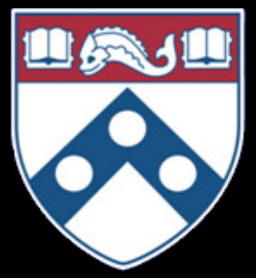
Climate Change & Dermatology



Misha Rosenbach, MD
Associate Professor, Dermatology & Internal Medicine
Vice Chair, Education & Training
Program Director, Dermatology Residency Program
University of Pennsylvania

Disclosures/Conflicts

- AAD Expert Resource Group on Climate Change & Environmental Issues Co-Founder and Co-Chair
  - I am speaking on behalf of myself and not the AAD

Outline

- Climate change, wildfires, & pollution:
  - Atopic dermatitis, inflammatory skin disease
- Warming & extreme weather:
  - Cutaneous sequelae
- Vectors & changing geographic patterns of disease
  - Cutaneous infections

International Journal of Women's Dermatology

Open access

Special Issue on Climate Change & Dermatology

Edited by Misha Rosenbach, Mary L. Williams

Volume 7, Issue 1,

Pages 1-124 (January 2021)

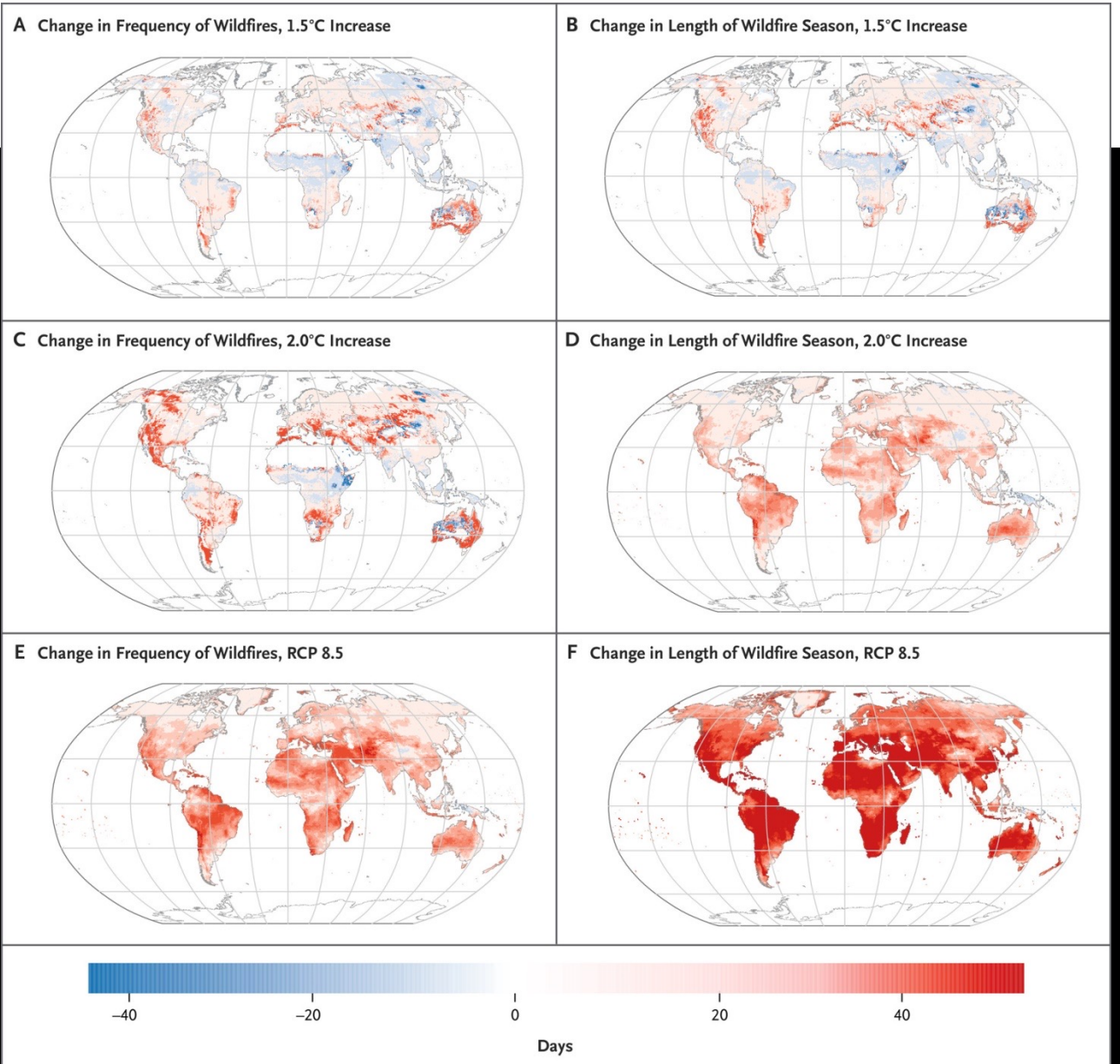
Download full issue

The NEW ENGLAND JOURNAL of MEDICINE

Wildfires, Global Climate Change, and Human Health

Rongbin Xu, M.B., B.S., Pei Yu, M.B., B.S., Michael J. Abramson, M.B., B.S., Ph.D., Fay H. Johnston, B.M., B.S., Ph.D., Jonathan M. Samet, M.D., Michelle L. Bell, Ph.D., Andy Haines, M.B., B.S., M.D., Kristie L. Ebi, Ph.D., M.P.H., Shanshan Li, M.D., Ph.D., and Yuming Guo, M.D., Ph.D.

November 26, 2020
N Engl J Med 2020; 383:2173-2181
DOI: 10.1056/NEJMsr2028985



JAMA Dermatology | Original Investigation

Association of Wildfire Air Pollution and Health Care Use for Atopic Dermatitis and Itch

Raj P. Fadadu, MS; Barbara Grimes, PhD; Nicholas P. Jewell, PhD; Jason Vargo, PhD; Albert T. Young, BA; Katrina Abuabara, MD, MA, MSCE; John R. Balmes, MD; Maria L. Wei, MD, PhD

RESULTS Visits corresponding to a total of 4147 patients (mean [SD] age, 44.6 [21.1] years; 2322 [56%] female) were analyzed. The rates of visits for AD during the Camp Fire for pediatric patients were 1.49 (95% CI, 1.07-2.07) and for adult patients were 1.15 (95% CI, 1.02-1.30) times the rate for nonfire weeks at lag 0, adjusted for temperature, relative humidity, patient age, and total patient volume at the clinics for pediatric patients. The adjusted rate ratios for itch clinic visits during the wildfire weeks were 1.82 (95% CI, 1.20-2.78) for the pediatric patients and 1.29 (95% CI, 0.96-1.75) for adult patients. A 10-μg/m^3 increase in weekly mean $PM_{2.5}$ concentration was associated with a 7.7% (95% CI, 1.9%-13.7%) increase in weekly pediatric itch clinic visits. The adjusted rate ratio for prescribed systemic medications in adults during the Camp Fire at lag 0 was 1.45 (95% CI, 1.03-2.05).

CONCLUSIONS AND RELEVANCE This cross-sectional study found that short-term exposure to air pollution due to the wildfire was associated with increased health care use for patients with AD and itch. These results may provide a better understanding of the association between poor air quality and skin health and guide health care professionals' counseling of patients with skin disease and public health practice.

JAMA Dermatol. doi:10.1001/jamadermatol.202
Published online April 21, 2021.

EDITORIAL

JAMA Dermatology Published online April 21, 2021

Wildfire Smoke Pollution, Climate Change, and Skin Disease

Kenneth W. Kizer, MD, MPH

Taking these things together means that Fadadu et al[6] captured only a small portion of the smoke-related skin health morbidity resulting from the Camp Fire. Given the millions of Californians who were exposed to the Camp Fire's drifting smoke and the population prevalence of atopic dermatitis (as high as 20% in children and 10% in adults[16]) and extrapolating from the increased incidence of atopic dermatitis and itch reported by Fadadu et al,[6] it is likely that many thousands of people developed smoke-related skin health problems.

To prepare for and manage the health consequences of the growing problem of wildfire smoke pollution requires more knowledge about how wildfire smoke affects health and health care use. A comprehensive, targeted research strategy along with resources to implement the strategy are needed.[13] In addition, because continuing climate change will likely worsen this situation and add skin health stressors (eg, heat and increased UV radiation), it should be expected that the health care burden of atopic dermatitis and other air pollution-sensitive skin diseases will grow substantially in coming years. Improved pharmacologic treatments and other interventions for these conditions will be helpful in addressing this growing problem, but more effective policies and practices to mitigate climate change and reduce wildfires will be even more helpful.

Atopic Dermatitis, Climate Change, & Pollution

- Air pollutants from wildfires, volanic ash, power plants, motor vehicle emissions
  - PM_x, nitrogen oxides, sulfur oxides, and volatile organic compounds
  - PM may be coated with polycyclic aromatic hydrocarbons which are lipophilic, penetrate skin, and induce oxidative stress
    - Pregnane X receptor, aryl hydrocarbon receptor
- Numerous studies demonstrating increased pollution with increased incidence & severity of AD
- Temperature, humidity, UV exposure, & precipitation may also influence AD
  - Increased pollen count

Schachtel A, et al. Int J Women's Derm 2021

Review

International Journal of Dermatology

Climate change and atopic dermatitis: is there a link?

Giang Huong Nguyen[1], MD, PhD, Louise Kronborg Andersen[2], MD, and Mark Denis P. Davis[3], MD

International Journal of Dermatology 2018

Conclusion

Taken together, it seems the changing environment, attributable to climate change, is having a profound effect on the epidemiology of AD. Increased temperatures, increased humidity, increased pollen, and air pollution are all associated with changes in the epidemiology and severity of atopic dermatitis.

