

Students:

* fold an A4 sheet of paper into 8 sections (half, half and half again)
* select an aspect of the problem to focus on
* draw, write, label one solution to this problem on a sector of their paper in 60 seconds
* share for 30 seconds with a partner
* repeat this process 7 more times
* students share their most successful idea with a larger group at the end of the eighth

Students explore a range of possibilities and [brainstorm](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/542#.X03-AuwIOCQ.link) solutions. Encourage ‘wild and wacky ideas’

Alternatively, [Brainstorming with Rules](https://www.interaction-design.org/literature/article/stage-3-in-the-design-thinking-process-ideate#:~:text=Brainstorming%20is%20one%20of%20the,and%20building%20on%20other%20ideas.) is a strategy to elicit ideas and drive energy of the session.

Record ideas in STEM learning journal.

#### Lesson 2: form project teams

To facilitate the development of a prototype, students need to placed in groups of 3 to 5. The structure of the groups is open, however, consider:

* common interests
* preferred tasks
* [jigsaw classroom](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/546#.X039ukLup6U.link)

Students

* document their group’s progress using [Microsoft Planner](https://app.education.nsw.gov.au/digital-learning-selector/LearningTool/Card/111#.X1WHEasRWI4.link) (access through Student Portal) – students create a new plan, share with group members and teacher/s, organise and assign tasks, share files, chat about what they are working on, and get updates on progress
* assign specific roles to each member such as engineer, architect, designer, materials scientist, bushfire consultant, researcher
* develop an authentic approach to the task by forming companies and generating products such as a business name, logos, cards, letterhead.

#### Lesson 3: success criteria

As a class, co-construct success criteria for designing a solution to answer the driving questions. Guide students to consider a range of criteria. For example, the product, team work, knowledge integration, presentation

In project teams, students create descriptors for a 4 level rubric for success that addresses the student-identified success criteria. [Resource 3: Student rubric](#_Resource_3:_Student)

As a project team, students identify and record their goals for their team, with reference to the developed descriptors and the shared vision for the group.

Record in STEM learning journal.

#### Opportunity to monitor student progress

**Assessment 7**: **EN3-9E** Observations of students as they identify and set goals for their project team

#### Lesson 4: research and project solution

This phase continues over a number of weeks as groups ideate, prototype and test their ideas.

Students will

* focus on their role in the group to research and locate information that is relevant to their solution
* create, share and discuss ideas with group.

This phase will require a high degree of teacher guidance in order to encourage students to continually analyse their research findings, assumptions and design proposals.

#### Lesson 5: Science and Technology – materials to protect

Discuss the local urban interface – where the bushland and housing intersect. Locate the school on [Six Maps](https://maps.six.nsw.gov.au/) and measure the distance, using the distance tool, to the closest bushland environment. Apply the Basemap for 1943 and discuss the changes to the environment.

Discuss how understanding our environment can help us to stay safe in times of bushfire. In pairs, students investigate the location of their home and its proximity to bushland using [ePlanning Spatial Viewer](https://www.planningportal.nsw.gov.au/spatialviewer/#/find-a-property/address). (For a simple view, select NSW Imagery in bottom right corner.)

Watch [Bush fire fact – what to wear in a bush fire](https://youtu.be/F_LcSQnB9UA) (0:53) and list the recommendations; the NSW Rural Fire Service recommend [what to wear](https://www.rfs.nsw.gov.au/plan-and-prepare/prepare-your-family/what-to-wear) including:

* + a wide brimmed hat or hard hat
  + glasses or goggles
  + gloves
  + a mask
  + a long-sleeved shirt made from thick cotton or wool
  + a pair of heavy cotton pants, such as denim jeans, oil free drill pants or cotton overalls
  + sturdy leather work boots or shoes along with a pair of woollen or cotton socks

Discuss and identify the materials used in each item of clothing.

