

# MODULE 1

## INTRODUCTION TO WILDFIRE



CITIZEN ENGAGEMENT



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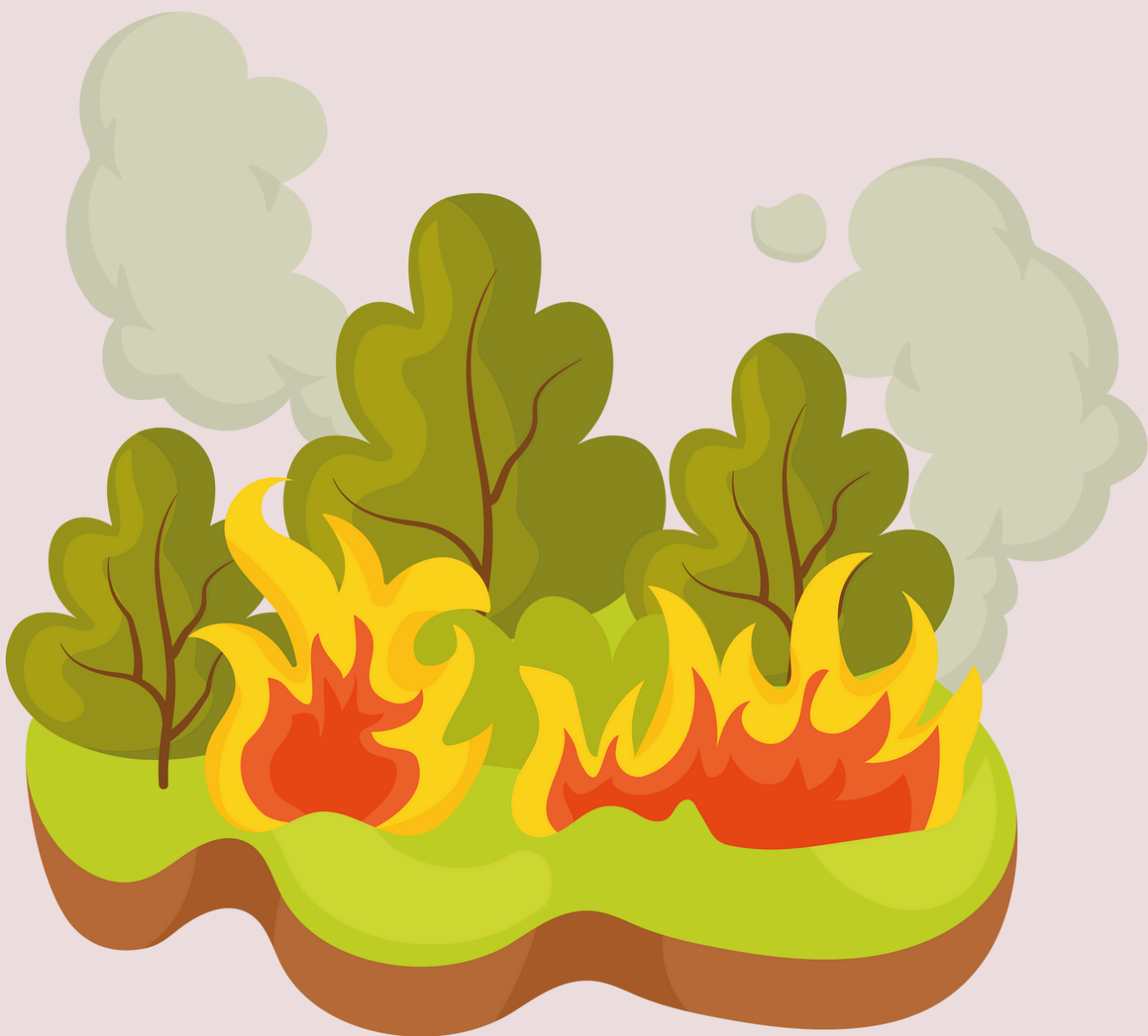


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# WILDFIRE

Wildfires are natural or human-caused fires that rapidly spread through vegetation. In this module, you will explore the essential concepts of wildfire, fire regime, fire behaviours and wild fire impact on ecosystems and human communities along with some examples.



Understanding wildfires is crucial  
for both preventing their  
occurrence and managing their  
consequences effectively.





# CONTENT

**Throughout this module, you will learn about:**

1. What is fire? (the triangle of fire)
2. Types of forest fire
3. Types of fuel
4. What is fire regime
5. What is “fire behaviour”?



6.Examples of recent significant wildfires worldwide

7.Fire as a natural disturbance and human intervention

8.Impact of Climate Change on Wildfires

9.Economic impact of wildfires

10.Wildfire Impact on Human Well-being and Health



# WHAT IS FIRE? (THE TRIANGLE OF FIRE)



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# FIRE

Fire is a chemical reaction that occurs when fuel, oxygen, and heat come together in the right proportions.



This interaction is often illustrated using the concept of the "fire triangle." The three sides of the fire triangle represent the three elements needed for fire to start and continue burning.

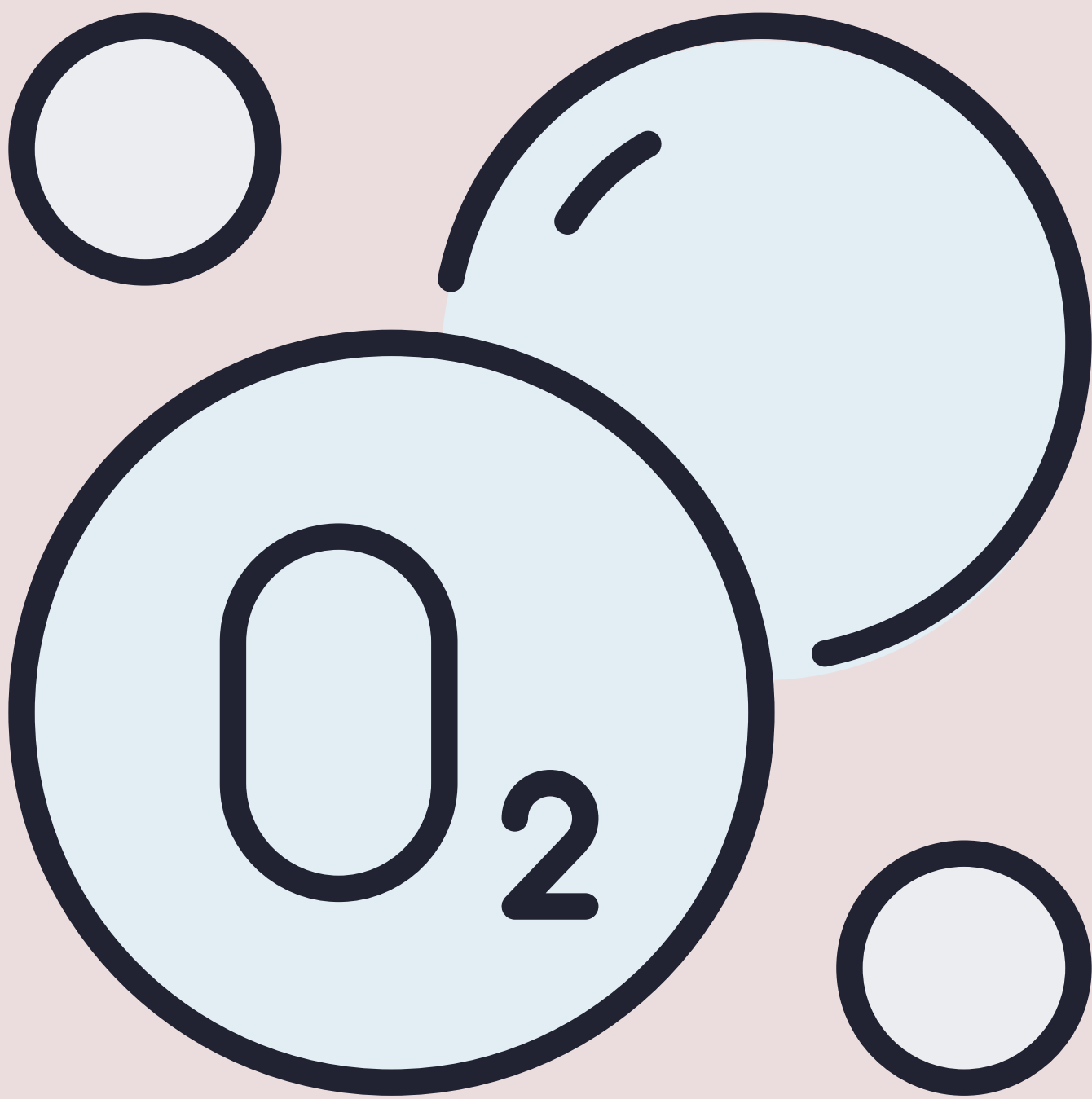
# FUEL

Any combustible material can serve as fuel for a fire. In a forest, grass, trees, and leaves act as a natural fuel for fires. Wood, paper, petrol or any other substance can ignite and sustain a flame.



# OXYGEN

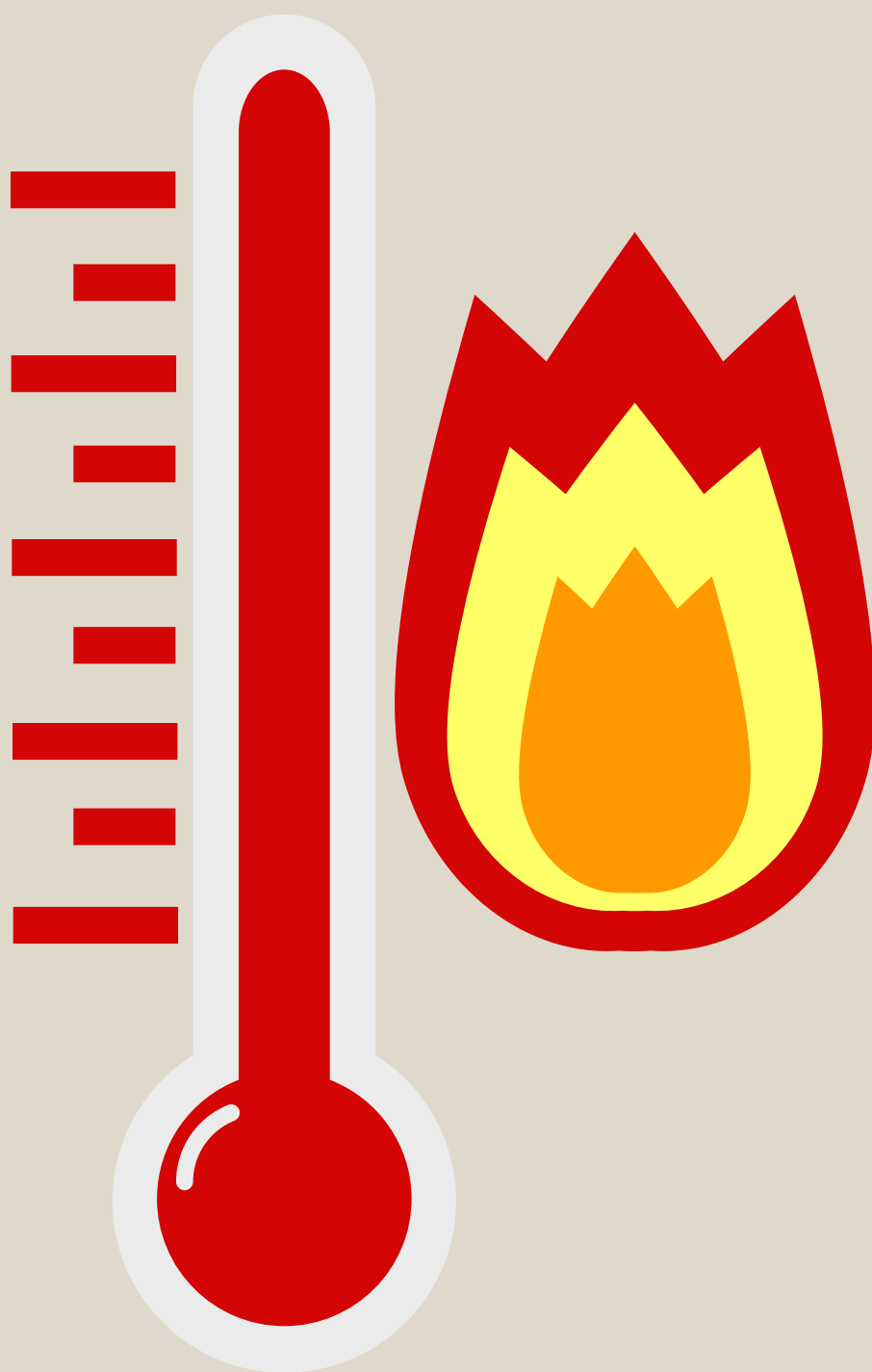
Oxygen from the air is required to support the chemical reactions that occur during combustion. Without sufficient oxygen, a fire cannot start or continue burning.





# HEAT

Heat is the energy source that initiates the combustion process. It raises the temperature of the fuel to its ignition point, causing it to release gases that react with oxygen in an exothermic reaction – one that releases energy in the form of heat and light, perpetuating the cycle.





For a fire to start and be sustained, all three elements of the triangle must be present. Removing any one of these elements will extinguish the fire. This principle is the basis for fire prevention and firefighting strategies.

For example, water extinguishes fire by cooling the fuel below its ignition point (removing heat) and by displacing oxygen. Fire blankets remove oxygen, and firebreaks remove fuel in the path of wildfires.



# TYPES OF WILDFIRE



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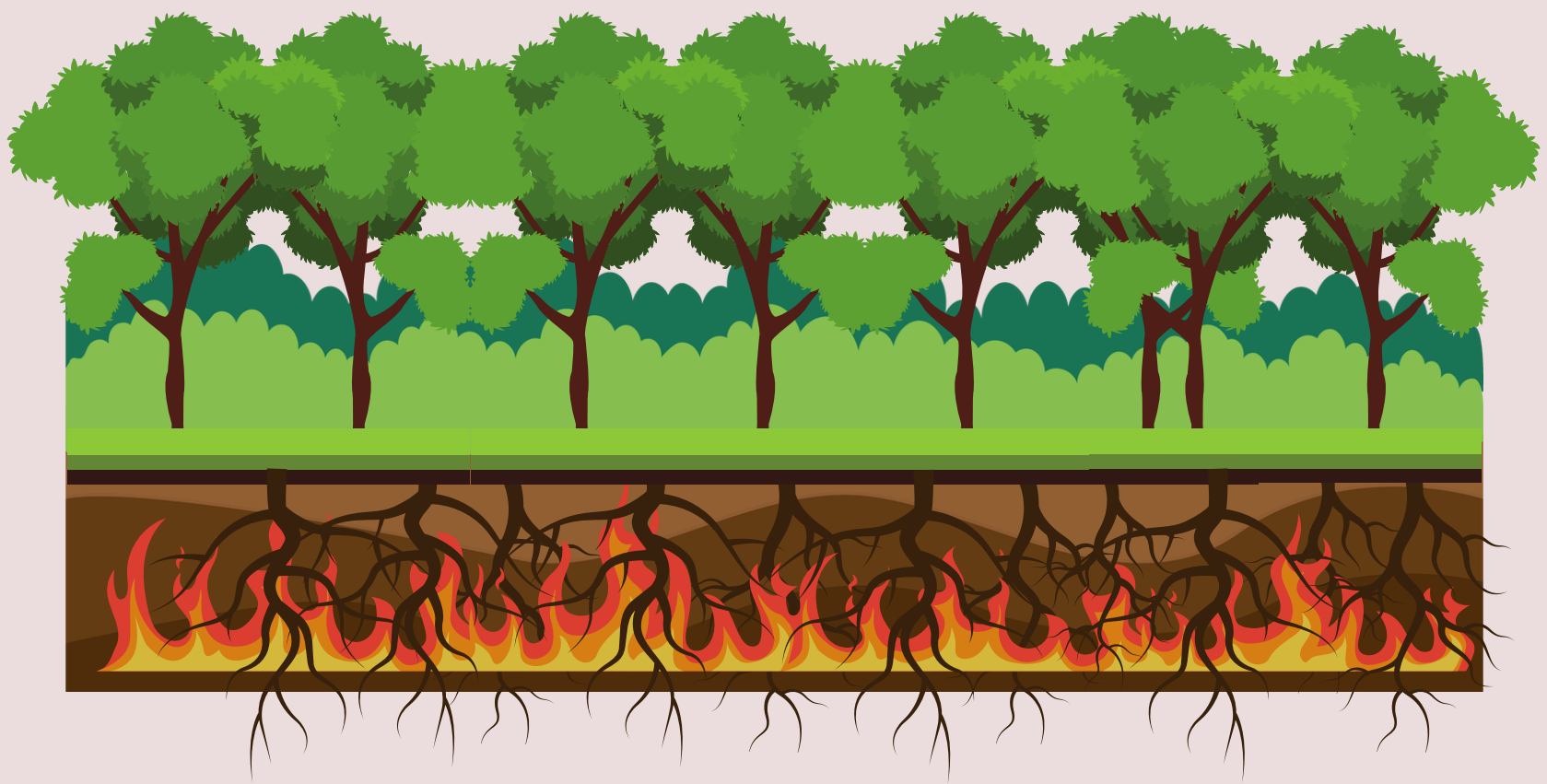


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Wildfires can be classified into three main types based on how they burn. These types are:



# 1-GROUND FIRES

Also known as subsurface fires, ground fires burn on or below the forest floor's surface, consuming organic material like peat, humus, and tree roots. These fires can smolder for weeks or even months, largely hidden from view.



Ground fires are usually slower-moving than surface or crown fires but can be particularly destructive to root systems and soil stability. They are often difficult to detect and extinguish due to their underground nature.



## 2-SURFACE FIRES

These are the most common type of forest fire. Surface fires burn through the underbrush and leaf litter on the forest floor. They can move quickly or slowly, depending on the amount of fuel available and the weather conditions.



While surface fires can cause significant damage to undergrowth, they often spare larger trees and can actually contribute to the health of the forest ecosystem by clearing out dense undergrowth and promoting the growth of new plants.



# 3-CROWN FIRES

Crown fires are more intense and destructive than surface fires.

They occur when the flames from a surface fire ascend into the canopies of trees, burning the tops of the trees.





Crown fires can spread rapidly, driven by the wind and the availability of fuel in the form of leaves and branches in the tree canopies. They are often hot enough to kill most of the vegetation in the affected area and can be difficult to control.

Each type of forest fire has distinct characteristics and requires different strategies for prevention, management, and control. Understanding these types helps in planning effective firefighting efforts and in managing forests to reduce the risk and impact of fires.





# TYPES OF FUEL



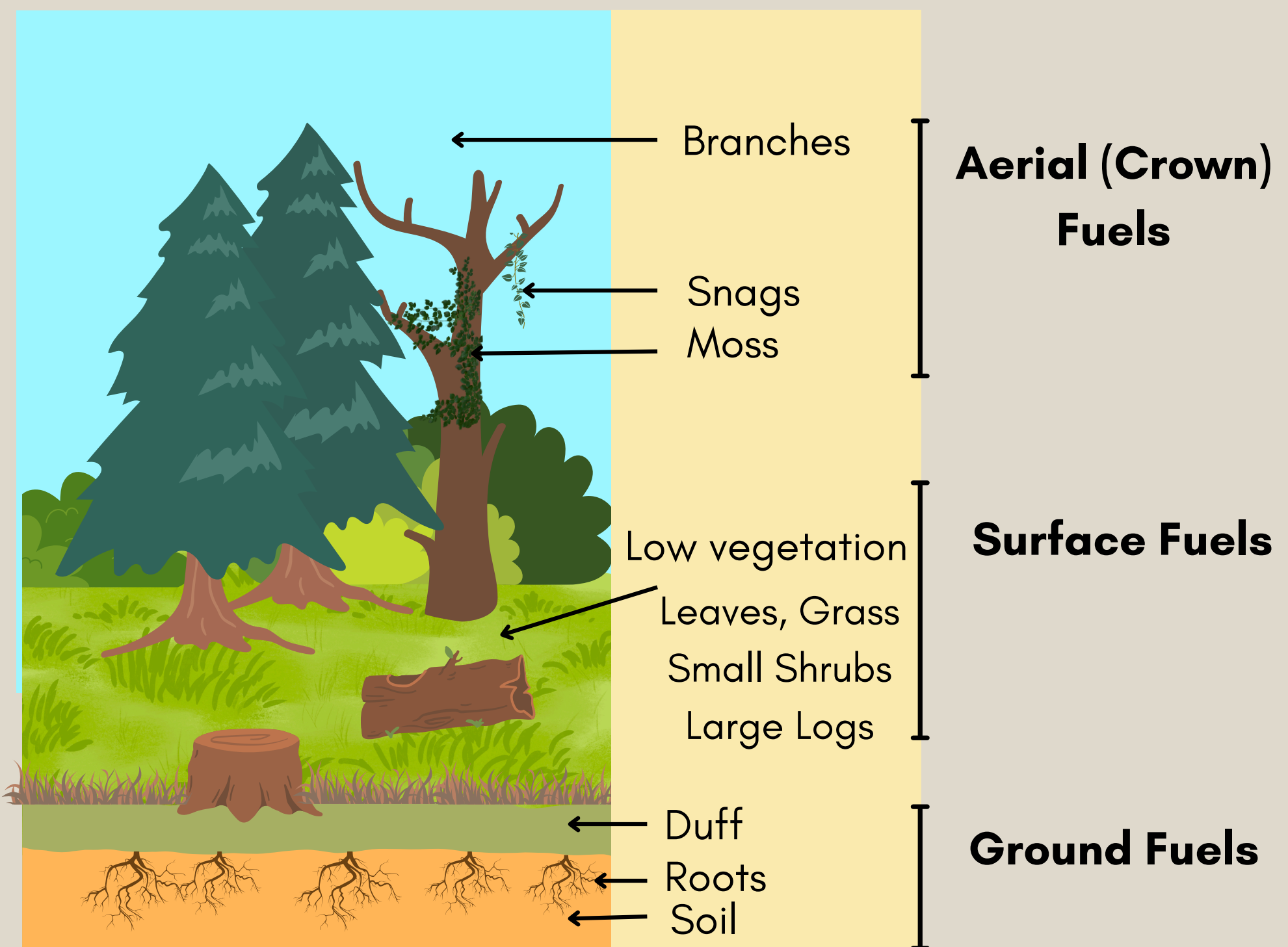
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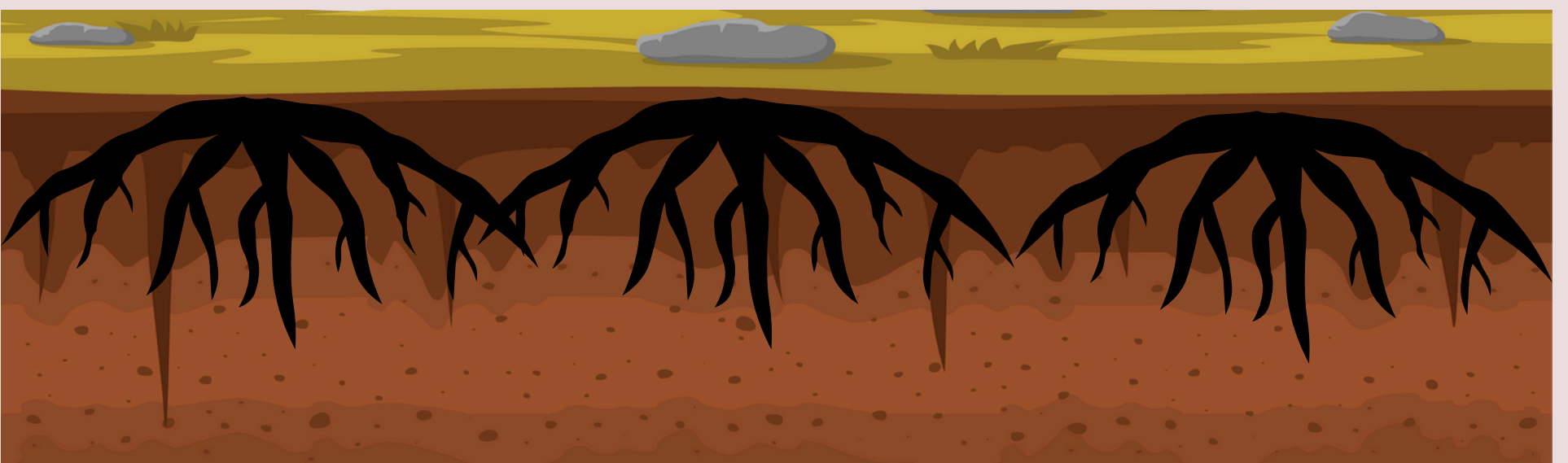
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In the context of forest fires, fuels are any materials that can ignite and sustain a fire. These materials are typically categorized based on their size, type, and how quickly they can ignite and burn. Here are the main types of fuels involved in forest fires:



# GROUND FUELS

These include organic matter present on or just below the forest floor, such as leaf litter, grass, moss, peat, and decomposing vegetation. Ground fuels can smolder for a long time, contributing to ground fires that burn slowly but can be difficult to extinguish.