BJD British Journal of Dermatology
IMPROVING PATIENT OUTCOMES IN SKIN DISEASE WORLDWIDE

Association between air pollution and atopic dermatitis in Guangzhou, China: modification by age and season

H.L. Wang, J. Sun, Z.M. Qian, Y.Q. Gong, J.B. Zhong, R.D. Yang, C.L. Wan, S.Q. Zhang, D.F. Ning, H. Xian, J.J. Chang, C.J. Wang, E. Shacham, J.Q. Wang, H.L. Lin

First published: 01 November 2020 | https://doi.org/10.1111/bjd.19645

Original article

CED
Clinical and Experimental Dermatology

Association between climate, pollution and hospitalization for pemphigus in the USA

Z. Ren,[1] D. Hsu,[1] J. Brieva[1] and J. I. Silverberg[1,2,3]

Departments of [1]Dermatology; [2]Preventive Medicine; and [3]Medical Social Sciences, Northwestern University Feinberg School of Medicine, Chicago, IL, USA

DERMATOLOGIC THERAPY

The impact of air pollution on skin and related disorders: A comprehensive review

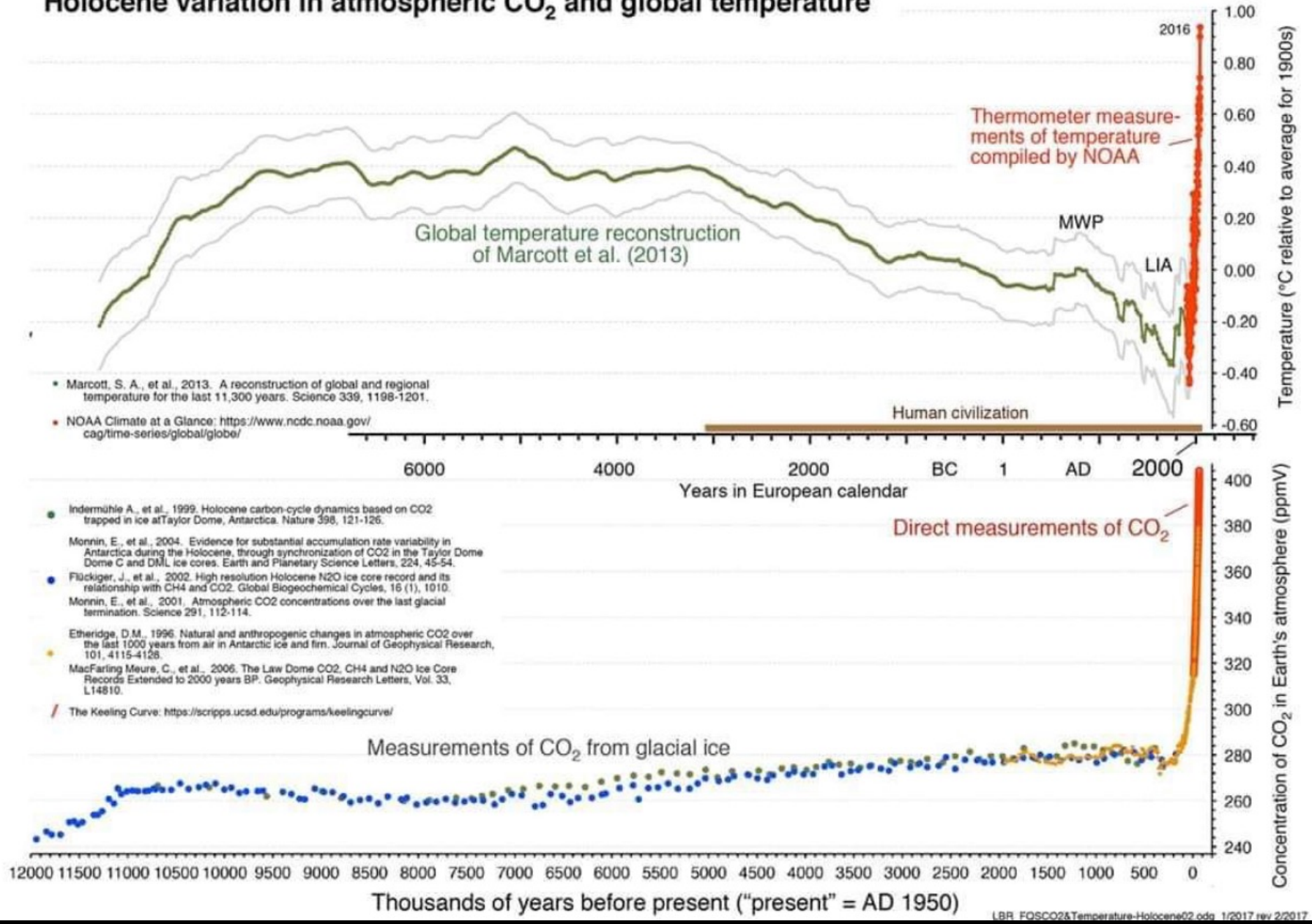
Ruhollah Abolhasani, Farnaz Araghi, Mohammadreza Tabary, Armin Aryannejad, Baharnaz Mashinchi, Reza M. Robati

First published: 01 February 2021 | https://doi.org/10.1111/dth.14840

…aging, inflammatory diseases (atopic dermatitis, cellulitis, psoriasis) acne, hair loss, and skin cancers (melanoma and SCC)

Railsback's *Fundamentals of Quaternary Science*

Holocene variation in atmospheric CO_2 and global temperature



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- NOAA Climate at a Glance: https://www.ncdc.noaa.gov/cag/time-series/global/globe/
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- MacFarling Meure, C., et al., 2006. The Law Dome CO2, CH4 and N2O Ice Core Records Extended to 2000 years BP. Geophysical Research Letters, Vol. 33, L14810.
- The Keeling Curve: https://scripps.ucsd.edu/programs/keelingcurve/

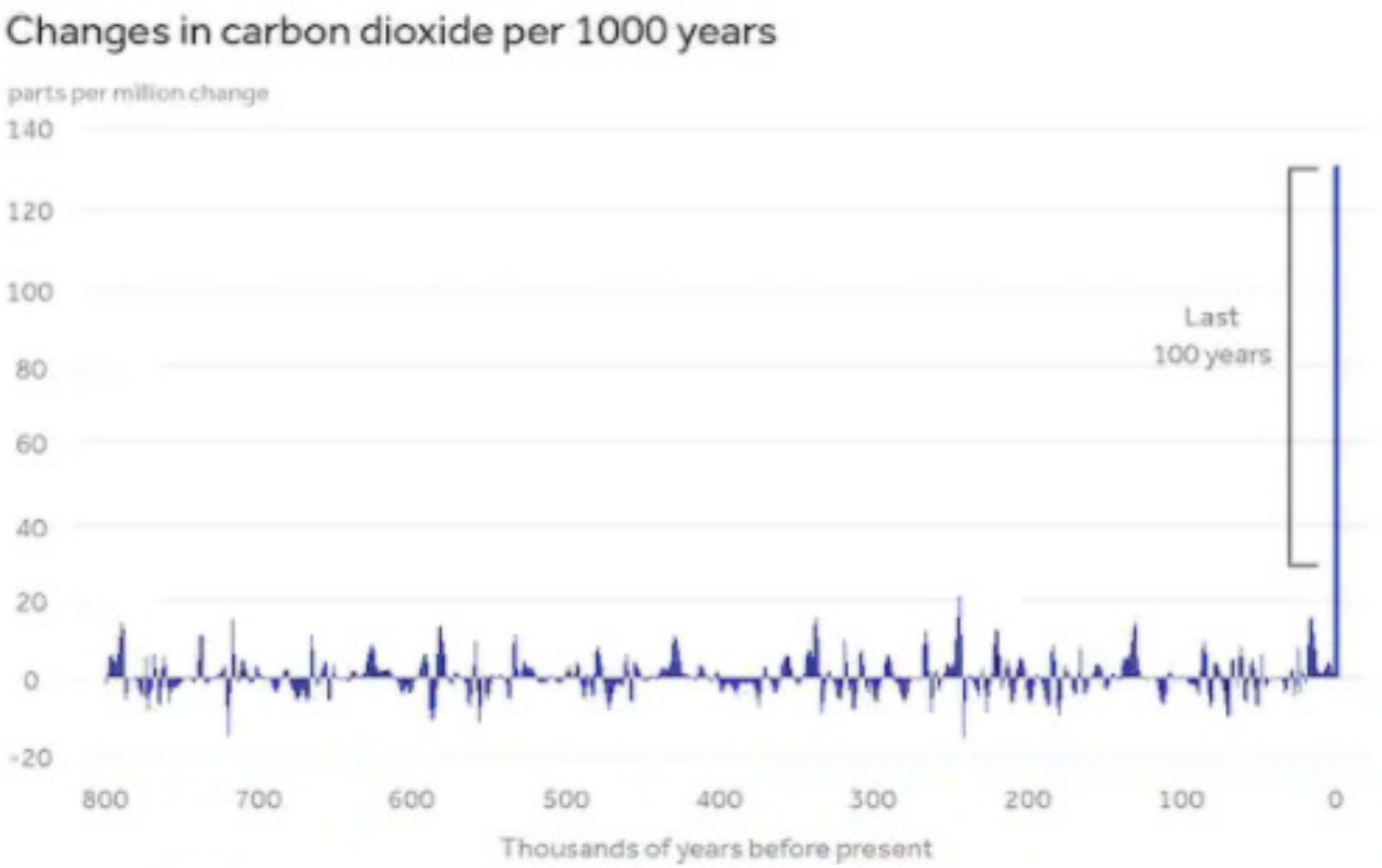
LBR FOSCO2&Temperature-Holocene02.odg 1/2017 rev 2/2017

