Most Americans Think Global Warming Is a Relatively Distant Threat

“Global warming will cause...”

- a great deal of harm
- a moderate amount of harm

<table>
<thead>
<tr>
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<th>%</th>
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<tbody>
<tr>
<td>You personally</td>
<td>41%</td>
</tr>
<tr>
<td>Your family</td>
<td>27%</td>
</tr>
<tr>
<td>People in your community</td>
<td>46%</td>
</tr>
<tr>
<td>People in the U.S</td>
<td>30%</td>
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<tr>
<td>The world’s poor</td>
<td>59%</td>
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<tr>
<td>People in developing countries</td>
<td>21%</td>
</tr>
<tr>
<td>Plant/animal species</td>
<td>65%</td>
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<tr>
<td>Future generations of people</td>
<td>65%</td>
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<tr>
<td></td>
<td>70%</td>
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<tr>
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<td>71%</td>
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How much do you think global warming will harm...?

A long time ago
in a planet
far, far
away...
(NOT!)
CO2 Levels Keep Going Up Like Never Before...

Carbon Dioxide Levels Today are Higher than over the Past 650,000 Years

Industrial CO₂ Levels

Pre-industrial CO₂ Levels

New Antarctic ice core data extends the record back to 650,000 years before the present and shows that CO₂ levels were below 300 ppmv.
Where Global Warming is Going

Ocean 93.4%

- Atmosphere 2.3%
- Continents 2.1%
- Glaciers & ice caps 0.9%
- Arctic sea ice 0.8%
- Greenland Ice Sheet 0.2%
- Antarctic Ice Sheet 0.2%
Global warming is the primary cause of current sea level rise.

- **Temperatures are rising**: Heat-trapping gases from human activity have increased global average temperatures by 1.4°F since the 1880s.
- **Ice is melting**: Shrinking glaciers and ice sheets are adding water to the world’s oceans.
- **Oceans are warming**: Sea water expands as its temperature rises.

**Contributions to global sea level rise (1942-2008):**
- Melting land ice: 52%
- Warmer oceans: 38%
- Other: 10%
Global sea level rise since 1880

[Graph showing the trend of global sea level rise from 1880 to 2000, with two data sets: Tide Gauge Data and Satellite Altimeter Data.]
Sea levels in the U.S. are rising **fastest** along the East Coast and Gulf of Mexico.

**Local Sea Level Rise Over the Last 50 Years (1963–2012)**

- Los Angeles, CA: 2.5 in
- San Francisco, CA: 3 in
- Seattle, WA: 3.5 in
- San Diego, CA: 4 in
- Pensacola, FL: 5 in
- Key West, FL: 5.5 in
- Boston, MA: 6 in
- Charleston, SC: 6 in
- New York City, NY: 7 in
- Washington, DC: 7 in
- Atlantic City, NJ: 9.5 in
- Norfolk, VA: 10.5 in
- Galveston, TX: 12.5 in

Global average sea level has increased 8 inches since 1880. The local rate varies depending on both global and local factors, including currents, ocean floor topography, variation in ocean density, and land uplift or subsidence due to geological processes or human activities.

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Sea Level Rise Projections

- Observed Sea Level Rise
- Highest
- Intermediate-High
- Intermediate-Low

Global Mean Sea Level (Inches)

Year
As global warming drives sea levels higher, flooding from high tides is expected to occur even more often and cause more disruption.
Implications for scientists or society

Even if emissions stopped today, we are committed to a certain rise in sea level because of past emissions. We can’t avoid it. Therefore, we must PLAN for it.

http://spearfysh.com/the-ostrich-manager/
The US Military on the Front Lines of Rising Seas

Growing Exposure to Coastal Flooding at East and Gulf Coast Military Bases

The Department of Defense (DOD) maintains more than 1,200 military installations in the United States—sites where the military tests weaponry, conducts training exercises, builds and launches ships, compiles intelligence, develops new technology, and houses critical military commands (Hall et al. 2016). Many of these sites are also where officers, enlisted men and women, and their families live.

