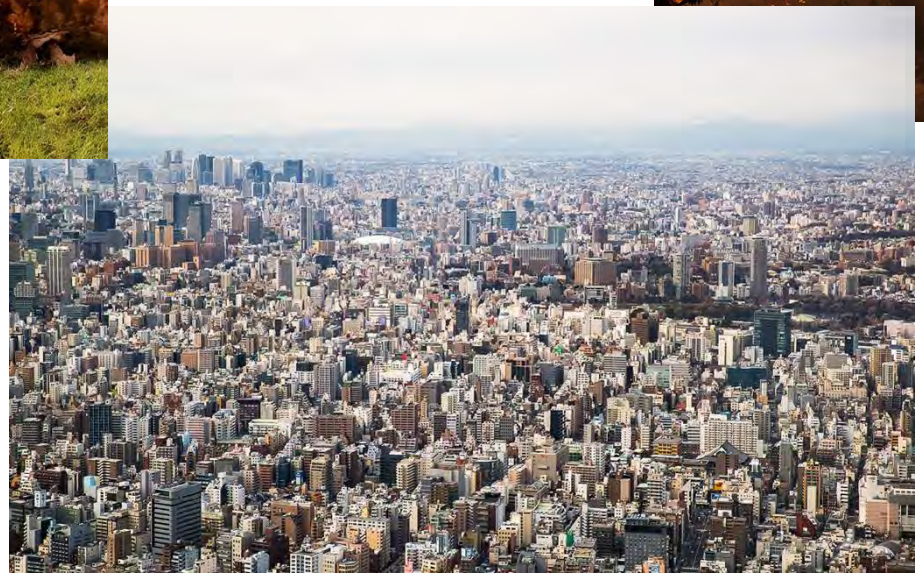
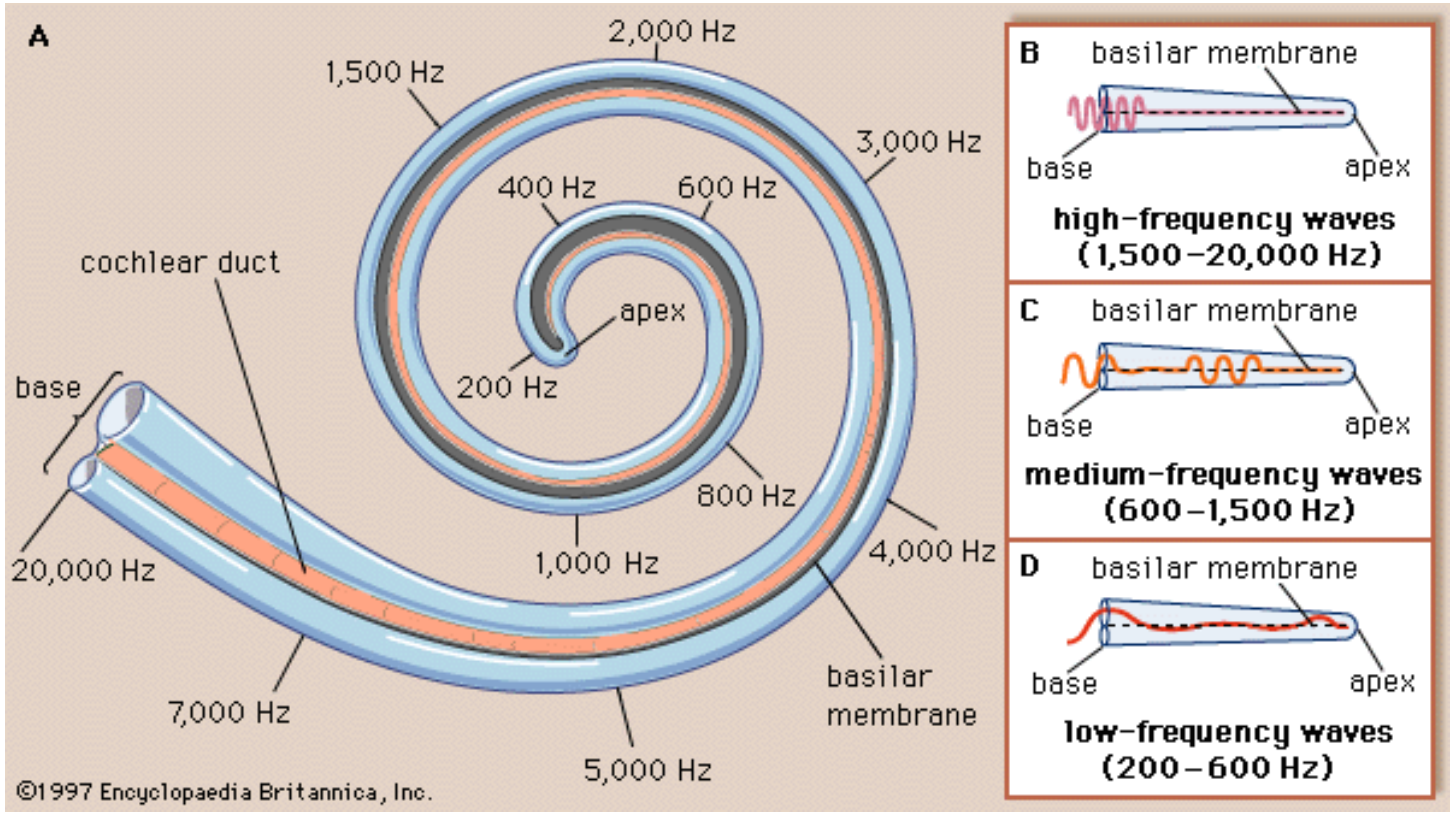
LLI Class 4: Noise, wildfires, urbanization

