YEARS FAQ
By Joe Romm, Ph.D.
Chief Science Advisor, YEARS OF LIVING DANGEROUSLY

What is the scientific basis for the claims you've made in the series?
As humanity's understanding of human-caused climate change is expanding rapidly, the series' producers and science advisors based their claims on peer-reviewed science and interviews with dozens of the world's top climate scientists. The climate scientists – both those featured in the series and those who were consulted – have offered to provide their contact information to further explain their findings, should there be a request.

But isn't it true that there is no scientific consensus on global warming?
Ninety-seven percent of climate experts agree that humans are causing global warming. There is a broad consensus among scientists that the climate is being changed by human activity. The *Associated Press* reported last year that "Top scientists from a variety of fields say they are as certain that global warming is a real, man-made threat as they are that cigarettes kill." Furthermore, science academies from 19 countries, including the U.S., U.K. and China, have affirmed the position that humans are causing global warming.

Isn't the climate always changing, naturally?
The climate changes when it is forced to change, and now humans are forcing it to change far more rapidly than ever before. Past climate change reveals that our climate is very sensitive to carbon dioxide. Levels of CO_2 in the air have increased 40% over the past 150 years, mainly from the burning of fossil fuels, which has warmed the planet more than it has in thousands of years.

Temperature records clearly show that the Earth has continued to warm over the past century. A 2010 study included ten key fingerprints of human-caused warming, and each fingerprint is moving in the direction expected of a warming globe.

Hasn't global warming stopped since 1998?
The latest scientific research makes it clear that surface temperatures are continuing to rise. Global records indicate that 2010 was the hottest year on record, and the 2000s were the hottest decade on record. As nearly 90% of all global warming ends up in the ocean, observations taken there further illustrate that global warming continues at a rapid pace.

Doesn't recent cold weather disprove global warming?
A short-term cold spell says nothing about the long-term trend of increasing global temperatures. The normal ups and downs of weather can make it hard to see slow changes in climate. To find climate trends you need to look at *how* weather is changing over a longer period of time. Observing high and low temperature data from recent decades demonstrates that new record highs now occur nearly twice as often as new record lows.

Is there evidence that carbon dioxide emissions are causing global warming?
Without greenhouse gases, like CO_2 and water vapor, the Earth's surface would on average be 60°F colder than it is now. Humans are adding CO_2 to the atmosphere at an unprecedented pace, mainly by burning fossil fuels. There are multiple lines of evidence that point to increased CO_2 as the cause of rising temperatures. As a 2009 NOAA-led report by the U.S. Global Change Research Program noted, only the increase in manmade CO_2 and the greenhouse effect can explain the rate and magnitude of recent surface temperature warming, the observed atmospheric profile of warming, the observed changes in ocean heat content, and the increased levels of atmospheric moisture, to name a few. The major 2013 summary report and literature review by the Intergovernmental Panel on Climate Change found that the evidence has gotten much stronger in recent years that human-caused emissions are driving climate change.

Are you blaming global warming for all extreme weather?
No. All weather occurs in the context of a changed climate, which makes many extreme events – especially heat waves, droughts, wildfires, deluges and superstorms – more destructive.

Like a baseball player on steroids, our climate system is breaking records at an unnatural pace. And like a baseball player on steroids, it's the wrong question to ask whether a given home run is "caused" by steroids or can be "blamed" on steroids. The question is whether, during the steroids era, you were seeing decades old records smashed on a routine basis by many different players.

Are you saying climate change caused Superstorm Sandy?
Climate scientists note that is the wrong question. The question is whether climate change made Superstorm Sandy more destructive – and the answer to that is 'yes.' Most significantly, Superstorm Sandy added about 1 foot of sea level rise to an already devastating storm surge, causing the flooding of 70,000 additional homes. A recent NOAA study found that most of the Jersey shore will see Sandy-level storm surges every year within a few decades – if we don't quickly decrease our use of fossil fuels.

How do we know the sea level is rising?
Sea levels are measured by a variety of methods – sediment cores, tidal gauges and satellite measurements. Each of these methods indicates that a rise in sea levels has been accelerating over the past century.

Many parts of the world are low-lying, and tens of millions of people will be displaced even by modest sea rises. Further, rice paddies are being inundated with salt water, which destroys the crops. Seawater is contaminating rivers as it mixes with fresh water further upstream, and aquifers are becoming polluted.

How does global warming impact droughts?
Climate change warms the ground, which causes greater evaporation. Once the ground dries out, energy from the sun makes both the ground and air even warmer.

In addition, climate change shifts precipitation patterns. Scientists have concluded that at least half of the drying in places around the Mediterranean (like Syria) is due to manmade climate change. Climate change also causes earlier snowmelt, reducing the amount of water stored on mountaintops for the summer dry season. Some recent evidence suggests that climate change also weakens the jet streams, which can further extend and exacerbate heat waves and droughts.

How is deforestation linked to climate change?
Deforestation is the second leading contributor of carbon emissions worldwide, after the burning of fossil fuels. In particular, burning trees – a key form of deforestation – releases stored carbon into the air. Research confirms that avoiding deforestation can play a major role in reducing future greenhouse gas concentrations.

Can renewable energy sources provide enough power to replace fossil fuels?
Renewable energy can be used to replace higher-carbon sources of energy in the power grid over the next few decades achieving a reduction in total greenhouse gas emissions from power generation. In some regions of the world, intermittent sources of renewable energy provide 40% or more of electricity. There are also hydro-electric and other baseload (24-hours per day) renewable sources – along with nuclear power.

Although some forms of renewable energy do not provide baseload power, others do. For example, geothermal energy is available at all times, concentrated solar thermal energy has storage capability, and wind energy can be stored in compressed air. Furthermore, energy storage is dropping in price and increasing in performance every year. Energy efficiency and demand response efforts (intentional modifications to energy consumption patterns) can also minimize the need for baseload power in most regions.