# SURFACE FUELS

Surface fuels consist of dead branches, leaves, and low-lying vegetation like grasses and shrubs. These fuels are on the forest floor and can easily catch fire, contributing to the rapid spread of surface fires. Surface fuels are influenced by seasonal changes and weather conditions, which can alter their moisture content and flammability.







## **AERIAL/CROWN FUELS**

These are the leaves, branches, and other materials located in the upper parts of trees. Canopy fuels are primarily involved in crown fires, where the fire spreads rapidly through the treetops, often driven by strong winds.

# FUEL LADDER

Ladder fuels are vegetation that can carry fire from the forest floor up into the tree canopy. They include small trees, shrubs, and tall grasses that can act as a "ladder," allowing the fire to climb to the tops of trees and potentially leading to more dangerous crown fires.





The type and arrangement of fuels in a forest determine the fire's behaviour, including how quickly it spreads, its intensity, and how difficult it may be to control.



# WUI

WUI stands for Wildland-Urban Interface. It refers to areas where human development meets or intermingles with wildland vegetation.

This interface can be particularly vulnerable to wildfires due to the combination of combustible vegetation and human structures, making wildfire management and prevention crucial in these regions.



As more people move into forested or rural areas, the extent of the WUI grows, leading to greater risk of property damage and human casualties during wildfires.





The presence of both human infrastructure and natural fuel (like trees and grasses) increases the potential for wildfires to ignite and spread. Human activities in these areas—such as campfires, equipment use, or electrical faults—can lead to accidental ignitions.

# ARSON

Arson, or intentional fire-setting, is a significant cause of wildfires and involves deliberately starting a fire with the intent to cause harm, destruction, or for personal gain. In the context of wildfires, arson can be particularly dangerous and devastating due to the uncontrollable nature of fire once it spreads in wildland areas.



Arson is a serious crime, and those found guilty can face severe penalties, including heavy fines and long-term imprisonment, particularly if the fire results in loss of life or significant property damage.

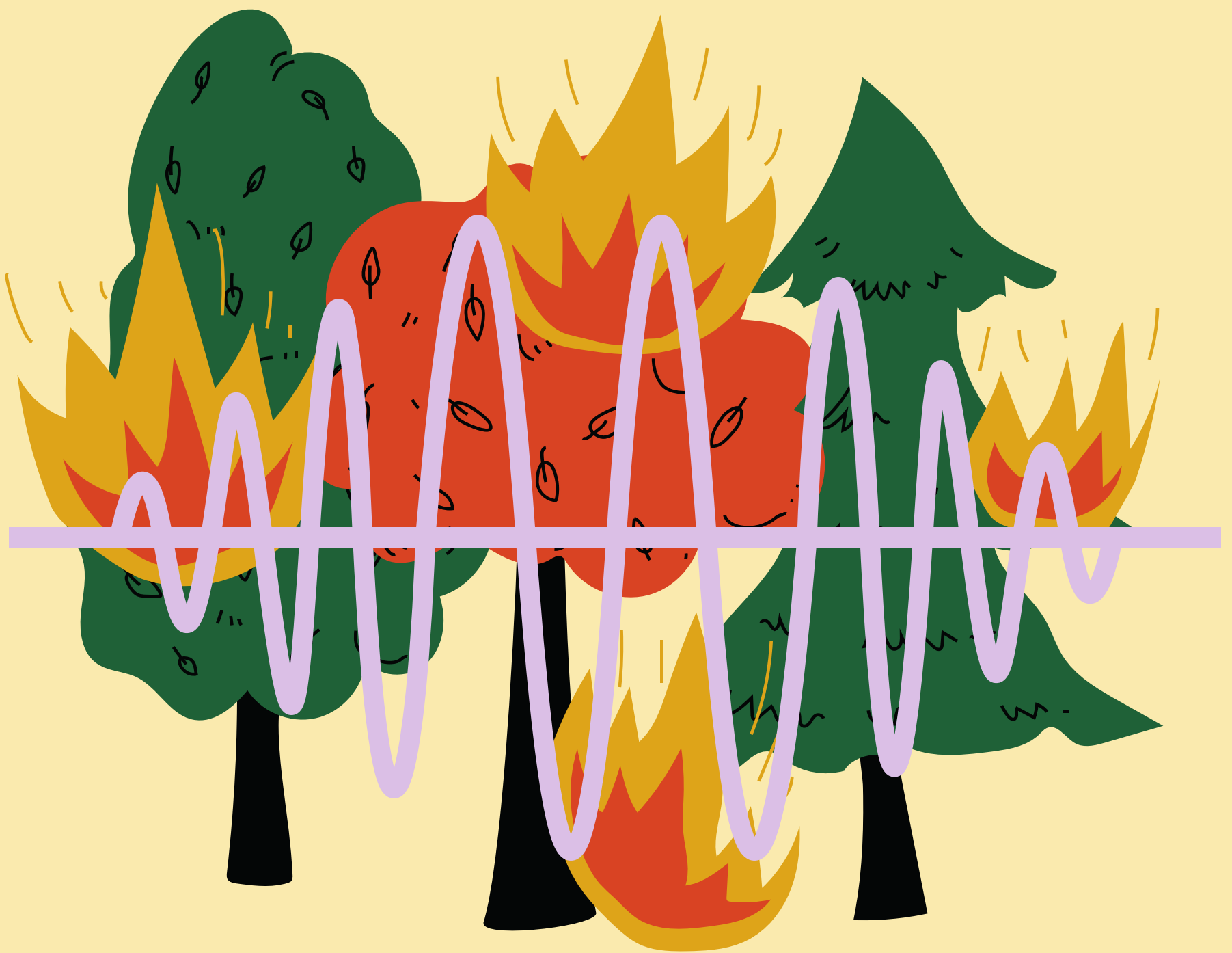


Effective fire management and prevention strategies often involve various techniques like prescribed burning, mechanical removal of fuel, nature based solutions such as grazing and creating firebreaks and implementing surveillance in high-risk areas to reduce the risk and impact of forest fires.





# WHAT IS A FIRE REGIME?



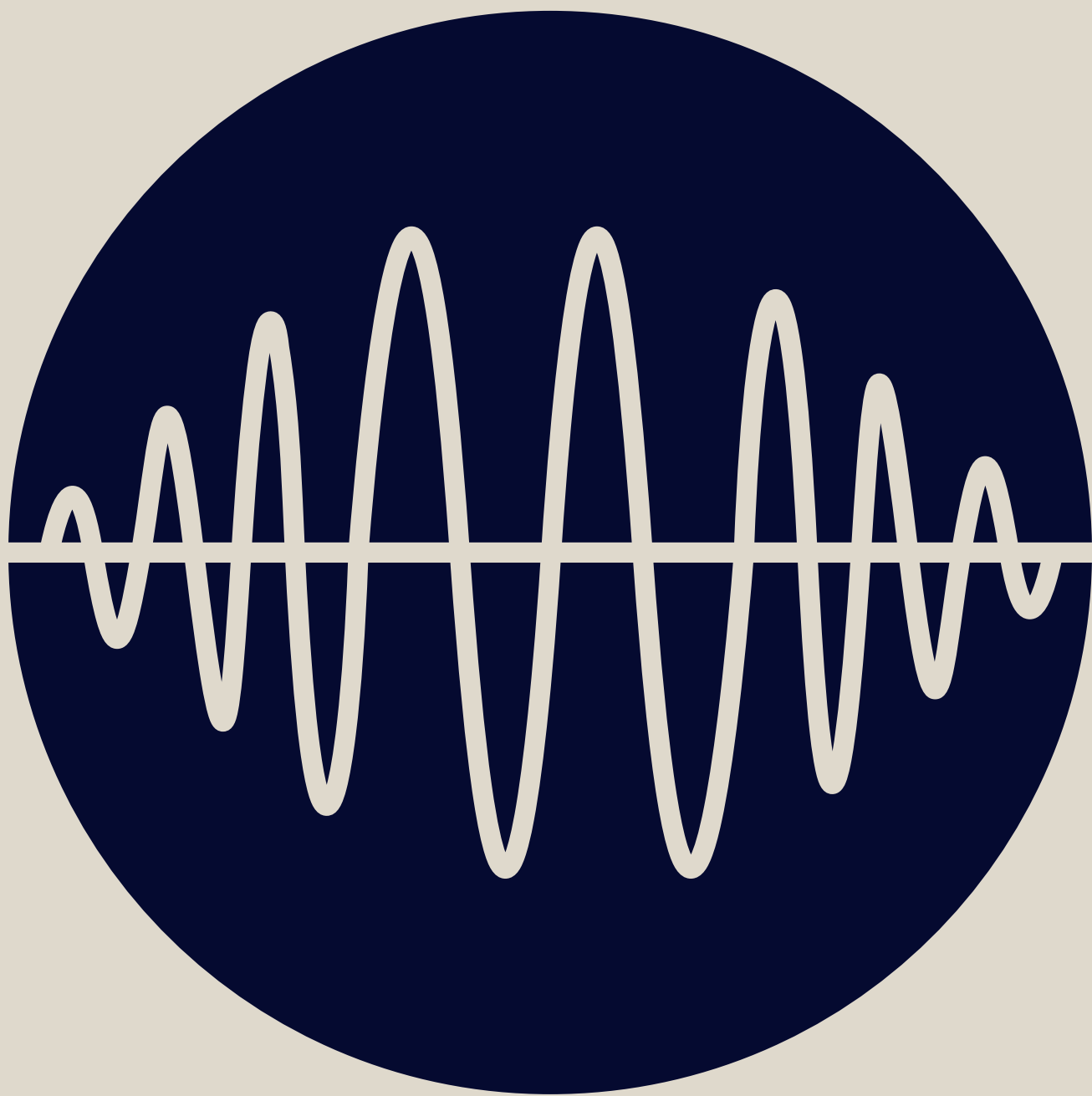
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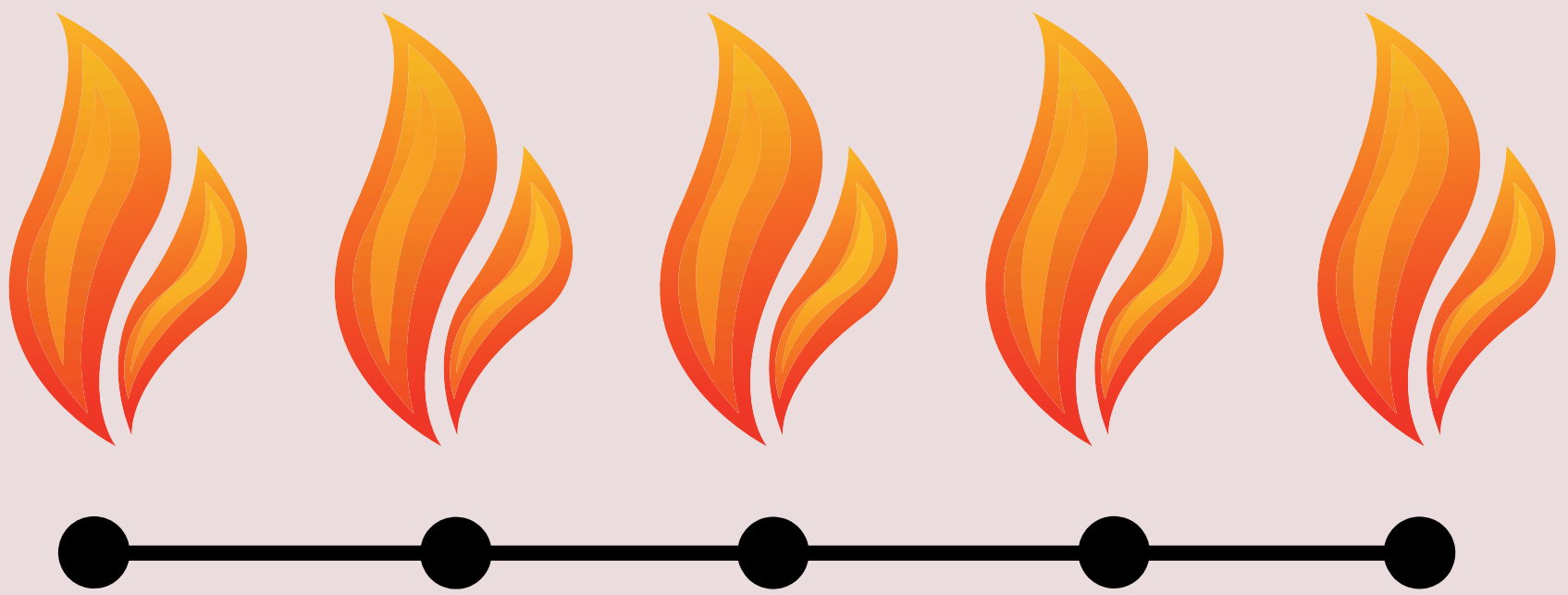
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A fire regime refers to the patterns, frequency, and intensity of the wildfires that occur in a particular ecosystem or area over time. It encompasses several key elements that describe how fires naturally occur and influence the environment, including:



# FREQUENCY

This indicates how often fires occur in a given area. Some ecosystems experience fires very frequently (every few years), while others may see fires only once in several decades or even centuries.



# INTENSITY

Intensity describes how hot and powerful a fire is. Low-intensity fires might only burn the underbrush and leave larger trees relatively unharmed, while high-intensity fires can consume everything in their path, from the forest floor to the canopy.



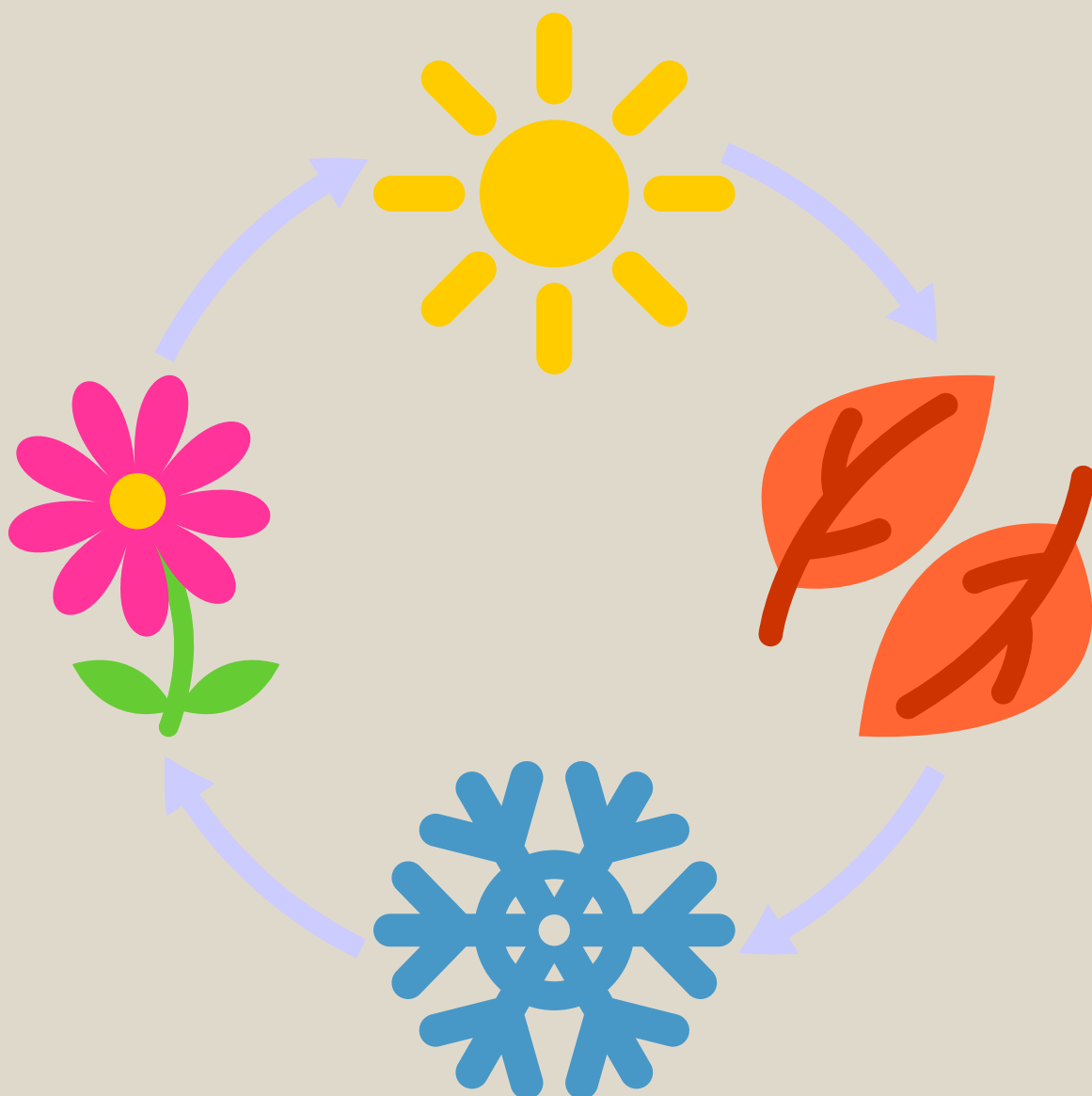
# SEVERITY

Severity refers to the impact of the fire on the ecosystem, particularly in terms of the damage to vegetation and alterations to the soil. High-severity fires might kill most of the plant life and alter the soil structure, while low-severity fires may actually stimulate growth and rejuvenation.