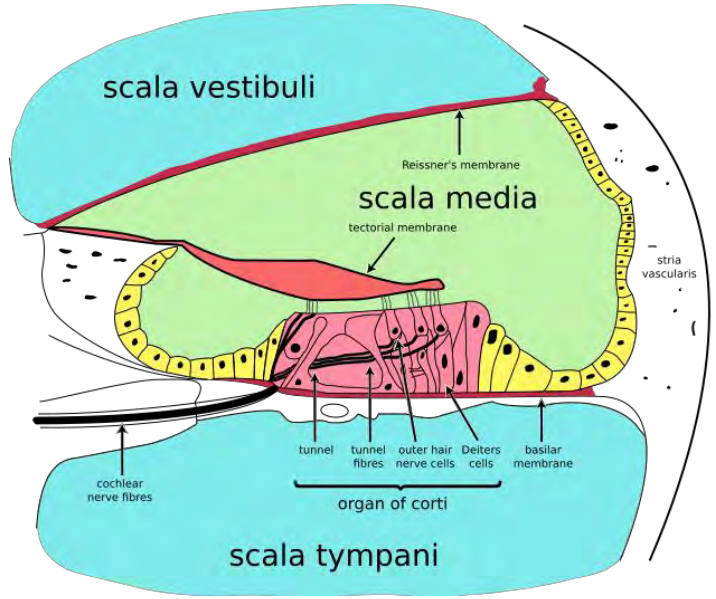


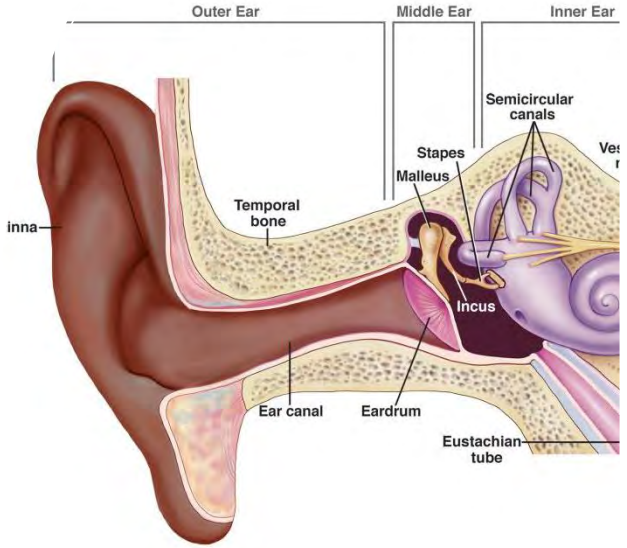




Frequency (pitch) coding in tympanic membrane

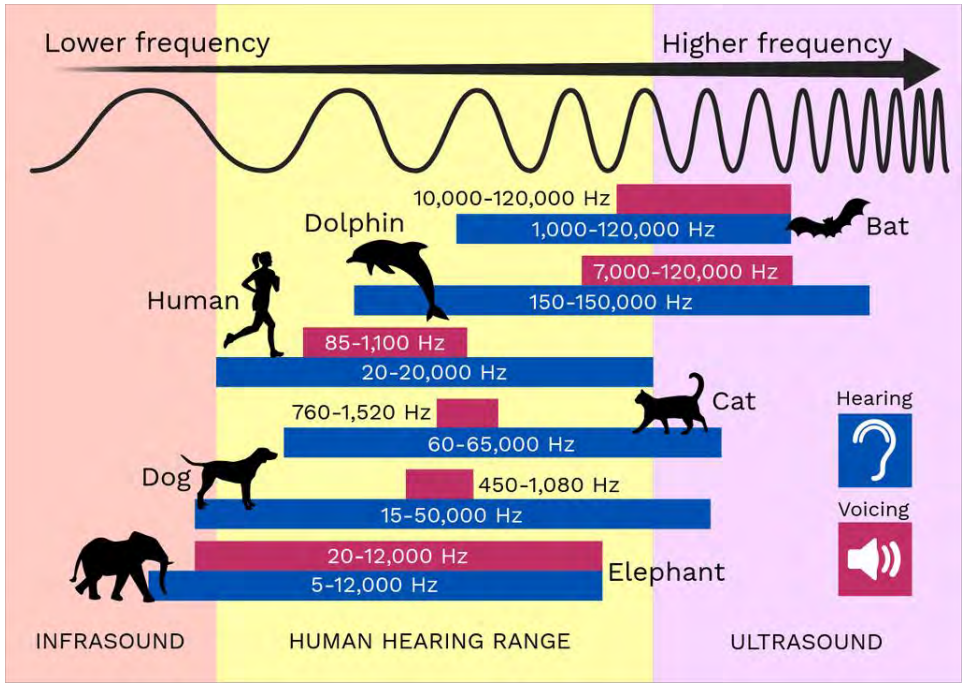


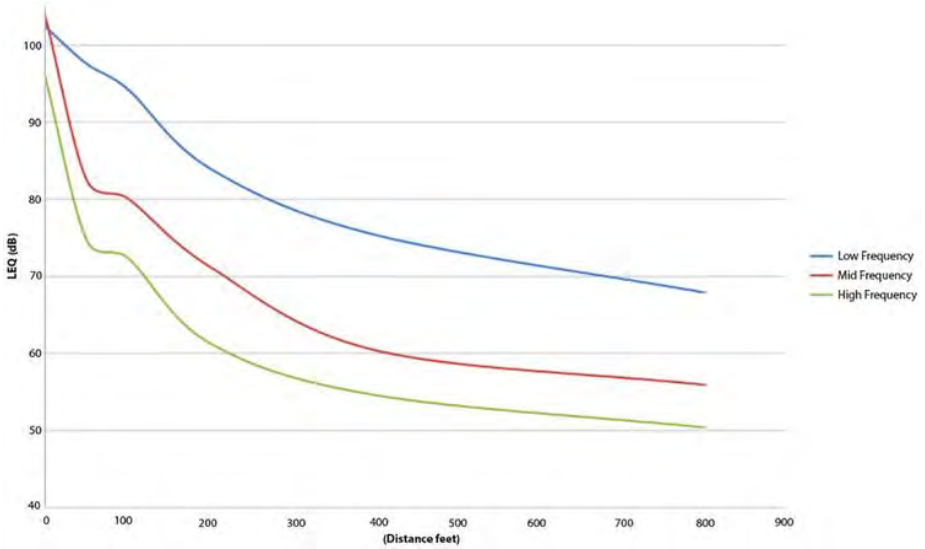


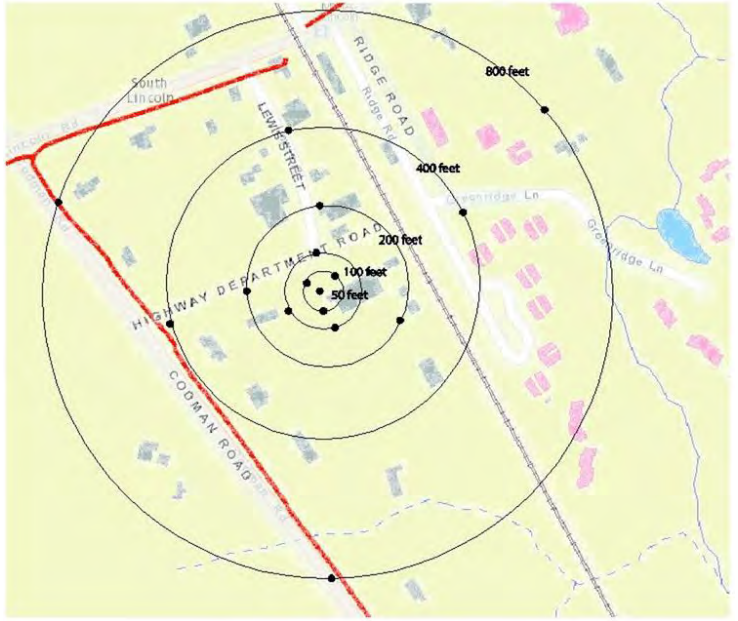


Sound frequency is important for how far sound travels and also the threshold for detection/damage

