

Explanations for Key Points

(Note: These are possible things you can say. You don't have to include all of them, and you may find new or better examples.)

What's Happening & Why

Indicators

Severe Weather Events

- I'm sure you could all name half a dozen.
- More intense, last longer, more frequent
- Houston had three "500 year flood" in last 3 years
- Cost to the global economy in 2017-18, \$653 billion.

Rising Temperatures

- Humidity also rising ("feels like") putting more moisture in the air and producing heavier rains.
- But most important thing to know is that since the beginning of the Industrial Revolution, the planet has warmed 1C (1.8F).
- Doesn't sound like much or feel like much on our skin, but to the planet, it is huge—enough to cause all of the severe, erratic weather and much more. A rise of one degree, even half a degree, can make an enormous difference!
- In some places, the increase already has more than doubled. Places like the Arctic, northern Canada and Alaska, a number of areas in the U.S., e.g., Northeastern states, and in Asia and the Southern Hemisphere.
- *The Inland Empire has risen 1.8-2.1C. San Bernardino and Riverside are listed as 2 of the top 5 cities with the lowest degree of readiness. (Note: Use only in inland Empire area.)*

Warming of Oceans

- First, remember that oceans cover 70% of the earth's surface and that ocean currents have a significant influence on the earth's weather and climate.
- So warming oceans is a factor in the growing severity of weather events and is causing the migration of marine life to cooler waters, as well as the spread of invasive species and marine diseases.
- Oceans also are becoming more acidic due to the large amount of CO₂ they are absorbing. The waters off the coast of California are acidifying twice as fast as the global average.
- Acidification will kill the remaining coral reefs when temperature hits 2C and devastate remaining marine life since coral reefs are the home of 25% of all marine life.
- And it has recently been discovered that oceans are running out of oxygen since warmer water can hold less oxygen.

Melting of Ice Caps

- Rising temperatures and warming oceans are causing the ice caps to melt.

- They are losing both extent and volume in the Arctic, Antarctica and Greenland.
- 95% of oldest ice in Arctic gone. The newer ice is thinner and melts faster.

Rising Oceans

- Oceans are rising due to ice melt and to thermal expansion caused by warming of the water.

Rapid Loss of Bio-diversity

- This is the worst loss of life on earth since the demise of the dinosaurs. We are losing both mammals and insects, like bees, for example.
- This is due to the changing climate that affects both habitats and food supplies, and alters and destroys eco-systems.
- This is what could lead to our own extinction. We humans, they say, may be the first species to document our own demise.

Releasing of Methane

- Methane is one of the greenhouse gases.
- Methane is 20-30 times more potent than CO₂.
- It is now 259% over the pre-Industrial level.

Melting of Permafrost

- Permafrost is organic material from plants and animals that has been frozen for millions of years under the polar ice.
- It contains gigatons of methane, plus CO₂, enough to catastrophically warm the planet
- It is now melting at an alarming rate, forming lakes in the Arctic where methane actually can be seen bubbling up.

Increasing Levels of CO₂

- CO₂ is the most prevalent greenhouse gas that absorbs solar energy and keeps the heat close to the earth.
- That trapping of heat is known as the greenhouse effect. It is what keeps the earth from freezing. So carbon is essential for life.
- Trees, plants, soil, and the oceans have always absorbed any excess CO₂, maintaining a delicate balance between oxygen and CO₂.
- That balance is being altered. This is what threatens life on earth.
- The safe level of CO₂ for humans is 350 ppm; it is now at 408-415. Before the Industrial Revolution, it was 280 ppm.
- In the last 4 years, it has increased 20%.
- Last time CO₂ levels reached as high as 400 ppm was 3 million years ago.
- And most concerning is that CO₂ stays in the atmosphere for 100-200 years. That's why they say warming is already baked in. So what we are now putting into the atmosphere will last a long, long time.

Causes

CO2

- Major emitters are transportation, electricity production, industry and agriculture.

Industrial Agriculture

- Industrial farming is one of the biggest contributors of methane worldwide.
- It raises methane-emitting livestock by the billions and relies heavily on fossil fuel-powered machinery, plus it uses insecticides, fertilizers, and weed killers that make the soil less able to absorb CO2
- And, of course, agriculture products are shipped worldwide, producing untold amounts of CO2.

Worldwide Deforestation/Wetlands

- Deforestation is a huge factor in global warming. There was a time when forests and wetlands together absorbed more than 2/3 of CO2.
- Already, half of the world's tropical forests have been cleared for farmland. The majority of that land is used to grow food for livestock.
- Wetlands have disappeared due to many of our cities and towns being built on top of them.

Feedback Loops

- A feedback loop is like a **vicious circle** and there are a number of them in the climate system.

Loss of Ice caps

- This is an example of a feedback loop. The sun melts the ice, which leaves less ice to reflect the heat back, which reveals more dark ocean that absorbs the excess heat, which causes more ice to melt and makes the earth warmer overall.

Melting of Permafrost

- Another example. As the permafrost melts, it releases methane. This causes more warming which causes more ice to melt, which reveals more permafrost that melts, which releases more methane and increases warming.

Rapidly Growing Population

- We have been consuming voraciously since the beginning of the Industrial Revolution without thinking of the consequences, while in my lifetime, the population has grown from 3 billion to 7.5 billion, heading for 11 billion by the end of the century.
- This is simply not sustainable with our current way of living.
- Even in this country where we have so much, we want more. And the rest of the world wants it, too.
- Can we blame them? Of course not.