Given their central role in national security, such installations have historically been well protected. But sea level rise, increased tidal flooding, and heightened storm surges do not stop for checkpoints. These climate-driven trends are already complicating operations at certain coastal installations (NAS 2011). A roughly three-foot increase in sea level would threaten 128 coastal DOD installations in the United States (83 percent of which are naval installations, valued at roughly $100 billion) and the livelihoods of the people—both military personnel and civilians—who depend on them (NAS 2011).

To enable decision makers to better understand these threats, how they may unfold this century, and where and when they could become acute, the Union of Concerned Scientists (UCS) has performed a new analysis of 18 military installations along the East and Gulf coasts. We selected these sites for their strategic importance to the armed forces, for their potential exposure to the effects of sea level rise, and because they represent coastal installations nationwide in terms of size, geographic distribution, and service branch. By analyzing their changing

Ships docked in 2011 at Naval Station Norfolk. The largest naval base in the world and home to the US Fleet Forces Command, Norfolk. Like most of the military bases analyzed here, Norfolk is at risk from rising sea levels. Here, water levels could rise 4.5 to nearly 7 feet this century, depending on the pace of ice sheet loss.
Land loss at most installations

Most of the 18 Installations Studied Risk Major Land Loss

Above are the 13 (out of 18) military installations that are projected to experience a 20% or greater land loss at some point this century. Some sites face substantial losses under either scenario.
Example: NAS Key West

As high tide reaches farther inland, extensive land loss is possible at NAS Key West. Affected land may include developed and undeveloped areas and even wetlands that reside above the current high tide mark. NAS Key West is projected to see substantial loss of currently developed and utilized areas, particularly with the faster rate of sea level rise.
Military readiness & mitigation
Coastal Adaptation

• Protect/Defend
• Accommodate
• Retreat
NS Norfolk

- Established in 1917 is Largest naval installation in the world
- Is home of the US Fleet Forces Command which trains naval forces and defends a massive area including the Atlantic Ocean and parts of the Pacific
- More than 22k military personnel live in the city of Norfolk and make up 11% of the population and 28k veterans live in Norfolk.
- Roughly 75 ships and 13 piers
Naval Station Norfolk
Langley AFB

- Established in 1916
- Makes up JB Langley – Eustis joined in 2010 but separated by 20 miles
- Provides airpower to the nation;
- 50 units, ~$19B budget and 192k jobs
Langley Air Force Base

Welcome to the Best Readiness & Emergency Management Flight in the U.S. Air Force

2013 ACC Col. Fredrick J. Reimer Award recipient
2014 USAF Col. Fredrick J. Reimer Award recipient
One-mile living shoreline at Langley AFB
Dam doors to protect critical infrastructure at Langley AFB
Oceana Dam Neck

- Established in 1941
- 5,600 personnel
- > 12 tenant commands;
- 20k students annually
NAS Oceana Dam Neck:
Rock core one-mile dune covered in native vegetation
Union of Concerned Scientists
Science for a healthy planet and safer world
"DoD values the UCS's insights into the impacts of climate change on military installations,"


"We welcome their report and its findings. We recognize climate change impacts and their potential threats represent one more risk that we must consider as we make decisions about our installations, infrastructure, weapons systems and most of all, our people."
Recommendations Congress & DOD:

• Support dev. & distribution of high-resolution hurricane & coastal flooding models;

• Adequately fund data monitoring systems e.g. nation’s tide gauge network;

• Allocate human, financial, & data resources to detailed mapping and planning efforts at installations;

• Allocate resources for adaptive measures & projects, many of which will stretch over decades.
There are Limits to Adaptation

Isle de Jean Charles, Louisiana
Apply ambitious common sense

15. Appreciate limits to adaptation and push mitigation
Toward Climate Resilience:
A Framework and Principles for Science-Based Adaptation

3 themes:
- Use rigorous science
- Aim for equitable outcomes
- Apply ambitious common sense
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.

https://www.pinterest.com/pin/514325219919218393/
Now it is time for your questions!

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