# Case Study: Storm Desmond 2015

These lesson objectives are intended for the **KS3 Geography curriculum**, specifically focusing on the topic of **weather and climate**. However, the content can be tailored to suit different key stages, accommodating varying levels of prior knowledge and understanding.

This lesson can be worked through at any pace, and it can be split into multiple lessons if needed. This flexibility allows you to adjust the flow based on the class's understanding and time constraints. If some sections require more in-depth exploration, feel free to extend them over additional lessons to ensure students fully grasp the concepts before moving on.

The worksheets can be filled in during the lesson, as homework, or in individual sections, depending on the pace of the lesson.

**Lesson Aim:**
The aim of this lesson is for students to understand the causes, impacts, and responses to Storm Desmond on and Lancashire through a detailed case study, while developing map reading skills.

**Lesson Objectives:**
- Explore the causes of the flooding, and what made Storm Desmond's impacts particularly bad in and Lancashire.
- Analyse the social, economic, and environmental impacts of Storm Desmond on local communities and infrastructure.
- Evaluate the immediate and long-term responses to Storm Desmond.

**Assumed Prior knowledge:**
- Experience with reading and interpreting maps and atlases.
- Basic understanding of social, economic, and environmental factors.
- Knowledge of immediate and long-term responses to disasters.
- Fundamental geographic knowledge of flooding, including causes and typical impacts.

**Resources:**
- Lesson 3 Worksheet
  - Mapping exercise
  - Impacts of flooding cut and stick exercise
  - Immediate and long term colour coordinating exercise
- Atlas or maps of North West England showing towns.
- Scissors
- Colouring pencils

All the blank worksheets for this lesson can be found as a separate download within the 'Lesson 3' page of The Flood Hub KS3 Geography Weather and Climate Learning section. The answers for the worksheets can be found at the end of this document.

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**Notes for Each Slide:**
Teachers should decide what students should copy into their workbooks. While most content is provided on the worksheet, any additional information can be recorded in the workbooks.

**Slide 1 - Learning Objectives**
- Introduce the aims and objectives of the lesson.

**Slide 2 - Starter Activity**
- Briefly introduce the lesson topic: Storm Desmond 2015.
- Explain that understanding the location of and Lancashire  is important for today's case study.
- **Activity:** Use an atlas to locate and colour and Lancashire on worksheets.

**Slide 3 - Location of Cumbria**
- Show the map of the UK with and Lancashire highlighted.
- Ask students to compare their worksheets to the map on the slide, ensuring they have correctly marked and Lancashire.

**Slide 4 - Worst affected towns and villages**
- Read out the names of the most affected towns: Keswick, Kendal, Cockermouth, Carlisle, Appleby, Lancaster, St Michael's and Churchtown
- **TASK:** Have students mark and label these towns on their worksheets using the atlas or maps of North West England showing towns.

**Slide 5 - Worst affected towns and villages**
- Ask students to compare their marked towns to the slide map and correct any mistakes.

**Slide 6 - Causes: Storm Desmond**
- Read the slide aloud, emphasising the text in bold.
- **TASK:** Students fill the blanks on their worksheet to record the key information.

**Slide 7 - Causes: Topography**
- Read the slide content aloud to the class and emphasise key terms.
- Explain that topography refers to the arrangement of the natural and artificial physical features of an area.
- Highlight that steep slopes facilitate rapid runoff, meaning rainwater quickly travels down the slopes into rivers and streams without being absorbed into the ground.
- Mention that this rapid runoff leads to shorter lag times, the time between peak rainfall and peak river discharge, resulting in quick and severe rises in river levels.

**Slide 8 - Soil Saturation**
- Read the slide aloud and explain that soil saturation occurs when the ground has absorbed as much water as it can hold. This soil saturation was due  Storm Abigail, Barney and Clodagh in the 3 weeks prior to Storm Desmond.
- Discuss how saturated soil cannot absorb additional rainfall, causing more water to flow over the surface instead.
- Mention that this increased surface runoff contributes to higher river levels and more severe flooding.

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**Slide 9 - River Systems**

- Explain that Cumbria and Lancashire has several major rivers, including the River Eden, River Derwent, River Kent, River Lune and the River Calder.
- Highlight that these rivers and their tributaries can quickly swell and overflow during periods of heavy rainfall.
- Discuss how heavy rainfall increases the volume of water in these rivers, leading to widespread flooding as they overflow their banks.