Long-term Ignoring of Scientists Warnings

- Scientists have been issuing warnings since the 1950s.
- Fossil fuel companies also were well aware of the CO2 danger, as were governments and utilities.
- If everyone had listened back in the 70s or even 80s, we wouldn't be where we are now.

How Bad How Fast

Uncertainties

Multiple Warming Factors

- This is making it difficult to do accurate forecasting. But we are rapidly developing more sophisticated computer models that can include many more variables and show more accurately what's happening.
- Unfortunately, each new forecast gets more dire.

Release of Methane

- Some scientists think it's time to declare a methane emergency.

Tipping Points

- A tipping point is a threshold that when exceeded, can lead to large changes in a system, sometimes abrupt. There are a number of them in the climate system.

Ice Free Arctic

- This is one example of a tipping point. It is predicted to happen in the next 10-20 years.
- When it does, it will significantly accelerate warming.

Amazon

- For many centuries, the Amazon has absorbed a huge amount of CO₂ for the world.
- Once the tipping point is reached, the Amazon will start turning into a savannah, losing much of its ability to absorb carbon and significantly accelerating warming.

The Paris Accord

- The Paris Accord held great promise that the world was going to take the climate crisis seriously. All nations agreed to a goal of keeping warming under 2C, ideally not more than 1.5C.
- However, the goal was based on the 2018 IPCC report that, it turns out, did not fully take into account feedback loops, so it is viewed to be very conservative.
- Thus the goals and plans set by the nations that signed the Accord (which is all nations except the U.S.) are not aggressive enough. Not even close.
- With the current plans, we are on track for temperatures to rise 3-4C in this century.
- There is some hope that during this critical year (2020), these plans will be strengthened.

Key Numbers

- This is how scientists talk about the projected temperatures.

Consequences

Severe Water Shortage

- Currently, $\frac{1}{4}$ of the world's population is facing water shortages. By 2025, that number is expected to rise to $\frac{2}{3}$ of the world's population.
- We already have major cities running out of water. Two recent examples are Cape Town, South Africa and the 6th largest city in India. Both have populations of over 4 million. In those cases, water trucks driving into the neighborhoods was the only source of water for weeks.
- Another concern, the snow packs in many mountain ranges are melting fast. Think of the Himalayans. It's snow pack is the only source of fresh water for hundreds of towns and villages, and it feeds 5 major rivers in Asia, including the Ganges. Many, many millions of people depend on that water for survival. Same goes for the Andes and other high mountain ranges, like the Sierras in California that provide a portion of the water for my town.

Massive Crop Failures

- Many places in the world are already experiencing this. Causes include drought, fires, flooding, insect infestation and salt water from rising seas permeating the soil.
- This has led to a recent increase in world hunger and malnutrition. In Africa, people are dying of starvation.
- The big concern here is the failure of major crops at the same time in many places in the world.

Unlivable Temperatures

- Many places in the Southern Hemisphere and Asia are already experiencing periods when it is too hot to be outside during the day. All work has to be done at night.
- The hottest city in the world last year was in Pakistan (120F for months). Many people are so poor they don't have electricity, so can't even run fans. Those who have it, find it is often turned off.
- This kind of heat kills, as well as making people very ill. In 2003, 30,000 people died in a heat wave in Europe.

Unprecedented Fires & Floods

- Recently, we have seen unprecedented fires in Australia, the Amazon, the Arctic and across the Northern Hemisphere, and in California, to name a few.
- In the U.S. in 2019, we saw major flooding of the Mississippi and Missouri rivers, in Venice and in Jakarta, Indonesia, to name a few.
- Much of the flooding everywhere is caused by a new phenomenon, rain dumps.

Loss of Island Nations

- Worldwide, more than 100 million people live in areas that will be affected by rising seas.

- All island nations are threatened. Very few will probably survive.
- Some of the world's largest cities will also be lost. The country of Indonesia, for example, has already decided to move its capital city of Jakarta inland. Jakarta has 4 million people. That's like moving the city of Los Angeles.

Mass Migrations

- This is already happening and is causing much conflict and suffering in the world.
- Within countries, we will see millions of people moving inland, out of coastal cities that will become uninhabitable.
- In the future, we will see much larger numbers of climate refugees from the Southern Hemisphere moving North.
- We already have vivid examples of what happens in these situation.

Destabilized Oceans

- We've already talked about how crucial the ocean is to life on this planet.
- Just to add to this, 12% of the world's population depends on fishing for livelihood.
- 3 billion people rely on fish as a main staple of their diet.
- Asian fisheries are expected to completely collapse by 2050.

Widespread Disease

- We are already seeing insect-carried tropical diseases like malaria, dengue fever, and Zika appearing in the northern hemisphere. As temperatures increase, there will be more.
- We are also seeing the rapid rise of respiratory diseases worldwide. They have become the #1 cause of death worldwide.

Collapse of Ecosystems

- We all know what happens when one species is lost in an ecosystem. Humanity has wiped out, on average, 50% of animal populations since 1970. We are talking about millions of ecosystems at risk of collapse.

Put next 3 up together.

Increased Conflicts/War, Political Instability, Social & Economic Collapse

These next 3 are very interrelated and could happen in any order or all together. They are happening already today, mostly over inequality and lack of basic necessities like food, water, and electricity. Millions of people in many nations are rising up. It's really about social justice. Global warming is part of that and it's going to make everything so much worse.

What Can Be Done

Ways to Mitigate

These can just be read without much added explanation or examples.

Resisting Forces

These also can just be read without much commentary.

What Can We Do

See procedures that follow the third Reflective Conversation.