washingtonpost.com/weather/2021/01/12/carbon-skyscraper-rapid-climate-change/

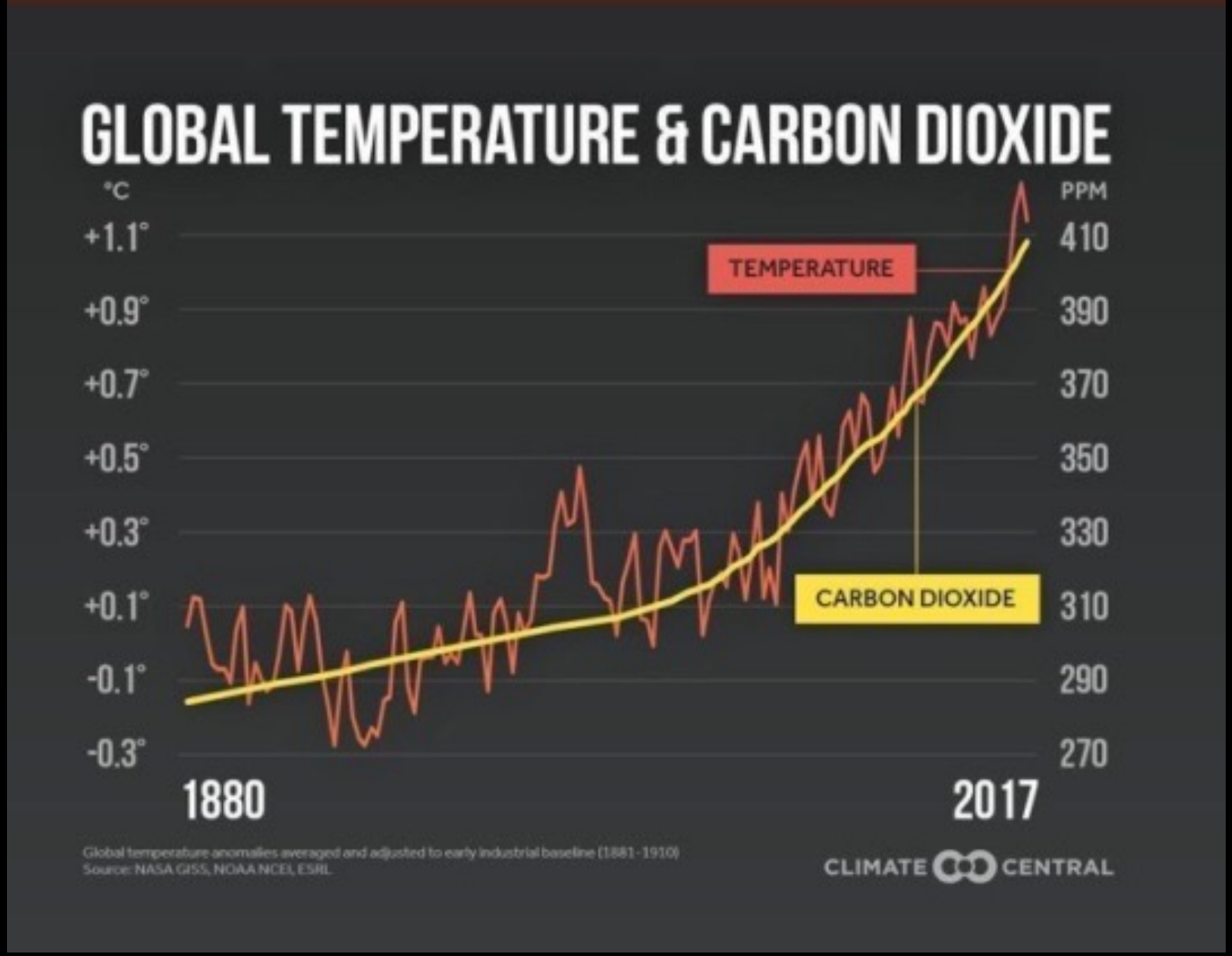
The carbon skyscraper: A new way of picturing rapid, human-caused climate change

By Benjamin Strauss

Jan. 12, 2021 at 2:05 p.m. EST



https://www.washingtonpost.com/weather/2021/01/12/carbon-skyscraper-rapid-climate-change/


GLOBAL TEMPERATURE & CARBON DIOXIDE
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PPM
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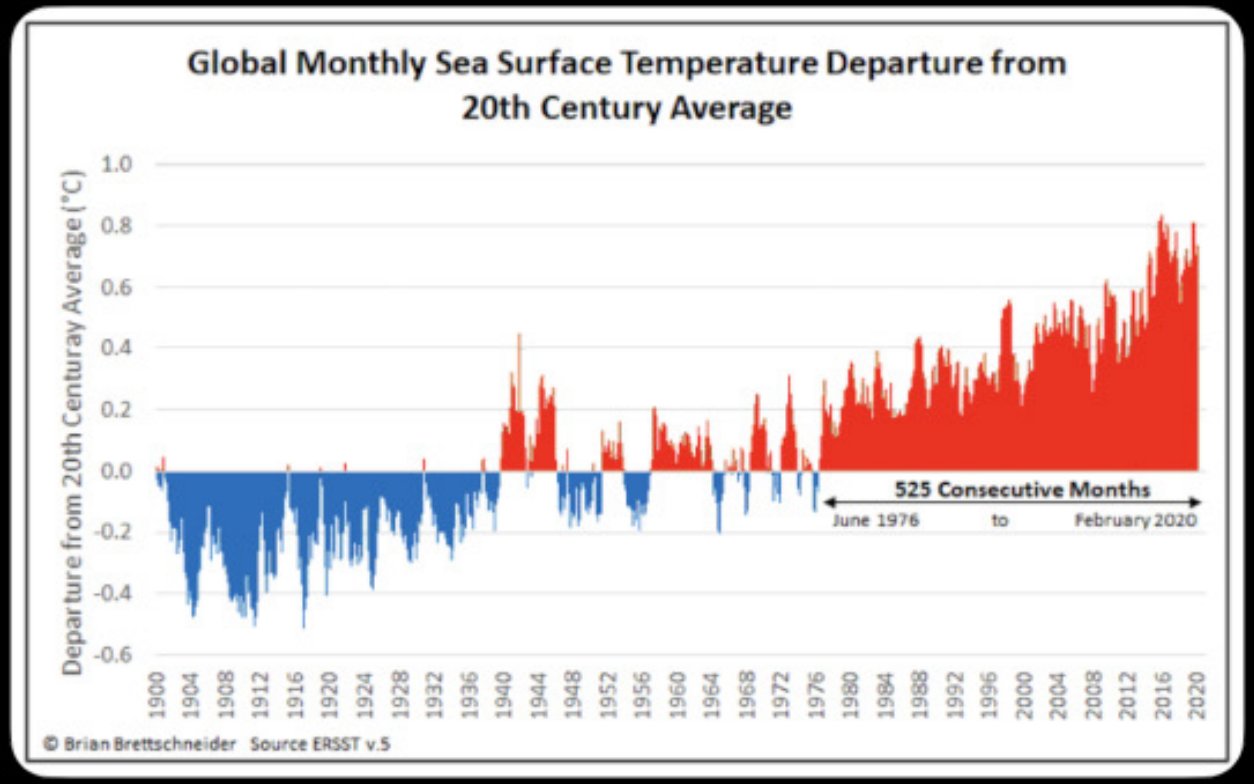
+0.9°
+0.7°
+0.5°
+0.3°
+0.1°
-0.1°
-0.3°
410
390
370
350
330
310
290
270
TEMPERATURE
CARBON DIOXIDE
1880
2017
Global temperature anomalies averaged and adjusted to early industrial baseline (1881-1910)
Source: NASA GISS, NOAA NCEI, ESRL
CLIMATE CENTRAL

