Fact - Myth - Fallacy
Compilation of Slides
5 CHARACTERISTICS OF SCIENCE DENIAL

F
Fake Experts
Magnified Minority

L
Logical Fallacies
Red Herring

I
Impossible Expectations
Misrepresentation

C
Cherry Picking
Jumping to Conclusions

C
Conspiracy Theories
False Dichotomy
Some notes about this slide-deck

The slides are based on http://sks.to/fmf

The code words on the index page are from here:
https://skepticalscience.com/shorturls.php

The shown graphics are just suggestions – there may be better ones to suit your purposes

The Fact-Myth-Fallacy texts are just very short explanations

Please use the URL shown at the bottom right of each slide for longer explanations
### Global Warming is happening
- 1998
- Cold
- Glacier
- Greenland
- Antarctica
- Temp
- UHI
- Winter
- Name

### We are causing Global Warming
- CO₂
- Volcano
- Residence
- Thermo
- Saturate
- Lag
- Hotspot
- Trace
- Sun
- Consensus

### Past and future climate change
- Past
- LIA
- Past CO₂
- MWP
- Model
- Hansen1988
- Weather
- 1970s
- Iceage

### Climate change impacts
- Vapor
- Cloud
- Species
- Bear
- Acid
- Impacts
- Pollutant
- Plant
- Extreme
Global Warming is happening

FACT
Our planet has continued to build up heat since 1998 - global warming is still happening.

MYTH
Global warming stopped in 1998.

FALLACY
Looking at one region or a short period ignores the full picture.
FACT
Global warming is like rigging the weather dice, making it more likely to get hot days.

MYTH
It's cold outside, so global warming must have stopped.

FALLACY
Global warming doesn't mean no more cold weather, just fewer cold days compared to hot days.
Global Warming is happening

**FACT**
Overall, glaciers across the globe are shrinking at an accelerating rate, threatening water supplies for millions of people.

**MYTH**
Glaciers around the world are increasing, disproving global warming.

**FALLACY**
Picking a handful of growing glaciers ignores the vast majority of glaciers that are shrinking.

Skeptical Science - https://skepticalscience.com/graphics.php?g=246  
http://sks.to/glacier
Global Warming is happening

**FACT**
Greenland on the whole is losing ice, at a rate of over 2 Mount Everests worth of ice every year.

**MYTH**
Greenland ice sheet is thickening in the middle so it must be gaining mass.

**FALLACY**
Looking at the whole ice sheet shows it's thickening in the middle but ice loss at the edges is accelerating.

[Image: Estimated Greenland Ice Sheet mass balance changes since 1950 using three different methods (Jiang 2010)]

http://sks.to/greenland
Global Warming is happening

FACT
The West Antarctic ice sheet is losing hundreds of billions of tonnes of ice every year, making it a major contributor to global sea level rise.

MYTH
Antarctic sea ice is on the increase and casts doubt on global warming.

FALLACY
A number of factors may contribute to the increase in sea ice - but in no way does it change the fact that climate change is happening.

http://sks.to/antarctica

Estimates of total Antarctic land ice changes and approximate sea level contributions using a combination of different measurement techniques (Shepherd, 2012).
Global Warming is happening

**FACT**
We can measure temperature in many ways and they all say the same thing - our planet is warming.

**MYTH**
The thermometer record is unreliable.

**FALLACY**
Just because measurements have uncertainties doesn't mean it's unknowable. The uncertainty is smaller than measured global warming.

http://sks.to/temp

---

Denial101x - 2.4.1. - https://youtu.be/YKQiyBkt4Vs

Jumping to conclusions
Global Warming is happening

**FACT**
Urban heat has had minimal effect on the climate record, with much warming happening where there is little urban development.

**MYTH**
Urban development is responsible for much of global warming over the last century.

**FALLACY**
Just because urban heat might affect the climate record doesn't mean it does. Scientists have confirmed it has negligible effect.

[http://sks.to/uhi](http://sks.to/uhi)
Global Warming is happening

**FACT**
Slowing jet stream is causing Arctic cold air to leak down into Europe and North America, like an open fridge leaking cold air into the kitchen.

**MYTH**
Record cold winters disprove global warming.

**FALLACY**
A cold winter doesn't disprove global warming, you need to look at the big picture.

Skeptical Science: [https://skepticalscience.com/graphics.php?g=98](https://skepticalscience.com/graphics.php?g=98)
FACT
Climate change and global warming have both been used for decades.

MYTH
They changed name from ‘global warming’ to ‘climate change’.

FALLACY
They didn't change the name (let alone in connection with temperature changes!)

Global Warming is happening

Temperatures increasing fastest

Relative use of “global warming” decreasing fastest

Data source: (http://sks.to/name)
We are causing global warming

**FACT**
For thousands of years, our atmosphere has been in balance. Humans have upset the balance..

**MYTH**
Human CO$_2$ emissions are tiny compared to natural CO$_2$ emissions so our influence is negligible.

**FALLACY**
Considers only natural CO$_2$ emissions and ignores natural CO$_2$ sinks.
We are causing global warming

FACT
Human emissions are responsible for all of the increase in CO$_2$ in the air over the past two centuries.

