



Lightning & EMS

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Photographer*

Mr. Random Enterprises, Inc.



Objectives

Understand Lightning Safety

Understand Lightning Injury

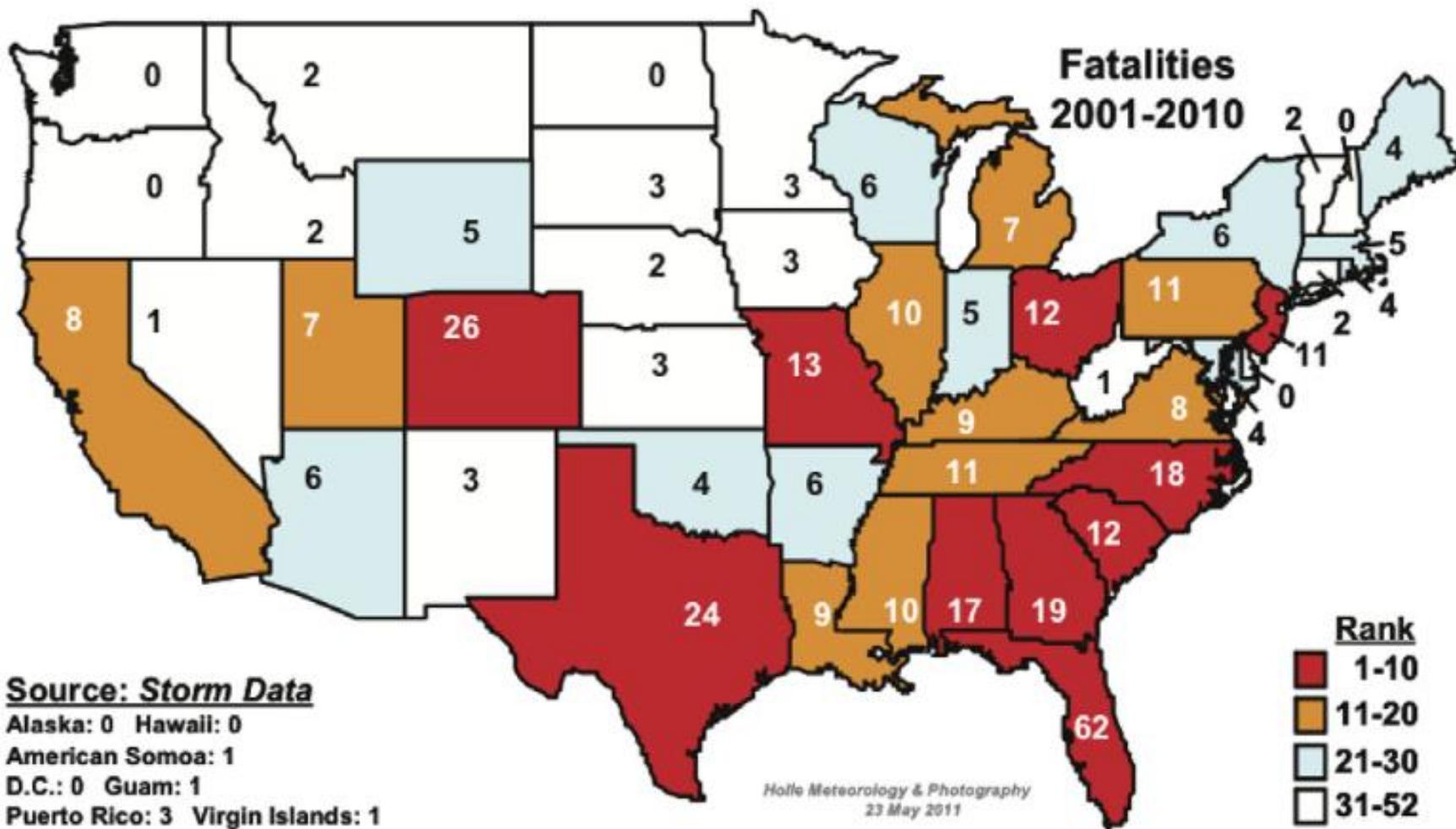
Know the signs of lightning injury

Understand why this is important

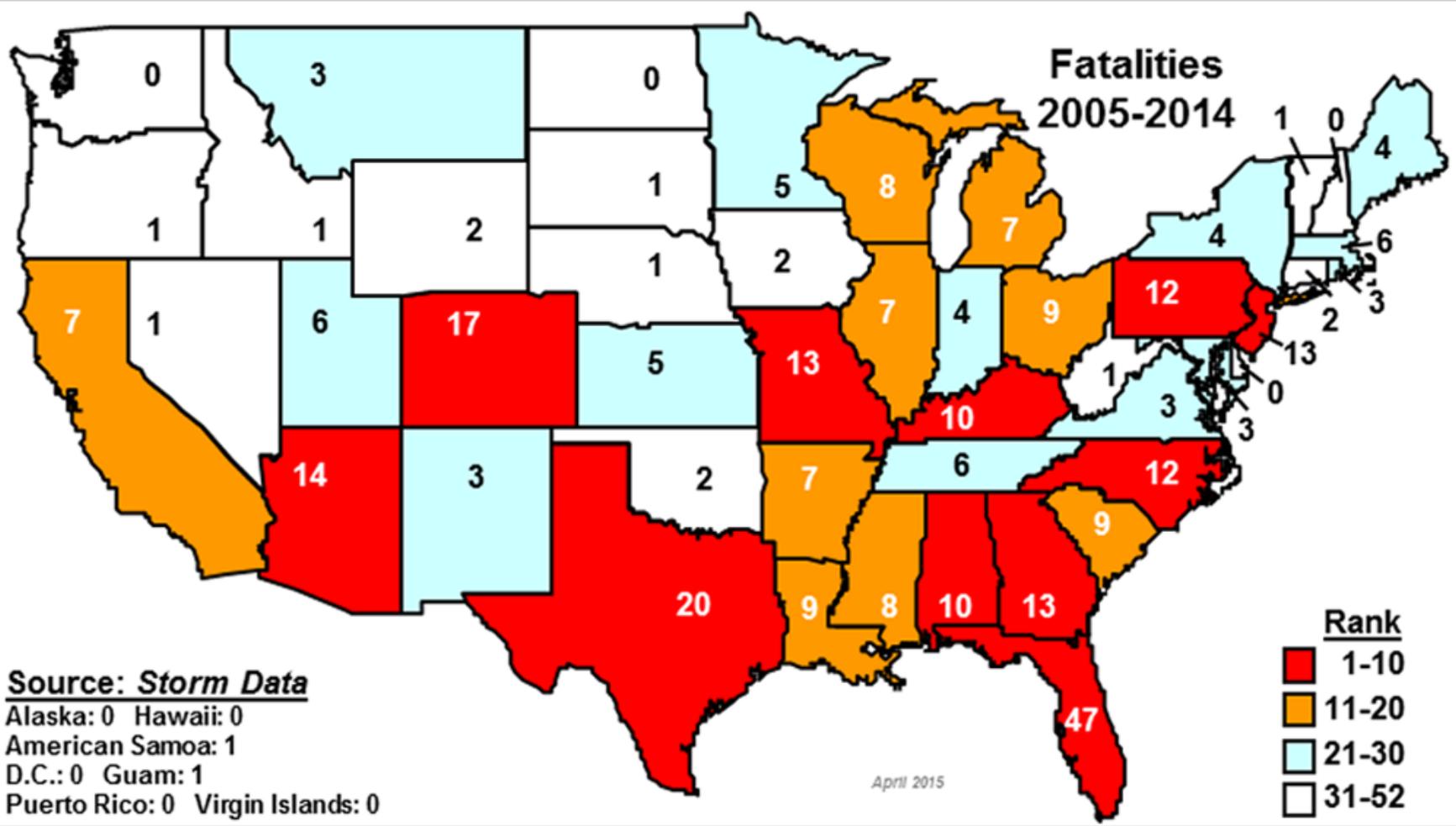
(Please hold questions to the end...)