# SEASONALITY

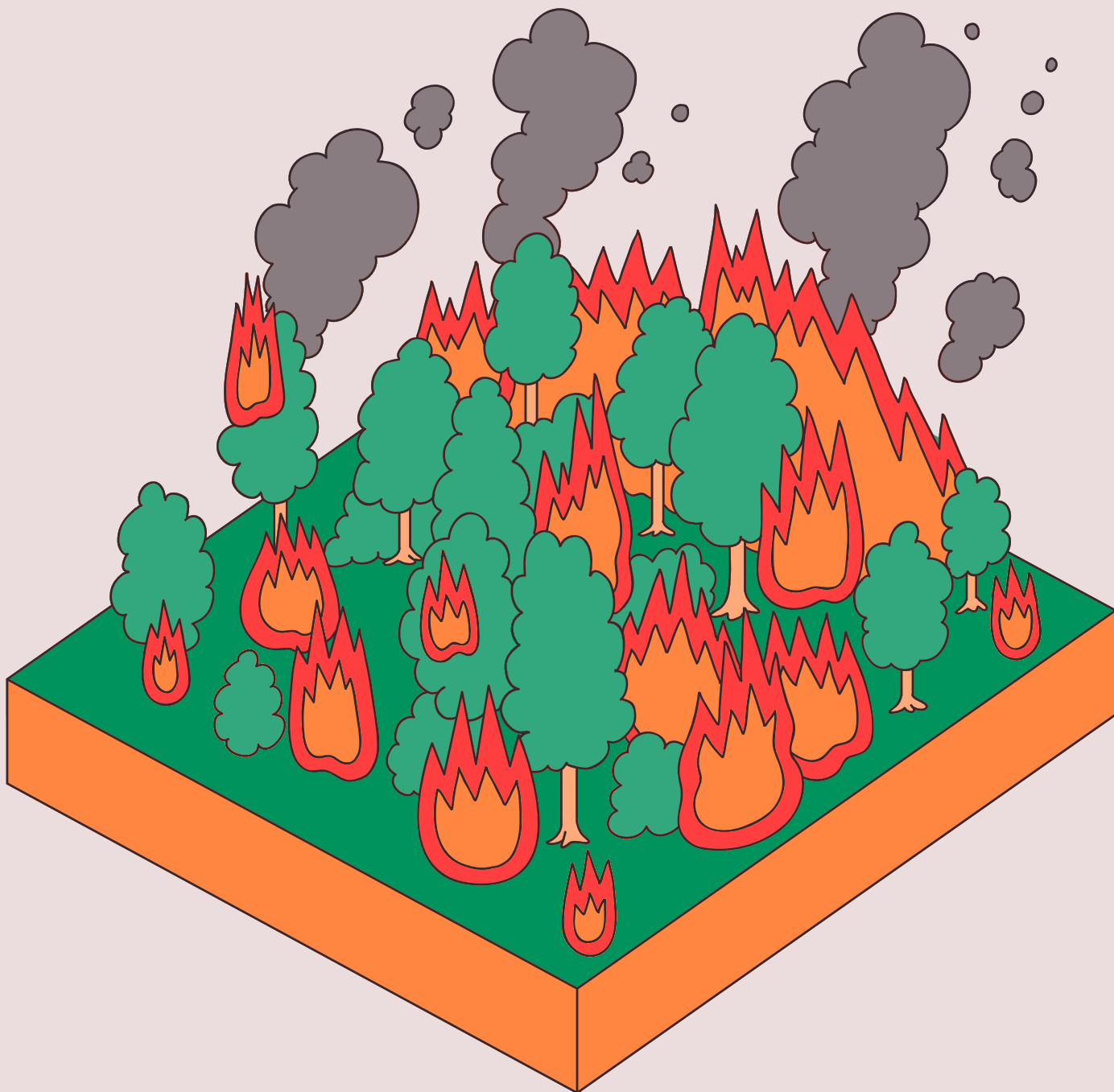
This aspect covers the time of year when fires are most likely to occur. Fire seasonality is influenced by climate, weather patterns (such as drought periods), and human activities. For example, in some regions, fires are more common during dry seasons when lightning strikes are frequent or when human-induced ignition is more likely.





# SCALE AND PATTERN

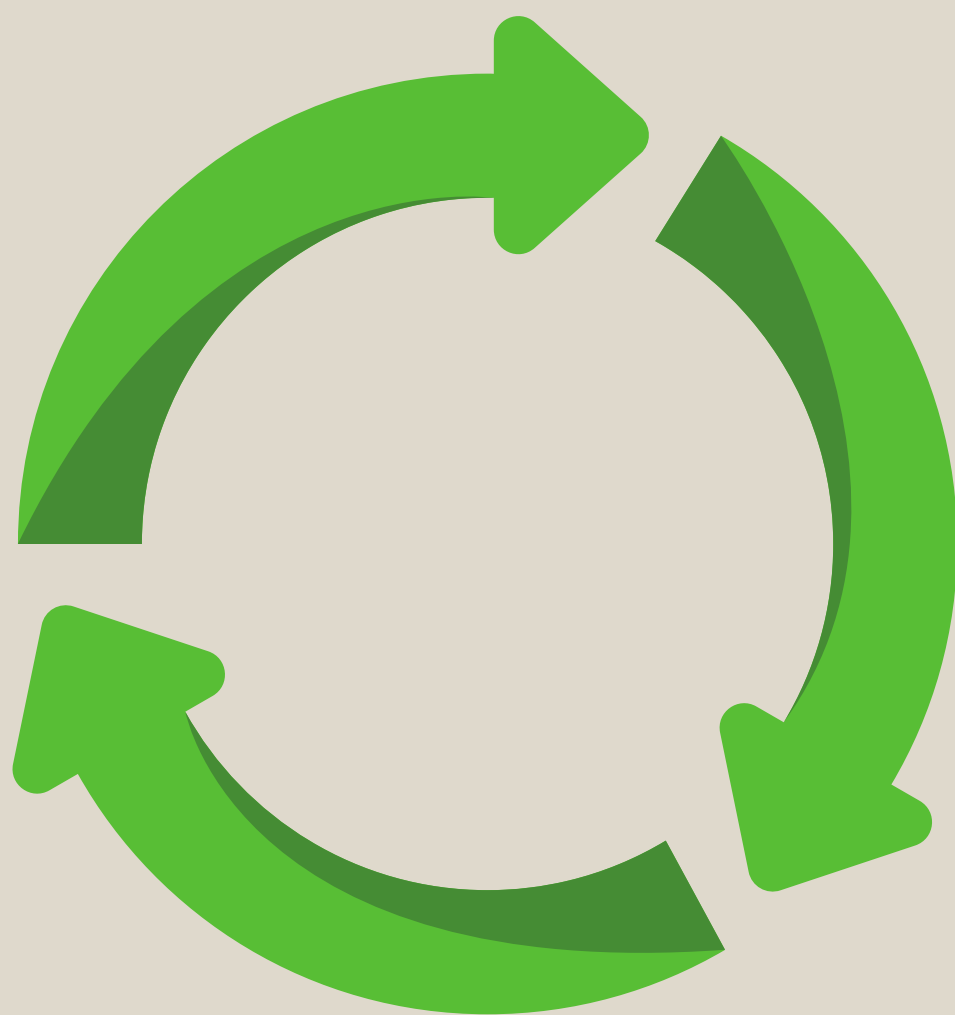
The size (scale) of fires and their spatial pattern (how they spread across the landscape) are also part of a fire regime. Some ecosystems may experience large, widespread fires, while others may have smaller, patchier fires that affect the landscape differently.





# ECOLOGICAL EFFECTS

The ecological effects consider how fires shape the ecosystem, including changes in dominant vegetation types, species composition and nutrient cycling. Different fire regimes can favour different types of vegetation and wildlife, shaping the structure and function of ecosystems.



# UNDERSTANDING FIRE REGIMES

Understanding the natural fire regime of an ecosystem is crucial for effective land management and conservation. It helps in predicting the behaviour of future fires, managing vegetation to reduce fire risk, and restoring ecosystems where the natural fire regime has been altered by human activity.



Fire regimes are also being affected by climate change, which can alter patterns of temperature and precipitation, leading to changes in fire frequency, intensity, and seasonality.



Adapting to these changes and managing fire regimes responsibly is essential for protecting ecosystems, human communities, and infrastructure from the potentially devastating impacts of wildfires.



# WHAT IS “FIRE BEHAVIOUR”?



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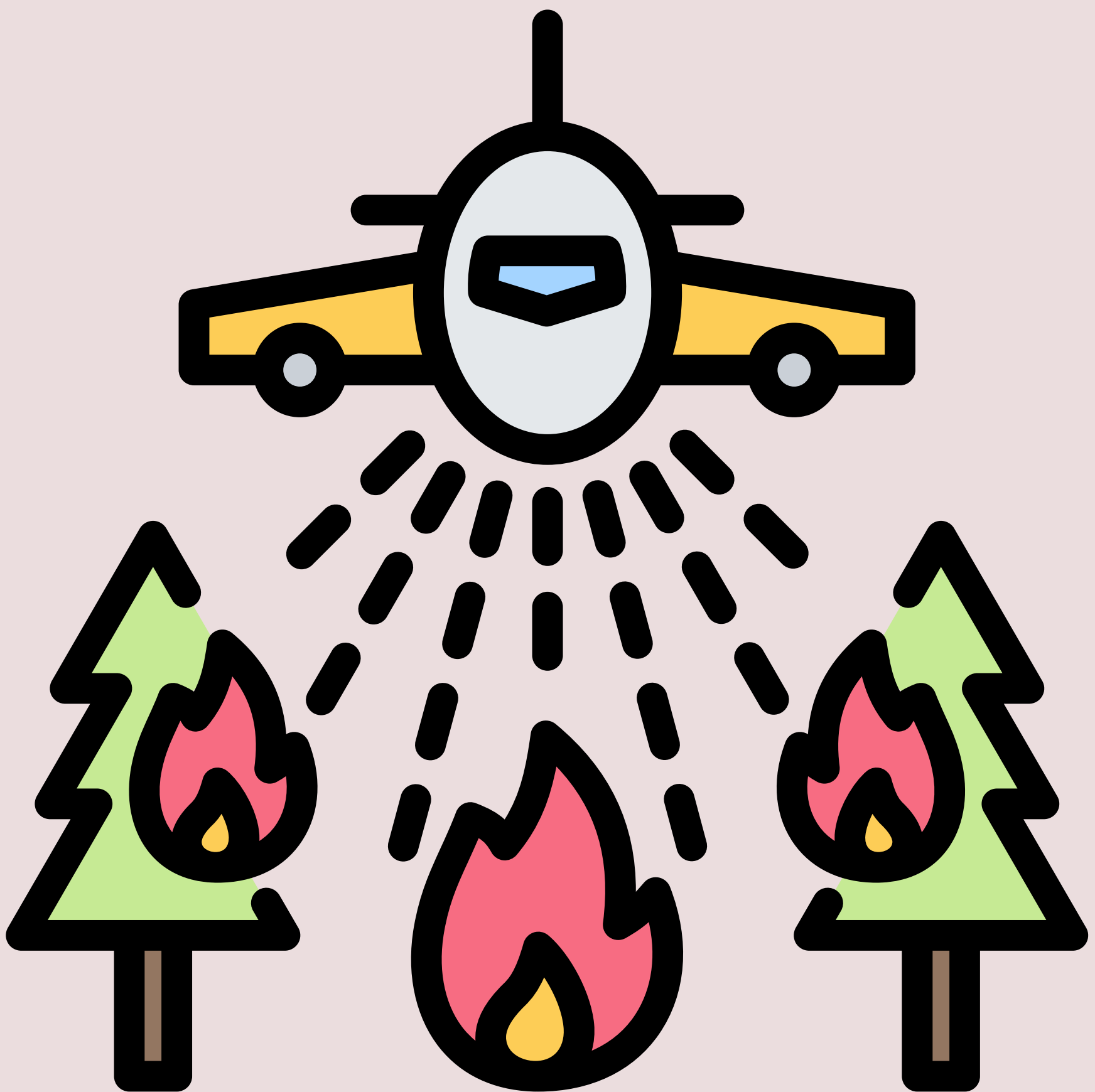
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Fire behaviour refers to the manner in which a fire reacts to the influences of fuel, weather, and topography. It encompasses various characteristics and dynamics of the fire, including its spread rate, intensity, flame length, and the pattern of its advance through the landscape.

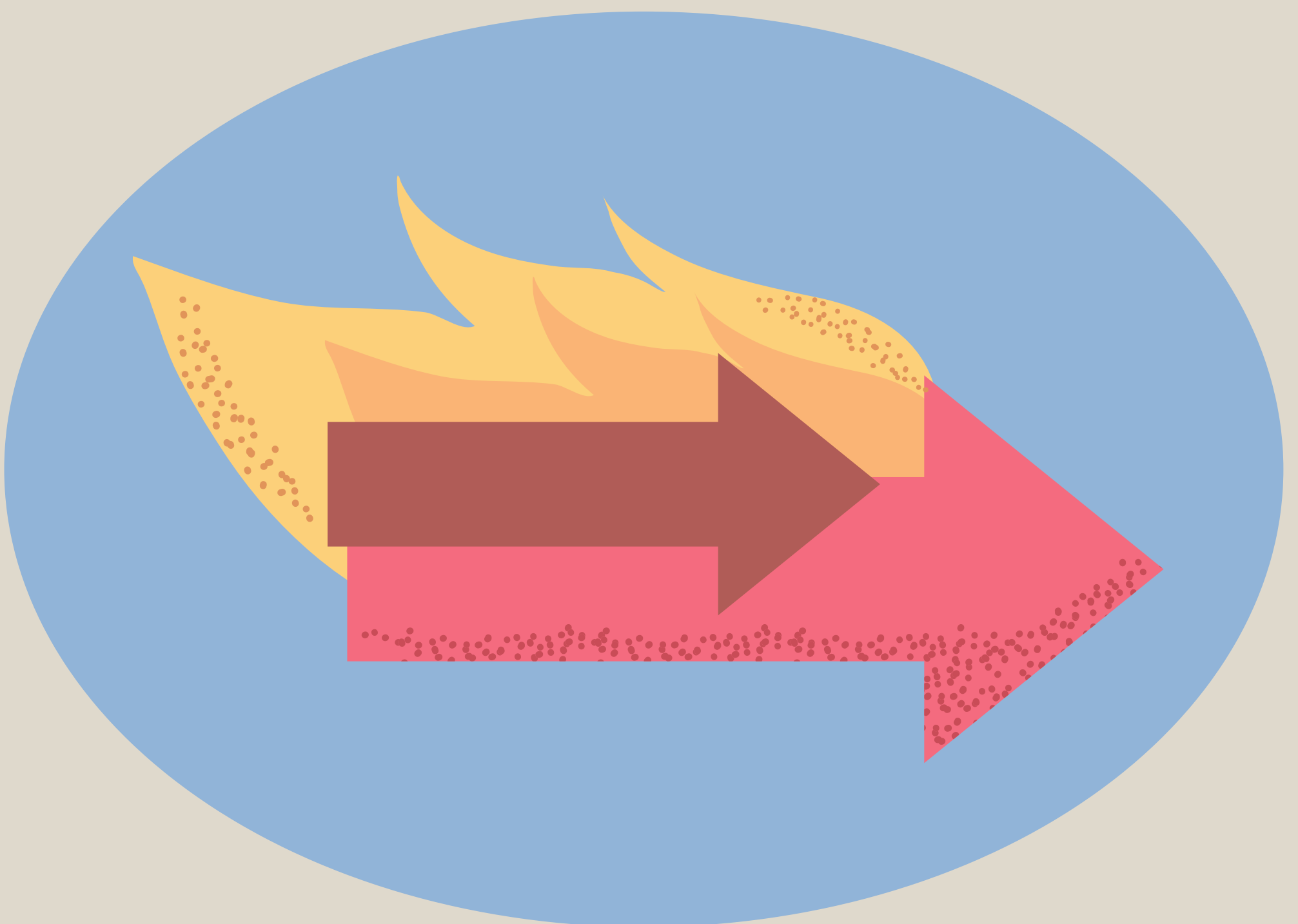
Understanding fire behaviour is crucial for predicting how a fire will progress, which informs firefighting strategies, evacuation plans, and measures to minimize damage and loss of life. Here are the key aspects of fire behaviour:





# RATE OF SPREAD

This is the speed at which a fire moves across the landscape. It can be influenced by wind, slope, fuel type, and fuel moisture, among other factors.



# INTENSITY

Fire intensity refers to the energy output of a fire, often described in terms of the heat released. It is affected by the amount and type of fuel, weather conditions, and fire size. High-intensity fires are more challenging to control and can cause greater ecological and property damage.



# FLAME LENGTH

This describes the visible portion of the fire and can be an indicator of fire intensity. Longer flames generally indicate a more intense fire, which can be more difficult to suppress and may pose greater risks to firefighters and structures.



# FIRE TYPE

The behaviour of a fire also depends on whether it is a surface, crown, or ground fire, each of which interacts differently with the environment and requires different strategies to manage.



# IGNITION PROBABILITY

This refers to the likelihood of a fire starting, based on the presence and condition of fuels and the prevailing weather conditions.



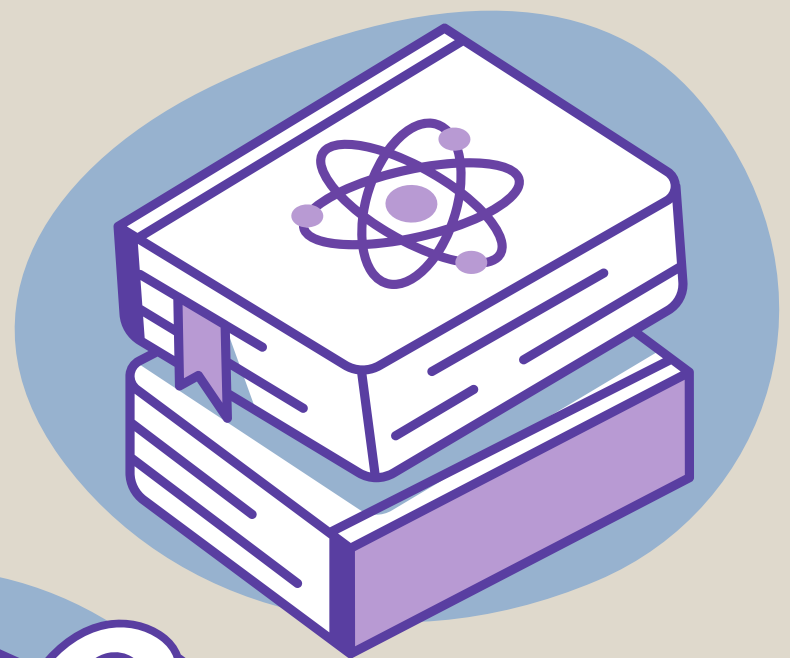
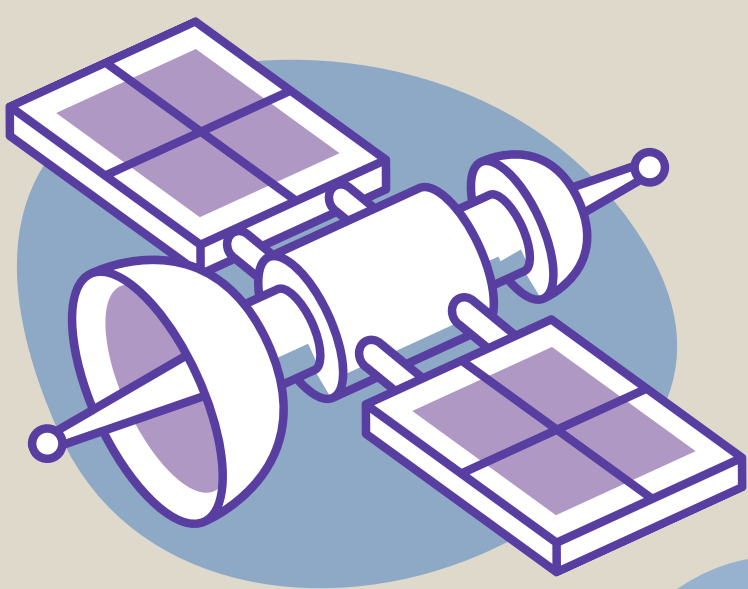
# FIRE DIRECTION AND SHAPE

The direction a fire moves and its shape can be influenced by wind direction, topography, and barriers to fire spread, such as roads, rivers, or previously burnt areas.





Understanding fire behaviour is a complex science that involves physics, chemistry, meteorology, and ecology.





Firefighters, land managers, and scientists study fire behaviour to improve wildfire management and mitigation efforts, aiming to reduce the impacts of wildfires on communities, ecosystems, and economies.

# EXAMPLES OF RECENT SIGNIFICANT FOREST FIRES WORLDWIDE



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As of 2024, severe wildfires have been reported in many countries, including the US (California), Canada, and Greece, primarily driven by ongoing drought conditions.



The increasing intensity and frequency of these wildfires are closely linked to climate change, with rising temperatures, prolonged droughts, and drier landscapes creating more favourable conditions for large and destructive fires. Below are some examples of severe wildfires and their consequences:



# The Dadia-Alexandroupoli wildfire in Greece, August 2023

The fire burnt around 73,000 hectares (730 square kilometers) of land, primarily in the Dadia. Tragically, 18 people lost their lives. This wildfire has been described as the largest ever recorded in the European Union.



The fire spread rapidly due to high winds and extreme temperatures, leading to widespread evacuations and significant damage to the environment and local communities.



# The 2023 Rhodes Wildfire

- Location: Rhodes, Greece
- Date: July 2023
- Area Affected: Thousands of hectares, leading to the evacuation of several villages and a hospital.