Frequency has different impacts- stress, interference, etc

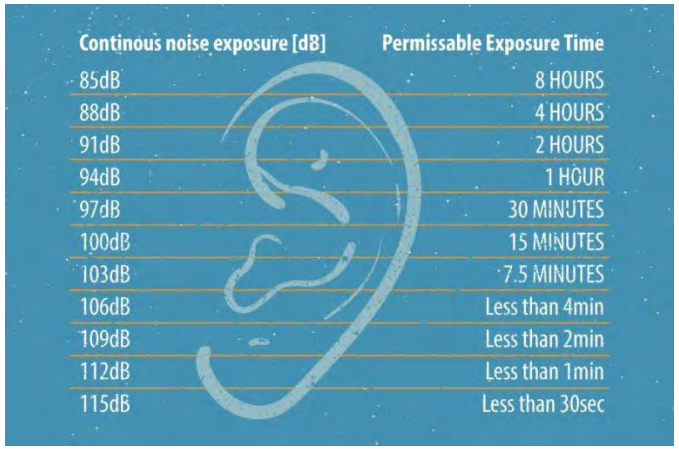




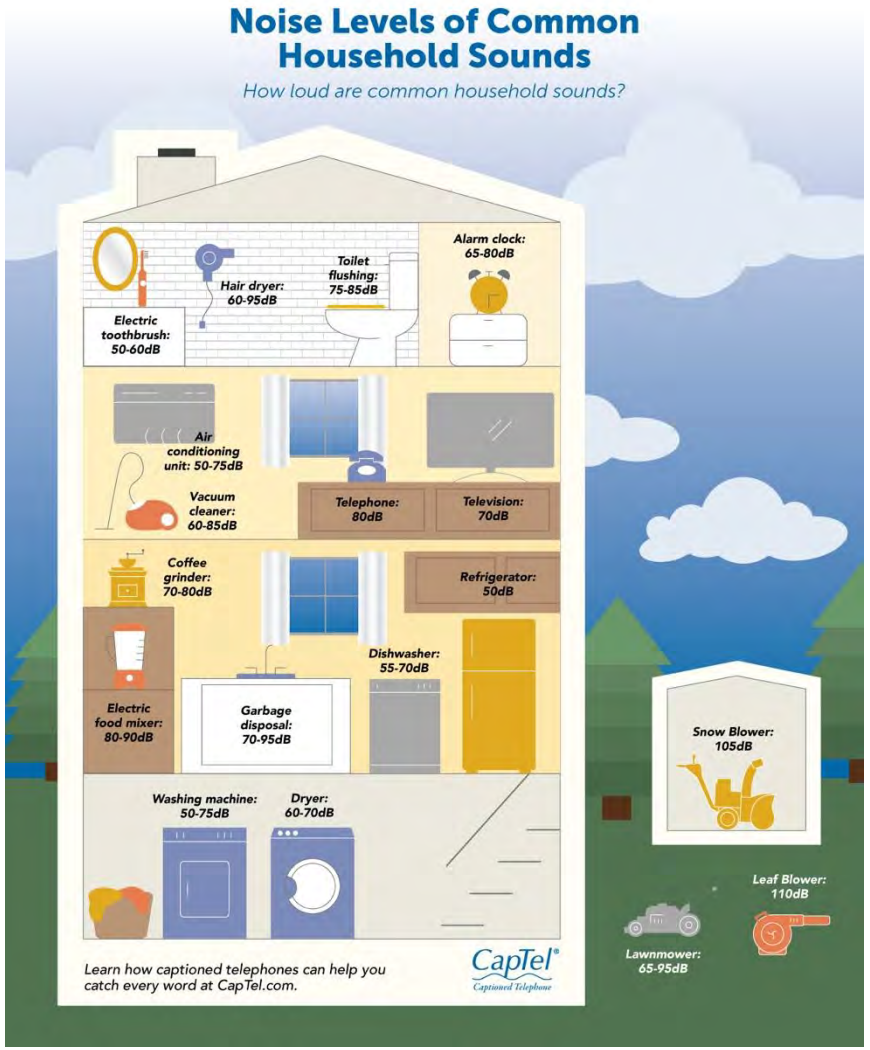




It’s not just loudness that’s harmful

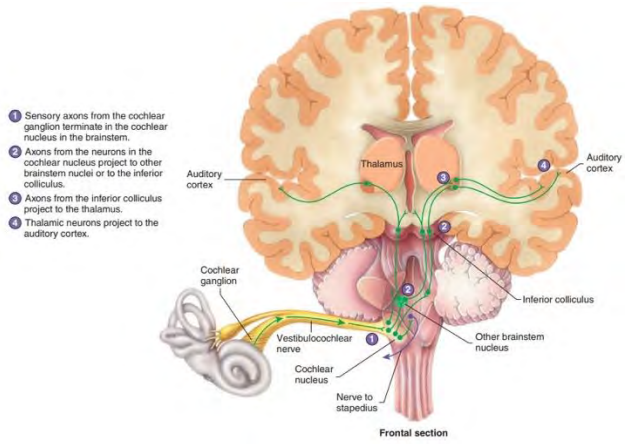


Breathing	10 dB	Safe sound level
Ticking watch	20 dB	
Average room noise	30-50 dB	
Normal conversation/ backgroud music	60 dB	
Average office noise	70 dB	
Landscaping equipment (inside house)	75 dB	Repeated or prolonged exposure could lead to NIHL over time
Vacuum / inside an airplane	80 dB	
City traffic (inside a car) / noisy restaurant	85 dB	
Subway, shouted conversation	90-95 dB	
Pro sports events/ car horn at 16 ft	95-100 dB	
Motorcycle, stereo	100 dB	
Chainsaw, leafblower, snowmobile	106-115 dB	
Music concert, ambulance siren	120 dB	Can result in immediate and permanent hearing loss after a single close-range exposure
Jet engine taking off	140 dB	
Gun shot	140-60 dB	