MYTH
Volcanoes produce more CO$_2$ than humans.

FALLACY
Volcanoes do produce CO$_2$, but over recent centuries the amounts are too small to account for the observed changes in the air.

We are causing global warming

**FACT**
If we stopped emitting CO₂, it would take thousands of years for the atmosphere to return to pre-industrial levels.

**MYTH**
CO₂ has a residence time of only 4 years so CO₂ levels would fall quickly if we stopped emitting.

**FALLACY**
How quickly a CO₂ molecule moves around the climate system is different to how long it takes CO₂ level to return back to normal.
FACT
Greenhouse gases are like a blanket. They trap heat, sending it back down to Earth where we measure it.

MYTH
Greenhouse effect violates the 2nd law of thermodynamics.

FALLACY
2nd law talks about net flow of energy and doesn't forbid some flow from cool to hot.

Skeptical Science - https://skepticalscience.com/graphics.php?g=304

http://sks.to/thermo
We are causing global warming

FACT
Emitting more CO₂ means more heat is being trapped higher up in the atmosphere where the air is thinner.

MYTH
The greenhouse effect is saturated so adding more CO₂ won't affect it.

FALLACY
Considers the atmosphere as a single layer when it's multiple layers.

Skeptical Science: https://skepticalscience.com/graphics.php?g=104
http://sks.to/saturate
We are causing global warming

**FACT**
Ice cores tell us warming causes the ocean to emit more CO$_2$. Combined with greenhouse effect, this is a reinforcing feedback.

**MYTH**
CO$_2$ lagging temperature means greenhouse effect is minimal.

**FALLACY**
It's not one or the other but both. CO$_2$ causes warming and warming causes CO$_2$ to rise.

Vostok Antarctic ice core records for carbon dioxide concentration (Petit 2000) and temperature change (Barnola 2003)

http://sks.to/lag
FACT
One human fingerprint is a cooling upper atmosphere with a warming lower atmosphere. Satellites have measured this pattern.

MYTH
One fingerprint of human-caused global warming is the tropospheric hot spot which hasn't been observed.

FALLACY
A hot spot should appear for any type of surface warming so is not linked uniquely to greenhouse warming.

Atmospheric temperature change from 1890 to 1990 from (a) solar forcing, (b) volcanoes, (c) greenhouse gases, (d) ozone, (e) sulfate aerosols and (f) sum of all forcing (IPCC AR4)

http://sks.to/hotspot
**FACT**
Satellites measure the warming effect from CO2. The increased greenhouse effect is an observed reality. It was predicted before it could be measured.

**MYTH**
CO2 is a trace gas so it’s warming effect is minimal.

**FALLACY**
The fact that CO2 is a trace gas is irrelevant to whether it can impact climate. Trace amounts of substances can have a strong effect.

http://sks.to/trace
We are causing global warming

**FACT**
The Sun has been getting colder for the last 30 years as the Earth has been warming. Sun and climate are moving in opposite directions.

**MYTH**
The sun is causing global warming.

**FALLACY**
Ignores human fingerprints and recent period where sun and climate move in opposite directions.

Skeptical Science - https://skepticalscience.com/

http://sks.to/sun
FACT
Between 90 and 100% of climate experts agree that we are mostly responsible for current global warming.

MYTH
More than 31,000 scientists disagree with the consensus.

FALLACY
The myth relies on fake experts and a magnified minority. Just about 0.1% of signees are actively publishing climate scientists while most of them work in other areas.

http://sks.to/consensus

Brian Angliss – Scholars & Rogues (2015)
FACT
Past climate change tells us climate is sensitive to the warming effect of CO₂.

MYTH
Natural climate change in the past implies current climate change is also natural.

FALLACY
Past climate change actually sends the opposite message than what the myth concludes.

Humans have died naturally in the past...

...so this death must be natural!

Jumping to conclusions
FACT
Natural influences that ended the Little Ice Age have been swamped by recent human activity.

MYTH
Current warming is just the continuation of natural recovery from the Little Ice Age.

FALLACY
The natural factors that ended the Little Ice Age are no longer significant.
FACT
In the past when the sun was cooler, CO₂ was higher. The two roughly balanced each other. We are now raising CO₂ levels with a warmer sun.

MYTH
CO₂ was higher in the past but the world didn't boil away so the greenhouse effect is weak.

FALLACY
Ignores the role of the sun which was cooler in the past.

Skeptical Science - https://skepticalscience.com/graphics.php?g=303
http://sks.to/pastco2
Past and future climate change

**FACT**
While the Medieval Warm Period saw unusually warm temperatures in some regions, globally the planet was cooler than now.

**MYTH**
The Medieval Warm Period was warmer than current conditions. This implies recent warming is not unusual and must be natural.

**FALLACY**
For average temperature over wide regions, the hot regions were cancelled out by other cool regions.
Past and future climate change

FACT
Models are based on fundamental physical principles.