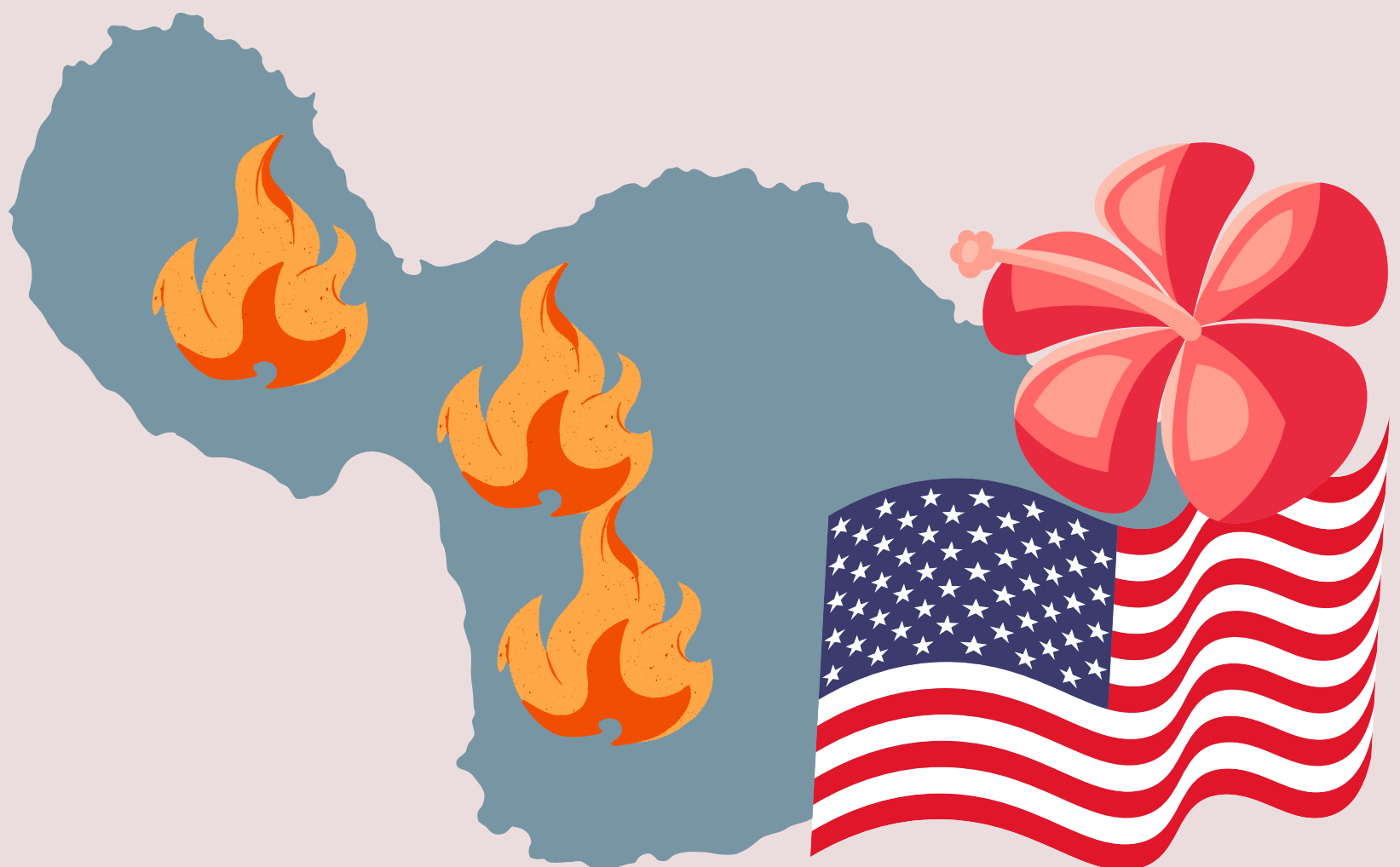


**Impact:** The wildfire on the island of Rhodes was part of a series of fires during a heatwave across the Mediterranean. The situation was exacerbated by strong winds and extreme temperatures, leading to significant evacuations and highlighting the challenges of firefighting in tourist destinations.



# Maui Wildfires (Hawaii, 2023)

- Location: *Maui, Hawaii, USA.*
- **Impact:** The Lahaina fire was particularly devastating, destroying much of the historic town of Lahaina. At least 115 people were killed, and thousands were displaced, making it one of the deadliest wildfires in the U.S. in over a century.

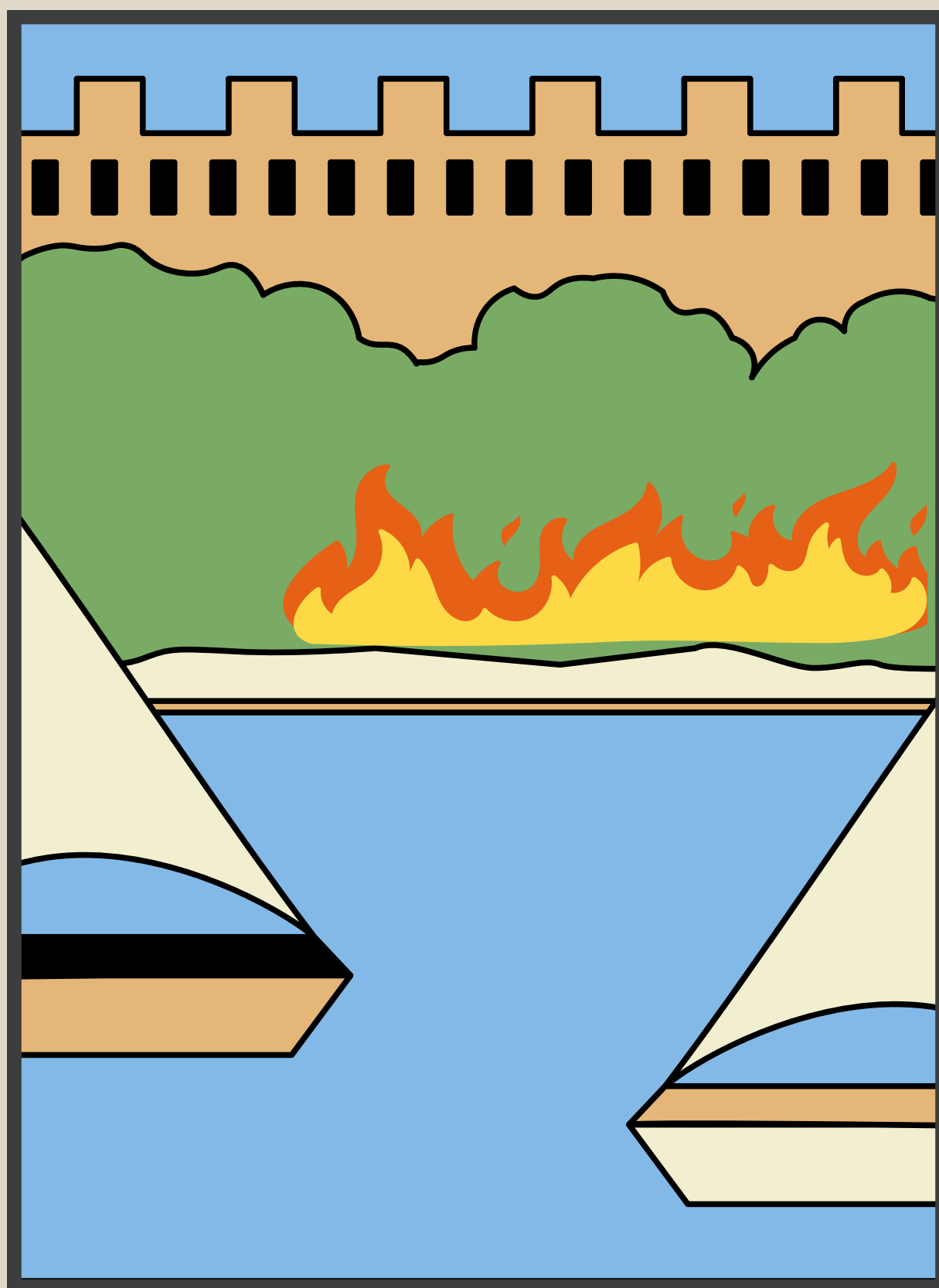


# The 2022 Wildfires in Spain and France

- Location: Multiple locations in Spain and France, including Catalonia in Spain and Gironde in France.
- Date: Summer 2022
- Area Affected: Tens of thousands of hectares across both countries.



**Impact:** The 2022 wildfire season was marked by early and intense fires due to a dry winter and spring, leading to widespread destruction of land and property and significant evacuations, particularly in tourist areas along the Mediterranean coast.



These events stressed the increasing wildfire risk under climate change scenarios and the need for enhanced preparedness and adaptation measures.



# The 2021 British Columbia Wildfires

- Location: British Columbia, Canada
- Date: Summer 2021
- Area Affected: Over 1.6 million acres (650,000 hectares)





**Impact:** Marked as one of the most severe fire seasons in British Columbia's history, it included the destruction of the town of Lytton just days after setting Canada's all-time-high temperature record. The season underscored the increasing intensity of wildfires in the context of global warming and extreme weather events.



# The 2020 Amazon Rainforest Fires

- Location: Amazon Rainforest, primarily in Brazil
- Date: Throughout 2020, peaking in August and September
- Area Affected: Thousands of individual fires burnt, significantly impacting the rainforest's biodiversity.



**Impact:** These fires were part of a trend of increasing deforestation and land clearing for agriculture in the Amazon. They resulted in significant carbon emissions and loss of biodiversity, drawing global attention to the policies and practices contributing to the Amazon's degradation.



# The 2019-2020 Australian Bushfire Season (Black Summer)

- Location: Across Australia, especially New South Wales and Victoria
- Date: June 2019 - March 2020
- Area Affected: Approximately 46 million acres (18.6 million hectares)



**Impact:** Over 33 people died, and about 3 billion animals were killed or displaced. Thousands of homes were destroyed. The fires were exacerbated by prolonged drought, high temperatures, and strong winds, highlighting the severe impact of climate change.

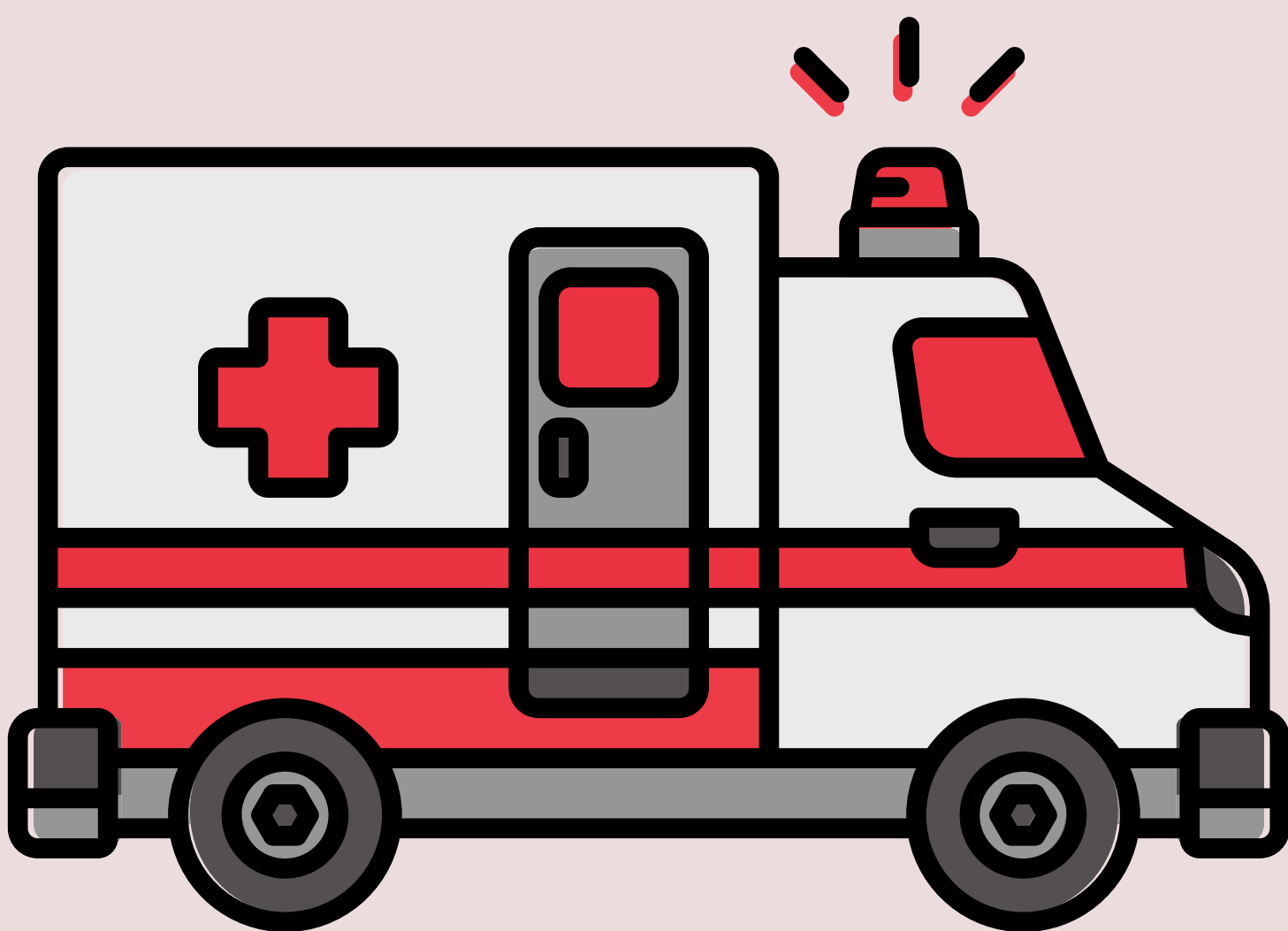


# The 2018 California Camp Fire

- Location: Butte County,  
Northern California, USA
- Date: November 2018
- Area Affected:  
Approximately 153,336  
acres (62,053 hectares)



**Impact:** The Camp Fire was the deadliest and most destructive wildfire in California's history, killing 85 people, destroying nearly 19,000 structures, and causing over \$16.5 billion in damages. The town of Paradise was almost completely destroyed. The fire was attributed to electrical transmission lines owned by the Pacific Gas and Electric Company.



# The 2018 Attica Wildfires

- Location: Attica region, near Athens, Greece
- Date: July 2018
- Area Affected: 1,276 ha, the fire had significant impact being the deadliest of all times in Greece and one of the deadliest worldwide.





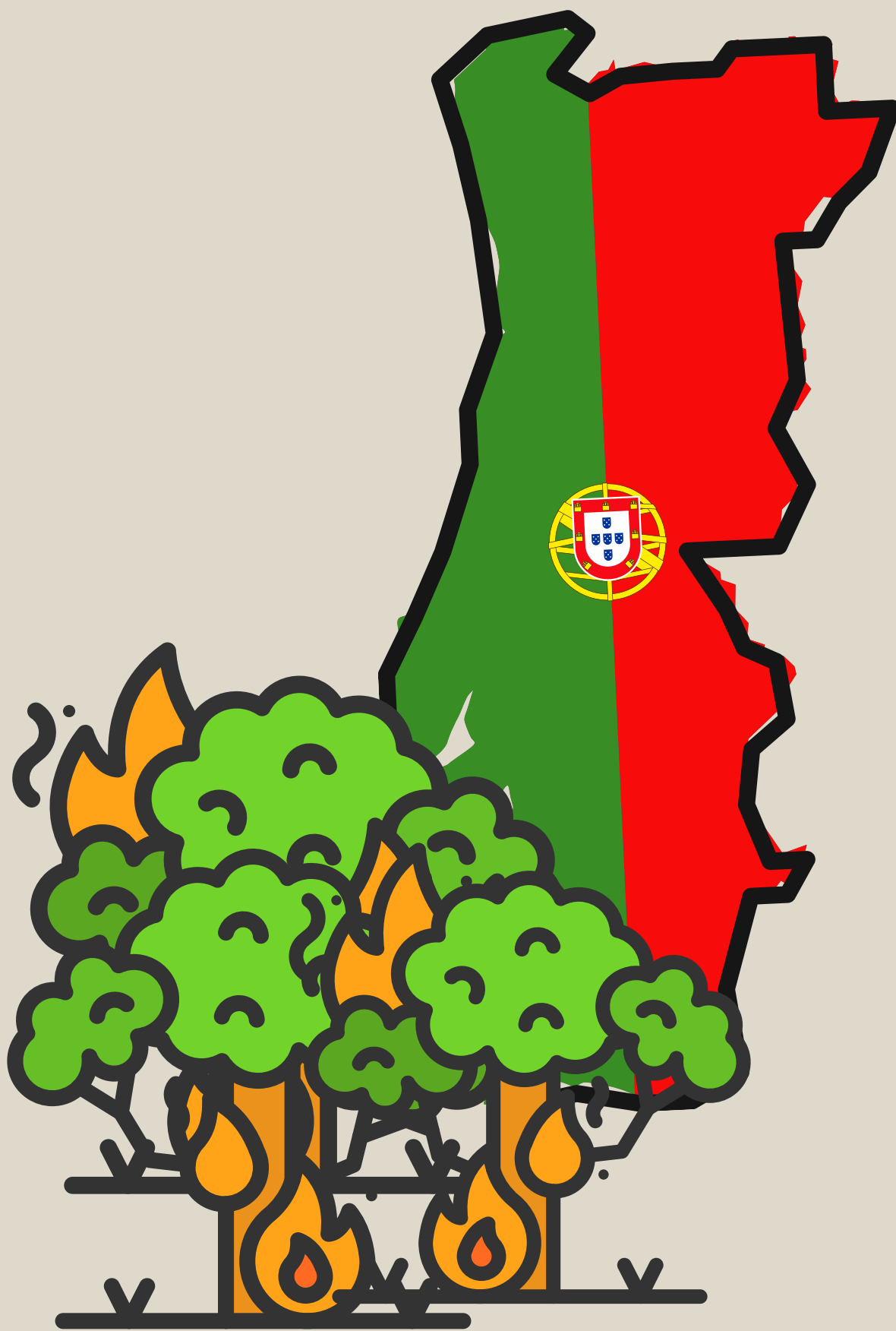
**Impact:** The Attica wildfires were the deadliest in Greek history, claiming at least 103 lives. The rapid spread of the fire, fueled by strong winds and high temperatures, led to a tragic loss of life and property.



The disaster emphasized the need for better preparedness and urban planning to mitigate wildfire risks.

# The 2017 Portugal Wildfires

- Location: Central Portugal
- Date: June and October 2017
- Area Affected: The June fires alone burnt approximately 560 square kilometers (216 square miles).



**Impact:** The June wildfires, particularly near Pedrógão Grande, were among the deadliest in Portugal's history, killing 66 people and injuring over 200. The October fires also caused significant destruction, with over 50 fatalities. These fires highlighted severe issues in forest management and emergency response systems.





# **FIRE AS A NATURAL DISTURBANCE AND HUMAN INTERVENTION**

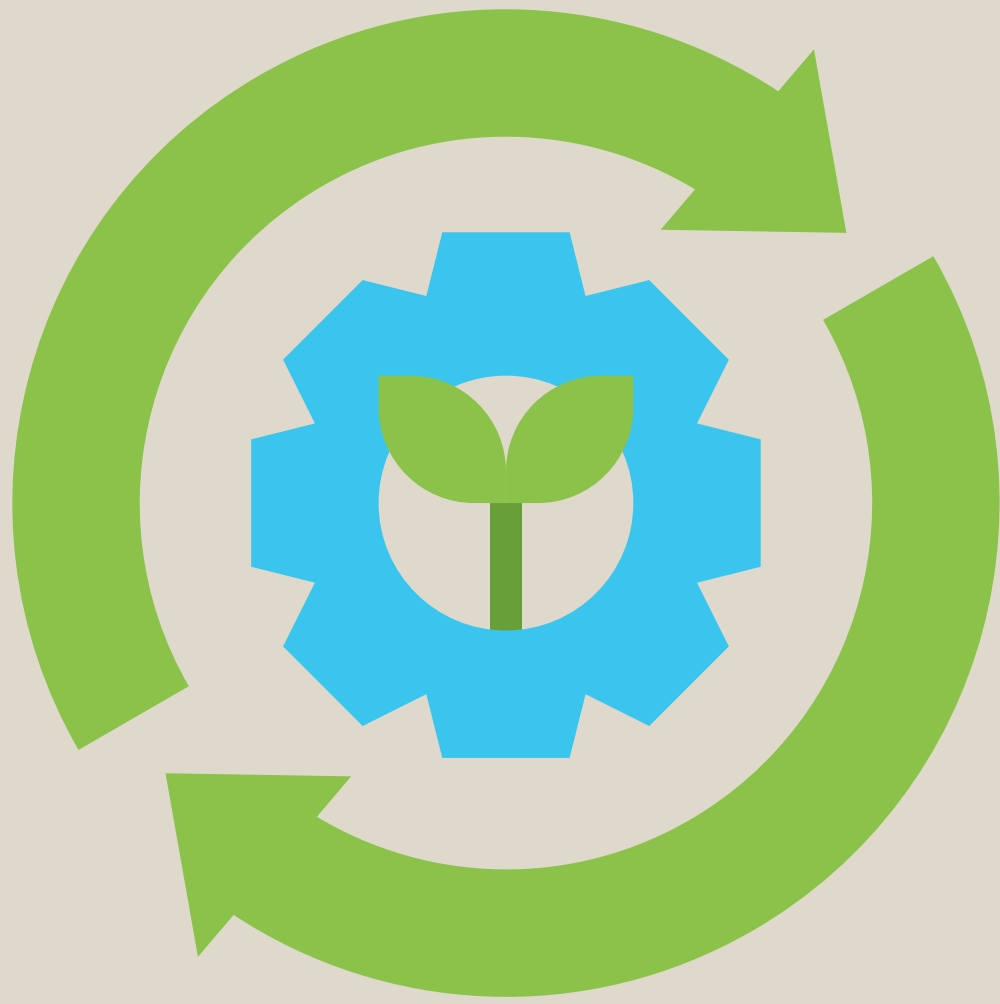


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Fire is a natural part of many ecosystems, playing a key role in shaping vegetation patterns, influencing biodiversity, and contributing to the nutrient cycle. However, when we talk about "Fire regimes are modified by humans," it refers to how human activities have changed the natural patterns and effects of fire in various ecosystems. Let's break this down for a clearer understanding:

# **FIRE AS A NATURAL DISTURBANCE**



## **Natural Role of Fire**

In many environments, fire acts as a natural disturbance that can benefit the ecosystem. It can help certain plants to germinate, maintain grasslands by preventing the encroachment of trees, recycle nutrients back into the soil, and create habitats for various wildlife species.

Fire regimes—patterns of fire frequency, intensity, size, type, and seasonality—have historically been shaped by natural factors such as lightning, climate, vegetation types, and topography.





# HUMAN MODIFICATION OF FIRE REGIMES

## Suppression and Prevention

For much of the 20th century, fire suppression policies have been aimed at preventing and quickly extinguishing wildfires to protect human lives and property.





While well-intentioned, these policies have led to an accumulation of underbrush and deadwood in many forests, increasing the potential for larger and more severe fires.

# Land Use Changes

Urban expansion, agriculture, and afforestation have altered landscapes, changing natural fire regimes. These activities can either reduce the land's natural fire resilience by fragmenting habitats and changing vegetation patterns or increase fire risks by introducing more flammable plant species.