Discuss the difference between the flammability of some materials and their thermal insulation qualities. Identify thermal insulation as a classroom experiment opportunity.

Students predict and sequence a range of materials for effectiveness of their thermal insulation properties, for example, paper, heavy cotton (denim), light cotton (a handkerchief), wool, foil, plastic.

Under supervision, students test their predictions about the thermal insulation:

* + add very hot water to metal containers wrapped in samples of materials
  + use thermometers to measure the temperature over time
  + record the results and graph to compare results.

Students apply this simple experiment to consider the concepts such as insulation, reflection, absorption, radiance, and conduction of heat.

In small groups, students discuss why the choice of materials is important to protect ourselves in bushfires. Share with class, list key ideas.

* + explain the effect of heat on the properties and behaviour of materials
  + explain how the properties of materials determines their use for a range of purposes

Students record their responses in their STEM learning journal.

#### Opportunity to monitor student progress

**Assessment task 8**

**ST3-6MW-S:** Collect work samples from STEM journals and review explanations - identify and evaluate the functional and structural properties of materials when exposed to heat,

**ST3-7MW-T:** select appropriate materials, components, tools, equipment and techniques and apply safe procedures to produce designed solutions

Extension activities – building materials that protect:

* test sample building materials under supervision, to determine their relative thermal insulating properties using thermal datalogging equipment such as [Lego Mindstorms (3:33)](https://youtu.be/tSJz0TgGAyg)
* place sample materials on insulating tiles to lift them (5mm) above a heated hot plate (minimum setting 60 degrees). Use samples commonly found in house environments; all of a similar size – fabric, foil, paper, timber, metal, cardboard, fibre cement sheet, tin, soil (clay), rocks
* use a timer to record the change in heat of the sample over a set time period (60 -120 seconds).
* examine charted results to explain and determine which materials are better insulating materials for building heat resistant dwellings
* evaluate samples and decide which materials are effective at slowing the transmission of heat inside the home.

#### Lesson 6: Mathematics - extreme evacuation

Download [Extreme Evacuation](https://www.projectfirestorm.com.au/teacher-resources/teacher-resources) (log in to Project Firestorm) as a guide for exploring the issues associated with an emergency evacuation of the local area.

Students watch [Spark – a better way to predict the spread of bushfires (2:10)](https://www.abc.net.au/education/spark-a-better-way-to-predict-the-spread-of-bushfires/13949720)

Students will be challenged to combine a range of mathematical skills and logical reasoning to determine the issues involved in moving large numbers of people out in a short amount of time. Students are required to draw conclusions and provide explanations based on data and information gathered from first-hand or secondary sources.

This task integrates the mathematical concepts of area, averages, length, percentages, position and mapping.

Record in STEM learning journal.

#### Lesson 7: Expert visit from the RFS

The NSW RFS staff make a return visit to the school to be an expert and a critical friend for the students. The RFS staff visit each class for approximately 60 minutes to listen to the students’ ideas and provide support and critical feedback.

From their first-hand knowledge base, the NSW RFS staff may take students back to their empathy maps to identify things that students have missed.

Students:

* present their initial problem/solutions to the class and the RFS experts with an introduction to their company (if relevant)
* pitch their ideas with evidence of its relevance, its innovation and its ability to solve an authentic problem
* receive feedback with respect and gratitude
* ask any clarifying questions regarding improvements or modifications

Record ideas, feedback and suggestions in STEM learning journal.