Low frequency sounds penetrate walls

Sound and cortex, neuroendocrine



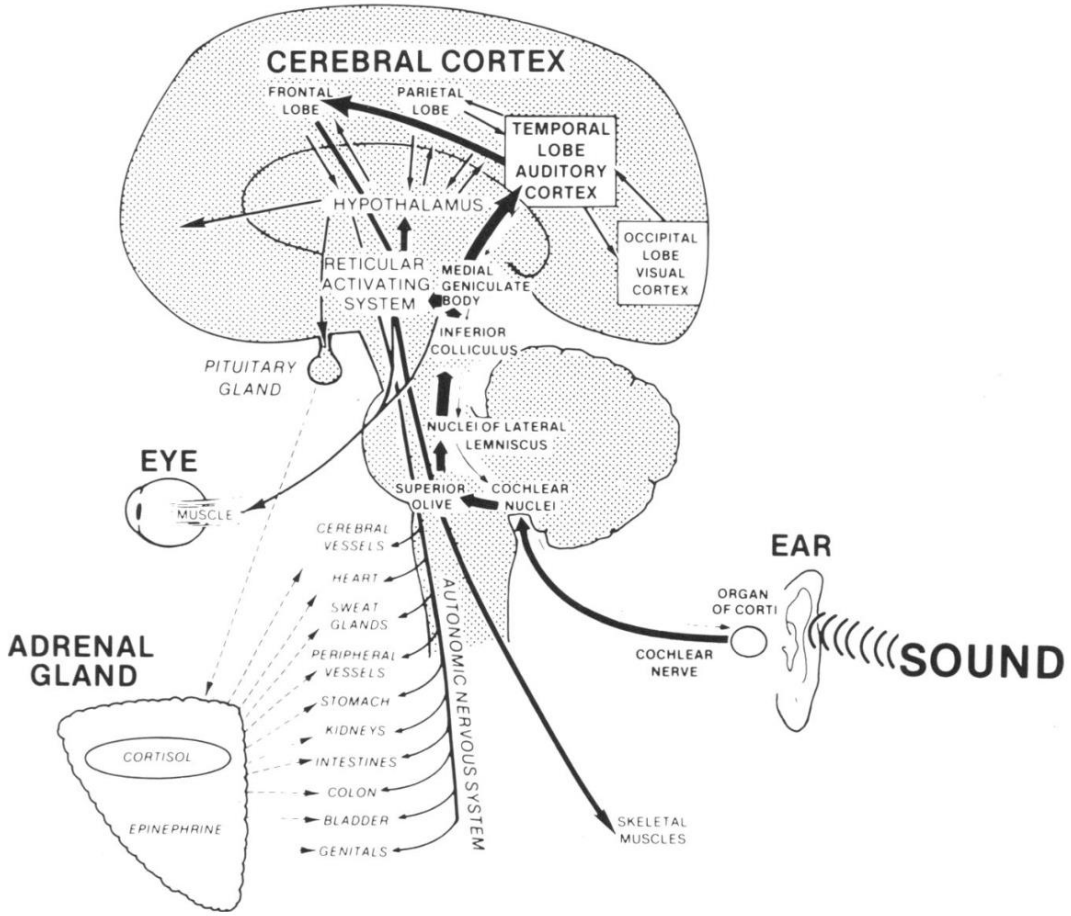


FIGURE 1. Processing of sound by the brain.

Westman and Walters, 1981 Noise and Stress: A comprehensive approach. Environ. Health Perspec 41:291

Hearing damage in humans (20% world pop)

- Noise-induced hearing loss.

Caused by one loud noise (explosion) or long-time of greater than 85 dB:

Motorcycles (95 dB), sirens (<1 min), leafblowers (5 min), gas-powered lawnmowers, weedwhackers, chainsaws, rock concerts (2-5 min), loud sporting events (14 min), loud in ear buds, air pods, etc.



Other causes of hearing loss

- Aging- chronic impacts
- High blood pressure (chronic, untreated)
- Illness/infection (measles, mumps, meningitis)
- Certain prescription drugs (malaria meds, aspirin, NSAIDs), opioids
- Environmental chemicals
- Injury
- Tumor (acoustic neuroma)



https://suncoastaudiology.com/hearing-loss/

Hearing loss correlates with neurodegenerative disease

- Accounts for 8% of new dementia cases: 800,000 each year
- Nearly 1/3 of adults over 65 have hearing loss
- Increased risk of **falls**, social isolation, depression, cognitive decline
- Increased risk of PD, AD

Li S, Cheng C, Lu L, Ma X, Zhang X, Li A, Chen J, Qian X, Gao X. Hearing Loss in Neurological Disorders. Front Cell Dev Biol. 2021 Aug 11;9:716300. doi: 10.3389/fcell.2021.716300. PMID: 34458270; PMCID: PMC8385440.

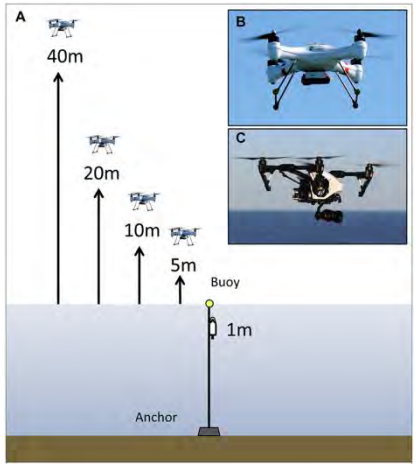
Human Noise is harming many animals

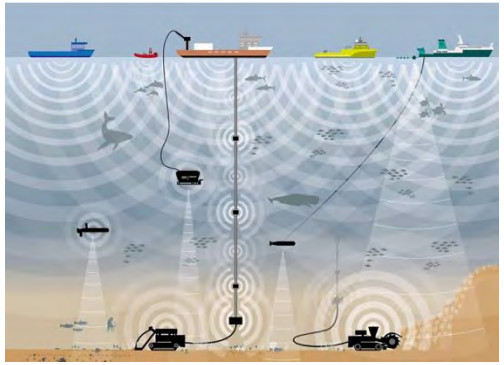
- Traffic noise, chainsaws, lawn mowers affect feeding, threat detection in birds (Great tits, black-capped chicadees)
- Underwater (freshwater streams, lakes) traffic noise dominant sound now
- Honeybee waggle dance disrupted by human noise
- Fish, bird embryos show reduced growth, delayed development
- Pile driving and harbor porpoises