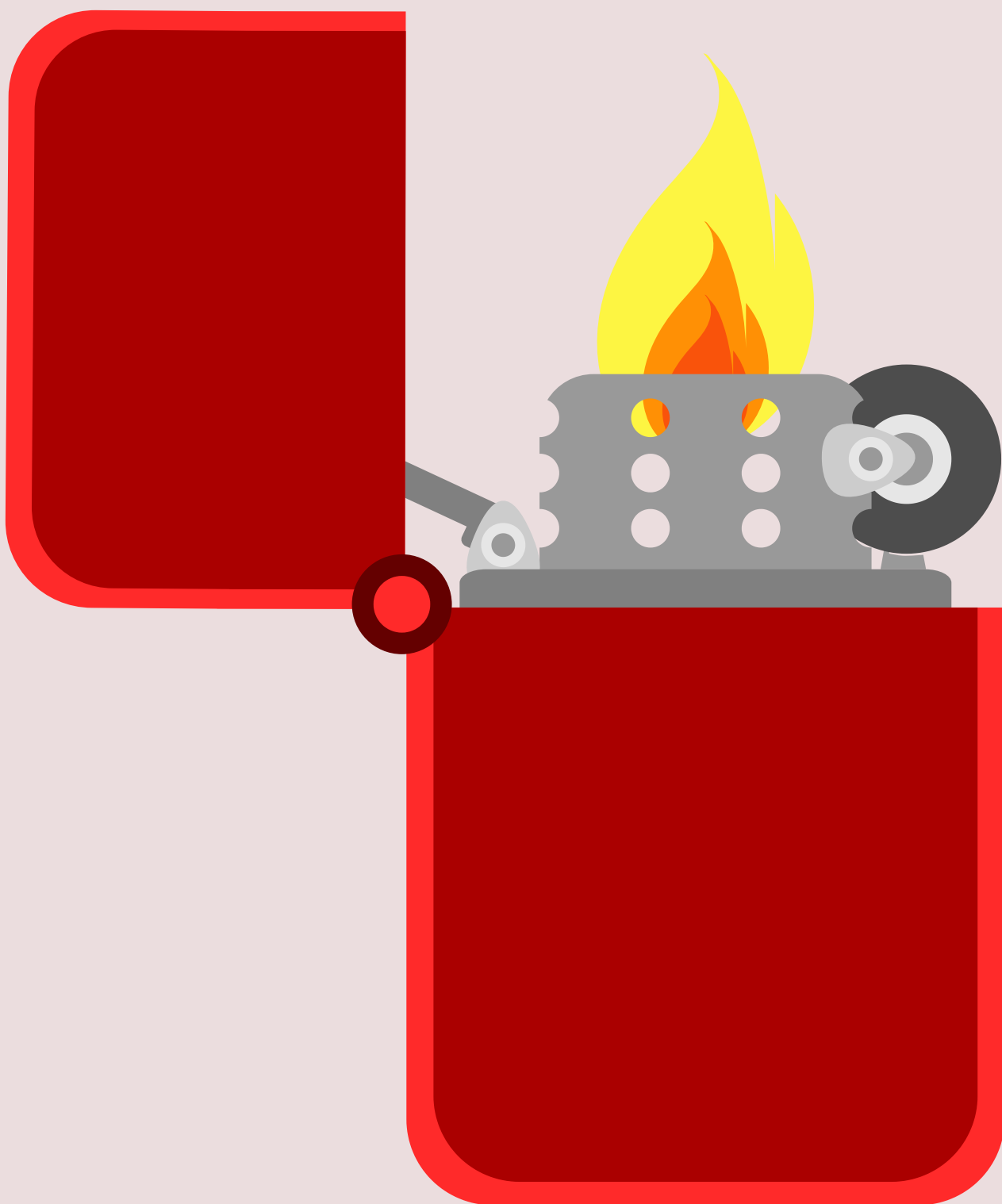


# Climate Change

Human-induced climate change is leading to warmer temperatures, changing precipitation patterns, and more extreme weather events, all of which can exacerbate fire conditions. Drier, hotter conditions increase the likelihood of fire and can make fires more intense and difficult to control.

# Intentional Fires

Humans also modify fire regimes through the intentional use of fire for land clearing, agriculture (such as slash-and-burn techniques), and prescribed burns.



While prescribed burns are controlled fires set to achieve specific management goals (like reducing fuel loads or managing invasive species), they still represent a human influence on the natural fire regime.



# IMPLICATIONS



The modification of fire regimes by humans has significant ecological, social, and economic implications. It can lead to more frequent and severe wildfires, loss of biodiversity, changes in vegetation structure and composition, and increased carbon emissions.



Managing fire regimes in the context of human influence involves understanding these complex interactions and implementing strategies that balance ecological health, fire risk reduction, and human safety.



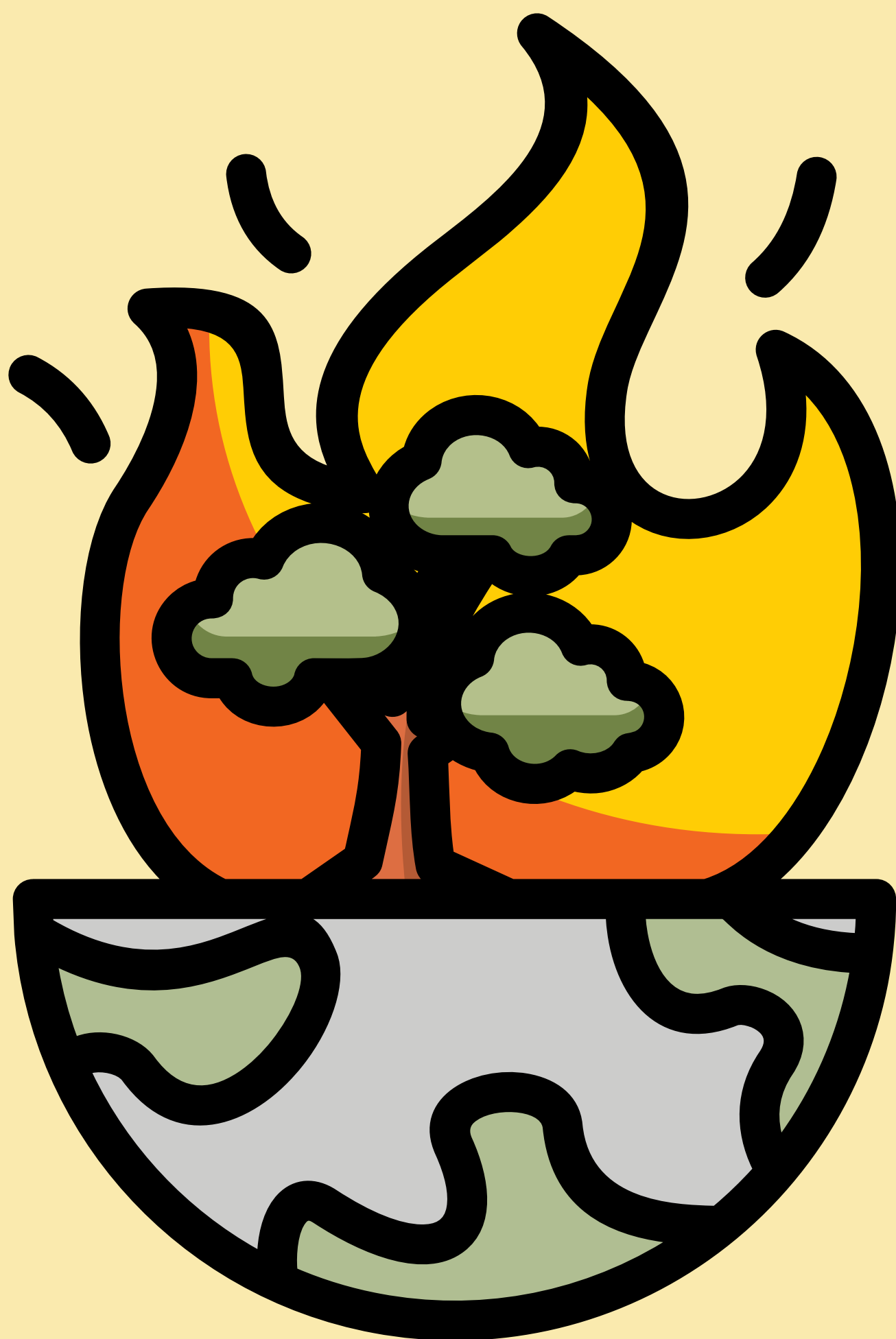


In summary, while fire is a natural process that ecosystems have adapted to over millennia, human activities have significantly altered the balance, leading to changes in how, when, and where fires occur.

The challenge now is to manage fire in a way that respects its role in natural ecosystems while minimizing negative impacts on human communities and the environment.



# IMPACT OF CLIMATE CHANGE ON WILDFIRES

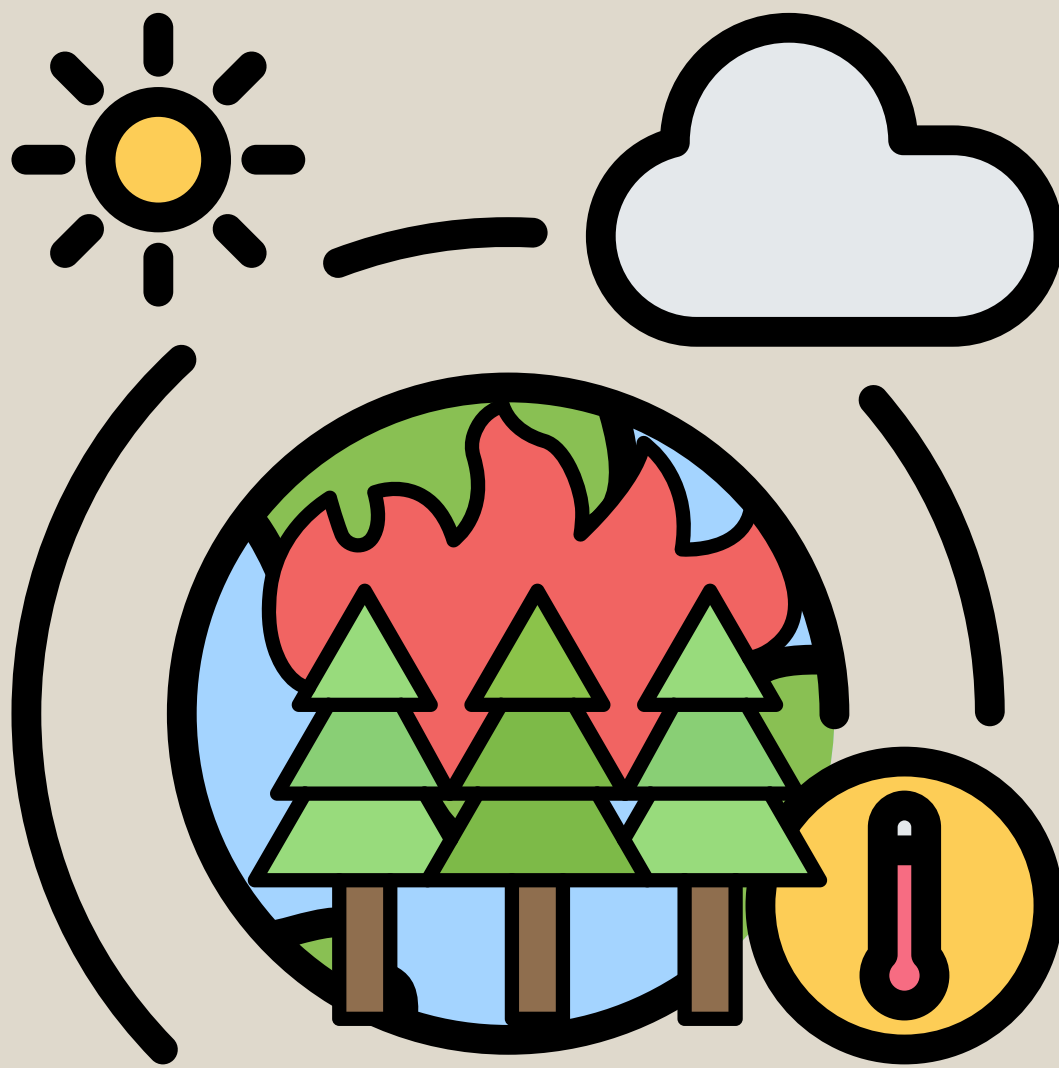


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The relationship between wildfires and climate change (global warming) is complex and interlinked, with each influencing the other in various ways. Here is an overview of how climate change impacts wildfires and vice versa:

# Increased temperatures

Global warming leads to higher temperatures, which can exacerbate drought conditions and reduce soil and vegetation moisture content. This makes vegetation more susceptible to burning and can increase the frequency, intensity, and duration of wildfires.



# Altered Precipitation Patterns

Climate change affects precipitation patterns, leading to more extreme weather events. While some areas may experience increased rainfall, others may suffer prolonged droughts.

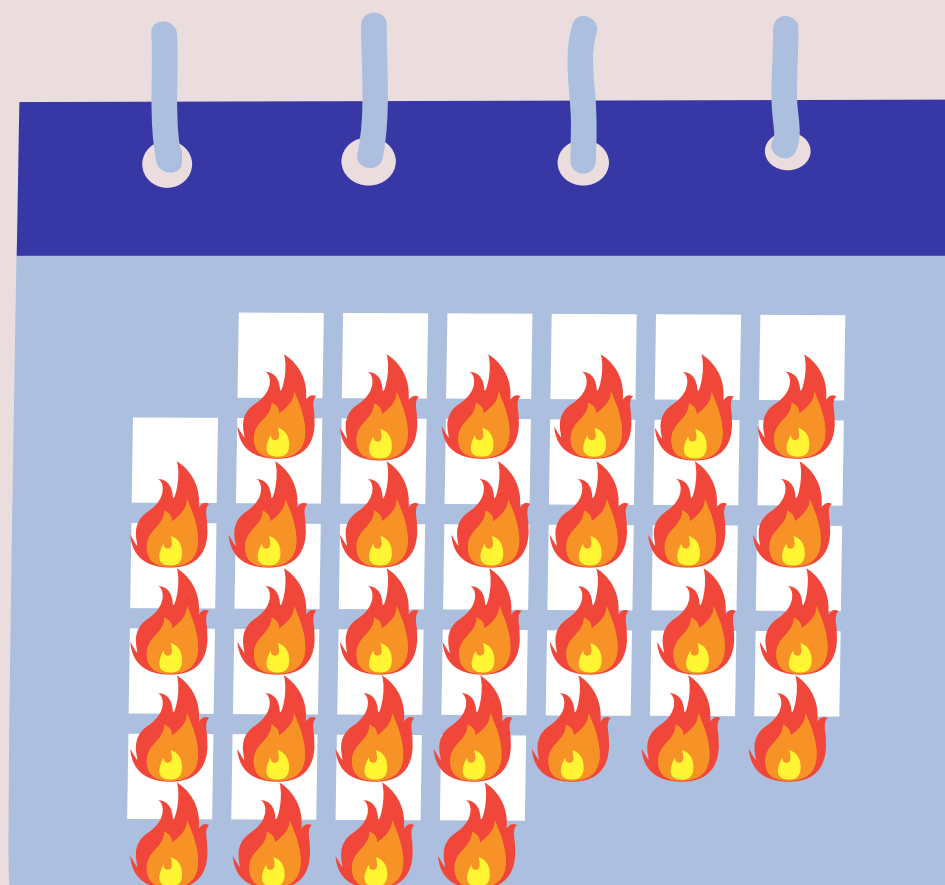


Changes in precipitation regimes also interact with warming conditions, aggravating drought. These changes can affect vegetation growth patterns and fuel availability for wildfires.



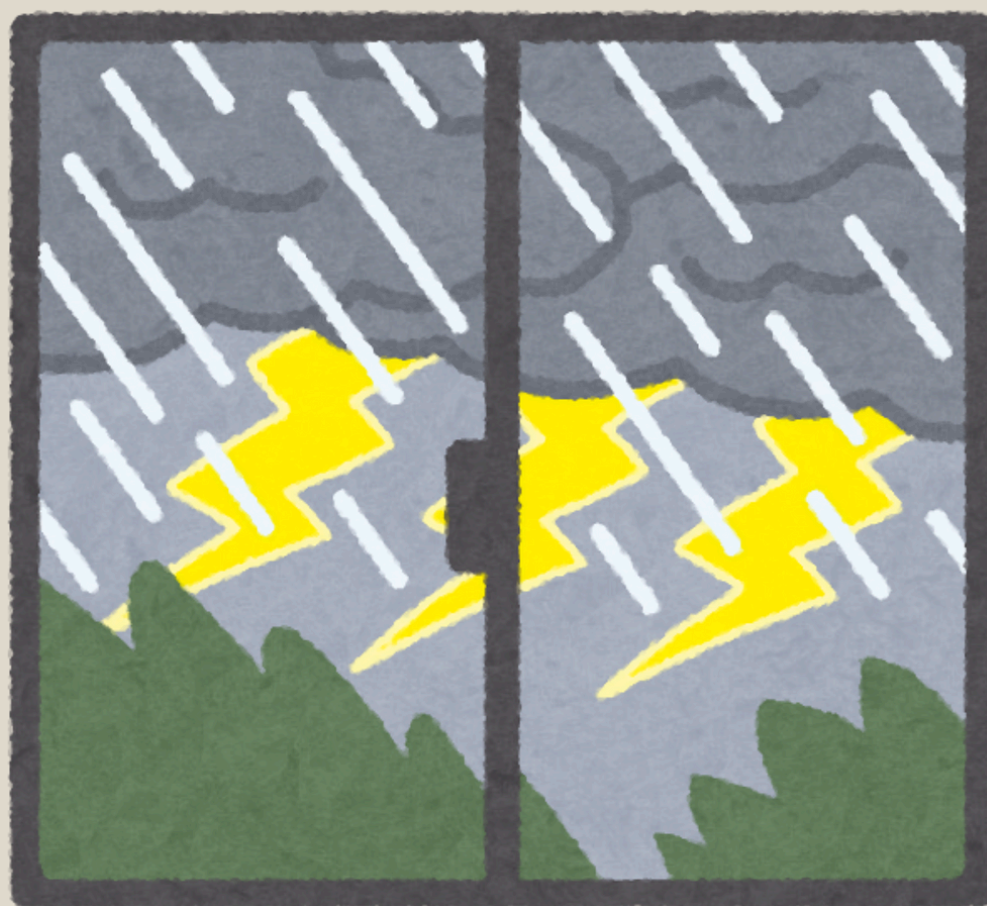
# Extended Fire Seasons

Warmer temperatures and changing precipitation patterns can lead to longer fire seasons. In some regions, what was once a limited season for wildfires has expanded, increasing the window of time during which fires can start and spread.



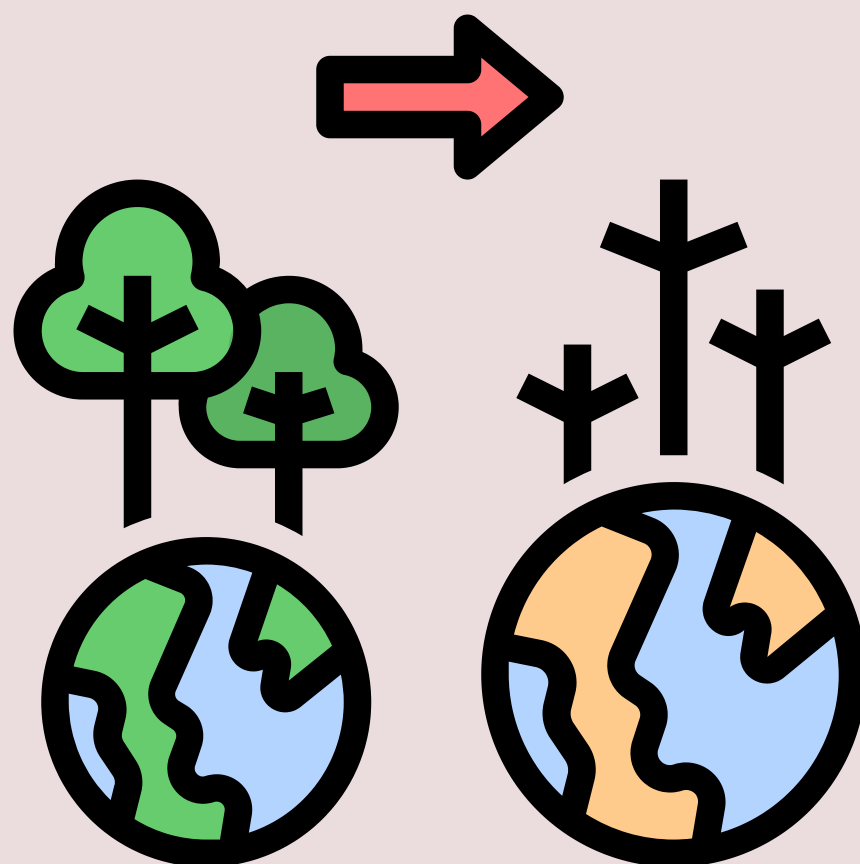
# Increased Lightning Activity

Warmer temperatures can lead to more thunderstorms, which in turn can increase lightning activity—a natural ignition source for wildfires. Additionally, a warmer atmosphere holds more moisture, potentially fueling more severe thunderstorms.



# Changing Ecosystems

Climate change can lead to shifts in vegetation types and distributions. Some ecosystems may become more prone to fires due to the encroachment of more flammable plant species, altering the landscape in ways that can make it more susceptible to wildfires.



# **ECONOMIC IMPACT OF WILDFIRES**



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The economic impact of wildfires is substantial and multifaceted, affecting various sectors and communities in both the short and long term. Here's an in-depth exploration of the economic consequences of wildfires:

# Firefighting and Suppression Cost

These include the expenses for personnel, equipment, aircraft, and other resources deployed to contain and extinguish wildfires.

Suppression costs can run into millions of dollars for large fires.



# Infrastructure for Firefighting

Investment in fire stations, lookout towers, and other infrastructure necessary for effective wildfire management.