### Sequence 5 – prototype

**Sequence 5 teacher notes:**

This learning sequence 5 aligns with Mission 4 in the RFS interactive[Project Firestorm](https://www.projectfirestorm.com.au/mission/level-3)

Review the design thinking phases and focus on prototype. Introduce the prototype phase by watching the [Prototype video](https://schoolsequella.det.nsw.edu.au/file/ba43743b-baca-4dd2-9689-2da09ad2ffc7/1/design-thinking-across-the-curriculum.zip/index.html#/id/5dce5dea534d6d1276d8dbf7)

#### Creating prototypes

Students may use a number of strategies including:

* [paper prototyping](https://www.interaction-design.org/literature/topics/paper-prototyping)
* [prototype to decide](https://www.interaction-design.org/literature/article/stage-4-in-the-design-thinking-process-prototype)

This phase may:

* vary greatly by group depending on the problem to be solved
* include schematics, sketches, rapid paper models, flowcharts, wireframe models, written explanations and computer simulations
* require students to move back and forth in the design thinking phases, interrogating their decisions at key moments along the way

To monitor progress ask:

* what have you accomplished so far?
* what is your next step?
* what do you still need to know, understand and do about the task/project?
* What have you learnt from your mistakes?
* How can you continue to motivate yourself to remain on task?

In small groups students plan and use materials, tools and equipment to create a prototype as a solution to the driving questions.

Share with class, list key ideas.

Record in STEM learning journal.

#### Opportunity to monitor student progress

**Assessment task 9**

**ST3-2DP-T:** review work samples in STEM journal: plans and uses materials, tools and equipment to develop solutions for a need or opportunity

### Sequence 6 – design and test

Review the design thinking phases and focus on test. Introduce the test phase by watching the [Test video](https://schoolsequella.det.nsw.edu.au/file/ba43743b-baca-4dd2-9689-2da09ad2ffc7/1/design-thinking-across-the-curriculum.zip/index.html#/id/5dce5dea534d6d1276d8dbf8)

Students test their prototype during development and production with a critical user such as a friend or teacher

Assist students to devise the best method to test their prototype and to capture and record feedback

Record test results and feedback in STEM learning journals.

Students refine the prototype with reference to the feedback.

Students:

* present their final conceptual ideas to their peers and review their learning to date in their STEM learning journal
* plan their next steps ready for production of their final products
* consult with expert teachers in technical, scientific or creative aspects of their design solutions
* consolidate final designs and produce associated material in preparation for presentation and display showcase
* prepare models and products
* re-visit and review their rubric and success criteria

Collect work samples

Observe students during presentations

#### Opportunity to monitor student progress

**Assessment task 10**

**ST3-1WS-S:** Working scientifically –observe students during presentations and review all work samples.

Focus on evidence of planning and applying design elements and testing to answer problems

### Sequence 7 – presentation and showcase

**Sequence 7 teacher notes:**

This learning sequence 7 aligns with Mission 5 in the RFS interactive[Project Firestorm](https://www.projectfirestorm.com.au/mission/level-3)

Students:

* articulate the processes to create solution
* demonstrate and share their understanding of the links to key learning areas throughout their STEM learning journey
* present final designs to client (NSW RFS)
* present projects in a showcase for parents and peers
* present projects to the wider-school community in an open-afternoon.

Students produce a range of solutions to problems related to preparing for, surviving or recovering from bushfires. Students present in a variety of forms including –

* STEM learning journals with notes and photos
* schematics, design sketches and detailed drawings
* information posters or digital presentations using software such as Keynote, PowerPoint, Google Slides
* digital simulations
* 3D CAD models
* cardboard or foam core scale models
* 3D printed models
* robotic solutions
* electronics, sensors and ICT interfaces
* interactive websites and apps
* dioramas
* video and multimedia products
* technical reports and support materials.

Record in STEM learning journal.

#### Opportunity to monitor student progress

**Assessment 11:**

**EN3-1A, EN3-9E** Speaking and listening – In groups, students complete final review of their shared rubric and goals. Mark and date rubric.

Record in STEM learning journal.

**This learning event aligns with the Commissioner’s Award in the RFS interactive** [Project Firestorm](https://www.projectfirestorm.com.au/mission/level-3).

### Reflection and unit evaluation

Reflect on your students’ learning and plan for next steps.

* What worked well and why?
* What didn’t work and why?
* What might I do differently next time?
* What are the next steps for student learning based on the evidence gathered?