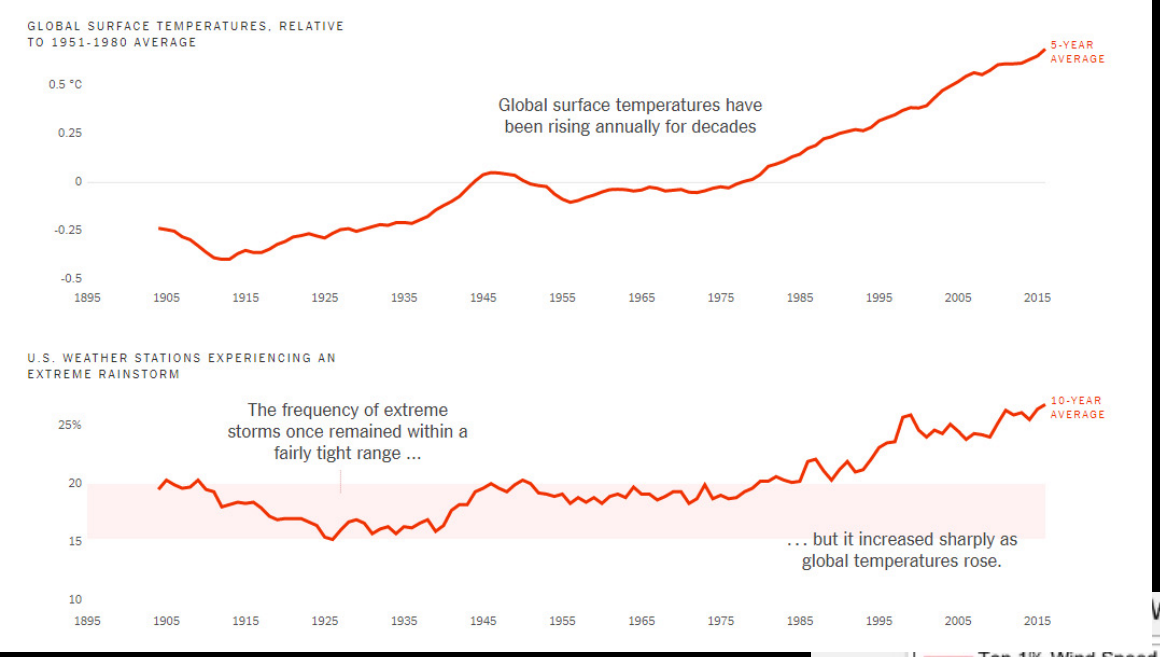
Brian Brettschneider
@Climatologist49

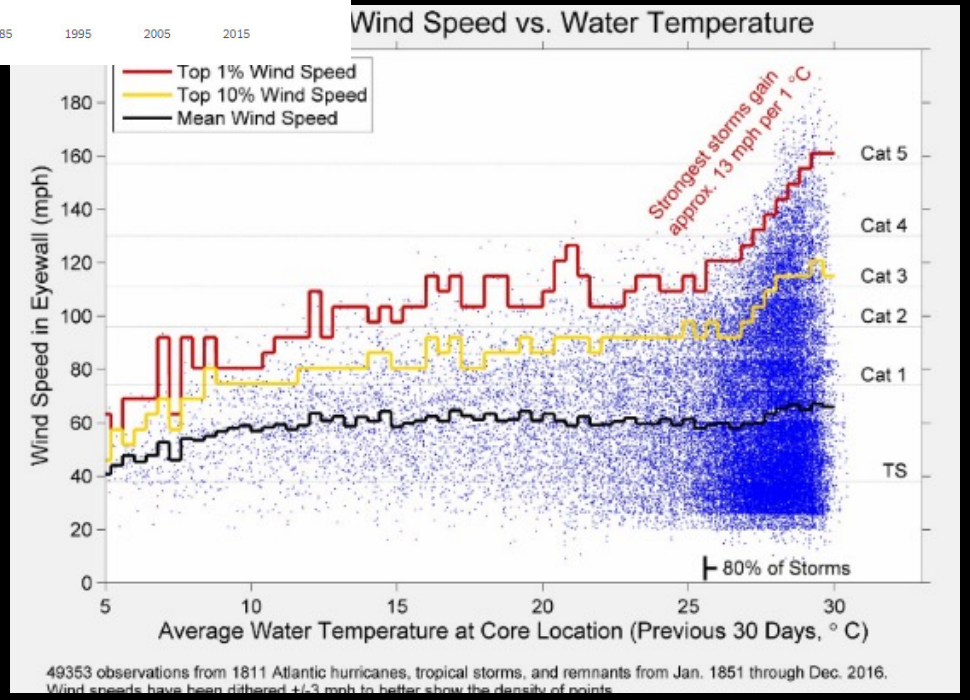
Anyone born after June 1, 1976, about 2/3 the global population, has never experienced a below average month in their lifetimes.

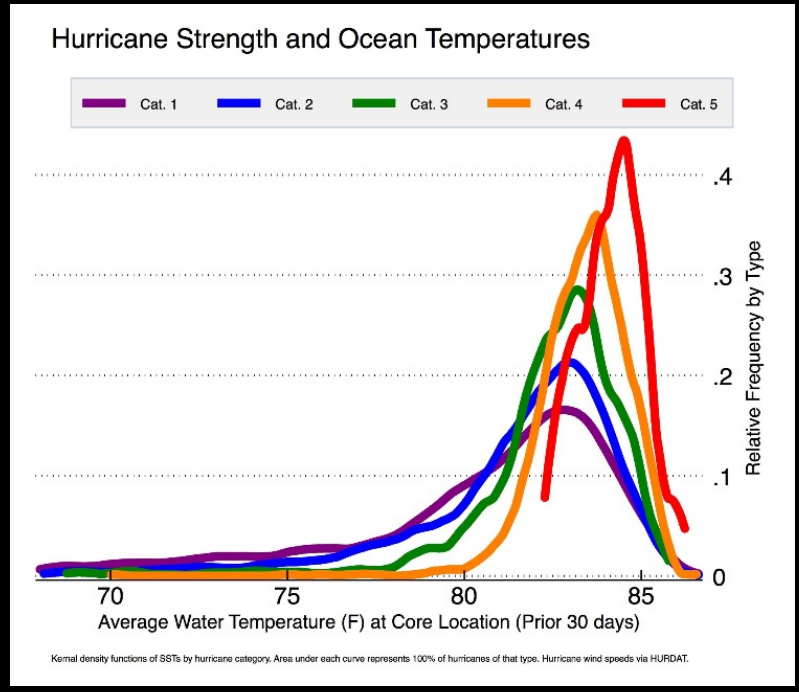


4:46 PM · 3/3/20 · Twitter Web App

www.NOAA.gov

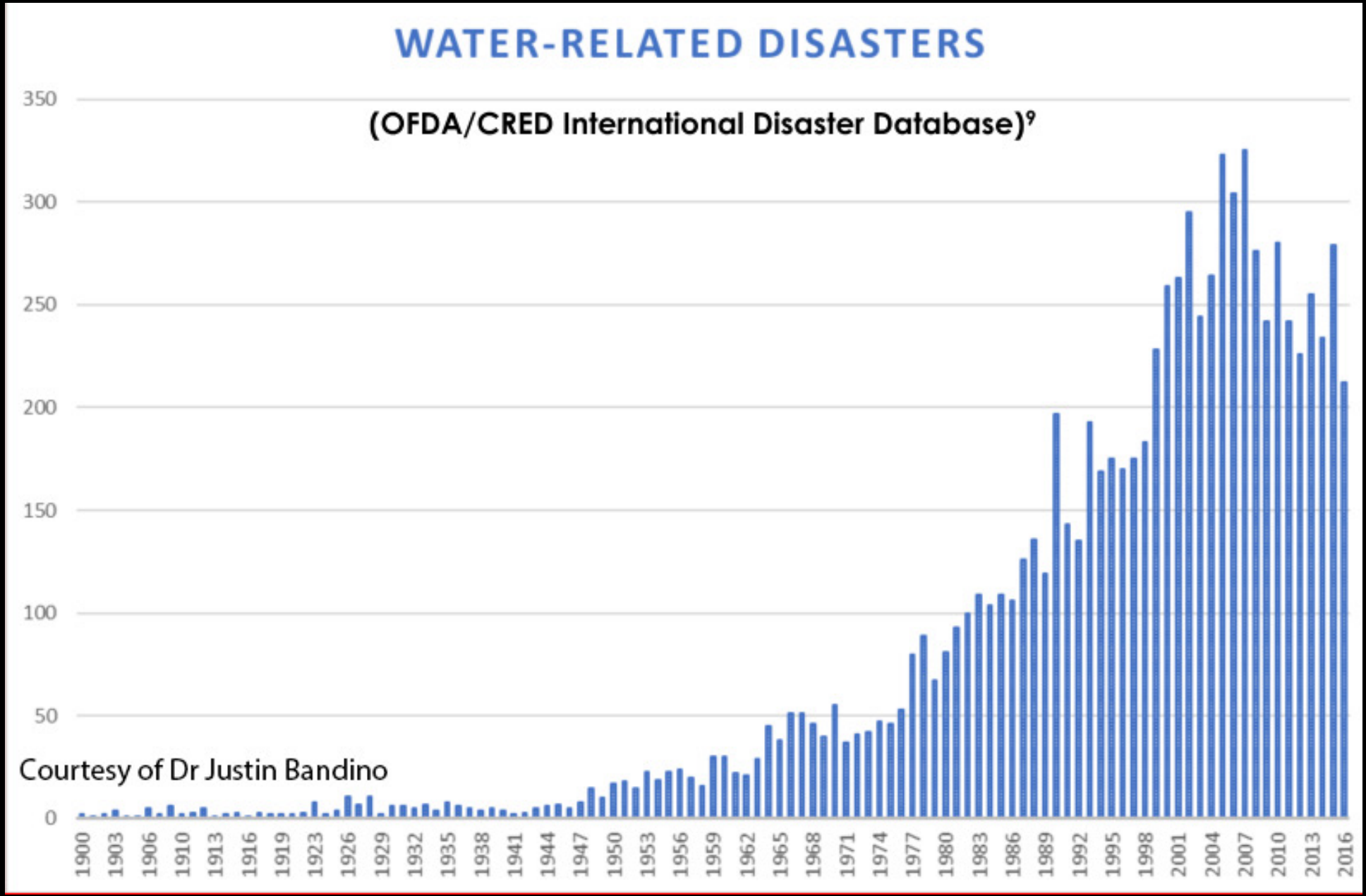






@NASAClimate
Zeke Hausfather
New York Times, 9/12/17, D Leonhardt

For more, see Dr. Michael Mann:
https://blogs.scientificamerican.com/observations/what-we-know-about-the-climate-change-hurricane-connection/


WATER-RELATED DISASTERS
(OFDA/CRED International Disaster Database)[9]
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Courtesy of Dr Justin Bandino
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November 2007

Skin Disorders Among Construction Workers Following Hurricane Katrina and Hurricane Rita

An Outbreak Investigation in New Orleans, Louisiana

Rebecca Noe, MPH; Adam L. Cohen, MD; Edith Lederman, MD; et al

Arch Dermatol. 2007;143(11):1393-1398. doi:10.1001/archderm.143.11.1393

The Infectious and Noninfectious Dermatological Consequences of Flooding: A Field Manual for the Responding Provider

Justin P. Bandino, Anna Hang & Scott A. Norton

American Journal of Clinical Dermatology

Review International Journal of Dermatology

Impact of climate change on dermatological conditions related to flooding: update from the International Society of Dermatology Climate Change Committee

Johannes F. Dayrit[1], MD, Lunardi Bintanjoyo[1], MD, Louise K. Andersen[2], MD, and Mark Dennis P. Davis[3], MD

After severe flooding, WHO reports skin diseases are the most common issue (19% of consultations), more than diarrhea (14%) or respiratory infxn (14%)

Flood-associated dermatological issues:

- Infections:
  - *S. aureus*
  - *Streptococcus*
  - *Vibrio vulnificus*
  - *Aeromonas hydrophilia*
  - *Mycobacterial infection*
  - *Fungal infections*
  - *Dermatophyte infections*
  - *Parasitic infections*
- Arthropod bites
- Animal bites
- Immersion foot
- Contact dermatitis
- Laceration from debris
- Traumatic injury