MYTH
Models are unreliable.

FALLACY
No model is perfect but they are useful tools that can reproduce the past and provide insights into the future.

One of these panels shows observed weather (as estimated by Era-Interim); the other three weather simulated by three different climate models (HadGEM2, CCSM4, and MIROC5) - which is which? Click to find out! Video from Philip Brohan - https://vimeo.com/213117747

http://sks.to/model
Past and future climate change

**FACT**
Models have made a number of successful predictions.

**MYTH**
Models predictions have failed, making them unreliable.

**FALLACY**
Climate models have had great success at predicting long-term effects like greenhouse warming.

http://sks.to/hansen1988
FACT
Climate models simulate climate which is weather averaged over time.

MYTH
Scientists can’t even predict weather.

FALLACY
Confusing weather with climate distracts from the fact that short-term predictions have little relevance to long-term climate predictions.
FACT
In the 1970s, the majority of climate papers were predicting warming.

MYTH
In the 1970s, climate scientists were predicting an ice age.

FALLACY
Confuses mainstream media reports with scientific papers which overwhelmingly pointed towards warming.

Survey of 68 Scientific Studies on "Global Cooling" literature from 1965 to 1979 (Peterson 2008)

- Predicted Cooling 10%
- No-Stance 28%
- Predicted Warming 62%

http://sks.to/1970s
FACT
Even if the sun fell to Maunder Minimum levels, it would only delay global warming by a decade.

MYTH
We're heading into another ice age because of the cooling sun.

FALLACY
Overstating the role of solar activity on climate - it actually has had little effect.

Skeptical Science - https://skepticalscience.com/graphics.php?g=21
Climate change impacts

**FACT**
The amount of water vapor in the air depends on temperature. Warming causes water vapor to rise, which causes further warming: a reinforcing feedback.

**MYTH**
Water vapor is the strongest greenhouse gas.

**FALLACY**
The fact that water vapor is a strong greenhouse gas means it amplifies the warming from greenhouse gases.

[Denial101x - 5.2.2 - Water Vapor](http://sks.to/vapor)
FACT
Clouds provide a reinforcing feedback but the effect isn't strong. Clouds play a minor role in climate sensitivity

MYTH
Clouds provide negative feedback

FALLACY
Acting as if clouds only have a cooling effect ignores that they can also warm.

Skeptical Science - https://skepticalscience.com/graphics.php?g=21
http://sks.to/cloud

Over-simplification
**FACT**
Mass extinctions happen when climate changes too fast for species to adapt. Currently species are going extinct at similar rates to past mass extinctions.

**MYTH**
Species can adapt to climate change.

**FALLACY**
Just because species can adapt to some climate change doesn’t mean they can adjust to the rapid climate change happening now.
FACT
Polar bears need sea ice to hunt so the shrinking of Arctic sea ice is endangering their populations.

MYTH
Polar bear numbers have increased so they're in no danger from global warming.

FALLACY
One threat (hunting) has been removed but replaced with an increasing threat (melting sea ice).

Over-simplification

http://sks.to/bear
FACT
Ocean acidity has increased 30% and poses serious threats to coral reefs that are also threatened by warming oceans and bleaching.

MYTH
Ocean acidification isn’t serious.

FALLACY
Ocean acidification means oceans are decreasing in pH so they are getting more acidic, even if they are not actually acid.

Misrepresentation

http://sks.to/acid
FACT
Climate change is having negative impacts on all parts of society.

MYTH
Global warming is good.

FALLACY
This focuses on a few good impacts of global warming but ignores the overwhelming number of bad impacts.

“Burning embers” from iPCC AR5 WGII 2013

http://sks.to/impacts
FACT
A pollutant is any substance that disrupts the environment - CO₂ does that by trapping heat.

MYTH
CO₂ is not a pollutant.

FALLACY
Quibbling over technical definitions of pollutant is a distraction from the realities of the negative impacts of global warming.

Skeptical Science - https://skepticalscience.com/graphics.php?g=21

http://sks.to/pollutant
FACT
Climate change impacts agriculture through extreme weather: heat stress and flooding.

MYTH
CO₂ is plant food.

FALLACY
CO₂ fertilisation is just one factor affecting plant growth. The full picture shows that negative impacts outweigh benefits.

FACT
Risk from extreme weather is increasing, albeit some forms of extreme weather are more confidently linked to global warming than others.

MYTH
Extreme weather not linked to global warming.

FALLACY
Just because extreme weather happened in the past doesn’t mean climate change isn’t having an influence now.

Mapped: How climate change affects extreme weather around the world
https://www.carbonbrief.org/mapped-how-climate-change-affects-extreme-weather-around-the-world

http://sks.to/extreme
Slide-deck put together by
Bärbel Winkler

Email – baerbelw[AT]skepticalscience[DOT]com
Profile - http://sks.to/BaerbelW
Web - http://www.skepticalscience.com
Fact-Myth-Fallacy page - http://sks.to/fmf
MOOC - http://sks.to/denial101x