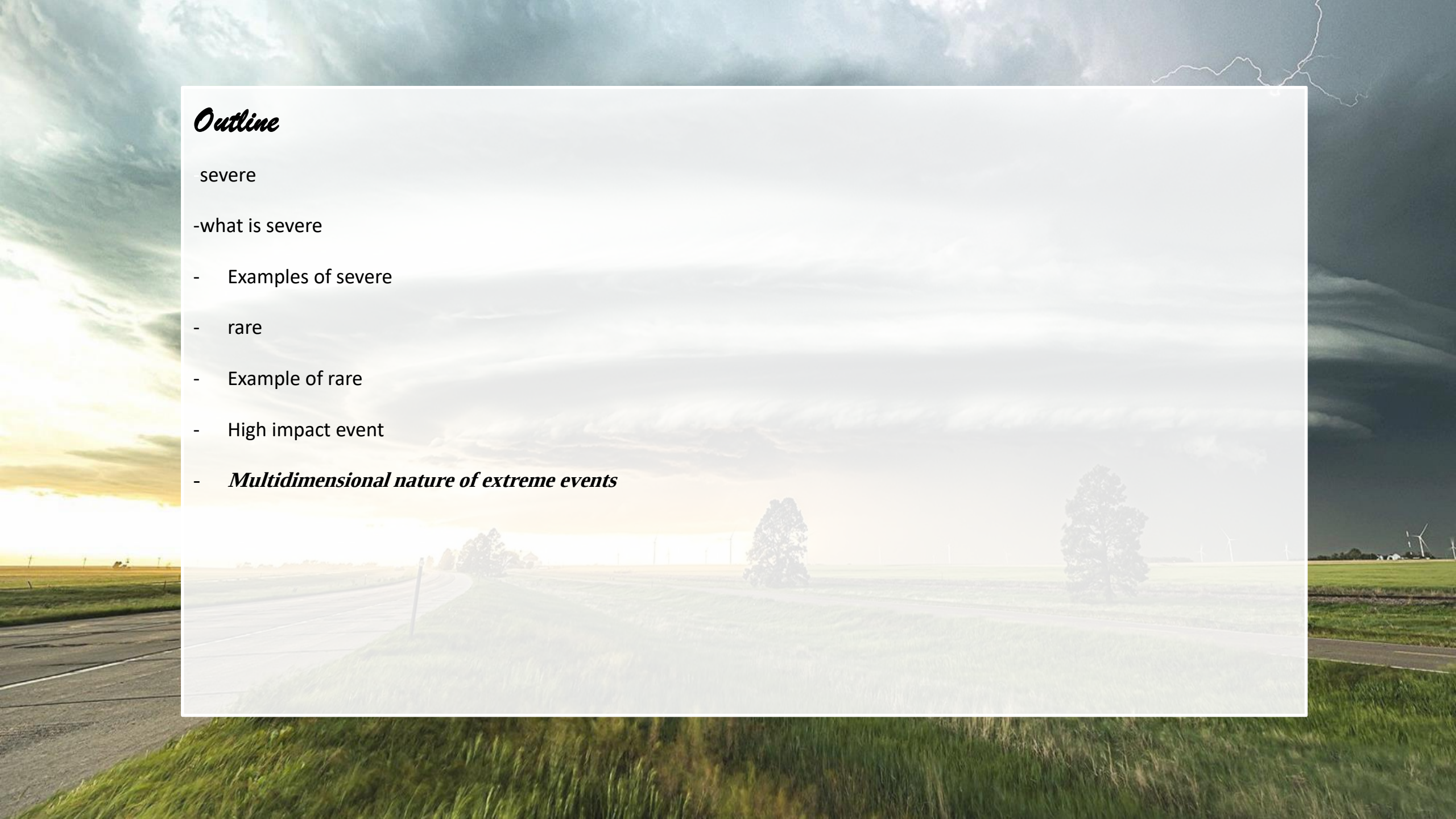
climate extreme events

Severe, rare, extreme, or high-impact

Multidimensional nature of extreme events



Outline

severe

-what is severe

- Examples of severe
- rare
- Example of rare
- High impact event
- ***Multidimensional nature of extreme events***

-What is severe?

Severe events are events that create large losses in measures such as number of lives, financial capital, or environmental quality (e.g., loss of species). The severity can be measured by the expected long-term loss, which is known as the risk. Risk depends on the product of the probability of the event (the hazard), the exposure to the hazards (e.g., how many people are exposed), and the vulnerability (i.e., how much damage ensues when someone is hit by the event).