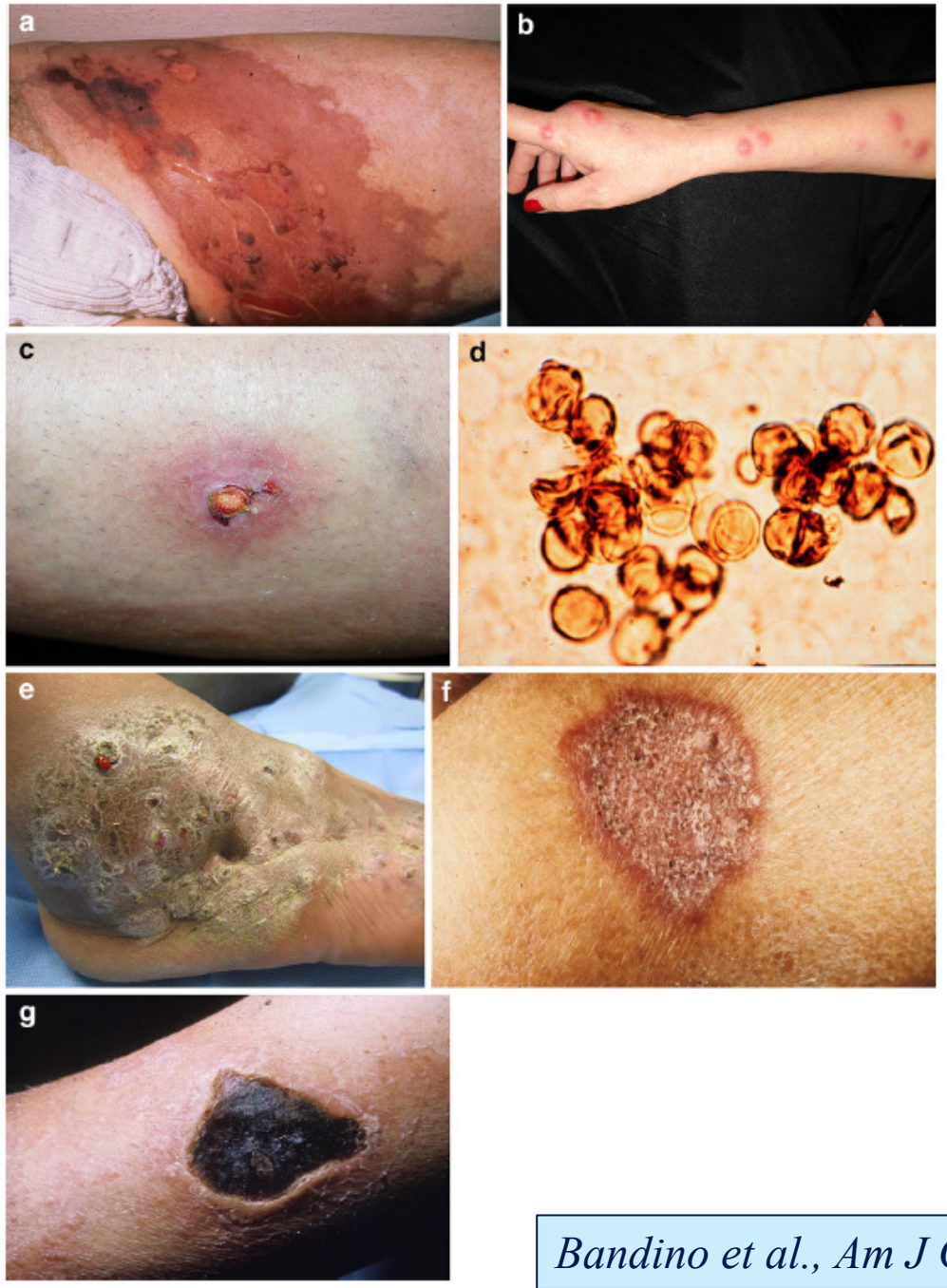
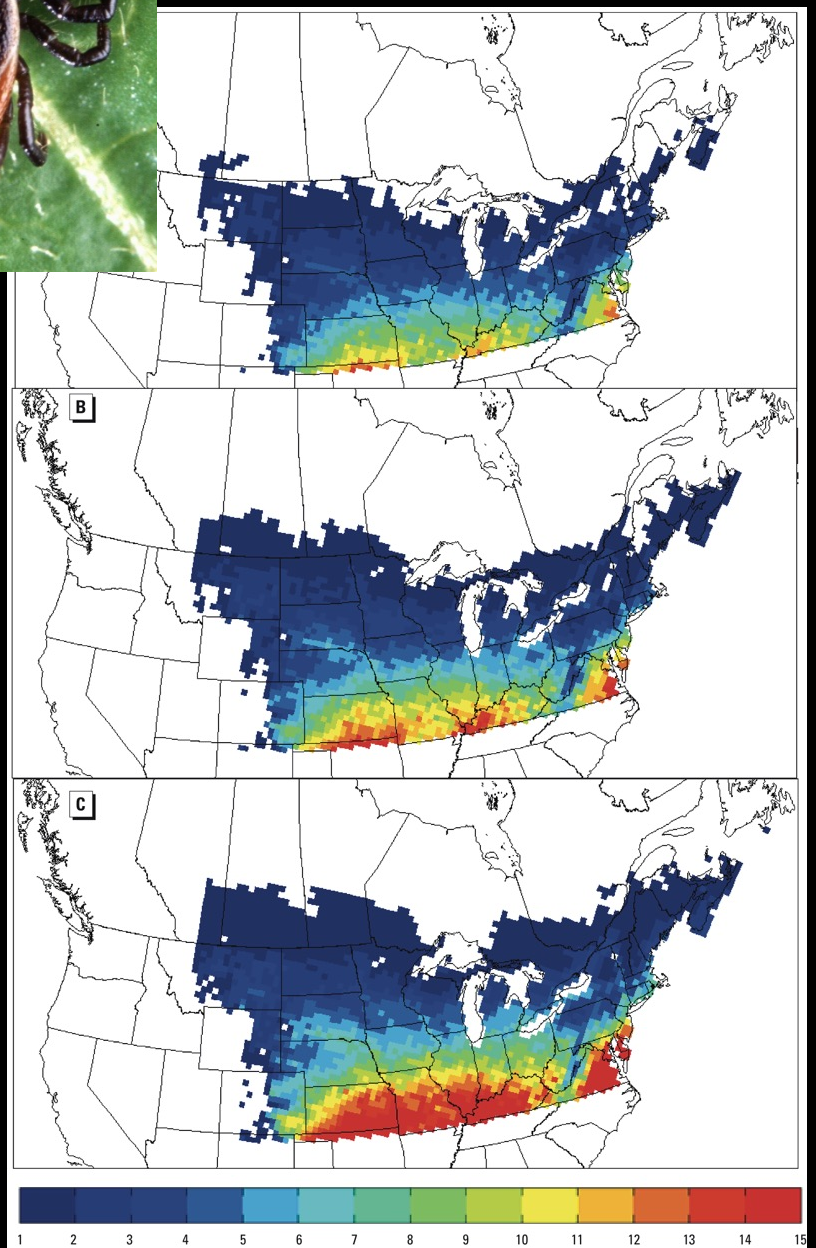


Fig. 2 **a** Hemorrhagic bullae and necrotizing fasciitis due to *Vibrio vulnificus*. **b** Sporotrichoid spread of *Mycobacterium marinum*. **c** Solitary abscess secondary to *Mycobacterium fortuitum* infection, packed with gauze. **d** Muriform (Medlar) bodies as seen in a KOH preparation. **e** Madura foot exhibiting a large plaque of draining sinuses. **f** A well-defined, solitary, verrucous lesion of blastomycosis. **g** Superficial necrosis from cutaneous mucormycosis

Bandino et al., Am J Clin Derm 2015

Lyme



Ogden NH, et al. Environ Health Perspect 2014
Levy S. Environ Heath Perspect 2014
Shapiro ED. N Engl J Med 2014