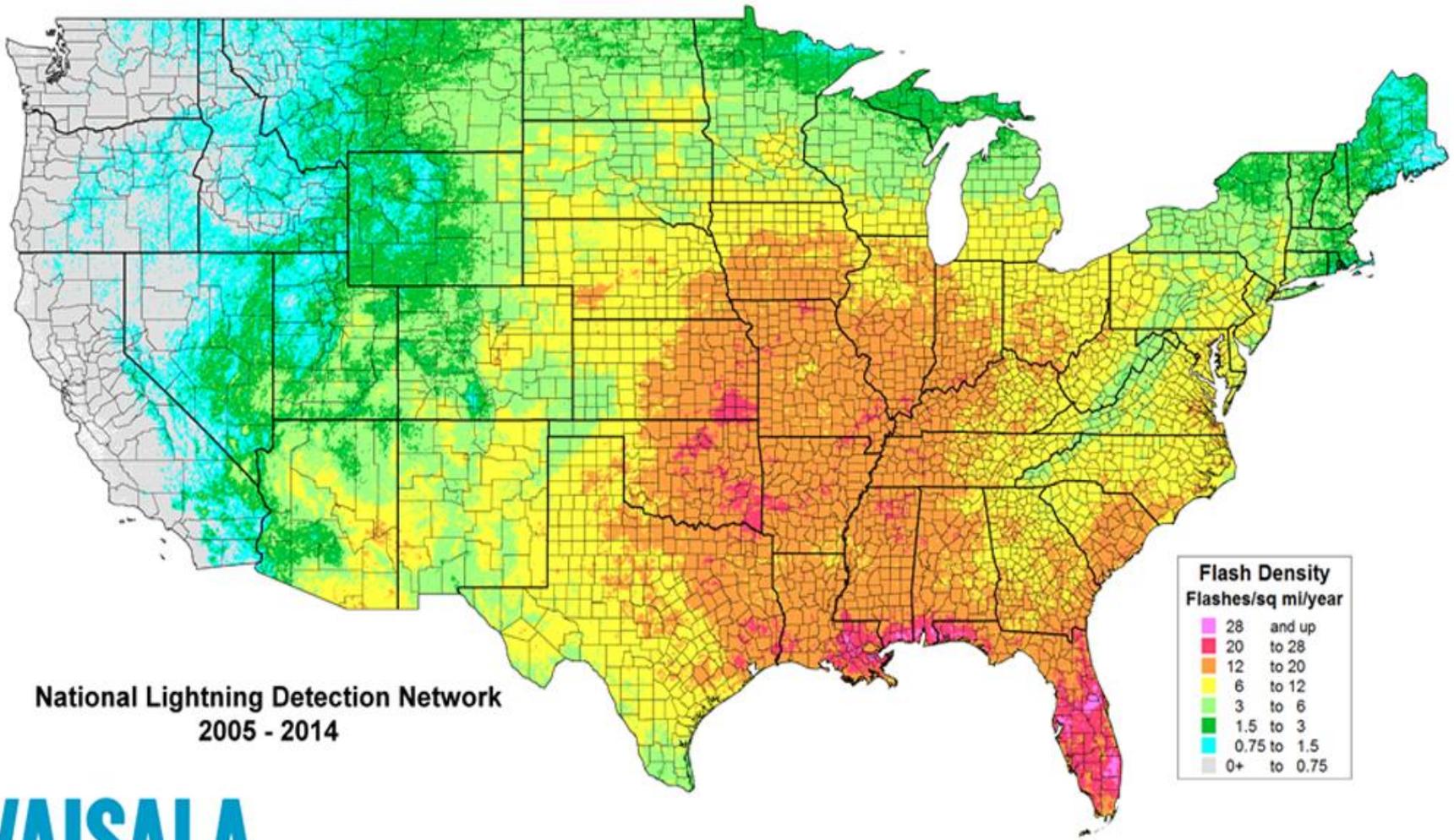
You Are Here



Lightning fatalities by state, 2001–2010. Map prepared from NOAA’s Storm Data by Ron L Holle.