- Example of severe weather

FLOODS

Except for heat-related fatalities, more deaths occur from flooding than any other weather-related hazard.

LIGHTNING

Lightning is one of the oldest observed natural phenomena on earth. At the same time, it also is one of the least understood.

THUNDERSTORMS

There can be as many as 40,000 thunderstorms each day around the world. They are most common in the U.S., where they can produce tornadoes, floods, lightning and damaging winds.

TORNADOES

Much about tornadoes remains a mystery. They are rare, unpredictable and deadly. The U.S. has more tornadoes than anywhere else in the world.

HAIL

Hail can cause billions of dollars of damage to structures, crops and livestock.

DAMAGING WINDS

Straight-line winds are responsible for most thunderstorm damage. These winds can cause as much damage as a tornado.

What is rare ?

Rare events are events that have a low probability of occurrence. Because of the rarity of these events, human societies (and other ecosystems) are often not well adapted to them and so suffer large amounts of damage when they do occur. Hence, despite their rarity, the large vulnerability associated with such events can often lead to large mean losses (and hence they are a type of severe event)

What is type of rare ?

1

WHITE RAINBOWS

The rare weather phenomenon of white rainbows occurs only when the water droplets responsible for diffracting the light of the Sun are of a specific size (0.02 mm to be precise). These rainbows are seldom encountered, and produce a soft white light which is a true wonder to behold!

2

CATATUMBO LIGHTNING

Among rare weather phenomena that produce the most spectacular light shows is Catatumbo lightning. Named after the only place in the world where it happens (the Catatumbo river in Venezuela), it involves marshes emitting methane gas that fuels the production of huge lightning bolts during a thunderstorm.

3

CAPPUCCINO COASTS

Algae and waste along the sea coast, mixing in the water, can often produce sea foam. In some instances they act similarly to a powerful surfactant, causing the water to foam up and even produce bubbles that look like someone spilled an insane amount of shampoo into the sea.

4

MIRAGES

Light refracting in the distance on a hot day or in an area such a desert produces the well-known, but rare occurrence of a mirage – an optical illusion showing objects or buildings in the distance that can be very demoralizing when you're stranded in the middle of nowhere – and you find out they weren't real.

5

VOLCANIC LIGHTNING

Volcanic lightning is truly a wonder to behold, and it's possibly the rarest weather phenomenon of this intensity you will encounter – mainly because it can only occur when a thunderstorm meets an erupting volcano. Positively charged particles are sent into the

6

“MOON BOWS”

Apparently, mist can diffract more than one type of light. Although the moon’s way of reflecting sun rays back at us is much less powerful than daylight, it can still form rainbows, but of a different kind. Normally, these “moon bows” will appear white due to their reduced brightness, but a prolonged exposure camera is all you need to reveal their true colors.

7

GLORY

Similar to rainbows, these unusual weather phenomena also occur through a special kind of light diffraction. Fog, clouds and a powerful source of light present right behind the observer are the main source of this colorful, localized light show.

8

RAINING FISH

Associated more with legend than reality, this rare phenomenon involving fish or tiny frogs seemingly falling from the sky during a storm nevertheless sparked a great deal of debate ever since the 1700s. Common explanations include the presence of waterspouts or heavy rain washing up fish that travel through subterranean water to the surface.

9

FIRE TORNADOES

One of the rarest weather phenomena of all time involve what can only be described as fire twisters. These hellish cyclones of flame occur mainly during forest fires combined with rare weather conditions that involve strong winds and intense heat.