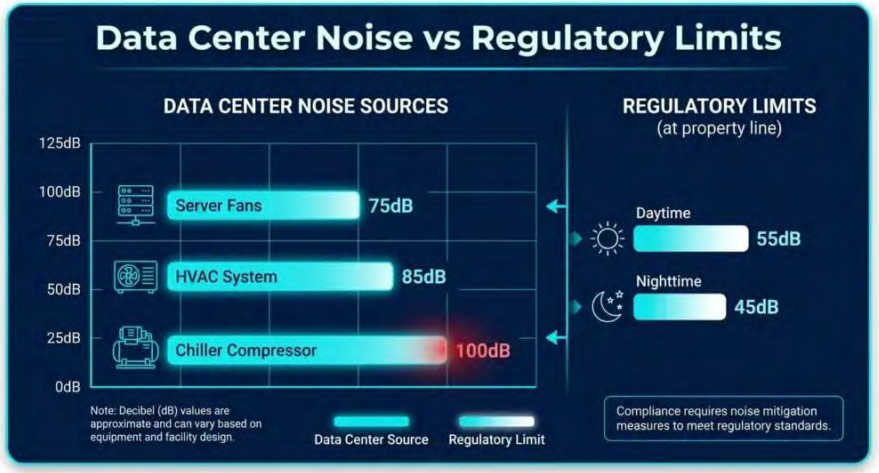
Newer noise concerns

- Drones penetrating areas where humans can’t go
- High speed trains
- HVAC and data centers
- Deep sea mining





- Noise was considered a national hazard, the 1972 Noise Control Act, OSHA/EPA, largely ignored now

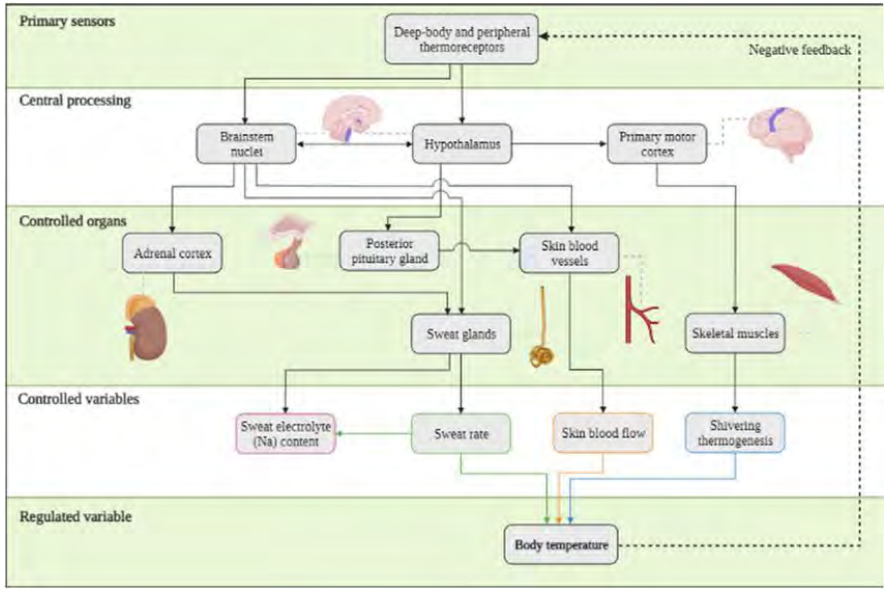


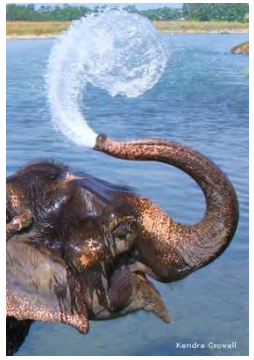
What can we do?

- Be mindful of when and how long you use equipment like leaf blowers- respect others around you (maybe use a rake?)
- Consider being active in your community on noise ordinances
- Trees, landscaping to reduce noise spread
- Use an app with warnings of loud noise
- Wear ear plugs on planes and in loud environments
- Support initiatives to reduce human noise pollution

Human Impacts: Heat and Wildfires

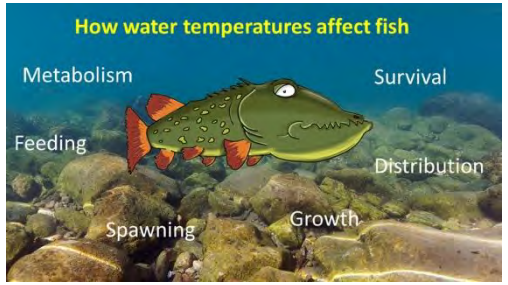
- Many animals, especially humans, evolved in much cooler and stable climates.
- Heat is a stressor: physiological and psychological
- Leads to physiological, neurological and behavioral responses