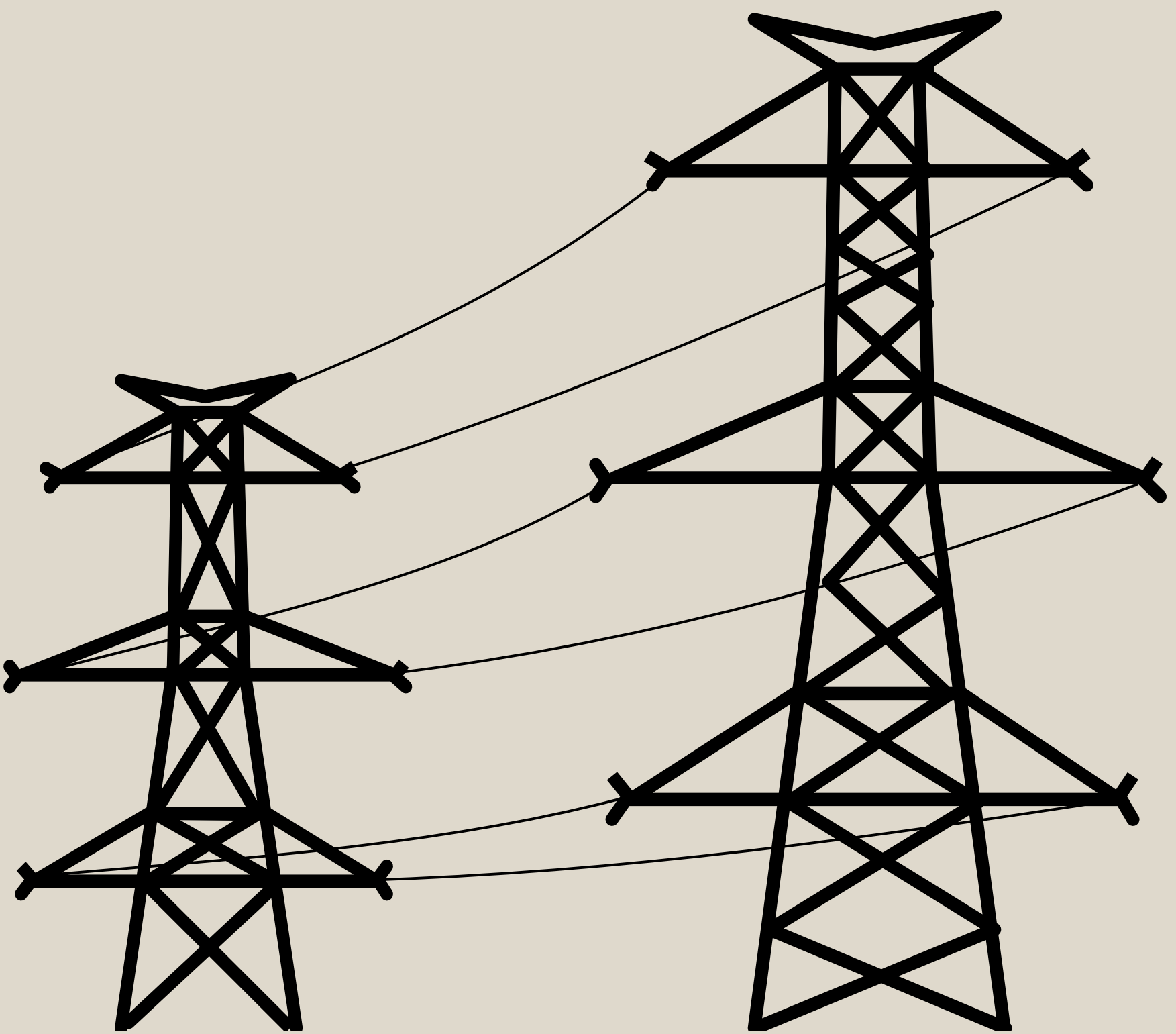
# Residential and Commercial Property

Destruction of homes, businesses, and public buildings leads to significant financial losses. This includes the cost of reconstruction and repairs.



# Utilities and Infrastructure

Damage to power lines, water supply systems, roads, and other critical infrastructure can be extensive and costly to repair.



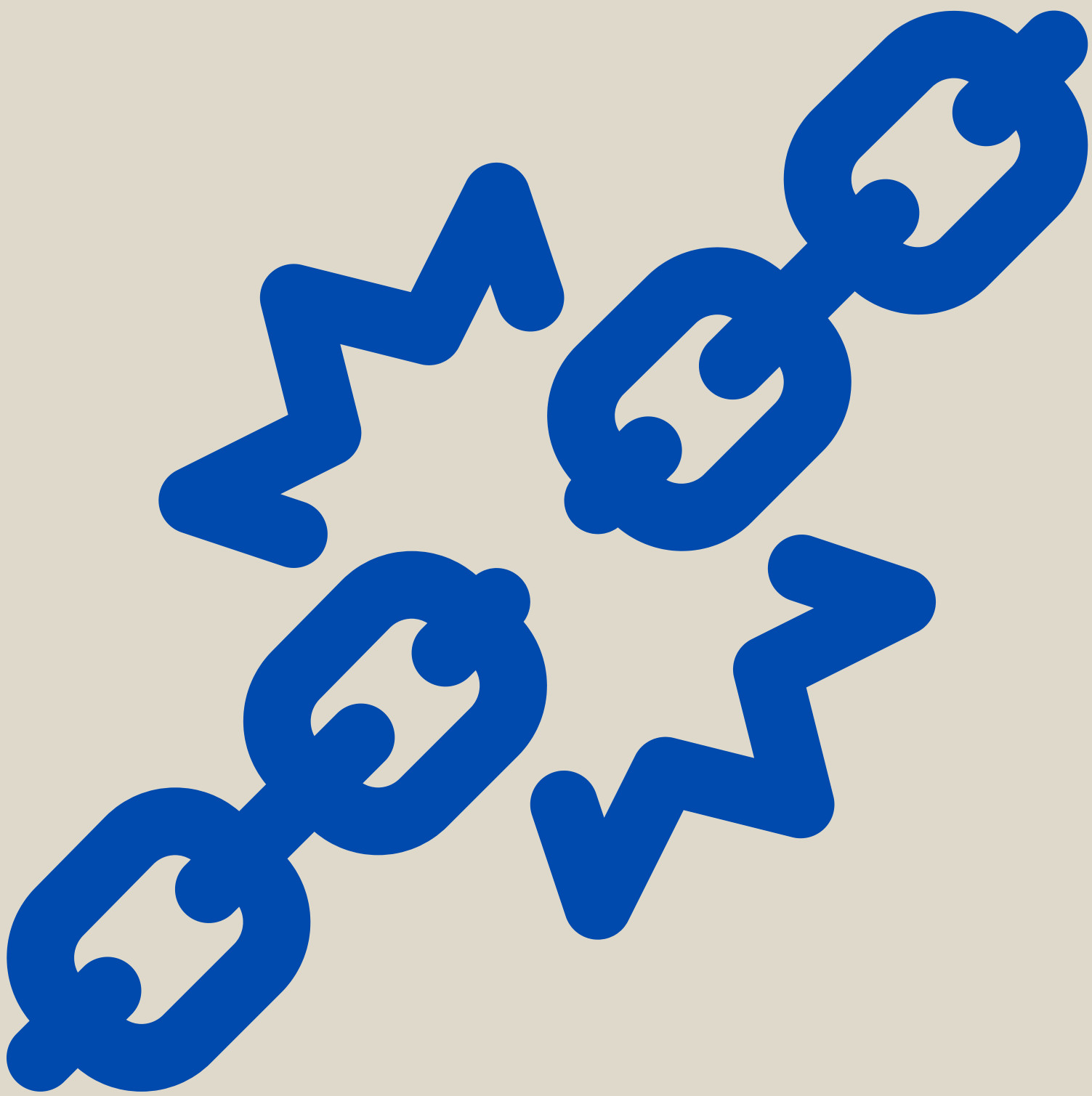
# Business Interruption

Wildfires can cause temporary or permanent closure of businesses, leading to lost income and employment. Sectors like tourism, agriculture, and forestry are particularly vulnerable.



# Supply Chain Disruption

Damage to transportation networks and facilities can interrupt the supply chains, affecting businesses even outside the immediate fire zone.



# Medical Expenses

Treatment for burns, respiratory issues, and other wildfire-related health problems incurs significant costs. This includes emergency medical care and long-term health consequences.



# Mental Health Services

Increased demand for mental health services due to trauma, stress, and anxiety resulting from wildfires.



# Decreased Property Values

Properties in wildfire-prone areas may suffer from reduced market values due to the increased risk, affecting homeowners' equity and local tax revenues.



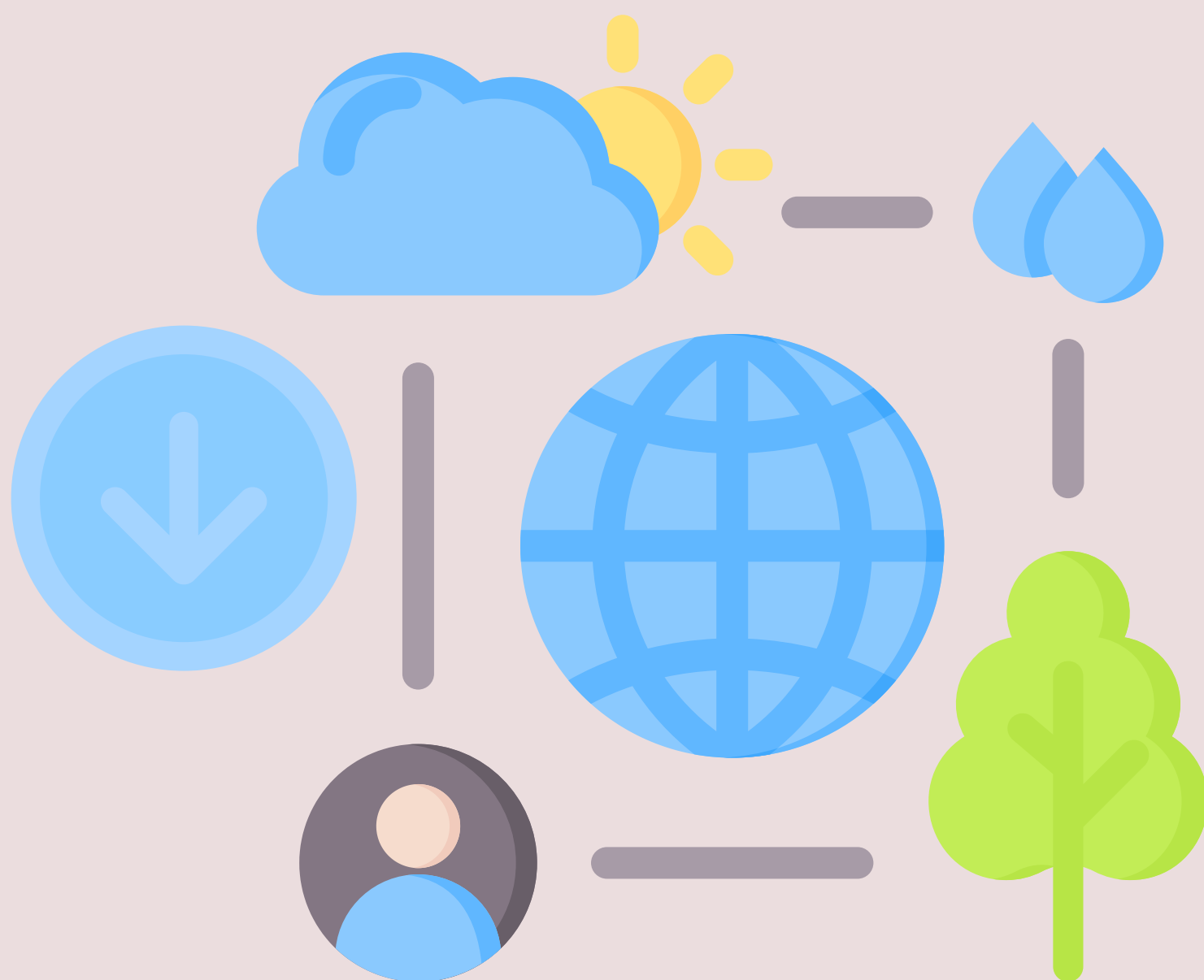


# Insurance Premiums

Higher insurance premiums and increased difficulty in obtaining coverage can further depress property values.



# Loss of Ecosystem Services



Forests provide valuable ecosystem services such as carbon sequestration, water filtration, and biodiversity. Wildfires can severely damage these services, leading to long-term economic losses.

# Rehabilitation Costs

Significant financial resources are required for reforestation, soil stabilization, and habitat restoration efforts.



# Crop and Livestock Losses

Wildfires can destroy crops and kill livestock, leading to immediate financial losses for farmers and long-term impacts on food supply and prices.



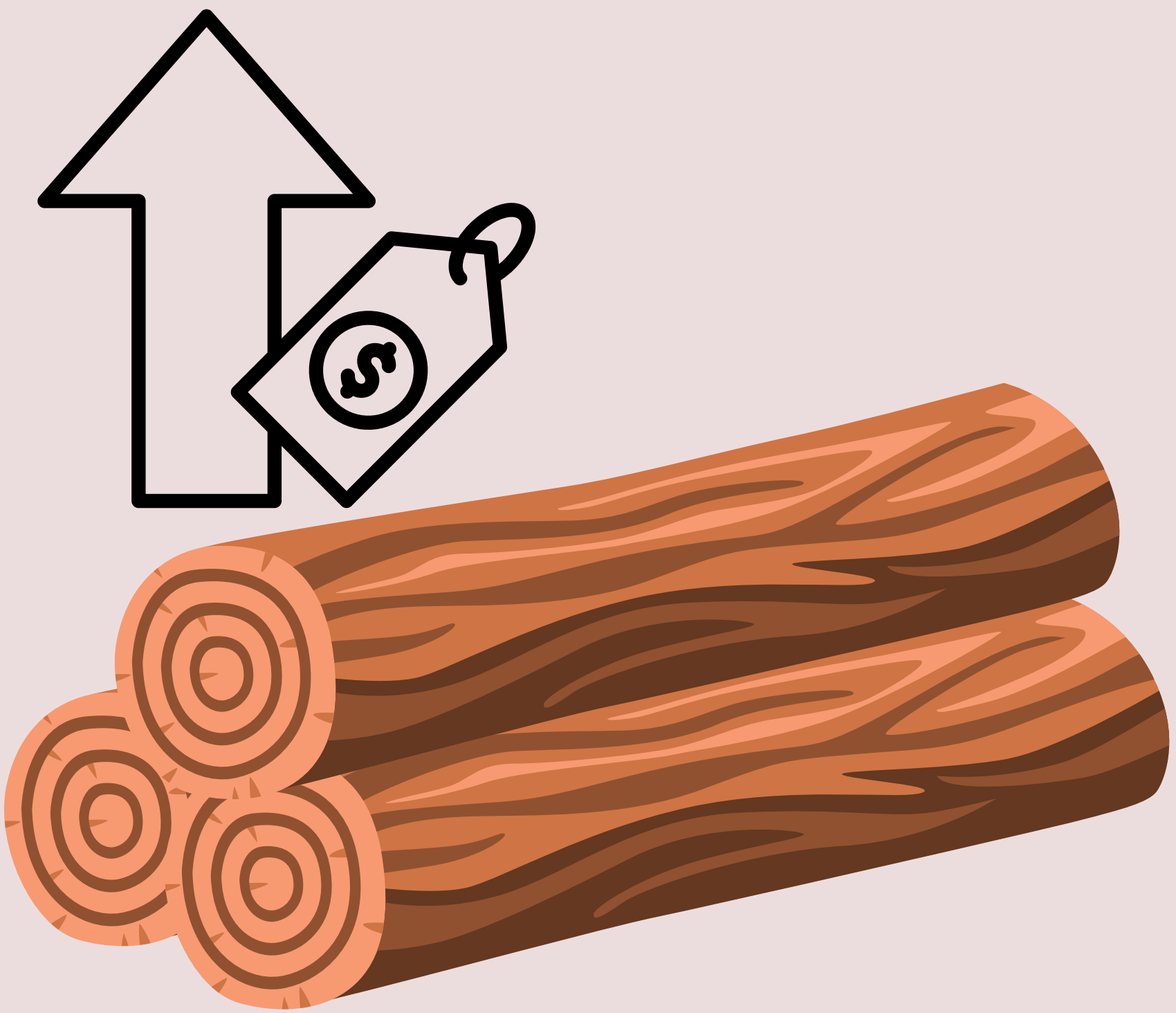
# Soil Degradation

Fire can degrade soil quality, reducing agricultural productivity and increasing the costs of soil rehabilitation.



# Forestry and Timber Industry

Destruction of commercial timber resources leads to direct economic losses for the forestry industry and can impact timber supply and prices.



# Reforestation Cost

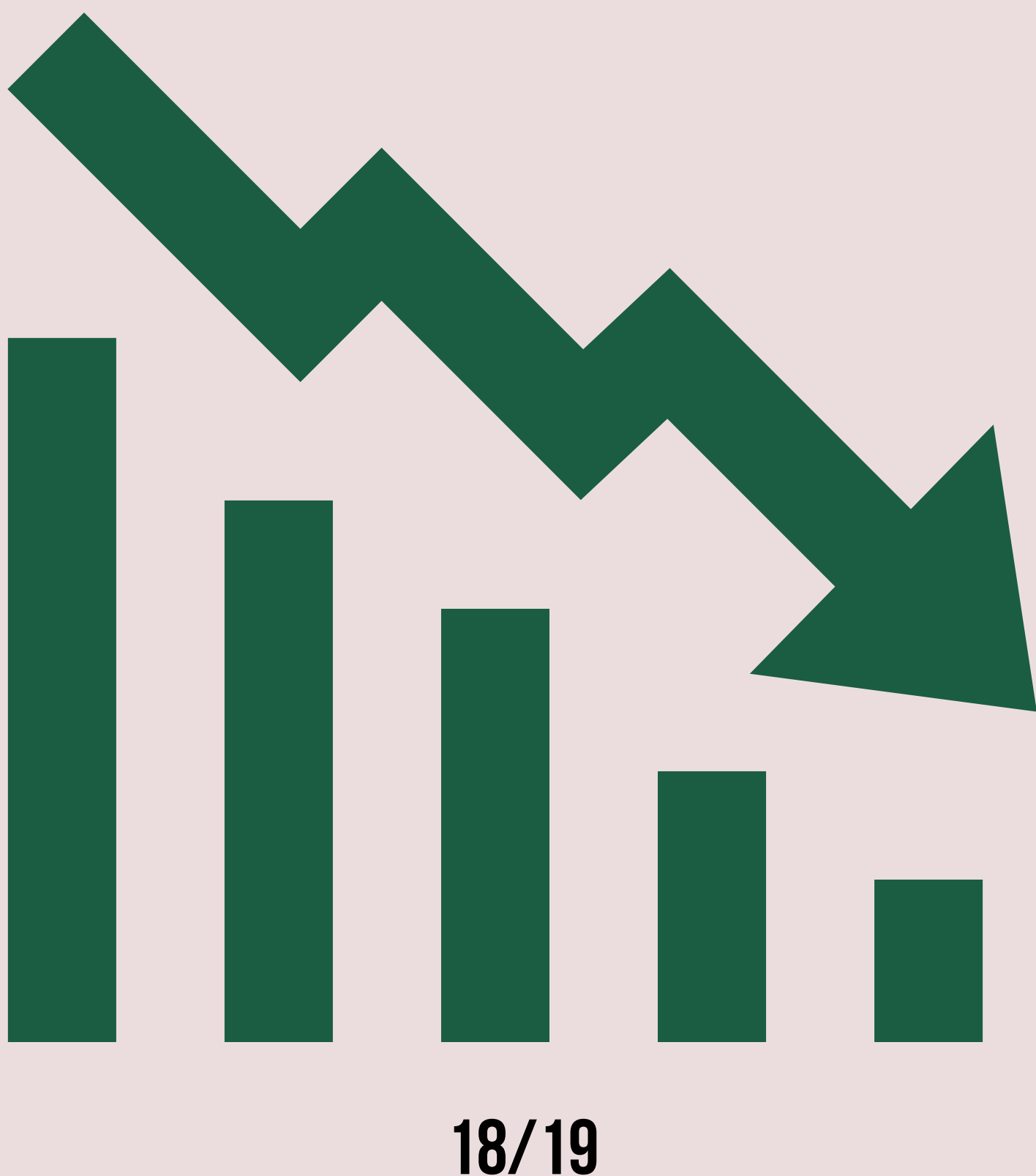
Investment in reforestation and sustainable forestry practices to restore damaged forests.





# Loss of Tourism Revenue

Destruction of natural attractions, parks, and recreational areas can lead to a decline in tourism, affecting local economies dependent on tourist spending.



# Event Cancellations

Wildfires can result in the cancellation of events, festivals, and other activities that generate economic activity.



# WILDFIRE IMPACT ON HUMAN WELL-BEING AND HEALTH



CITIZEN ENGAGEMENT



**SILVANUS**

[www.silvanus-project.eu](http://www.silvanus-project.eu)

The contamination of air due to wildfires has significant impacts on human well-being and health. The smoke produced by wildfires contains a complex mixture of gases and fine particles that can have both immediate and long-term health effects.