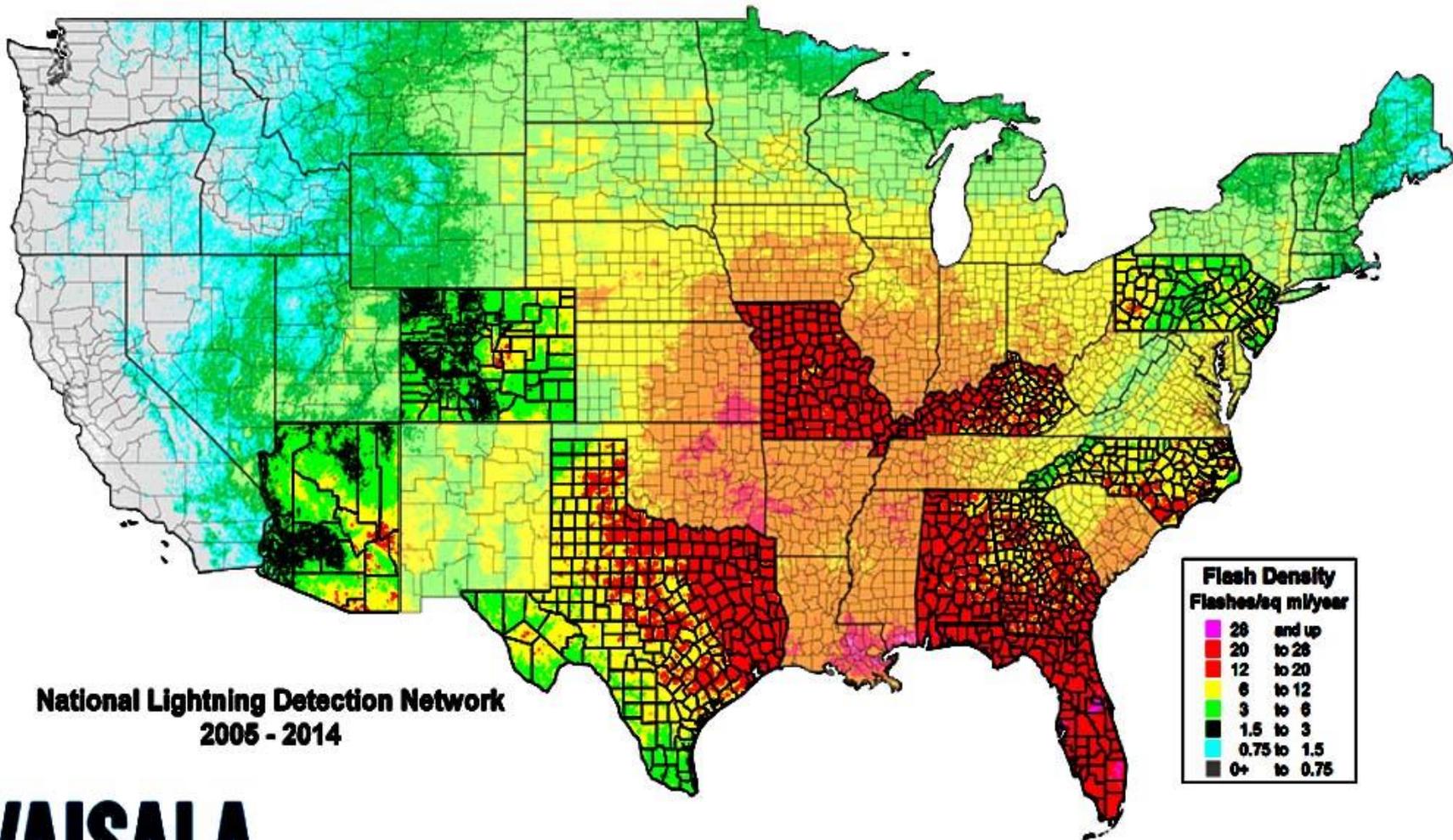


Map prepared from NOAA's Storm Data by Ron L Holle.