**Slide 10 - River Record**

- Read aloud the fact from the slide: "The River Lune recorded the highest river flow on record of an English river at 1,750$m^3$ per second at Caton."
- This record-breaking river flow highlights the extreme nature of Storm Desmond's rainfall, demonstrating the intensity of flooding and its impact on river systems.
- The high river flow led to severe flooding downstream, damaging homes, infrastructure, and businesses, showing how extreme weather events can overwhelm natural and man-made defences.

**Slide 11 - Causes Matching Activity**

- **TASK:** Match the cause to the description and its impact on flooding on the worksheets and explain the answers.

**Slide 12 - Impacts of Flooding**

- Explain that impacts fall into 3 categories, social economic and environmental.
- Social Impacts: Effects on people's lives, such as displacement, health issues, and disruption to daily routines.
- Economic Impacts: Financial consequences, including damage to property, loss of businesses, and the costs of repairs and recovery.
- Environmental Impacts: Changes to the natural environment, such as habitat destruction, pollution, and alteration of landscapes.
- Clarify that sometimes these impacts overlap. For example, the damage to homes (economic impact) also affects people's lives (social impact), and pollution (environmental impact) can harm local communities (social impact) and incur clean up costs (economic impact).

**Slides 13- 16 Impact Categories**

The next 4 slides show different impacts of the flooding. Discuss as a class and decide which category it f**alls into: social, economic, or environmental.**

**Slide 13 - Fatalities**

- Storm Desmond led to two confirmed deaths across Cumbria and Lancashire. A man in Cumbria died after being swept away by floodwaters, and another person lost their life in a road accident caused by severe weather conditions.
- This is a social impact of Storm Desmond because it directly relates to the loss of human life and the well-being of people.

**Slide 14 - Homes Flooded**

- Across Cumbria and Lancashire, over 5,200 homes were flooded, with thousands more left without power, clean water, and essential services.

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- This is a social impact because it affects people's daily lives, well-being, and living conditions. Flooded homes lead to displacement, loss of personal belongings, and emotional distress. The lack of power, clean water, and essential services also disrupts communities, making it difficult for people to carry out their normal activities and access necessities.

**Slide 15 - Flooded Train Lines**

- The West Coast Main Line in Cumbria is submerged under floodwater from the River Caldew. This disrupts daily travel, stranding passengers and causing major commute issues.
- Social and Economic; it disrupts daily travel and causes inconvenience to passengers, impacting both people's lives and the economy.

**Slide 16 - Lancaster substation**

- The electric substation on Caton Road flooded: leaving 43,000 properties without power for days, severely impacting homes, businesses, and communication networks.
- Social impact – The loss of power affected people's daily lives, cutting off heating, lighting, communication, and access to essential services. This would have caused distress and disruption to households and communities.
- Economic impact – Businesses were unable to operate without power, leading to financial losses. The cost of repairing the substation and restoring power would also have been significant.

**Slide 17 - Bridges**

- 1600 bridges were closed across Cumbria, including Pooley Bridge.
- Economic impact – The closure of 1,600 bridges would have disrupted transport, businesses, and supply chains, leading to financial losses and increased costs for repairs.
- Social impact – Communities were cut off, making travel difficult and affecting access to work, schools, healthcare, and essential services.

**Slide 18 - Impacts Sorting Activity**

- TASK: Instruct students to cut out the statements describing different impacts of Storm Desmond on Cumbria and Lancashire, then stick the statements under the appropriate headings on their worksheets or workbooks.

**Slide 19 - Social Impacts**

- Review the social impacts, such as displacement from homes, health issues, disruption of daily activities, and community strain.
- Ensure students have correctly categorised social impacts.

**Slide 20- Economic Impacts**

- Review economic impacts, such as damage to properties, loss of businesses, and the costs of repairs and recovery, highlighting how these lead to financial challenges for individuals, businesses, and the community.
- Confirm students have categorised economic impacts accurately.