CDC: Illnesses from ticks and mosquitos tripled over 13 years

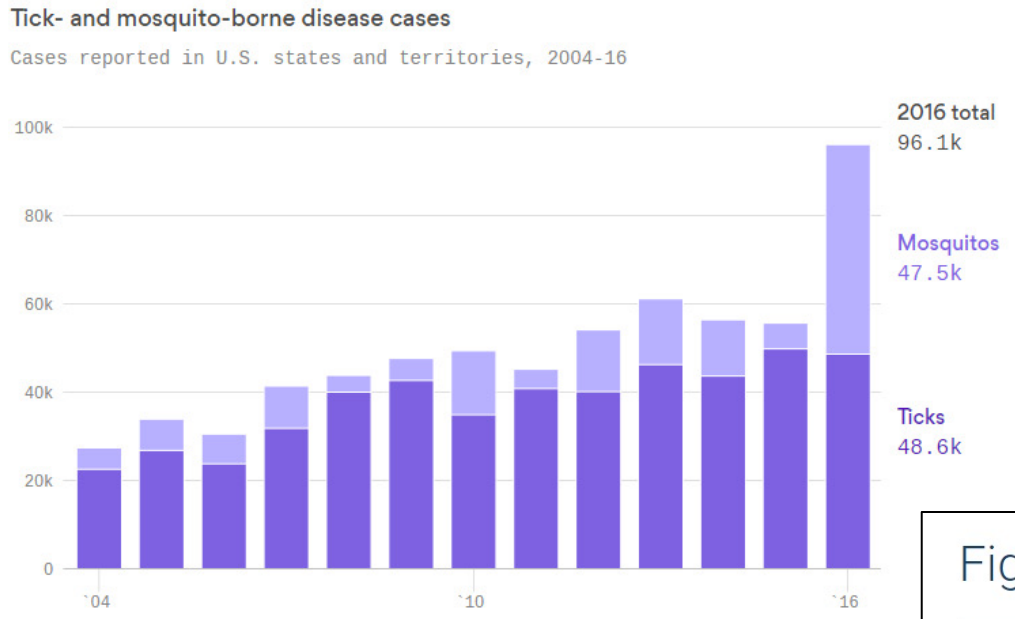
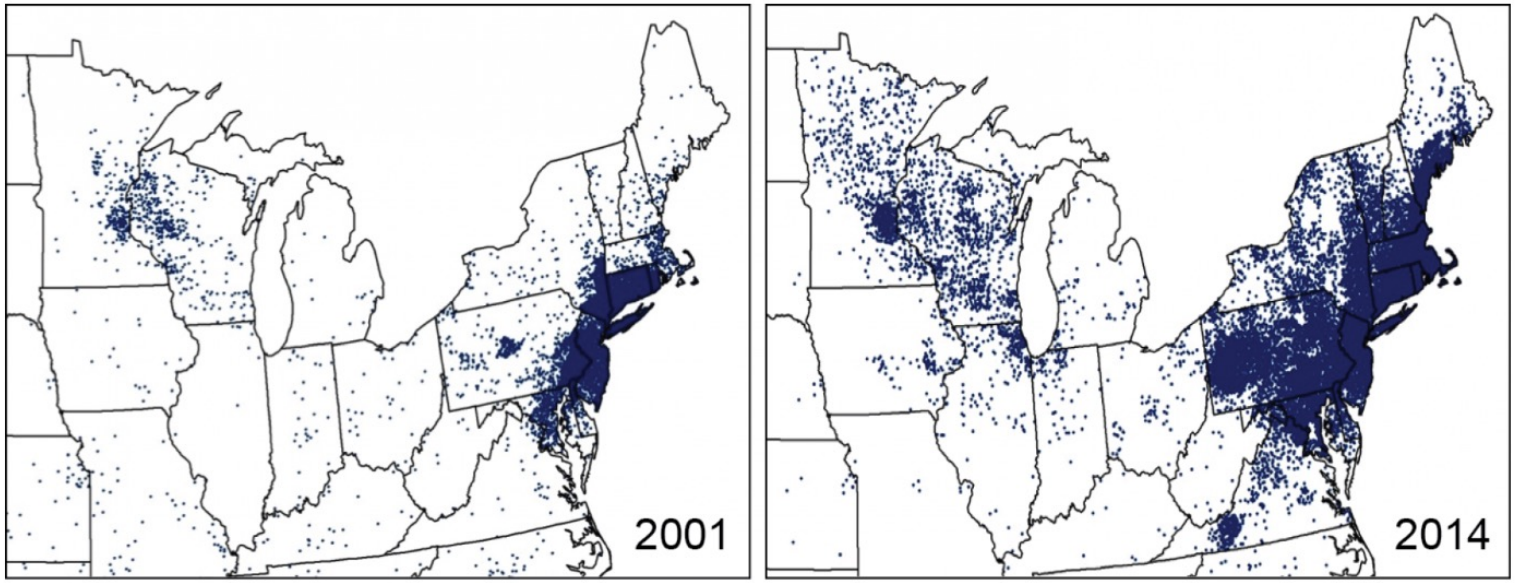
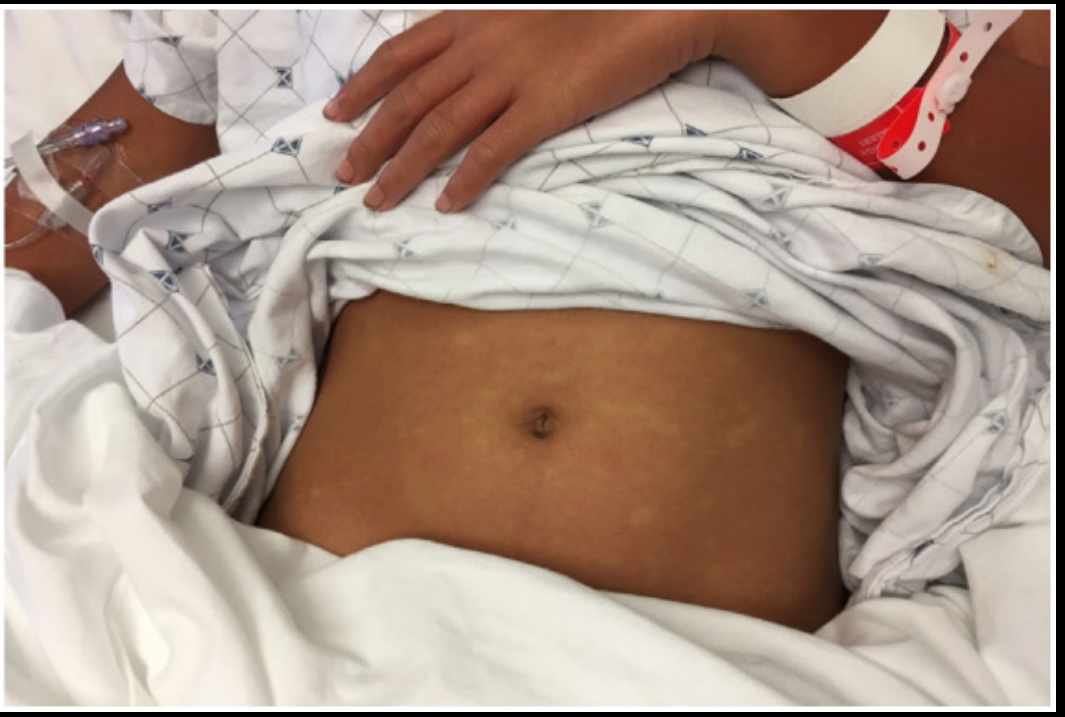


Figure 5.2: Changes in Lyme Disease Case Report Distribution



cdc.gov

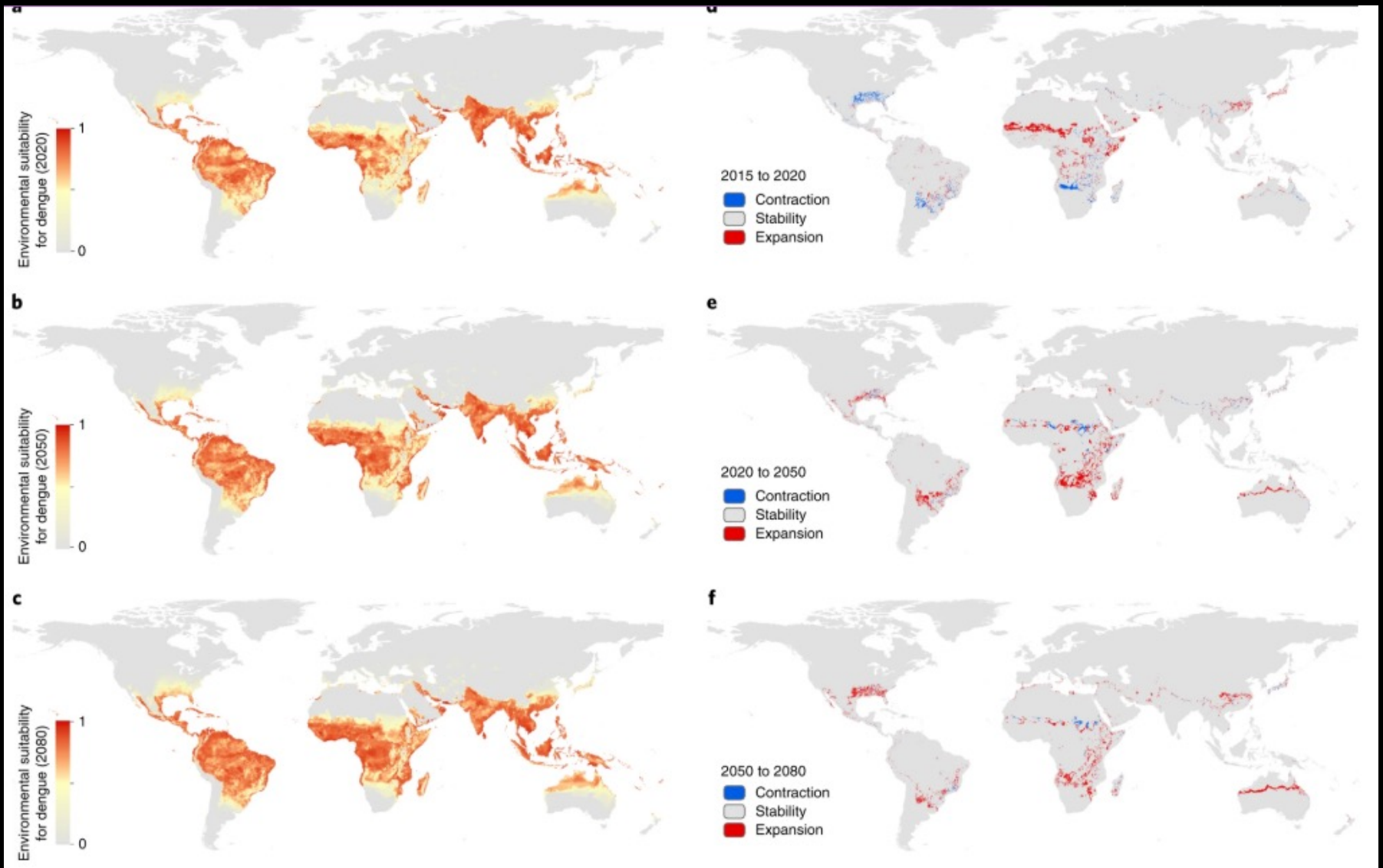
Dengue



Chikungunya

Zika

Bandyopadhyay D, et al. Indian J Dermatol 2010
Coates S, et al. Int J Women's Dermatol 2021
Derrington SM, et al. JAMA Dermatol 2016



a–c, Projected data shown for 2020 (**a**), 2050 (**b**) and 2080 (**c**). **d–f**, Changes in areas classified as at-risk (using the suitability threshold of 0.467).

