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Safety, Risk and Vulnerability.

Three concepts that should be well understood and identified

An example: **The case of the closure of the Retiro Park of Madrid in summer**

Tornado en el aeropuerto de Barcelona

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Dictionaries define **Safety as the condition of being safe: free from danger, or injury.** A few facts to be taken into account :

1. Weather elements pose a threat to life, property and the environment when they are intense or persist for abnormal periods of time.
2. Hazardous and extreme weather exist on widely varying temporal and spatial scales.
3. Safety is not something that can be absolutely guaranteed. For the purpose of protection programmes safety could be more appropriately defined as **the condition where risks are managed to acceptable levels** (Canada Civil Aviation)

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Risk can be defined as “the degree of probability of loss or injury” as a consequence of a given scenario. **The scenarios includes:**

- **The factors potentially provoking losses or injuries and:**
- **The vulnerability** of persons or material goods to those factors which on its turn depends on different conditions.

In In the simplified context of risk of death or injuries to human individuals due to hazards related to weather the Risk can then be expressed as:

RISK = HAZARD PROBABILITY x **HUMAN VULNERABILITY**

Where Probability is expressed in the mathematical sense and vulnerability also ranges from 0 to 1. If every person subject to the hazard is injured the vulnerability takes the value 1 and it decreases as the probability of being injured by the hazard decreases.

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Of course the vulnerability depends on the intensity of the hazard. It is usual to use thresholds which raise the hazard risk to significant levels, for instance "winds higher than 100 Km / h". Some hazards are dangerous enough to make unnecessary to define intensity thresholds: avalanches, tornados.

Vulnerability is at least conditioned by:

1. ***The type of hazard and its intensity***
2. ***The area affected (global, regional and local scales + physical environment)***
3. ***The time of occurrence (yearly and daily scales)***
4. ***The exposure to the hazard***
5. ***The sector of population affected***
6. ***The type of human activity (e.g.: staying at home or driving a car)***

These conditions are variable according to exposure and a wide range of factors with frequent interaction between them.

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El caso del cierre del parque de El Retiro de Madrid en verano.

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Rough evaluation of risk level in Spain for 8 weather hazards and 4 activities

HAZARD / ACTIVITY	Strong wind	Heavy snow	Flash Flood	Intense TS & lightning	Tornados (*)	Avalanches	Extreme COLD	Extreme HEAT
STAYING AT HOME								
ROAD TRAFFIC								
CIVIL AVIATION								
MOUNTAIN SPORTS								

Risk level	Little	Moderate	High	Quite High

The only variables here are the types of hazard and human activity. If we include others or if we study other regions the table would change .

(*) Tornadoes are highly dangerous but very scarce and their impact extension is small.

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Retiro Park: A huge shade area witw several lakes in the middle of Madrid

AME Asociación Meteorológica Española

XXXVII Jornadas de la AME. Málaga 25 – 27 febrero 2026

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There is a growing discontent among residents and visitors regarding the frequent summer closures of the park, allegedly for safety reasons due to weather-related risks. However, this measure has a countereffect: Temperatures in Madrid may very well reach 35 ºC or higher in summer and the benefit of shade and fresh air in the park also contributes to safety, particularly for elder people.

The closure protocol in summer, depends on the information the City Council receives from the national meteorological Agency (AEMET). The park is closed if thunderstorms are forecasted with high probability in the area of Madrid.This is because thunderstorms are associated to strong gusts of wind and subsequent break and fall down of tree branches is possible..

However, the closure protocol is too simple. it asumes a series of inconsistencies abd shortcomings. his will be shown in a full paper to be published shortly by the author (hopefully)
..

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Advertissement in one of the entrances to the park on a windy winter day, february 2026-

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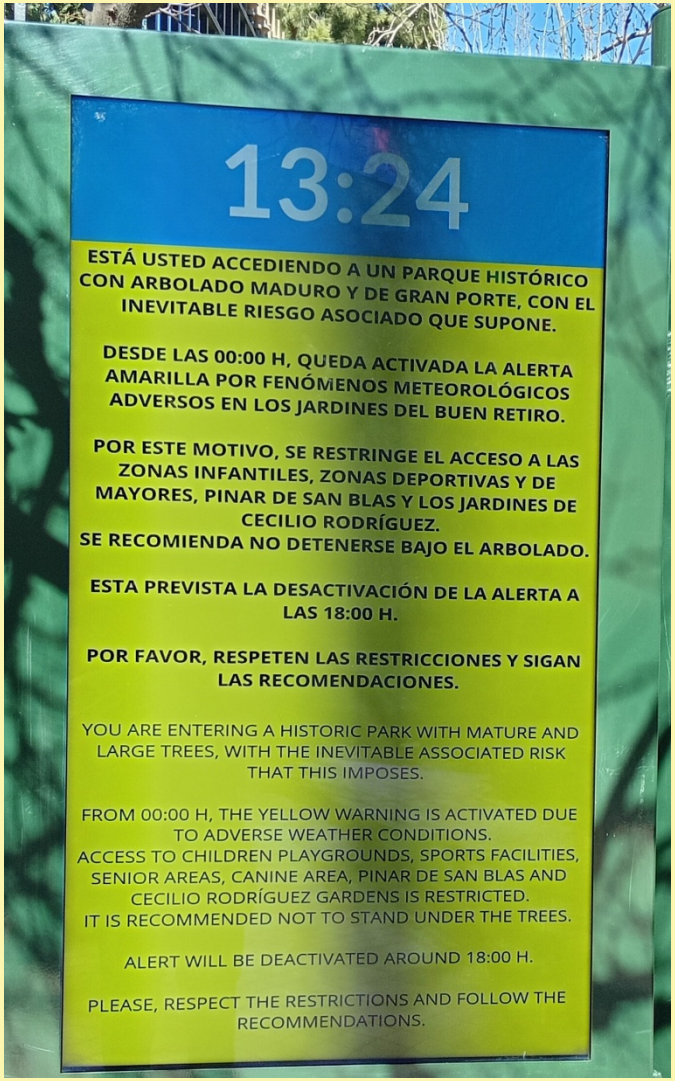

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Episodes of temperature significantly over the normal values (heat waves) are now identified as the biggest lethal weather factor.

Heat waves take the greatest human toll in cities where people is more vulnerable to and less protected from intense heat than in the countryside. Air pollution, which usually is worse in cities, can also exacerbate the health-damaging effects.

A lack of public recognition of the danger that high temperatures pose adds to the lethality of heat waves.

In cases such as the above, a balance should be achieved between protection from branches falling down and the refusal to enter the park to thousands of citizens and visitors.