**Slide 21 - Environmental Impacts**

- Review environmental impacts, such as damage to natural habitats, pollution of water sources, and changes to landscapes, emphasising how these effects disrupt ecosystems and alter the natural environment.
- Ensure students have correctly categorised environmental impacts.

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**Slide 22 - Immediate and Long-Term Responses**

- Explain the difference between immediate and long term responses. Read out the examples so that students understand the difference.
- Explain that the next slides will go through some of the responses to the flooding from Storm Desmond. For each response categorise them into immediate (short-term) or long-term responses.

**Slide 23-27 - Responses**

The next 8 slides shows the responses to Storm Desmond. Talk them though as a class and discuss weather they are immediate or a long term response.

**Slide 23 - Rescue Operations**

- Emergency services and the military conducted numerous rescue operations, evacuating residents from flooded areas and providing immediate medical assistance.
- This is an immediate response as it focused on saving lives and providing urgent assistance during and after the storm.

**Slide 24 - Government aid**

- The UK government provided financial aid, including a £50 million recovery fund for affected communities. Additional grants and loans were made available to help with property repairs and resilience improvements.
- This is a long-term response as it focused on helping communities recover and rebuild after the storm.

**Slide 25 - Emergency Aid**

- Distribution of emergency supplies, including food, water, and blankets, to affected individuals and families.
- This is an immediate response as it focused on providing essential supplies to those in need right after the storm.

**Slide 26 - Backup Generators at Royal Lancaster Infirmary:**

- The activation of backup generators at Royal Lancaster Infirmary ensured that critical healthcare services continued to operate, preventing further disruption to patient care during the flooding.
- This is an immediate response as it aimed to maintain essential healthcare services and prevent further disruption during the flood.

**Slide 27 - Flood Defences**

- Improved flood defences were initiated, reinforcing riverbanks and constructing new barriers. £2.6 billion was invested in flood defence schemes in Cumbria, currently implementing projects in Carlisle, Appleby, and Kendal.
- This is a long-term response as it focuses on strengthening flood defences to reduce future risks and improve resilience over time.

**Slide 28 - Flood Defences Continued**

- The Lancaster Flood Defence Scheme includes £12.1 million spent on defences along Caton Road and Aldrens Lane, a £10.8 million flood wall along the River Lune protecting over 2,000 jobs, and a £5.7 million upgrade to the Caton Road substation to prevent power cuts.
- This is a long-term response as it involves investing in infrastructure to protect communities and businesses from future flooding, ensuring long-term resilience.

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**Slide 29 - Public Awareness and Preparedness**

- Increased efforts to educate the public about flood risks and preparedness measures, aiming to improve community resilience for future events.
- This is a long-term response as it focuses on raising awareness and building long-term resilience to future flooding events.

**Slide 30 - Formation of Community Food Groups**

- St Michael's Flood Action Group formed after Storm Desmond, advocating for better flood defences and flood risk management in the area, working with local authorities to protect the community from future floods.

**Slide 31 - Responses Activity**

- TASK: Students colour code the responses on their worksheet and sort them into immediate and long-term responses.

**Slide 32 - Answers to Responses Activity**

Review and discuss the answers to ensure correct categorisation. Explain why each response fits its category.

**Slide 33 - Recap**

- Explain that for the plenary activity, students will think about and discuss the difference between weather and climate before next lesson.

**Slide 34 - Homework**

- Instruct the students to write a newspaper article about the 2015 Cumbria floods, covering causes, effects, and responses.
- The length can vary, and teachers can decide on the appropriate word count. It can be submitted hand-written or digitally. Students should use their English skills to ensure the article is clear, engaging, and well-written.