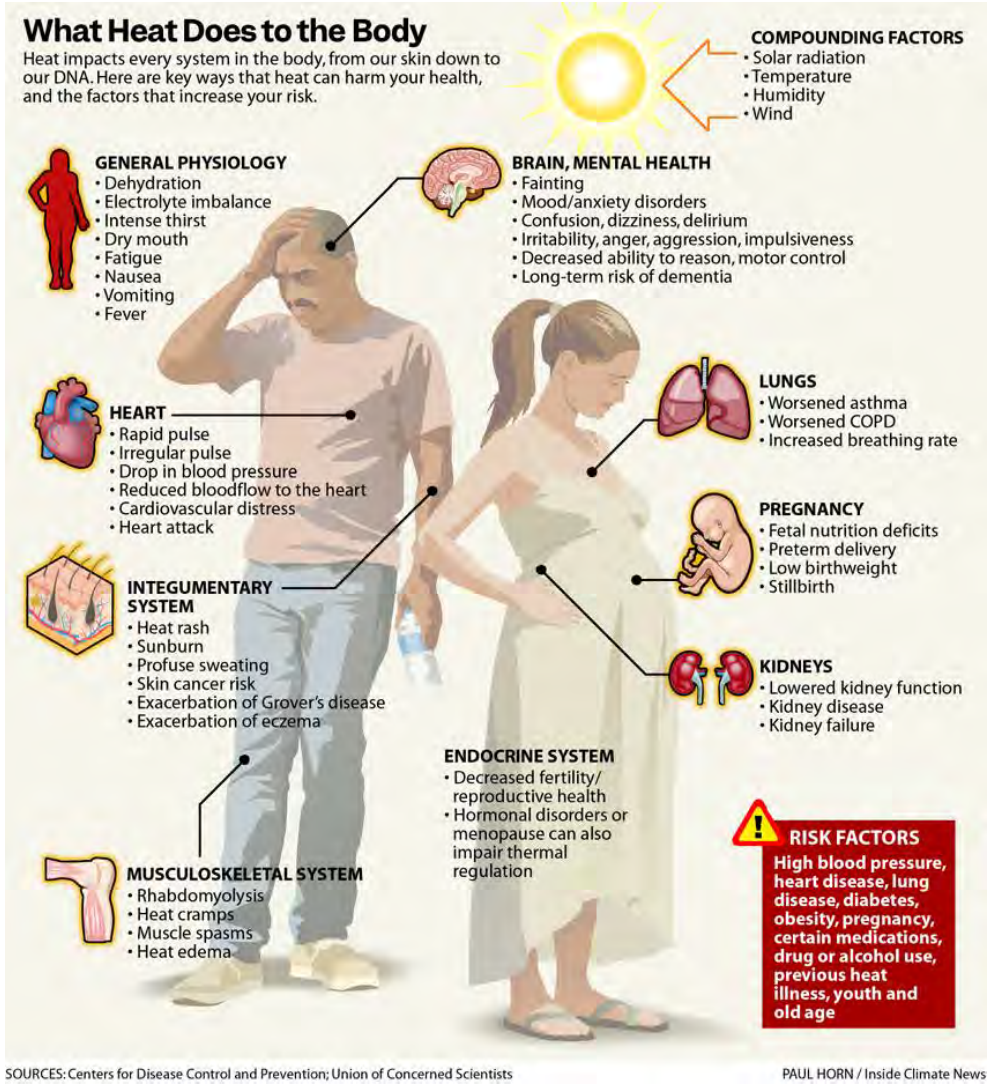






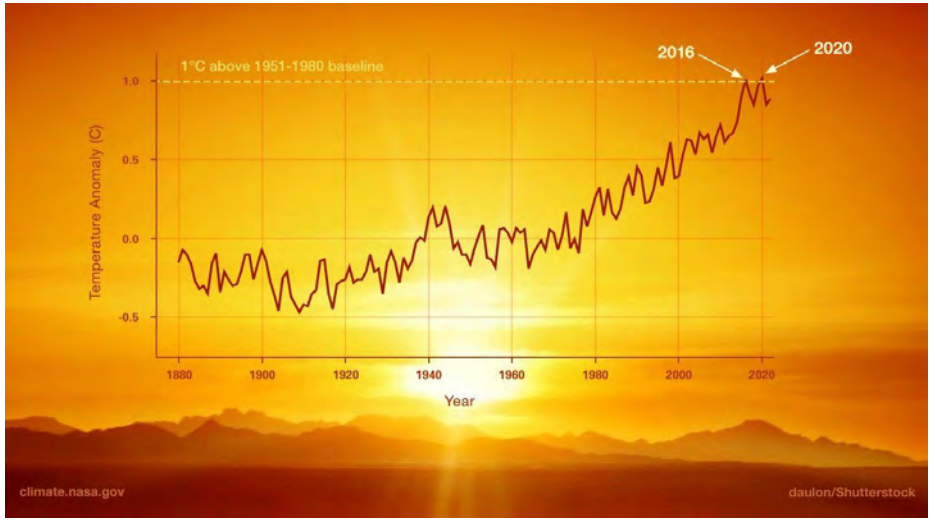
Heat waves and human health

- Increased hospitalizations
- Seizure sensitivity
- Sleep disturbances
- Anxiety, aggression
- Heat stroke, heat exhaustion
- Increased risk of dementia
- Increased risk of kidney damage



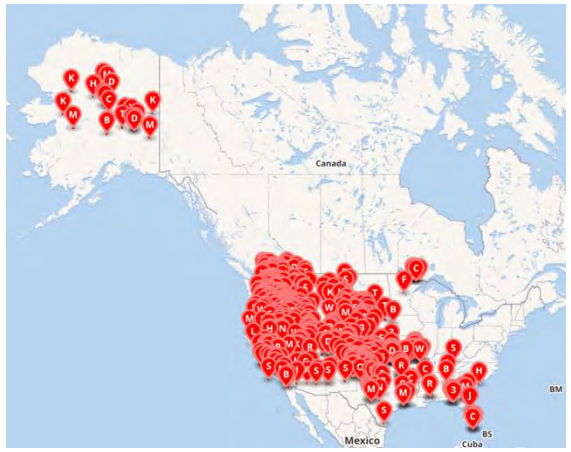
Global warming: other impacts

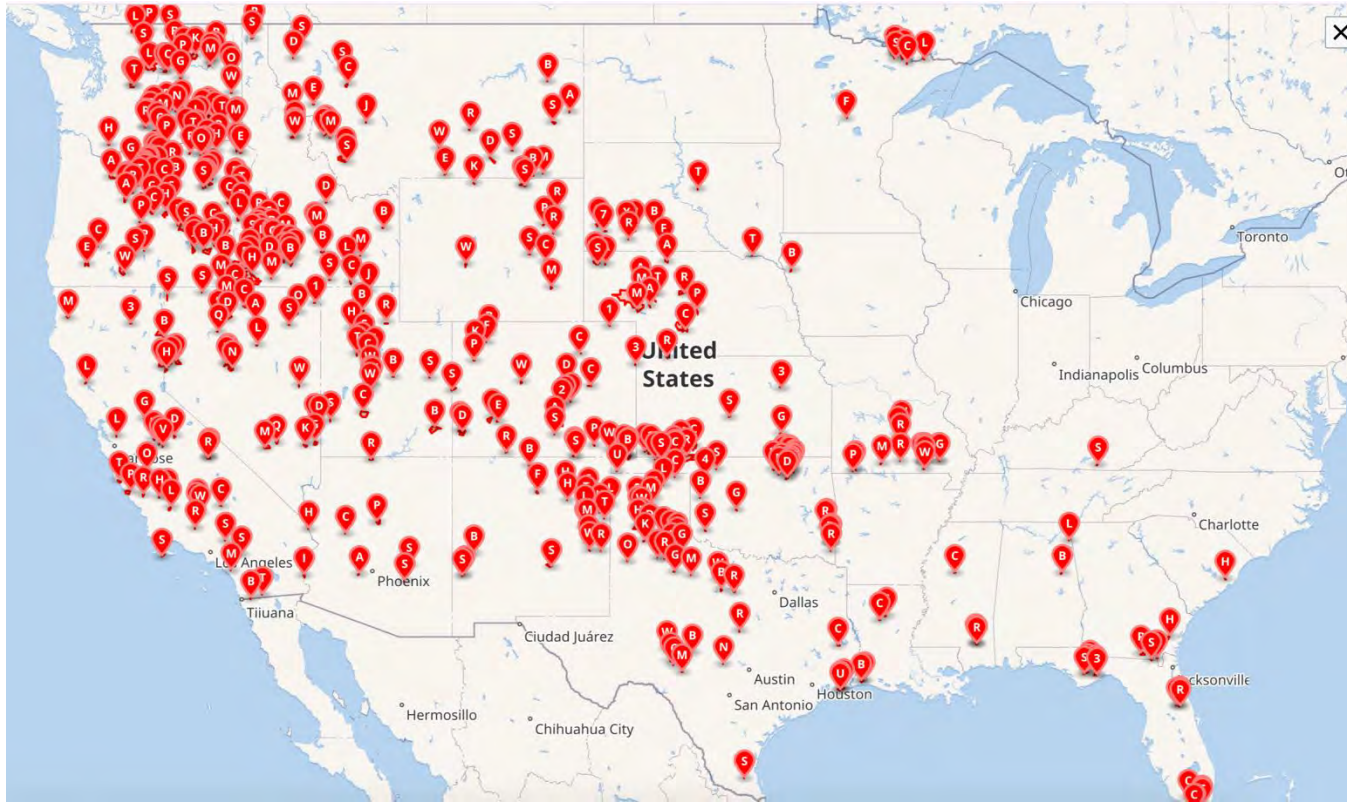
- Infectious diseases- plants, animals, people
- NYT Oct. 20: tree pandemics- new diseases enter before older diseases are under control (movements due to human activities and also warming)
- Drought, flooding, wildfires
- Extreme weather
- Seasonal changes affect species interactions