National Lightning Detection Network
2005 - 2014

VAISALA

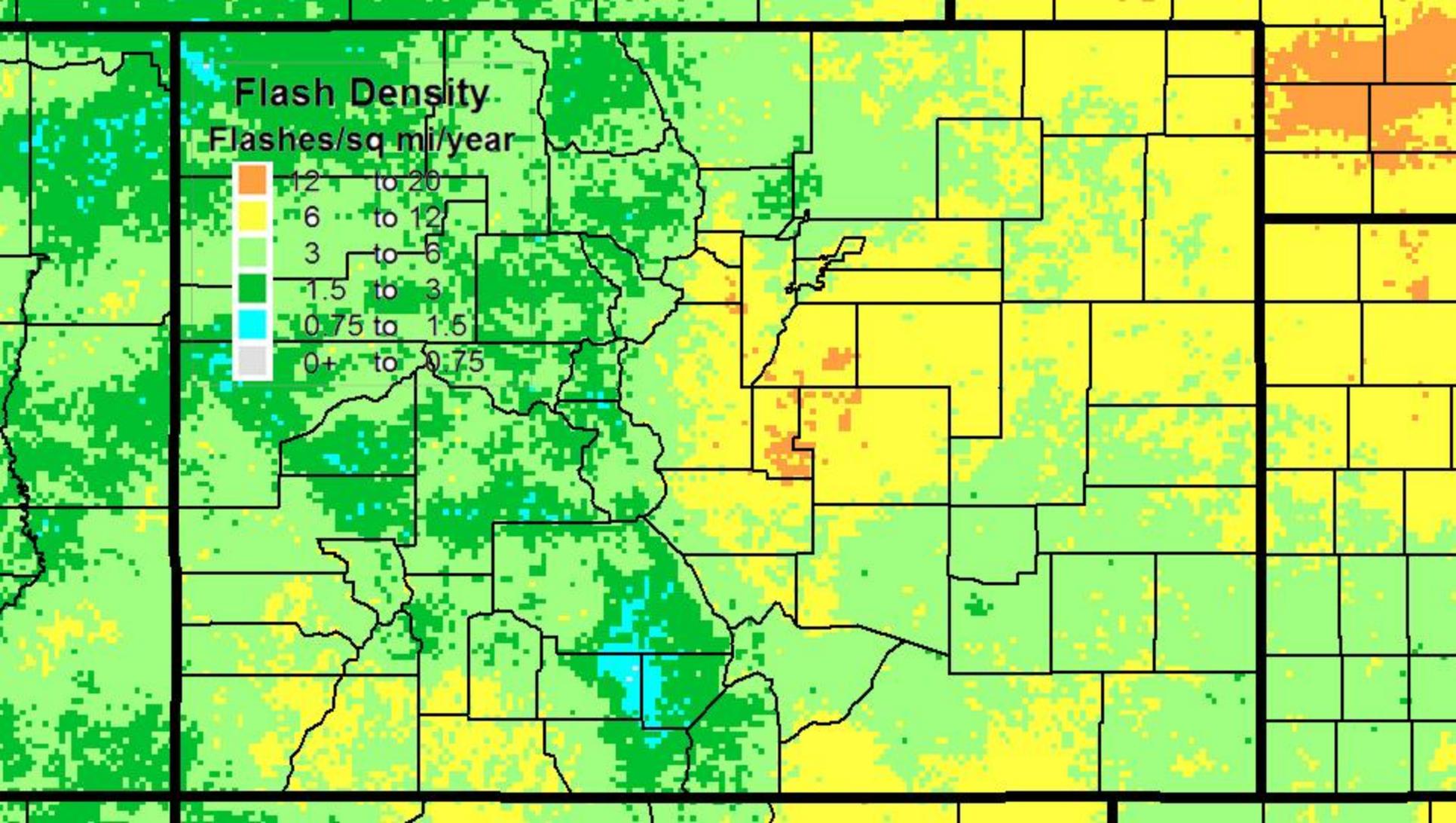
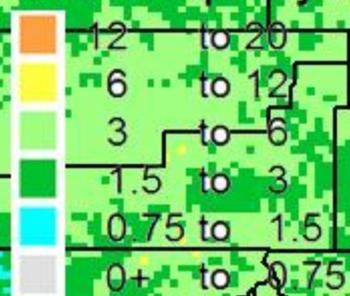


**National Lightning Detection Network
2005 - 2014**

Flash Density	
Flashes/sq mi/year	
26 and up	
20 to 26	
12 to 20	
6 to 12	
3 to 6	
1.5 to 3	
0.75 to 1.5	
0+ to 0.75	

VAISALA

Flash Density Flashes/sq mi/year



State	Death Rate Per Million People from 2005-2014	Rank of Death Rate Per Million
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Wyoming	0.38	1
Colorado	0.36	2
Montana	0.32	3
Maine	0.31	4
Rhode Island	0.28	5
Mississippi	0.28	6
Florida	0.27	7
Arkansas	0.25	8
Utah	0.24	9
Arizona	0.24	10

Lightning In Colorado

- 17 Deaths in ten years (2005 – 2014)
- On average, 17 > 25 injuries per year
- A “lightning maximum” by the Palmer Divide
- An active outdoor enthusiast population
- Activities that transport participants long distances from lightning safe locations.