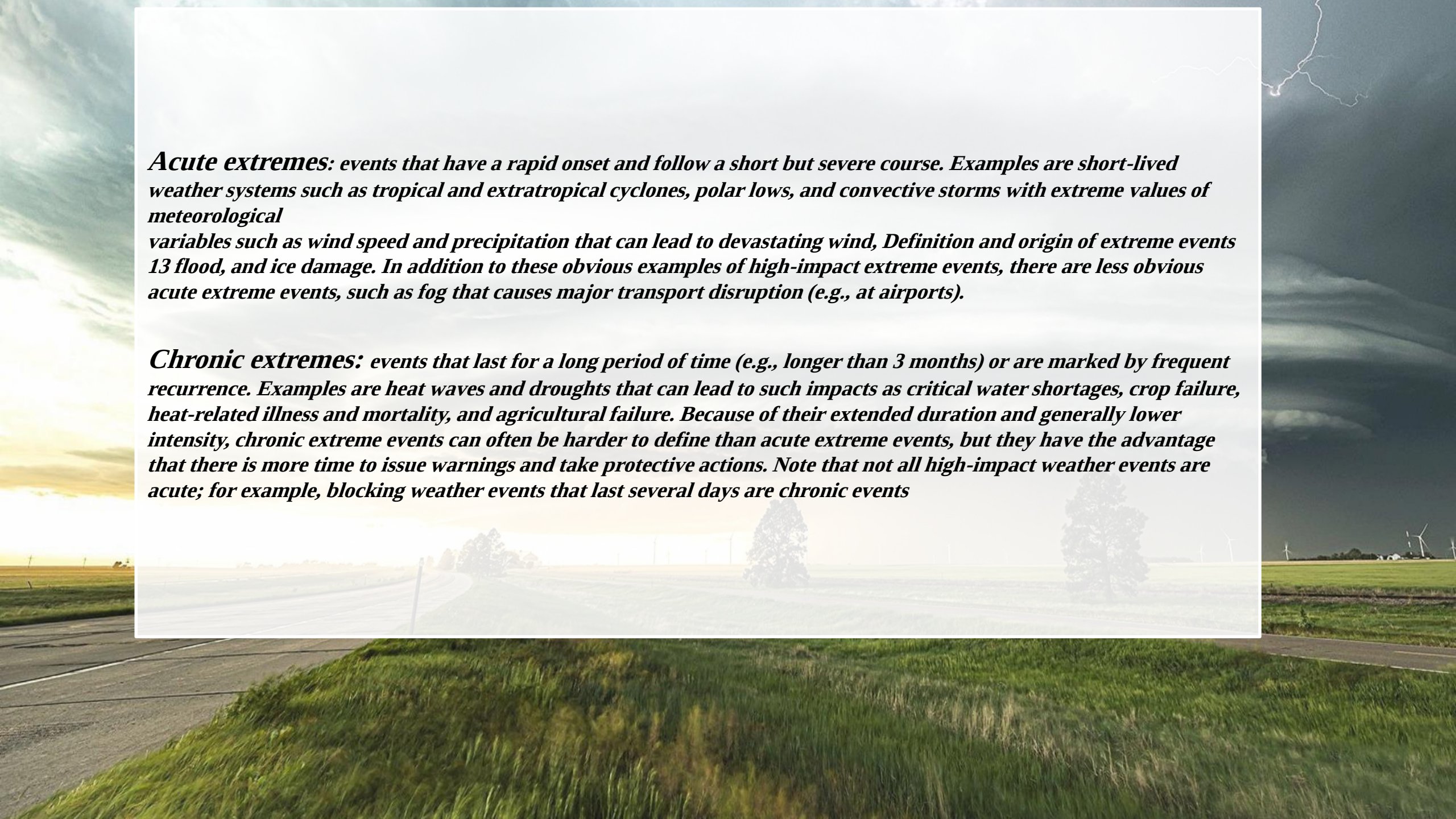
-What is high impact event ?

High-impact events are severe events that can be either short-lived weather systems (e.g., severe storms) or longer-duration events such as blocking episodes that can lead to prolonged heat waves and droughts. The World Meteorological Organization (WMO) program THORPEX uses the phrase ‘‘high-impact weather’’ rather than ‘‘severe weather’’ to help people avoid confusing the term severe with only short-lived events such as individual storms (D. Burridge, personal communication).

Multidimensional nature of extreme events

The multidimensional nature of extreme events is often overlooked in rankings of the events based on only one of the attributes (e.g., the category numbers for hurricanes based solely on maximum surface wind speed). Extreme events have attributes such as:

- rate (probability per unit time) of occurrence
- * magnitude (intensity)
- * temporal duration and timing
- * spatial scale (footprint)
- * multivariate dependencies



***Acute extremes**: events that have a rapid onset and follow a short but severe course. Examples are short-lived weather systems such as tropical and extratropical cyclones, polar lows, and convective storms with extreme values of meteorological*
variables such as wind speed and precipitation that can lead to devastating wind, Definition and origin of extreme events 13 flood, and ice damage. In addition to these obvious examples of high-impact extreme events, there are less obvious acute extreme events, such as fog that causes major transport disruption (e.g., at airports).

***Chronic extremes:** events that last for a long period of time (e.g., longer than 3 months) or are marked by frequent recurrence. Examples are heat waves and droughts that can lead to such impacts as critical water shortages, crop failure, heat-related illness and mortality, and agricultural failure. Because of their extended duration and generally lower intensity, chronic extreme events can often be harder to define than acute extreme events, but they have the advantage that there is more time to issue warnings and take protective actions. Note that not all high-impact weather events are acute; for example, blocking weather events that last several days are chronic events*


Thank you