Here's a detailed examination of the impacts of air contamination from wildfires on human health:

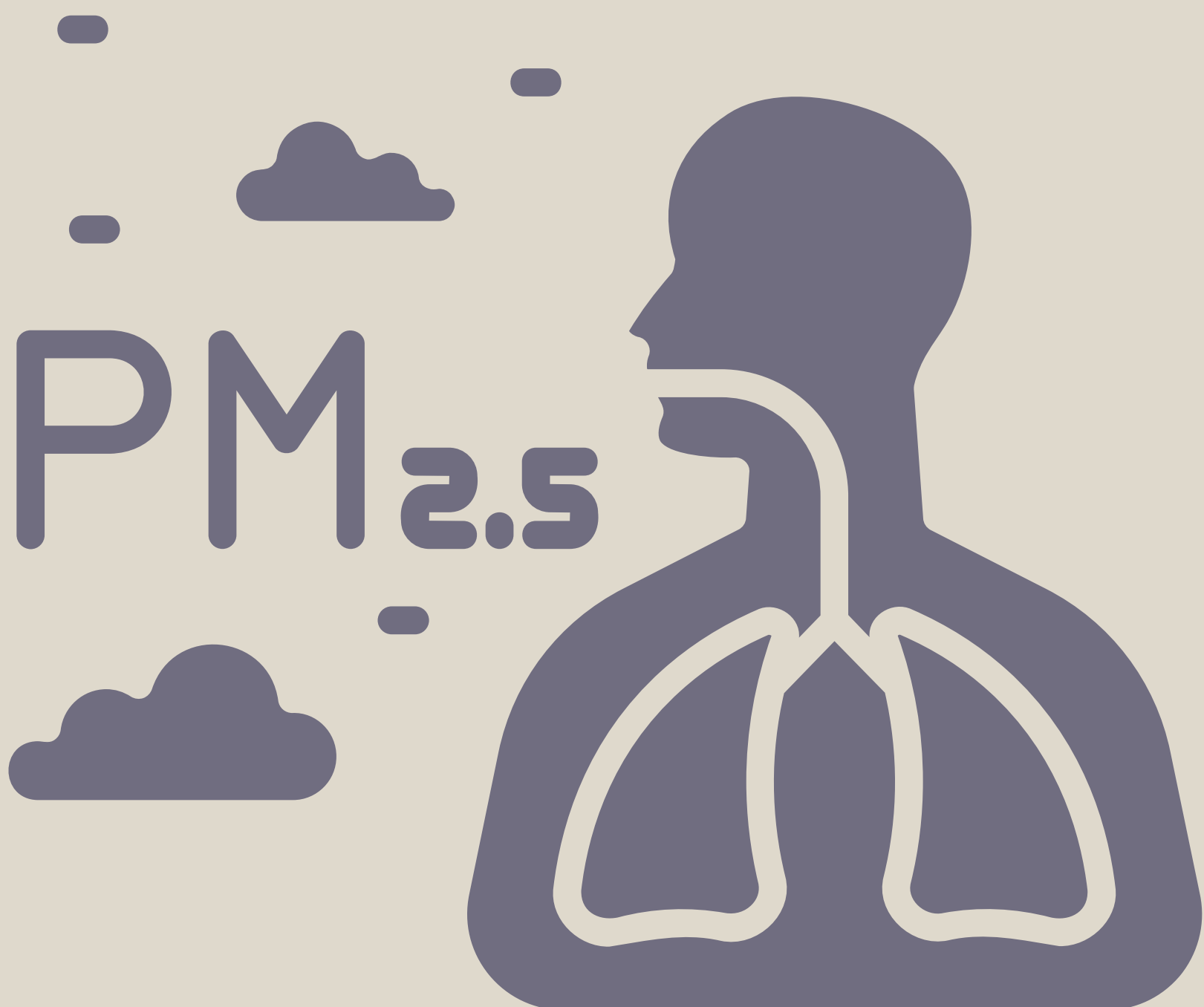
# **COMPONENTS OF WILDFIRE SMOKE**



# PARTICULATE MATTER (PM)

## PM2.5 and PM10

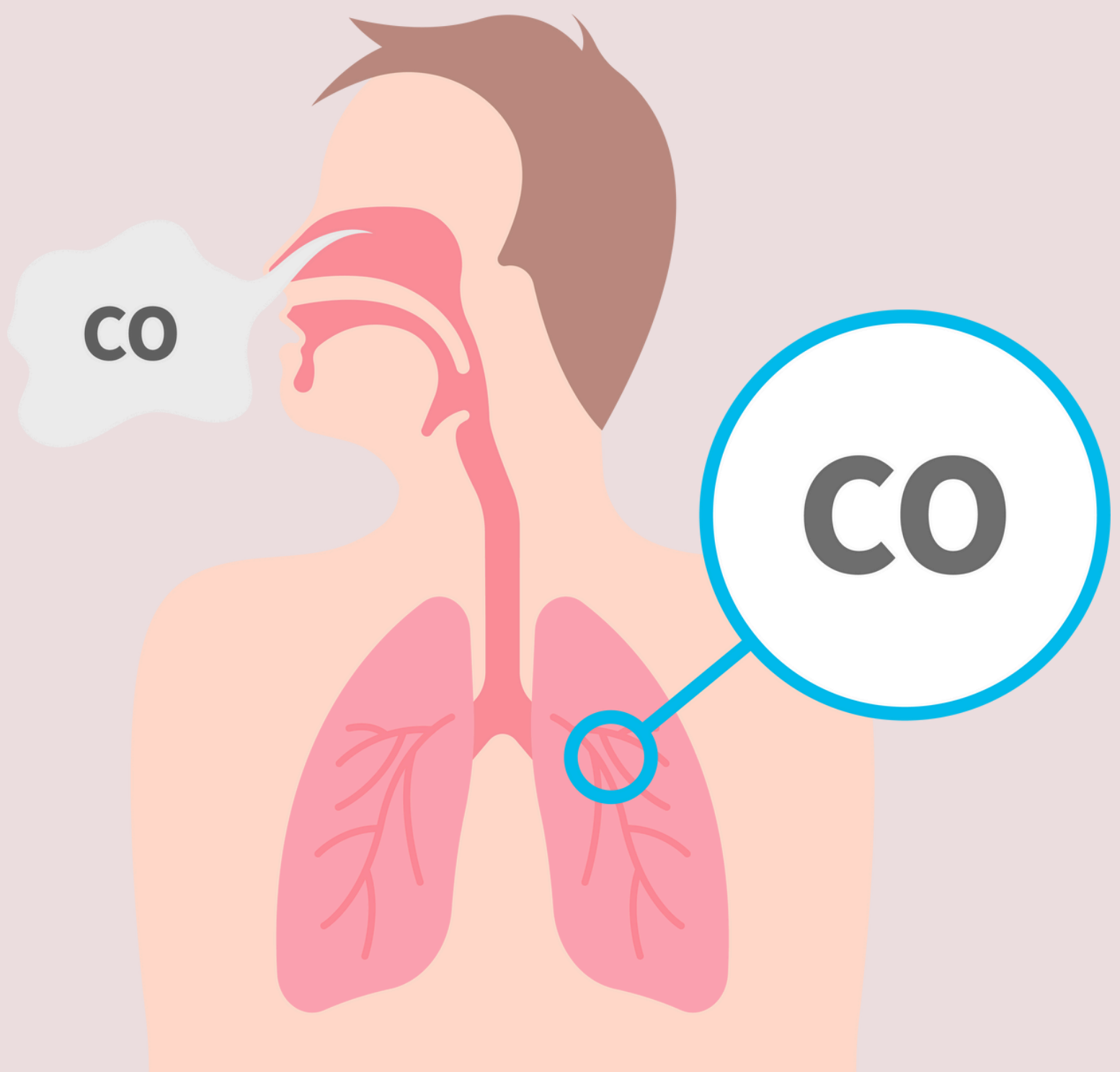
Fine particles with diameters less than 2.5 micrometers (PM2.5) and 10 micrometers (PM10) can penetrate deep into the lungs and even enter the bloodstream.



# GASES

## Carbon Monoxide (CO)

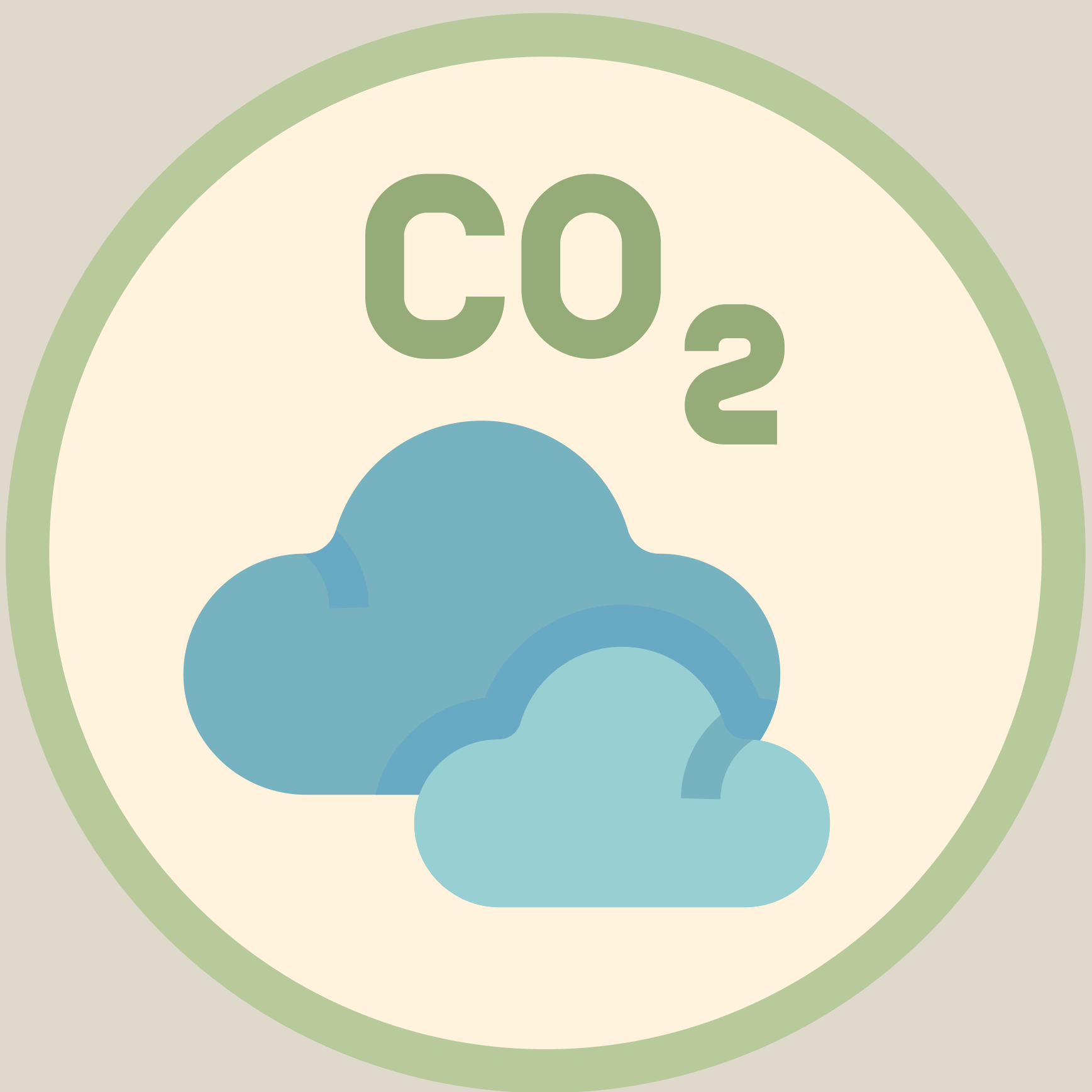
A colourless, odourless gas that can be harmful when inhaled in large quantities, leading to reduced oxygen delivery to the body's organs and tissues.





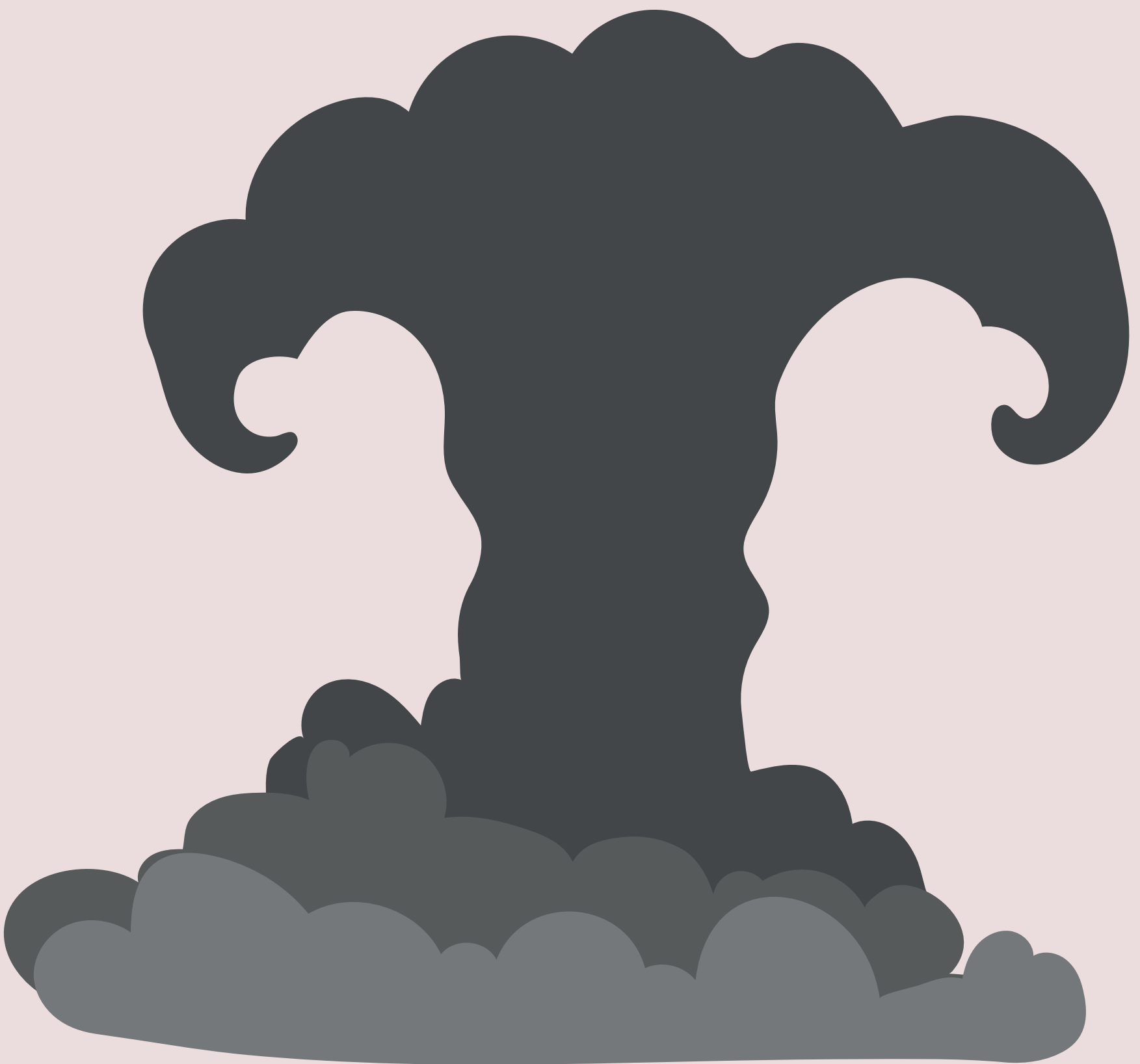
# Carbon Dioxide (CO<sub>2</sub>)

A greenhouse gas produced in large quantities by wildfires.

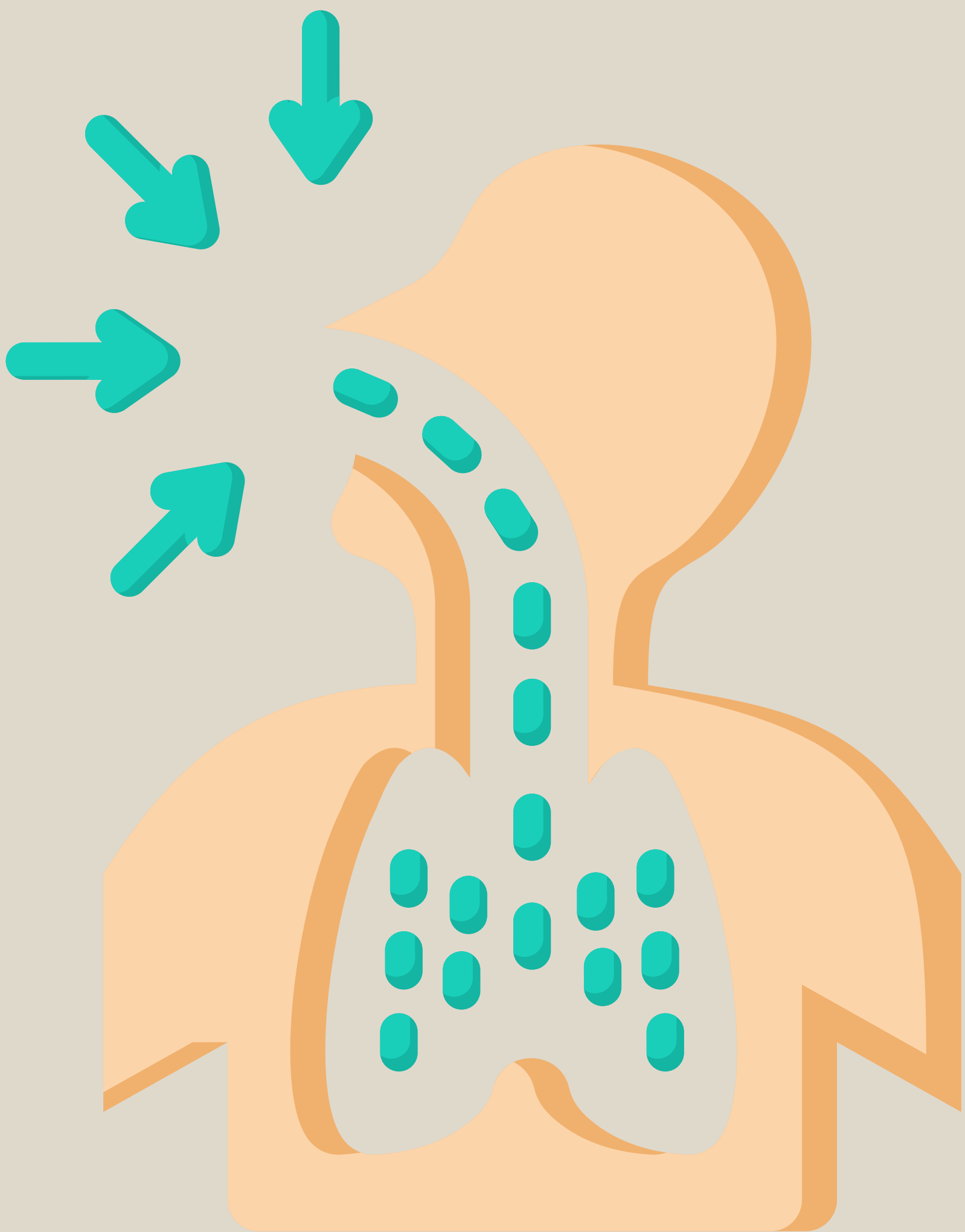


# Other Gases

Nitrogen oxides (NO<sub>x</sub>), volatile organic compounds (VOCs), and other toxic gases that can contribute to air pollution and health issues.



# IMMEDIATE HEALTH IMPACTS



# Eye Irritation

Smoke and ash in the air can cause immediate eye irritation, leading to redness, tearing, and discomfort. Prolonged exposure can result in more severe eye conditions, such as conjunctivitis.



# Burn Injuries

Direct exposure to flames, heat, or hot gases can cause burn injuries ranging from mild to severe (first-degree to third-degree burns). These injuries can affect the skin, underlying tissues, respiratory system, and even organs, leading to pain, infection risk, and long-term scarring or disability.



# RESPIRATORY ISSUES

## Irritation

Wildfire smoke can cause immediate irritation of the eyes, nose, throat, and respiratory system.



# Asthma and COPD Exacerbation

Individuals with asthma, chronic obstructive pulmonary disease (COPD), or other pre-existing respiratory conditions can experience worsened symptoms and increased frequency of attacks.

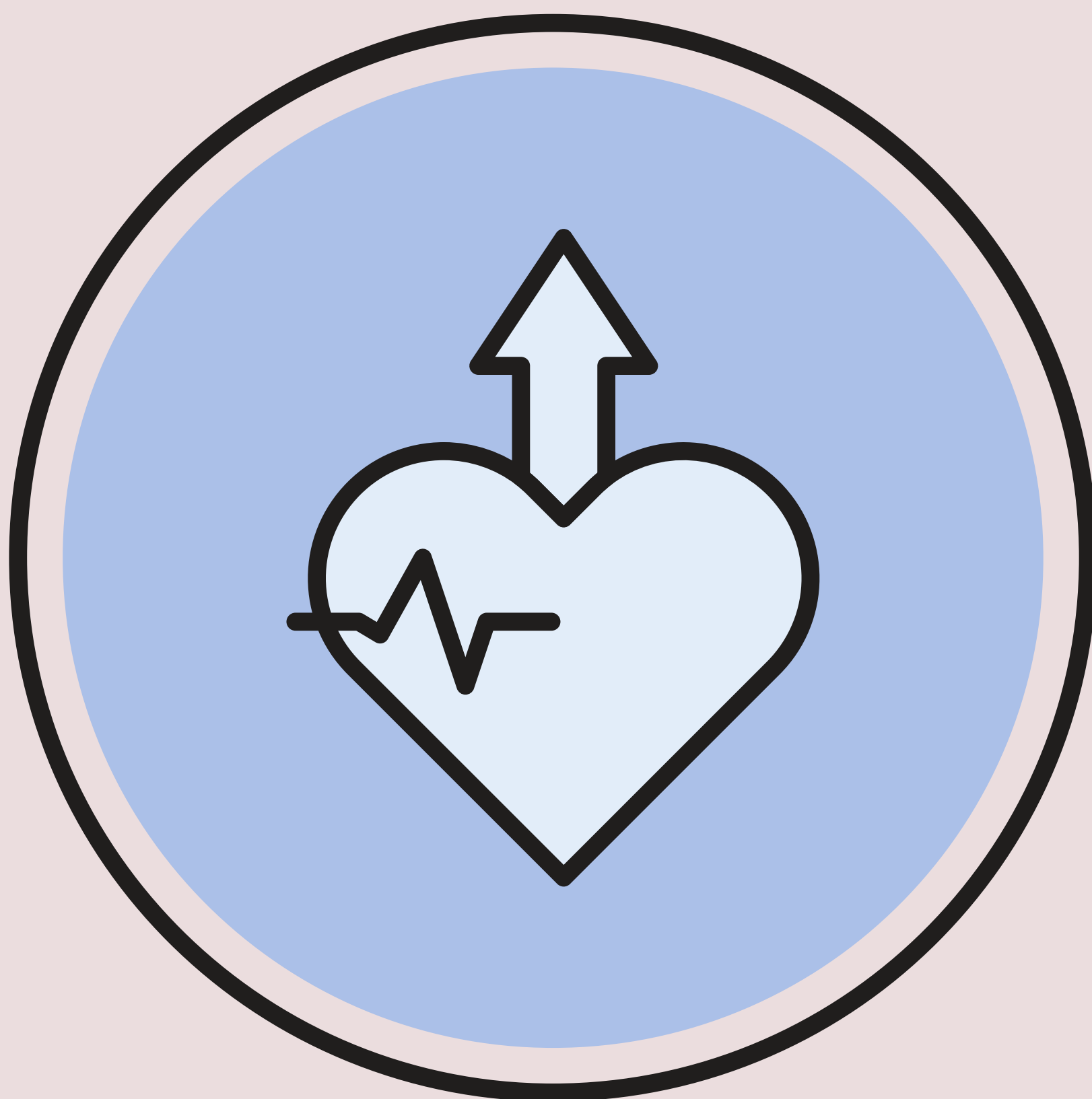




# CARDIOVASCULAR EFFECTS

## Increased Heart Rate

Exposure to wildfire smoke can lead to elevated heart rates and increased blood pressure.