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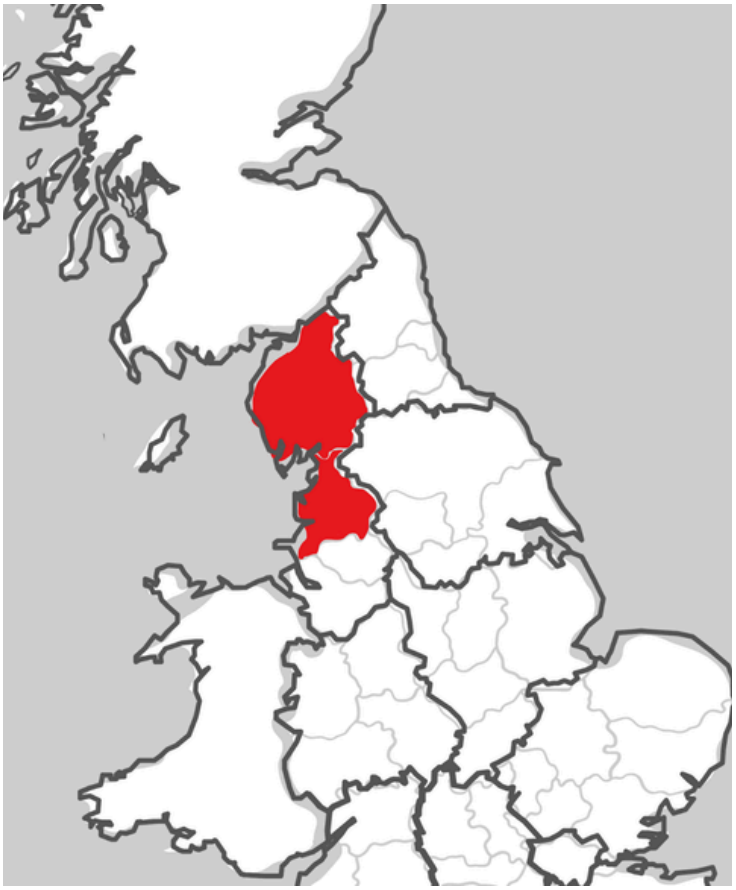
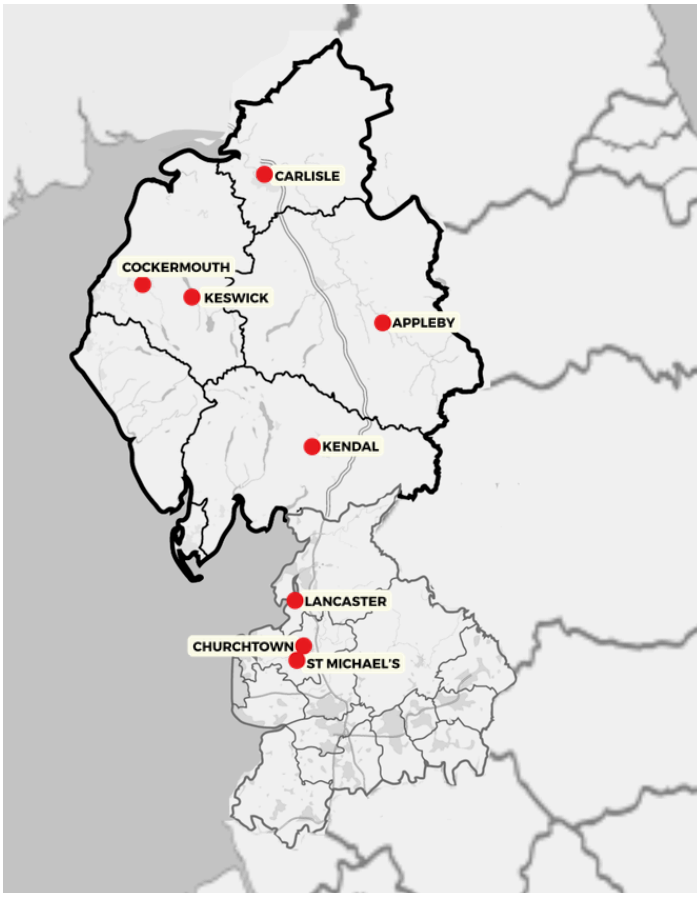
Using your atlas, **locate and Lancashire** on this map of England and Wales. Colour it in on your worksheet to identify it.



Using your atlas, mark the worst affected towns and villages onto the map.

Towns and Villages Worst Hit:
Keswick, Cockermouth, Carlisle & Appleby




## Causes:

Fill in the blanks:

Storm Desmond affected the UK from the 4th to the 6th of December 2015, bringing heavy Winds and strong Rainfall, due to an area of low pressure from the Atlantic. This led to severe Flooding, particularly in Cumbria, and Lancashire. experienced record-breaking rainfall, with some areas receiving over 300 mm of rain in just 24 hours. The River Lune in Lancashire recorded flows of around 1,750 m³ per second at Caton (just upstream of Lancaster), the Highest flow ever recorded on an English river, contributing to widespread flooding.