Source: Ron Holle & Colorado Climate – Spring 2002

Lightning In Colorado

- People are struck:
 - In the mountains hiking, biking, camping
 - Outdoor sports: golfing, climbing, playing ball
 - Working outside: construction, farming
 - House Painting, lawn mowing

I invite you to observe the behavior of others during an active storm (from a safe location)!

Source: Colorado Climate – Spring 2002

Why Some People Ignore Lightning

- There is a perception that the odds are against being struck by lightning (lottery odds)
 - According to the National Weather Service, the chances of being hit by lightning at all over an 80-year lifetime are 1 in 10,000. Harvard School of Public Health says the chance of death is 1 in 3 million.
- Lightning Safety is inconvenient
- Lightning strike rarely affects large groups
- It is low probability - but high consequence

A Good Rule of Thumb

The odds of being struck by lightning...
...increase if you are outside in a thunderstorm

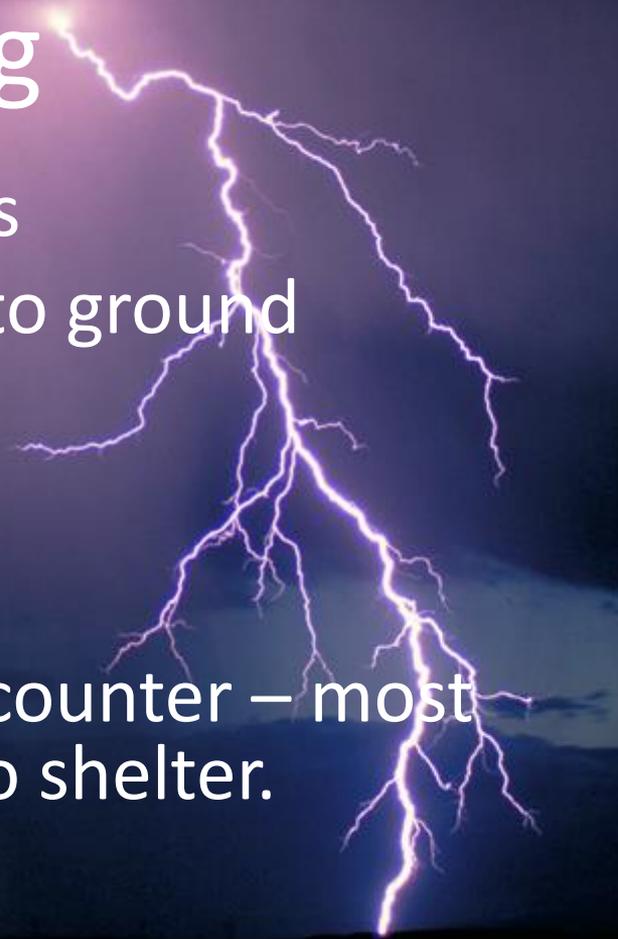
Lightning In America

- 32.2 people were killed by lightning per year (last 10)
- About 320 children and adults encounter lightning each year (for each 1 fatality, 10 sought medical attention)
- Effects range from “a good story to tell” to permanent and profound disability
- 30% of survivors suffer serious long term effects

Source: Ron Holle

About Lightning

- Lightning obeys the laws of physics
- Lightning seeks the quickest path to ground
- You cannot “attract” it
- You cannot “repel” it
- All you can do is seek safe shelter
- Certain choices may impact an encounter – most importantly, act quickly to move to shelter.



General Lightning Safety

- Check weather predictions
- Anticipate the storm – the first flash can kill
- Seek “safe” shelter – for lightning this is an enclosure surrounded by metal, like a car or a substantial building with plumbing and electrical wiring.
- Practice “When Thunder Roars, Go Indoors”

When Thunder Roars...