- Messina et al. **The current and future global distribution and population at risk of dengue.** June 2019. Nature Microbiology

Climate Change

Jpn. J. Infect. Dis., 56, 48-53, 2003

Original Article

Seasonal Models of Herpangina and Hand-Foot-Mouth Disease to Simulate Annual Fluctuations in

Mitsuyoshi Urashima[1,2]*, Nahoko Sh

[1]*Division of Clinical Research and Develo*
Jikei University School of Medici
[2]*Infectious Disease Surveillance Center, National Institut*

(Received February 10, 2003. A

SUMMARY: In order to investigate the effects of global wa

Huang *et al. BMC Infectious Diseases* 2013, **13**:134
http://www.biomedcentral.com/1471-2334/13/134

BMC Infectious Diseases

RESEARCH ARTICLE **Open Access**

Effect of meteorological variables on the incidence of hand, foot, and mouth disease in children: a time-series analysis in Guangzhou, China

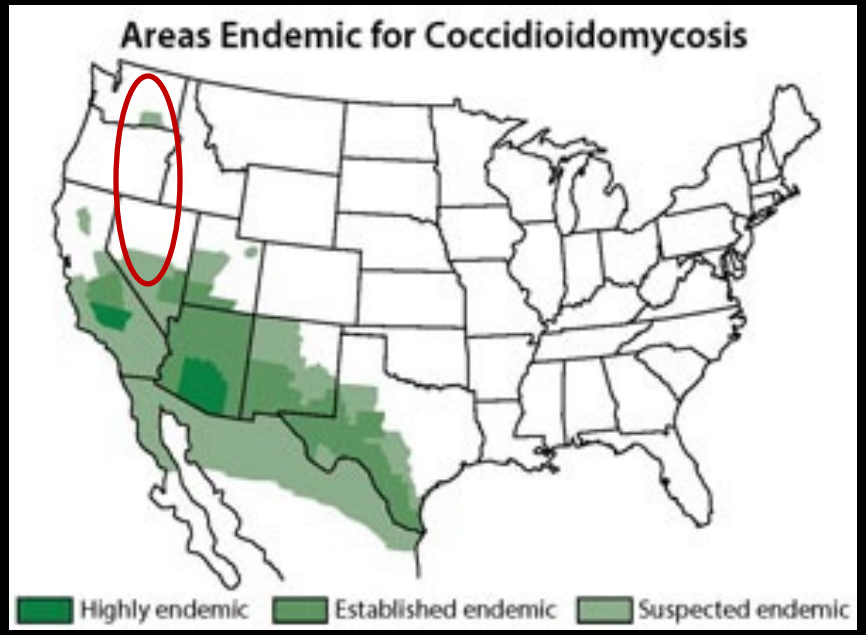
Yong Huang[1], Te Deng[1], Shicheng Yu[2], Jing Gu[1], Cunrui Huang[3], Gexin Xiao[2] and Yuantao Hao[1*]

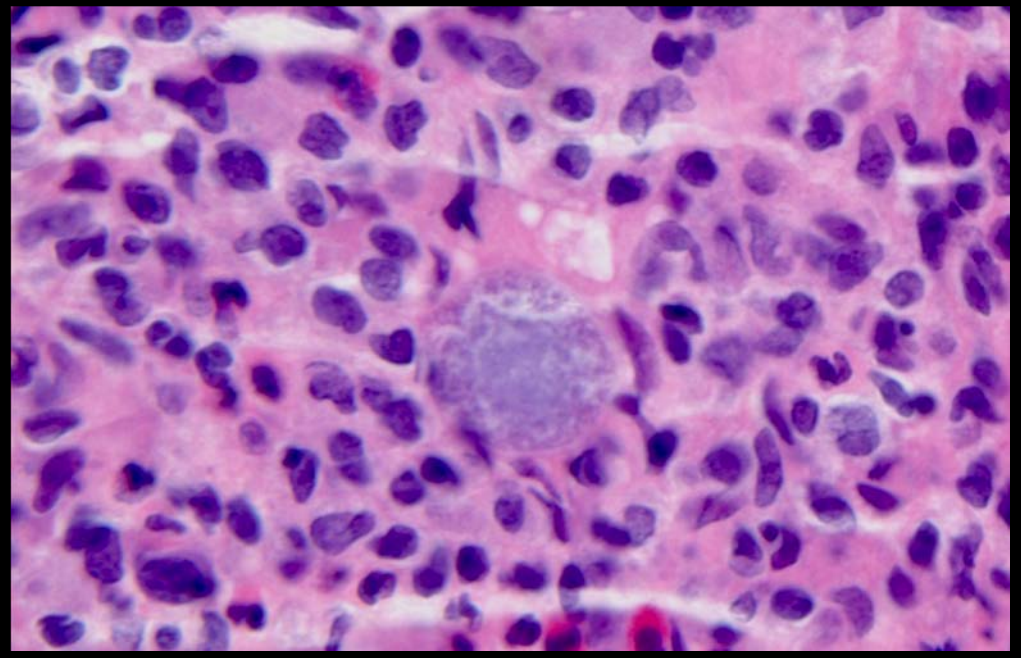
Review *International Journal of Dermatology* 2018

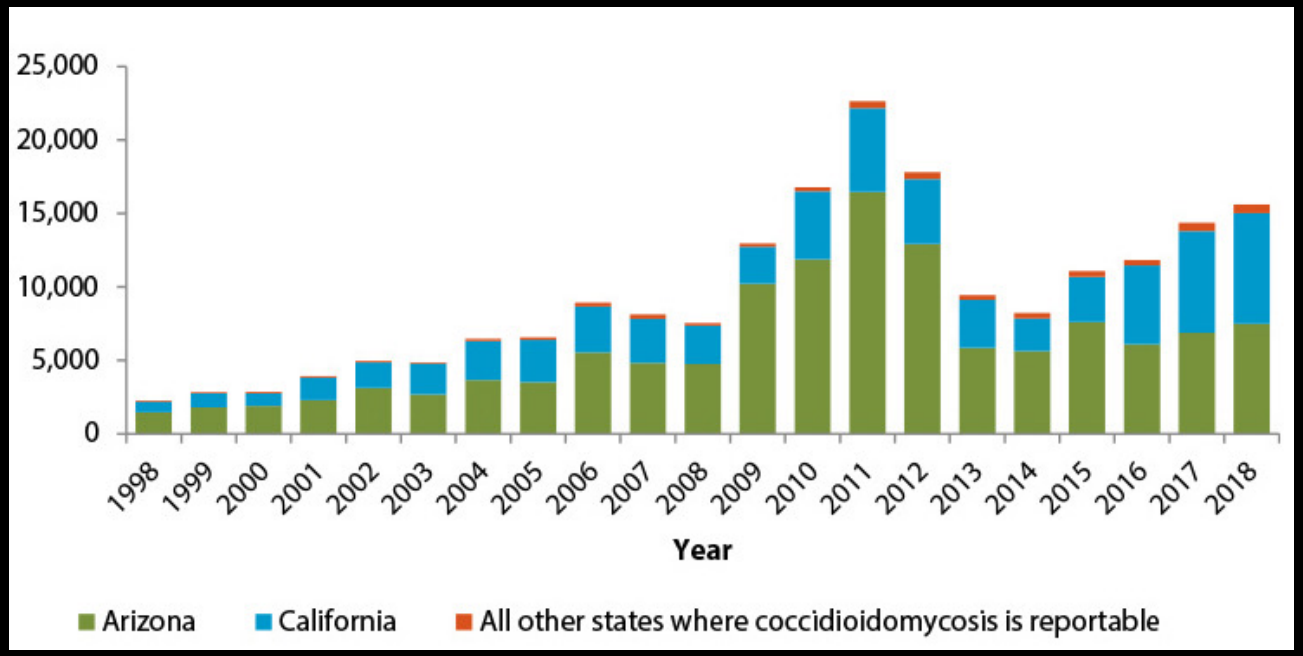
Temperature and humidity affect the incidence of hand, foot, and mouth disease: a systematic review of the literature – a report from the International Society of Dermatology Climate Change Committee

Sarah J. Coates[1], MD, Mark D. P. Davis[2], MD, and Louise K. Andersen[3], MD

Coccidioidomycosis







Marsden-Haug N, et al. Clin Infect Dis. 2013.
CDC.gov

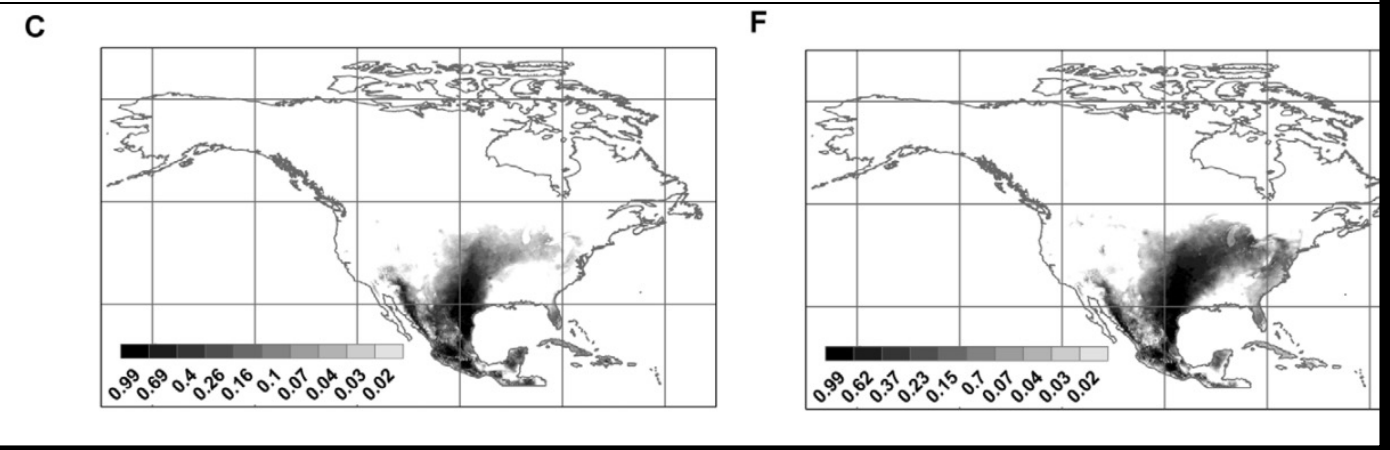
OPEN ACCESS Freely available online

PLoS NEGLECTED TROPICAL DISEASES

Climate Change and Risk of Leishmaniasis in North America: Predictions from Ecological Niche Models of Vector and Reservoir Species

Camila González[1], Ophelia Wang[2], Stavana E. Strutz[3], Constantino González-Salazar[4], Víctor Sánchez-Cordero[1], Sahotra Sarkar[3]*

1 Laboratorio de Sistemas de Información Geográfica, Departamento de Zoología, Instituto de Biología, Universidad Nacional Autónoma de México, Coyoacán, México, **2** Department of Geography and the Environment, University of Texas at Austin, Austin, Texas, United States of America, **3** Biodiversity and Biocultural Conservation Laboratory, Section of Integrative Biology, University of Texas at Austin, Austin, Texas, United States of America, **4** Laboratorio de Análisis Especiales, Departamento de Zoología, Instituto de Biología, Universidad Nacional Autónoma de México, Coyoacán, México