Match the cause to the description and its impact on flooding:

| | | |
|---|---|---|
| Heavy Rainfall | Ground already soaked with water | Causes rivers to overflow |
| Soil Saturation | Major rivers and tributaries | Rapid runoff leading to quick river rises |
| Topography | Rainfall exceeding normal levels | Overflow of rivers during heavy rainfall |
| River Systems | Hilly or mountainous terrain | Reduced absorption, increased runoff |

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**Cut out the impacts of Storm Desmond on and categorise them by sticking them under the headings Social, Economic and Environmental impacts.**

| Social Impacts | Economic Impacts | Environmental Impacts |
|---|---|---|
| 45 schools were affected in Cumbria, resulting in 3,034 children not attending school at the end of the autumn term. | Around 600 farming businesses experienced impacts from flooding and water run-off, affecting livestock health and welfare. Around 702 cattle and sheep are known to have drowned | Trees, shrubs, and other plants were washed away or damaged by the floodwaters. Debris was also washed onto meadows, posing a threat to fragile habitats. |
| Over 5200 homes across and Lancashire were flooded internally. | 1,029 businesses were reported as flooded in Cumbria, with an average expected impact cost of £54,600 per affected business. | Water Pollution increased due to sewage overflow and debris, leading to contamination of water sources. |
| 1,051 operations, clinics, treatments, and diagnostics were cancelled or rescheduled, affecting healthcare services. | It was estimated that 354.8 km of carriageway had been damaged, causing road closures in 107 different locations across the county. | Landscapes were altered by landslips, particularly around mine treatment works above Braithwaite, raising contamination concerns. |
| Around 43,000 homes lost power during the flooding, with the Caton Road substation in Lancaster being flooded, causing widespread outages, including at Royal Lancaster Infirmary. | The Lake District, renowned as a favourite tourist destination, suffered a decrease in visitors, significantly affecting the local economy. | The disposal of flood waste in landfills posed challenges for waste management practices and recycling efforts. |
| There was 2 reported deaths and several injuries. | 127 incidents over December 2015 and January 2016 caused total delays on the Network Rail network of 100,364 minutes (1,673.7 hours or about 69.7 days). | |
| Six months after the storms, a quarter of households were unable to return to their homes. | | |

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## 2015 Floods Responses:

**Key:**

Immediate Responses  Long-Term Responses

| | |
|---|---|
| **Flood Defences:** Improved flood defences were initiated, reinforcing riverbanks and constructing new barriers. The council invested £2.6 billion in flood defence schemes, currently implementing projects in Carlisle, Appleby, and Kendal. | **Power Restoration:** Efforts were made to quickly restore electricity to the customers without power. The activation of backup generators at Royal Lancaster Infirmary ensured that critical healthcare services continued to operate, preventing further disruption to patient care during the flooding. |
| **Rescue Operations**: Emergency services and the military conducted numerous rescue operations, evacuating residents from flooded areas and providing immediate medical assistance. | **Government Aid:** The UK government provided financial aid, including a £50 million recovery fund for affected communities. Additional grants and loans were made available to help with property repairs and resilience improvements. |
| **Public Awareness and Preparedness**: Increased efforts to educate the public about flood risks and preparedness measures, aiming to improve community resilience for future events. | **Temporary Shelters:** Local authorities set up temporary shelters for displaced residents, ensuring they had a safe place to stay |
| **Emergency Aid:** Distribution of emergency supplies, including food, water, and blankets, to affected individuals and families. | **Infrastructure Repair:** Extensive repairs to damaged roads, bridges, and public transportation networks. |
| **Formation of Community Food Groups:** St Michael's Flood Action Group formed after Storm Desmond, advocating for better flood defences and flood risk management in the area, working with local authorities to protect the community from future floods. | **Flood Defences:** The Lancaster Flood Defence Scheme includes £12.1 million spent on defences along Caton Road and Aldrens Lane, a £10.8 million flood wall along the River Lune protecting over 2,000 jobs, and a £5.7 million upgrade to the Caton Road substation to prevent power cuts. |