- Don't count the seconds, act to take shelter
- Most thunder can be heard < 10 Miles – the next visible flash may be 6 – 8 miles from the last one.
- What if you cannot hear thunder? Use your other senses & prepare to take shelter.
- Once in safe shelter, wait 30 minutes after the last audible thunder before venturing out

...Go Indoors - To Safe Shelter

- An all metal car, bus, or ambulance is excellent
- A normal house or business is excellent
- In all cases, keep windows closed, and hands off metal connected to the outside including plumbing and electrical appliances

Unsafe Shelter

- Small structures like bus shelters, gazebos, lean-to's, or vehicles with cloth tops, or tents
- Porches, decks, carports or open garages
- Shallow or wet caves
- Small or unprotected boats
- No place outside is safe from lightning

EMS Lightning Safety

- Follow safety protocol, which includes general lightning safety protocol.
- Balance the urge for swift response with the desire to not add to casualties
- If you choose exposure, make it quick
- Always retreat to safe shelter asap
- A storm that has “passed over” is still a threat

Injury Mechanisms

- Direct Strike 3 - 5%
- Contact Potential 3 - 5%
- Splash/Side Flash 30 - 35%
- Earth Potential Rise 50 - 55%
- Upward Streamer/Leader 10 - 15%

Injury Mechanisms

- Contact Potential – The person is in contact with something else that is struck, such as a tree, a fence, an electrical circuit, plumbing – anything that can pass lightning current, which then flows through the person to ground.