## Assessment summary

* Assessment 1: Pre-assessment of the effect of bush fires on the environment
* Assessment 2 Geography - **GE3.2, GE3.3, GE 3.4**
* Assessment 3 **Visual arts – AS3-1**
* Assessment 4 Mathematics **MA3-18SP; MA3 – 1MW**
* Assessment 5 Personal development, Health, Physical Education: **PD3.2:**
* Assessment 6 Science and technology - **ST3-4LW-S**
* Assessment 7 Rubric **EN3-9E**
* Assessment 8Science and technology - **ST3-6MW-S:**
* Assessment 9Science and technology - **ST3-2DP-T:**
* Assessment 10Science and technology -**ST3-1WS-S:**
* Assessment 11: English: **EN3-9E**

## Resources

### Resource 1: In the cold light of day

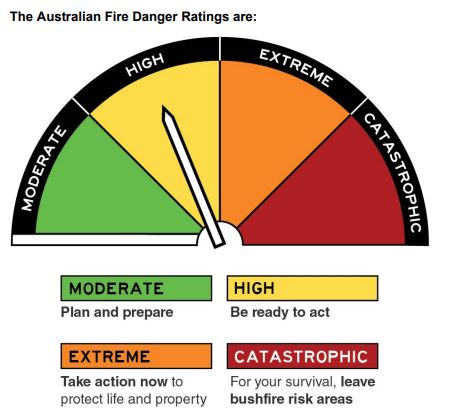
**Sample table– in the cold light of day examine the aftermath**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Fire event** | **Maximum temperature** | **Hectares burnt** | **Properties lost** | **Fatalities** | **Economic cost** |
| Gippsland and Black Sunday 1926 |  |  |  |  |  |
| Black Friday 1939 |  |  |  |  |  |
| Black Tuesday Tasmania 1967 |  |  |  |  |  |
| Ash Wednesday 1983 |  |  |  |  |  |
| Black Saturday 2009 |  |  |  |  |  |
| Red October NSW 2013 |  |  |  |  |  |
| Black Summer 2019/2020 |  |  |  |  |  |

**Teacher completed example only: not for distribution**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Fire event** | **Maximum temperature** | **Hectares burnt** | **Properties lost** | **Fatalities** | **Economic cost** |
| Gippsland and Black Sunday 1926 | 48 | 400 000 | 1000 | 60 | $942m |
| Black Friday 1939 | 47.2 | 1.3m | 700 | 36 | $750m |
| Black Tuesday Tasmania 1967 | 39 | 260 000 | 1 300 | 62 | $610m |
| Ash Wednesday 1983 | 40+ | 600 000 | 383 | 28 | $200m |
| Black Saturday 2009 | 48 | 400 000 | 145 | 173 | $4.4b |
| Red October NSW 2013 | 35.6 | 50 000 | 248 | 2 | $94m |
| Black Summer 2019/2020 | 45-50 | 1.5 m | 2448 | 26 | $5b |

### Resource 2a: Australian Fire Danger Rating System - poster



### Resource 2b: Australian Fire Danger Rating System poster - Community messaging table



### Resource 3: Student rubric template

**Project Firestorm: Example co-developed class criteria**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | STEMtastic | | STEMazing | | STEMprogress | | STEMworkin’ on it | |
| Product:  Originality of idea | |  | |  | |  | |  | |
| Product:  Real-world application | |  | |  | |  | |  | |
| Product:  Functionality | |  | |  | | . | |  | |
| Product:  Deliverables | |  | |  | |  | |  | |
| Presentation:  Design choices | |  | |  | |  | |  | |
| Presentation:  Organisation | |  | |  | |  | |  | |
| Presentation:  Format | |  | |  | |  | |  | |
| Presentation:  Delivery | |  | |  | |  | |  | |
| Knowledge Integration: application of learning into solution | |  | |  | |  | |  | |