Wildfires in US 2026

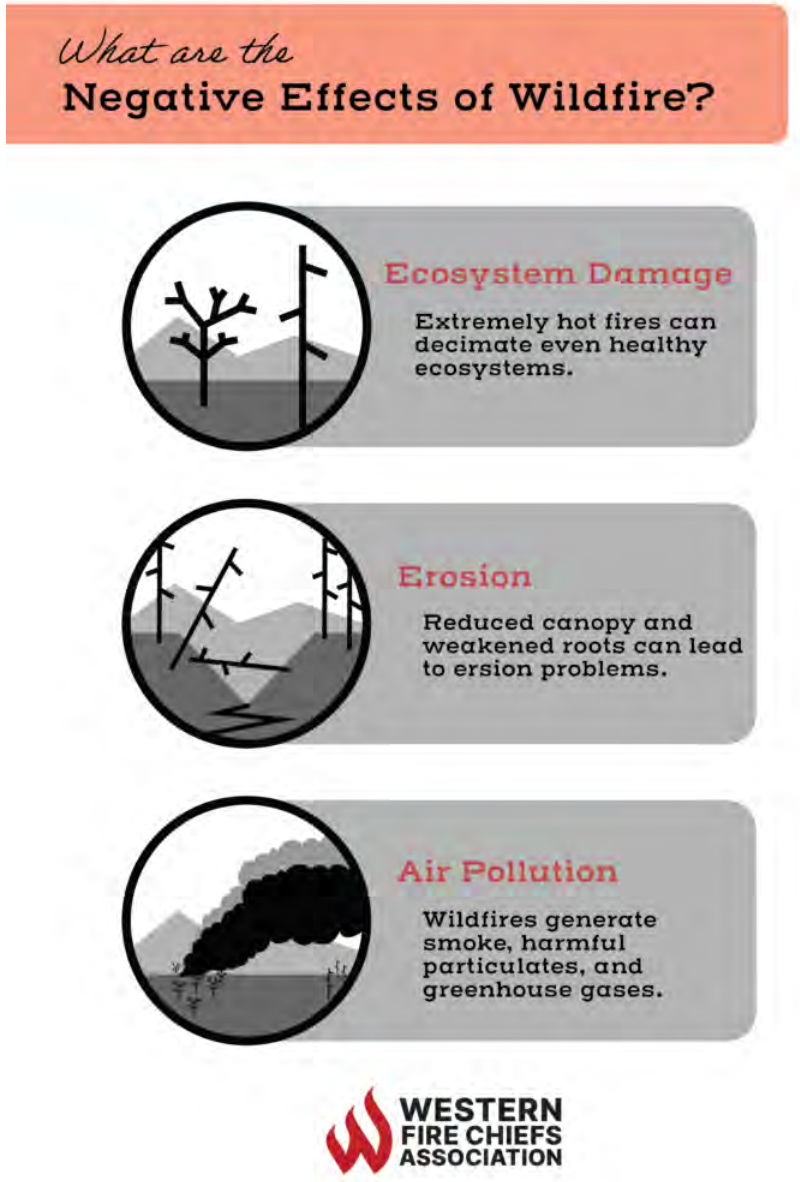
- >68,000 wildfires with more than 1000 acres
- Over 9 million acres burned





Impacts on wildlife

- Habitat destruction- vegetation
- Loss of life
- Altered predator-prey dynamics
- Shifts in species abundance
- Long-term changes in species dynamics and ecosystems
- Wildfire smoke contains many toxic chemicals
- Runoff into water toxic to aquatic species