Gonzalez C, et al. PLoS Negl Trop Dis. 2010;4(1).
Pigott et al. eLife 2014;3:e02851
McIlwee BE, et al. JAMA Dermatol 2018

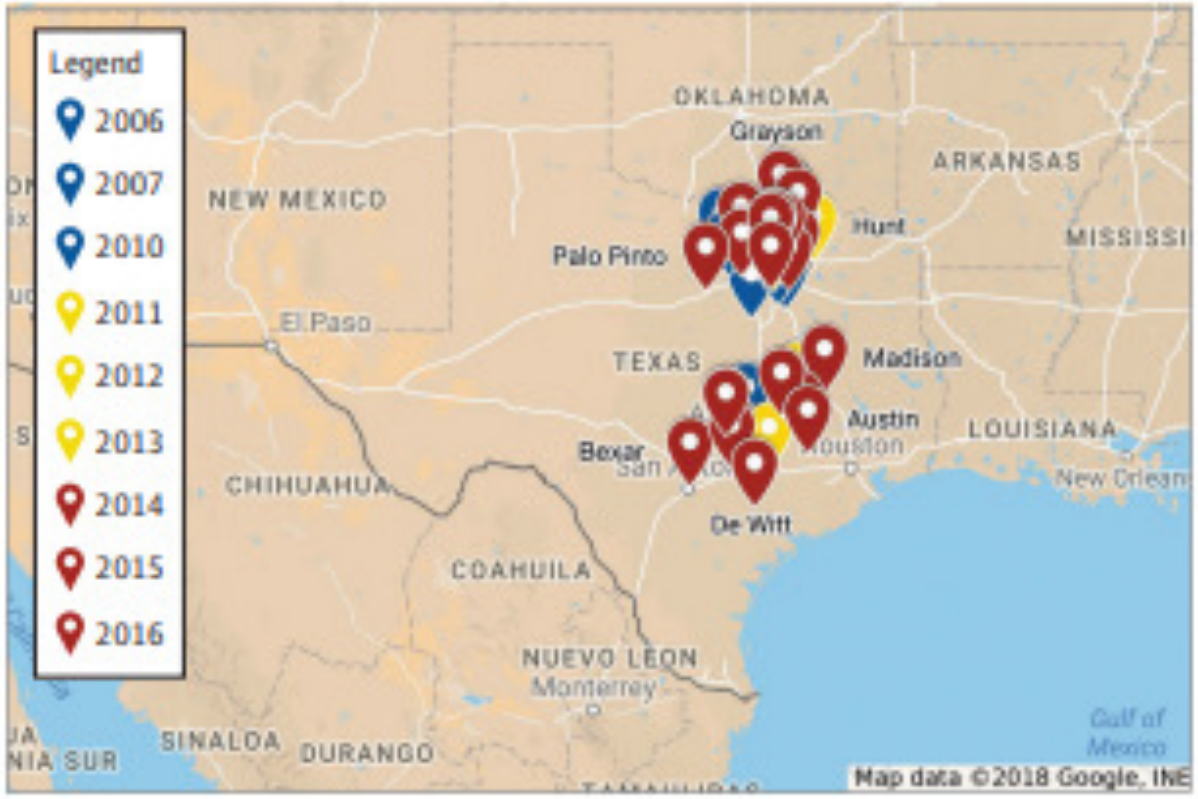
JAMA Dermatology | Original Investigation

Incidence of Endemic Human Cutaneous Leishmaniasis in the United States

Bridget E. McIlwee, DO; Stephen E. Weis, DO; Gregory A. Hosler, MD, PhD

Figure 2. Previously Unreported Cases of Endemic Cutaneous Leishmaniasis Diagnosed in Humans From 2006 Through 2017

A All cases



McIlwee et al., JAMA Derm 2018

2030 Health risks +1.5°C

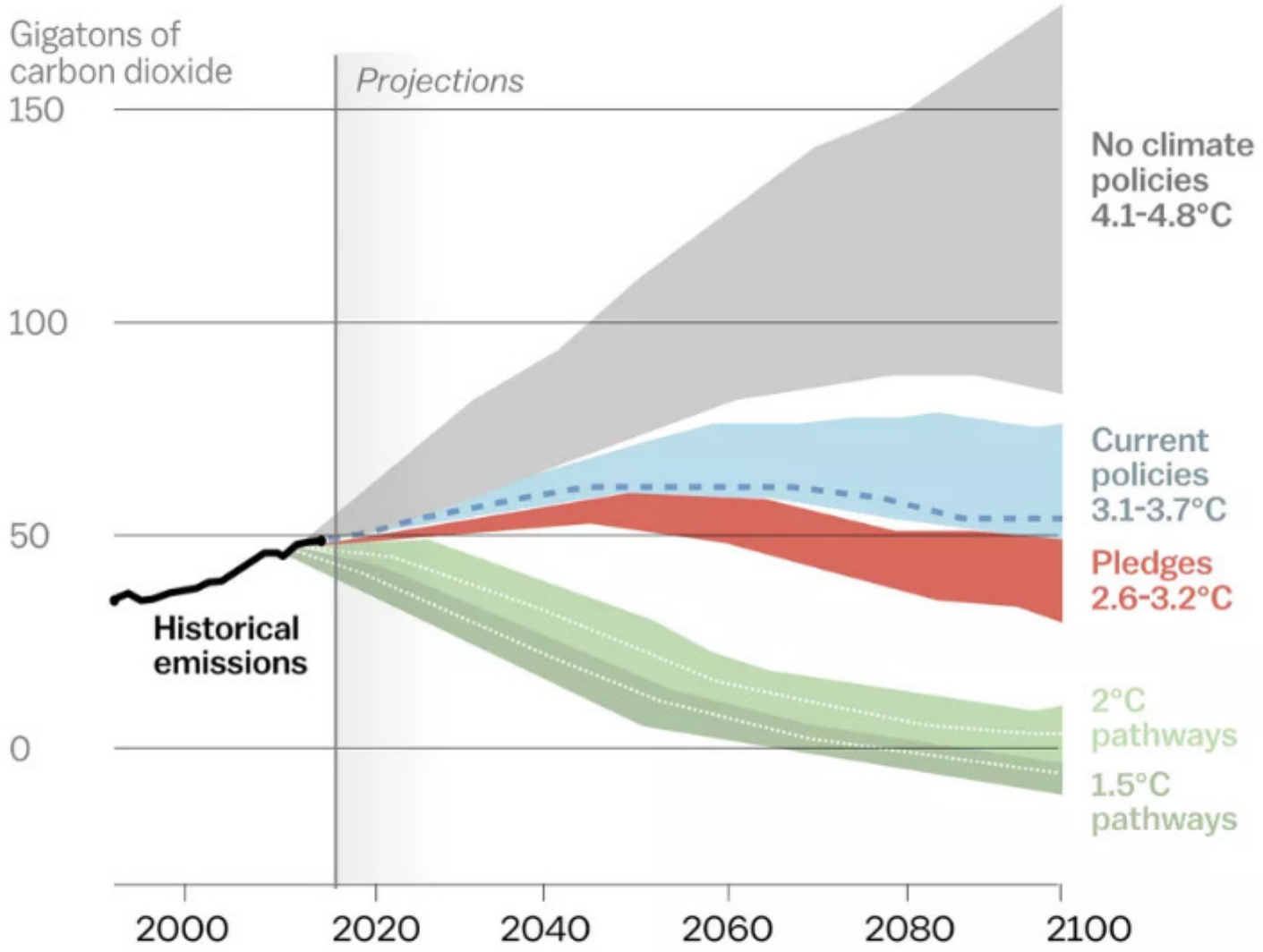
NUMBER OF DEATHS

		2010	2030
Climate	Diarrheal Infections	85,000	150,000
	Heat & Cold Illnesses	35,000	35,000
	Hunger	225,000	380,000
	Malaria & Vector Borne Diseases	20,000	20,000
	Meningitis	30,000	40,000
	Environmental Disasters	5,000	7,000
Carbon	Air Pollution	1,400,000	2,100,000
	Indoor Smoke	3,100,000	3,100,000
	Occupational Hazards	55,000	80,000
	Skin Cancer	20,000	45,000
World		**4,975,000**	**5,957,000**

Haines A, et al. Lancet 2014
DaraInt.org

Effect of current pledges and policies

Global greenhouse gas emissions



Source: Climate Action Tracker

Vox


CLIMATE
SUMMIT
WHAT IF IT'S A BIG HOAX AND WE CREATE A BETTER WORLD FOR NOTHING?
• ENERGY INDEPENDENCE
• PRESERVE RAINFORESTS
• SUSTAINABILITY
• GREEN JOBS
• LIVABLE CITIES
• RENEWABLES
• CLEAN WATER, AIR
• HEALTHY CHILDREN
• ETC. ETC.
JOEL PETT

Climate Change — A Health Emergency

Caren G. Solomon, M.D., M.P.H., and Regina C. LaRocque, M.D., M.P.H.

N ENGL J MED 380;3 NEJM.ORG JANUARY 17, 2019

Selected Resources for Physicians' Response to Climate Change.

Resource	Website	Description
American College of Physicians	www.acponline.org	Climate change tool kit
American Lung Association	www.lung.org	"State of the Air" report on air pollution
Health Care without Harm	https://noharm.org	Environmentally responsible health care, physician advocacy network
Medical Society Consortium on Climate and Health	https://medsocietiesforclimatehealth.org	Coalition of U.S. medical societies supporting climate action, educational materials, and consensus statements
Physicians for Social Responsibility	www.psr.org	List of local chapters, "Climate change makes me sick" educational campaign
The Lancet Countdown on Health and Climate Change	www.lancetcountdown.org	International research collaboration tracking the world's response to climate change, including a policy brief for the United States

International Journal of Women's Dermatology

Open access

Special Issue on Climate Change & Dermatology

Edited by Misha Rosenbach, Mary L. Williams

Volume 7, Issue 1,

Pages 1-124 (January 2021)

Download full issue

Thank you

Some Dermatology Articles on Climate Change

Kaffenberger B, Norton S, Rosenbach M. The effect of climate change on skin disease in North America. J Am Acad Dermatol 2016

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