# Cardiac Events

There is an increased risk of heart attacks and other cardiovascular events, particularly among individuals with pre-existing heart conditions.



# NEUROLOGICAL SYMPTOMS

## Headaches and Dizziness

Inhalation of smoke can cause headaches, dizziness, and lightheadedness.



# Fatigue

Prolonged exposure can lead to general fatigue and weakness.



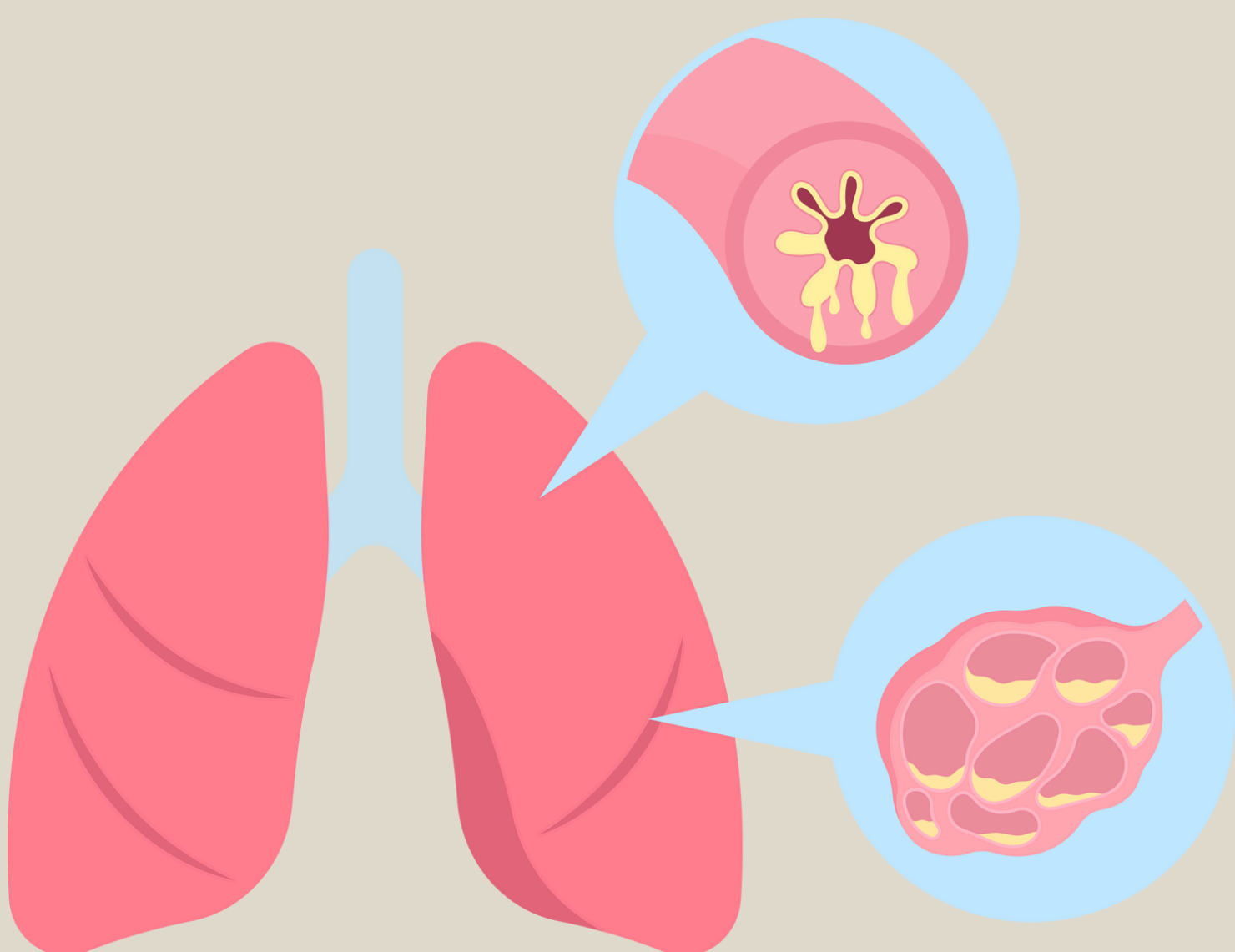
# LONG-TERM HEALTH EFFECTS



# CHRONIC RESPIRATORY DISEASES

## Development of Chronic Conditions

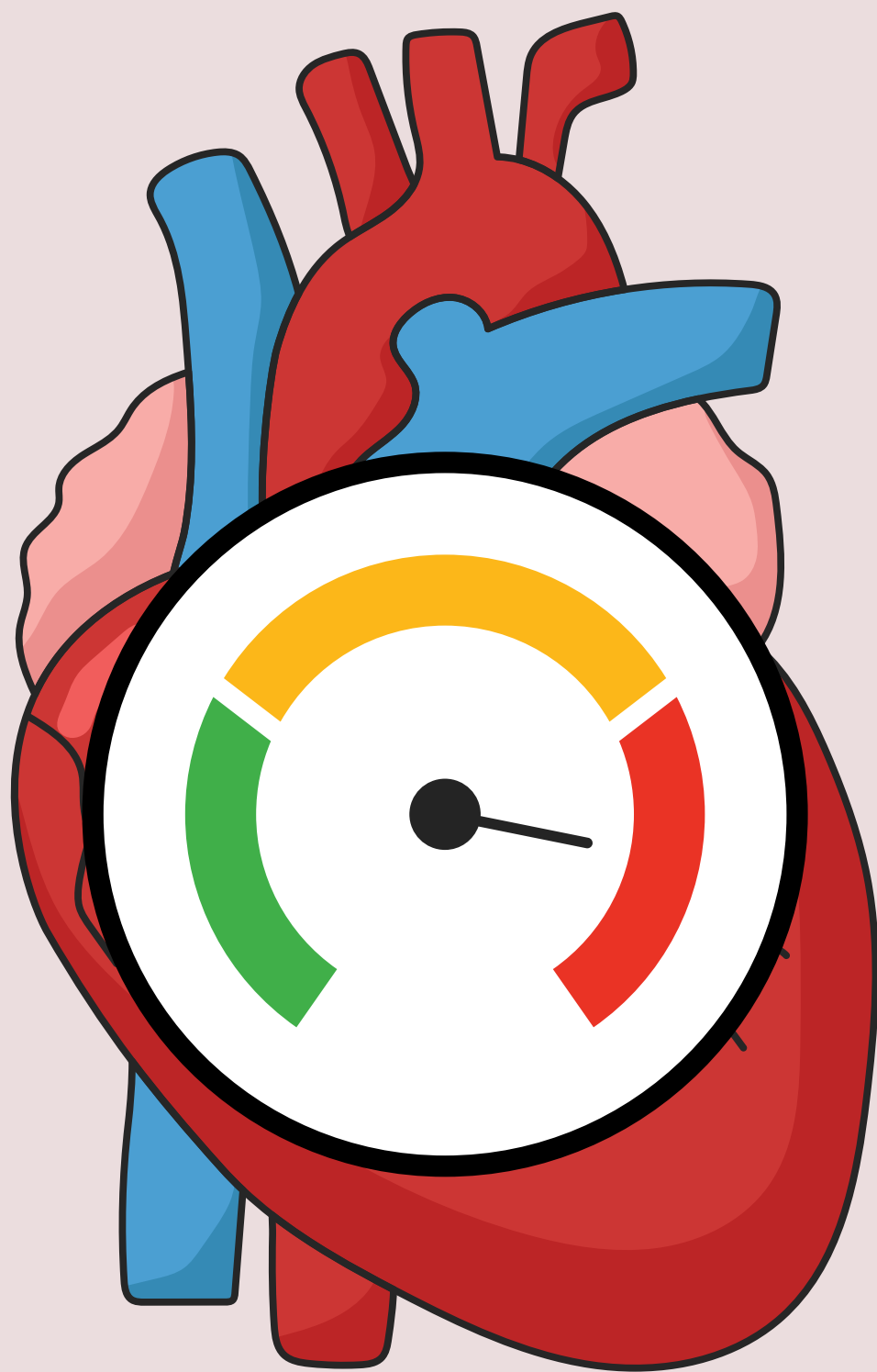
Long-term exposure to particulate matter and other pollutants from wildfire smoke can contribute to the development of chronic respiratory diseases such as bronchitis and asthma.



# CARDIOVASCULAR DISEASES

## Increased Risk

Prolonged exposure to fine particulate matter is associated with an increased risk of developing cardiovascular diseases, including hypertension and atherosclerosis.

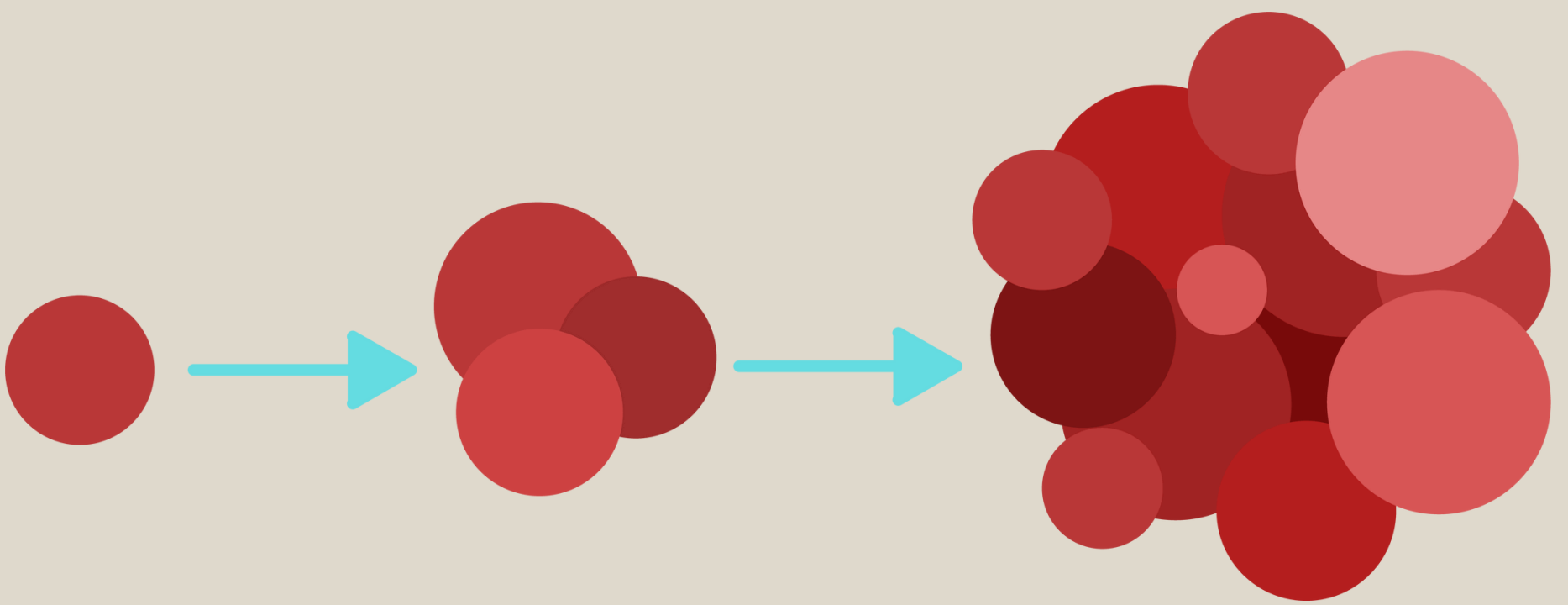




# CANCER RISK

## Carcinogens

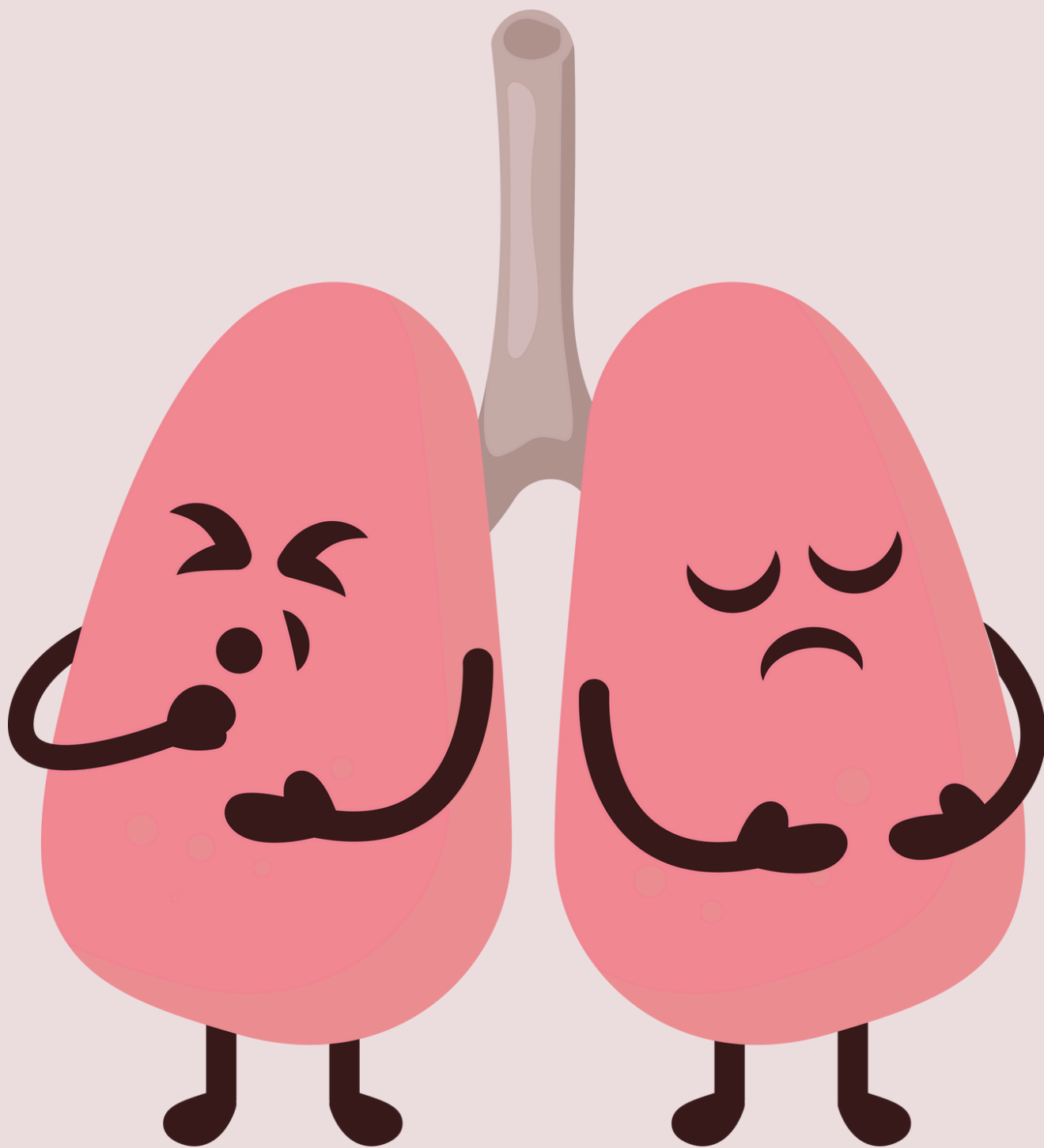
Wildfire smoke contains carcinogenic compounds, including benzene and formaldehyde, which can increase the risk of cancer with long-term exposure.



# IMPAIRED LUNG DEVELOPMENT

## Children's Health

Children exposed to wildfire smoke may experience impaired lung development, leading to long-term health issues.



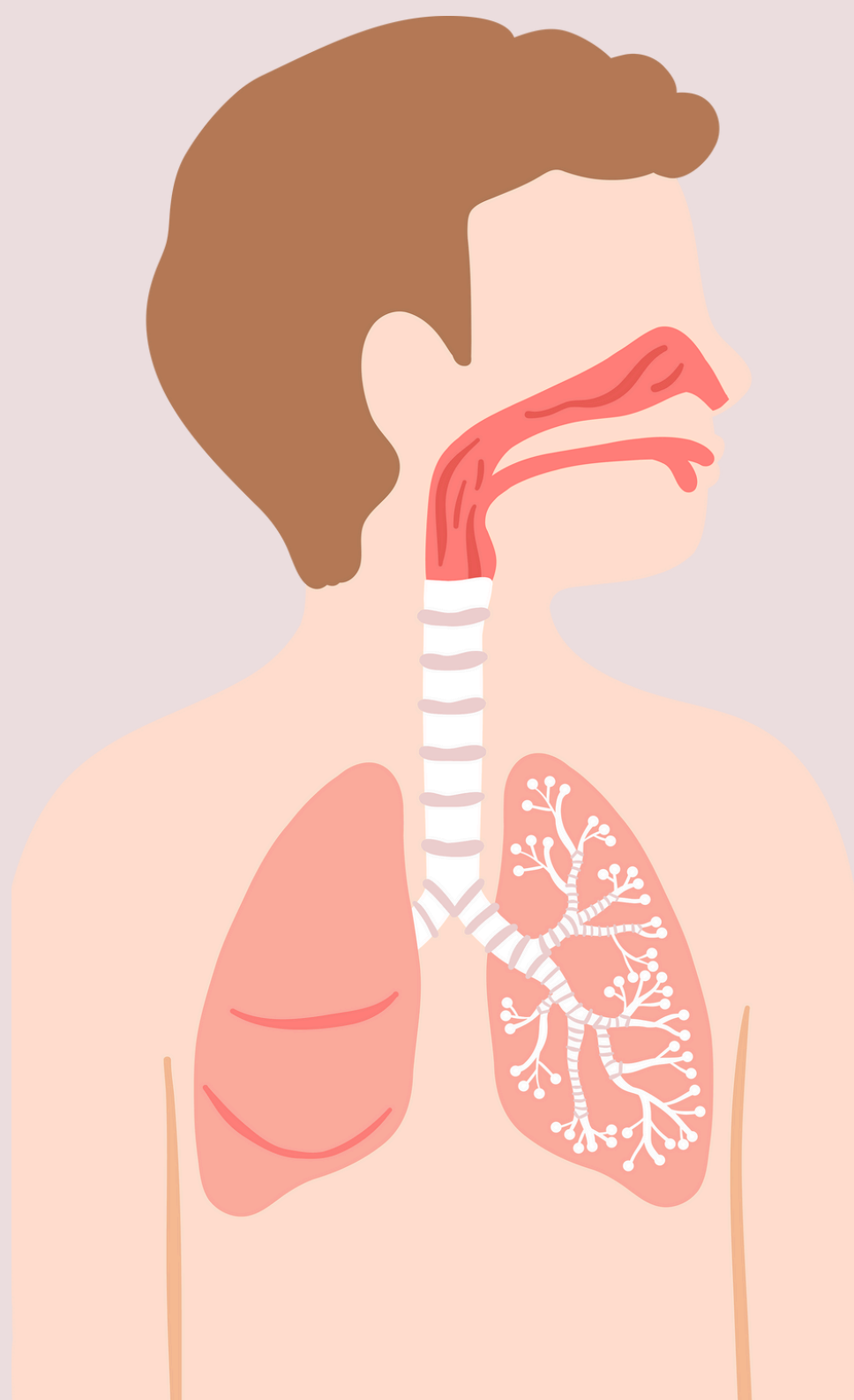
# VULNERABLE POPULATIONS



# CHILDREN

## Developmental Impact

Children are more susceptible to the harmful effects of smoke due to their developing respiratory systems and higher rates of respiration.



# Increased Risk of Respiratory Infections

Exposure can lead to an increased risk of respiratory infections and other health problems.



# ELDERLY

## Pre-existing Conditions

Older adults often have pre-existing health conditions that can be exacerbated by smoke exposure.



# Reduced Immune Function

The elderly may have a reduced ability to cope with the physical stress caused by smoke inhalation.





# **PREGNANT WOMEN**

## **Fetal Health**

Exposure to wildfire smoke can affect fetal development, potentially leading to low birth weight and preterm birth.



# INDIVIDUALS WITH PRE-EXISTING CONDITIONS

## Exacerbation of Symptoms

People with asthma, COPD, heart disease, and other chronic conditions are at a higher risk of experiencing severe health effects from smoke exposure.