https://www.youtube.com/watch?v=WCfU2D_kRtw

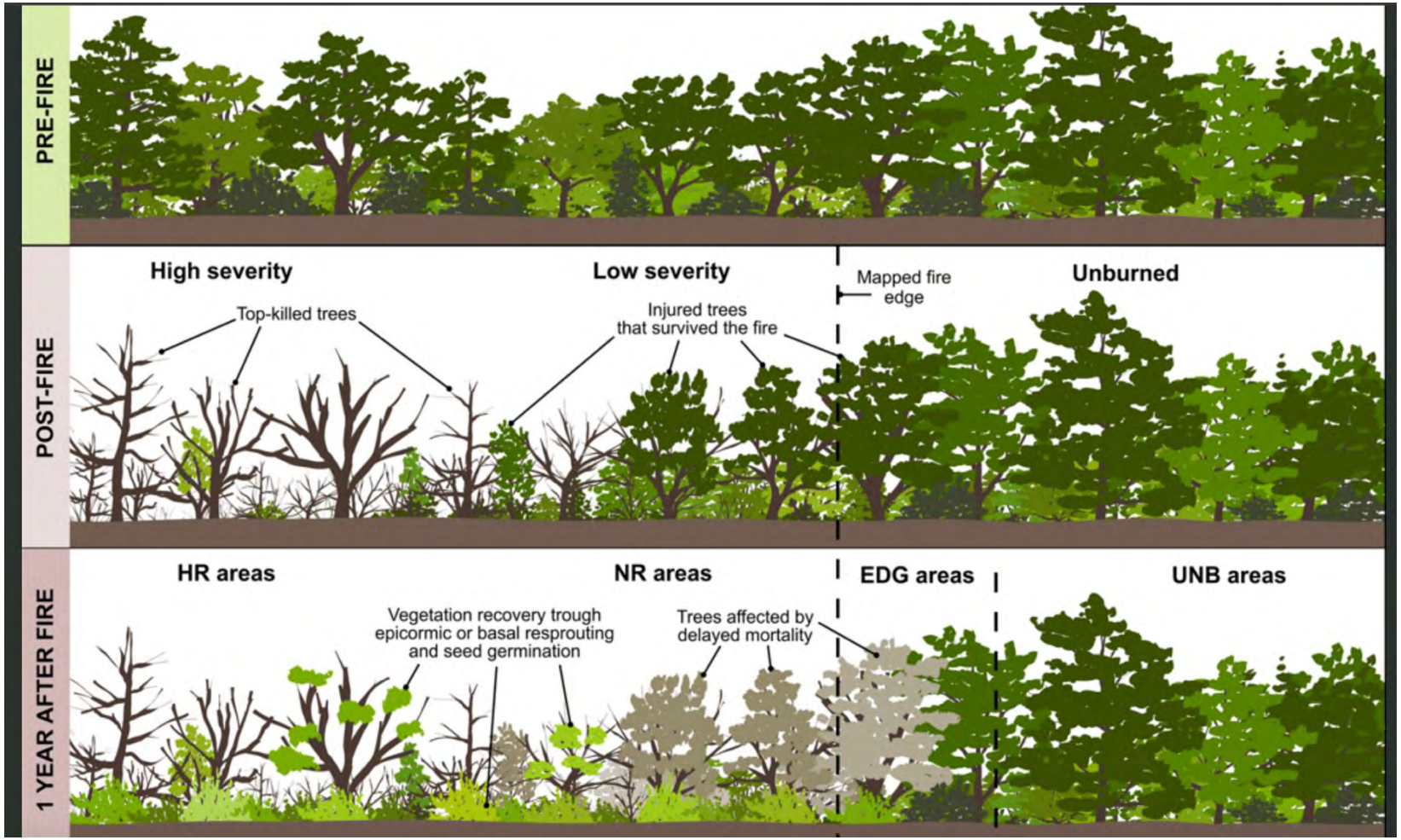
https://www.youtube.com/watch?v=u-zBBIygzHU

Physiological changes

- Smoke particles (PM2.5): impaired cognitive function, cognitive de line, decreased attention, elevated anxiety, depression; heightened stress responses
- Elevated risks of emergency hospitalizations
- Sleep disturbances

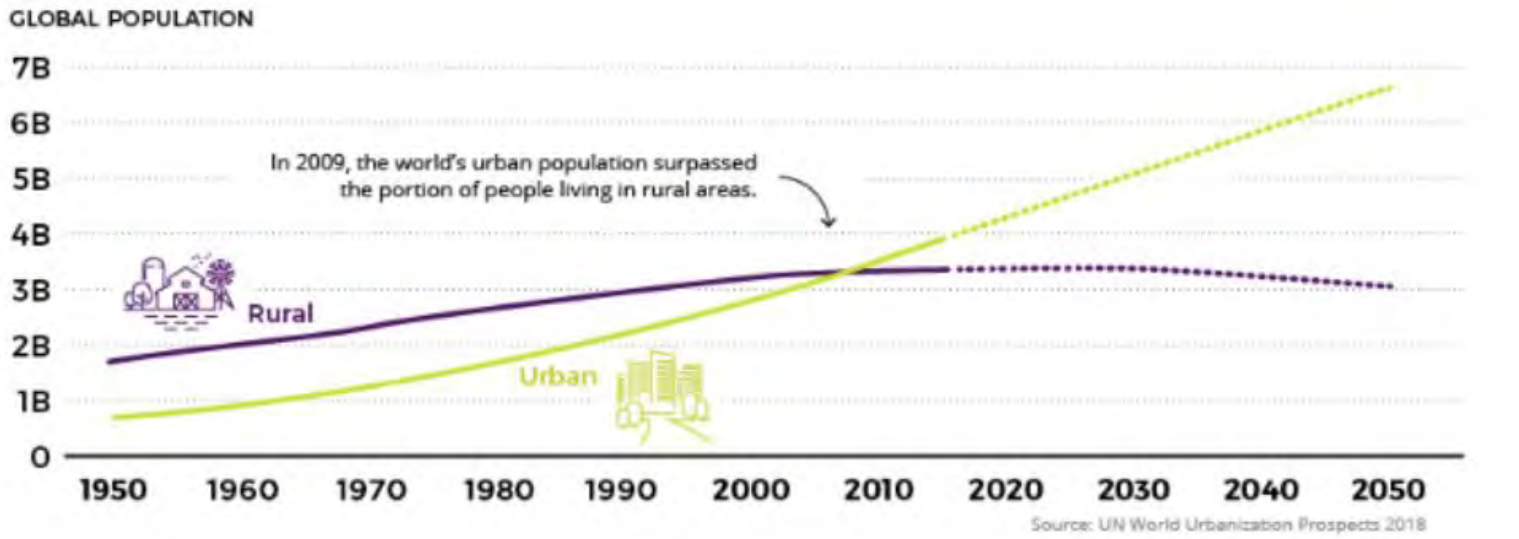


After a fire


PRE-FIRE
POST-FIRE
1 YEAR AFTER FIRE
High severity
Low severity
Mapped fire edge
Unburned
Top-killed trees
Injured trees that survived the fire
HR areas
NR areas
EDG areas
UNB areas
Vegetation recovery trough epicormic or basal resprouting and seed germination
Trees affected by delayed mortality

Urbanization and animals

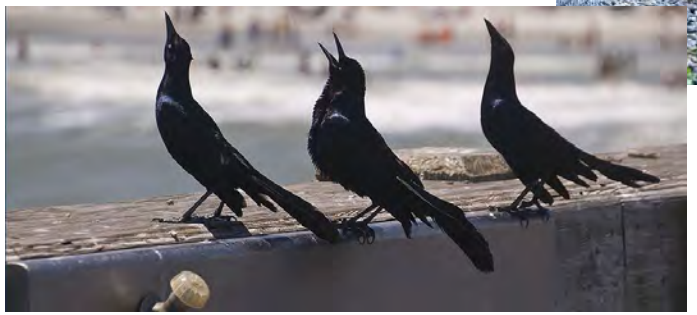
- By 2018, more than 50% of world's humans are in cities



Animals in urban areas



- Behavioral plasticity
- Evolution in action?



- Assortative mating, hybridization, maladaptive behaviors (food)







Urbanization and people



- High density social stressor
- Low social cohesion in some cities, neighborhoods



- Inequality
- Migration to/from cities
- Green spaces (or lack)
- Noise, light, air pollution, chemical pollution
- Sensory overload
- Excessive heat



Reflections, Discussion

- Mixtures: chemicals, noise, light, land disturbance…..
- What harms wildlife harms us too