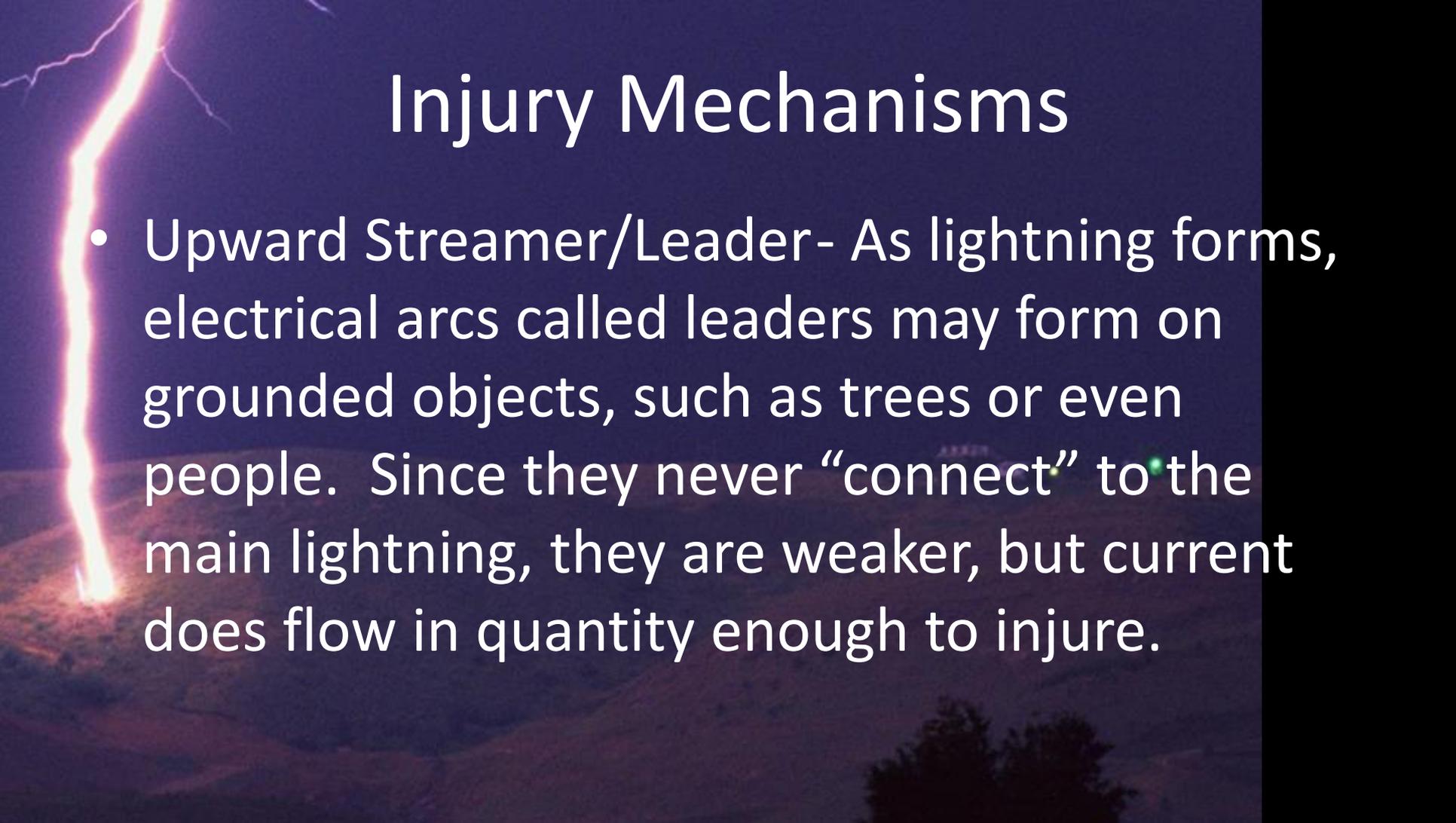
Injury Mechanisms

- Side Splash/Flash – A person is close enough to an object that is struck that some of the current can “jump” to the person before passing through them to ground.

Injury Mechanisms

- Earth Potential Rise - Aka “ground current,” when lightning strikes earth, it may spread; different points on the ground can be at different electrical potential, so contacting two points (such as legs standing) may cause current flow across the legs and lower body.

Radial horizontal arcing has been measured at least 60 ft. from the point where lightning hits ground.

A vertical lightning bolt strikes the ground on the left side of the frame. The sky is dark and cloudy, with some faint light reflecting off the clouds. The lightning bolt is bright yellow and white, with a jagged path. The ground is dark and appears to be a field or open area.

Injury Mechanisms

- Upward Streamer/Leader- As lightning forms, electrical arcs called leaders may form on grounded objects, such as trees or even people. Since they never “connect” to the main lightning, they are weaker, but current does flow in quantity enough to injure.

Injury Mechanisms

- Related effects – Blunt concussive impact of shrapnel, or a fall caused by the blast effect of a nearby flash (felt up to 10s of yards away!).
- Temporary blindness or deafness resulting in the inability to prevent other injury.
- Keraunoparalysis, may hinder evacuation.

Special Considerations for Lightning Struck Patients

- Lightning injury is a rare affliction
- Lightning treatment specialists are rare
- Patients are often misunderstood, and also often doubted!
- Any visible marks usually fade, but sequelae may not resolve

How you can help

- As a 1st responder, no other medical personnel will ever be closer to the ground zero of this unusual injury. Medical procedures come first, but carefully documenting the initial assessment may be the most compassionate act you can perform.

How you can help

- A struck patient may be ill-equipped to manage the doubt and misunderstanding of the medical and insurance establishments. If the mechanism of injury is supported with real documentation, this will be one less obstacle faced by a genuine lightning injury patient.

How you can help

- A lightning struck patient may refuse care or shrug off the injury. Keep in mind a person with this injury may be unable to make sound judgements following the insult. Perform a standard mental status exam.

Signs of Lightning Injury

- Cold, pulseless extremities - A sign of vasomotor instability
- Confusion, amnesia, paralysis, and loss of consciousness
- Temporary hearing loss or tympanic membrane rupture - Caused by concussive shock wave
- Hypotension - Usually from vasomotor instability and spasm - but spinal cord injuries and other more common causes should be ruled out
- Prolonged paresis or paralysis of the extremities - Indicates possible spinal cord injuries

Source: Mary Ann Cooper, MD & Richard F Edlich, MD

Signs of Lightning Injury

- Lichtenberg figures - Rare but pathognomonic of lightning injury; also known as ferning patterns or keraunographic markings or singeing of hair
- Clothing that is singed, shredded, or blown apart; shoes that appear to be exploded from the inside; magnetized watches, zippers, or other metal objects; melting or fusing of brass grommets or zippers.

Source: Mary Ann Cooper, MD & Richard F Edlich, MD

Signs of Lightning Injury



Data Collection of Lightning Struck Patients

- Because lightning injury is rare, it is harder to collect data on these injuries.
- Lightning injury has been shown to be under-reported.
- There is no “cure” for lightning strike. All we have is prevention and treatment.

How it benefits you

- Any improvement to the understanding, diagnosis, and treatment of the condition will improve the quality of life for the lightning injured patient.

In Summary

We want you to be safe.

We want to help you understand
these patients so they can receive
appropriate care.