

The Consequences of Climate Change to the Oceans

Transcript of Panel Presentations

COP22, November 11, 2016
Marrakesh, Morocco

Panel members: from left to right

Mr. Mark Bryant
Dr. Kyle Van Houtan
Dr. Nigel Crawhall
Dr. Richard Miller
Dr. Charles Kennel
Fred Krueger, moderator



Introduction by Fred Krueger

Good morning. Welcome to this official UNFCCC side event panel on the changes taking place in the oceans as a consequence of rising CO₂ levels. My name is Fred Krueger. I'll be the moderator for this panel sponsored by the NRCCC of the United States. Other sponsors include the Monterey Bay Aquarium, Interfaith Oceans, and the Earth Day Network in Washington, DC and around the world.

Our topic is the plight of the world's oceans. Our purpose is to bring ocean issues into formal discussion and inclusion into these UN accords. Today, we will examine the consequences of climate change and the implications of human abuse on the oceans. We already know that unless rapid steps are undertaken to reduce CO₂ levels, we risk collapse of the ocean food chain and mass extinctions.

We will proceed by hearing a set of opening presentations on the plight of the oceans, then each panelist will make specific recommendations for what we can do to address this deepening predicament – as individuals, as nations, and finally to the entire United Nations COP process.

It's my privilege now to introduce the scientists and religious leaders on this panel. On my right is Dr. Kyle Van Houtan, he is the science director at the Monterey Bay Aquarium. Next we have Dr. Charlie Kennel; he is director of the Scripps Institute of Oceanography, one of the premier ocean science organizations in America and the world. Next is Dr. Richard Miller and he is unique in that he teaches both climate change and theology at Creighton University in Nebraska. Dr. Nigel Crawhall is from Capetown, South Africa; he represents both the indigenous peoples of Africa and the Concerned Buddhists organization. And at your far left, we have Mr. Mark Bryant; he represents the Islamic Foundation on Ecology and Environmental Sciences (IFEES); he's from Birmingham in the UK.

And now it's my privilege to welcome to the podium our initial presenter, Dr. Kyle Van Houtan from Monterey, California.

Dr. Kyle Van Houtan

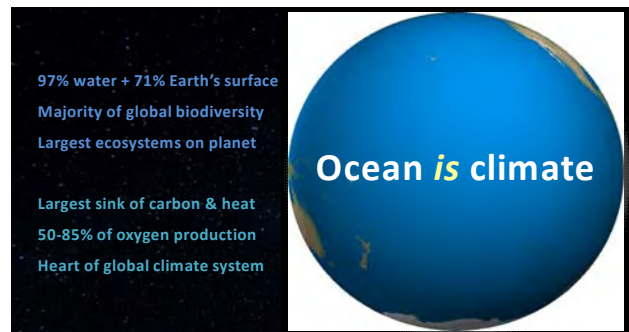
Monterey, California

I'm Kyle Van Houtan, I'm from the Monterey Bay Aquarium. I want to talk to you today about the role of the ocean in the global climate system, and how this awareness is a rather recent phenomenon scientifically. Not that it wasn't important before, but our appreciation of its role is recent.



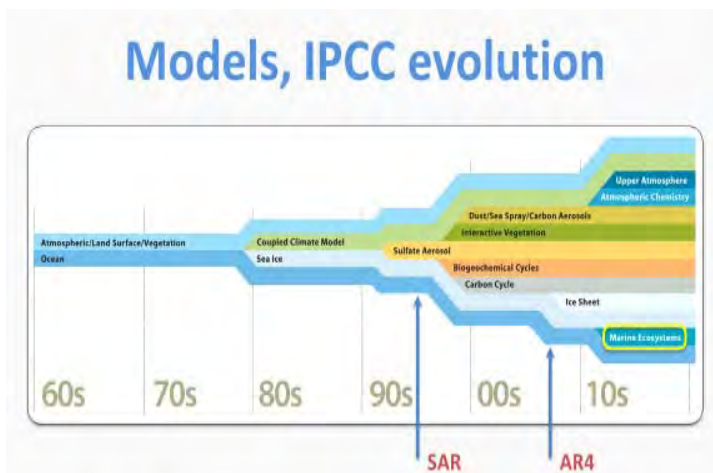
This is a picture of the earth. It's not doctored in any way. It's what the earth actually looks like if you tilt it a certain way. As you can see it is mostly ocean. That little speck at the top is Hawaii where I spent a lot of my life in the middle of the ocean. This highlights that 97% of the water on our planet is in the ocean. 71% of the earth's surface is in ocean. It holds a majority, a taxonomic, and biologic diversity; it's the largest ecosystem on the planet. It is also the largest carbon sink and the largest heat sink on our planet. And something we learned just recently, it produces up to 85% of the oxygen in our atmosphere - through phytoplankton. So with every breath you take, you should thank the ocean.

We didn't always know this. When we first started to think globally about the problem of climate change, were we focusing on the ocean? No, we were focusing on tropical rainforests. And some people still refer to the Amazon Basin as "the lungs of our planet." We now know that the ocean is the lungs of the planet.



I would add, the ocean is also the heart of the planet system. All of this is really to say – “the ocean is climate.” You cannot talk about the climate system without talking about the ocean as the number one contributor, measuring stick, and front line of climate change impacts.

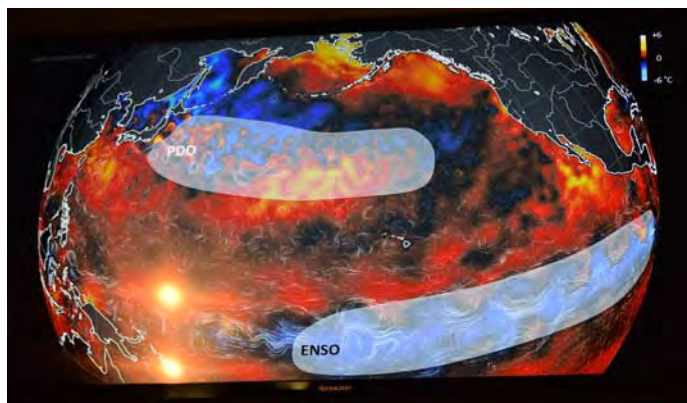
We haven't always appreciated this in the science sphere as you can see. This next image is a diagram of the evolution of the sophistication of general circulation models where these massive equations and algorithms describe the oceans in the global climate system.



In the very beginning [of our study of climate change] we did not include ocean and atmospheric components. The first IPCC assessment in 1990 just had a swamp. It didn't depict a deep ocean. It didn't circulate and it was stagnant. It wasn't until the second IPCC assessment that a circulating ocean appeared. It wasn't until the fourth assessment in 2007 where the standard General Circulation Model, had an integrated atmosphere and ocean component.

Now given the importance of oceans to the climate system, and for taxonomic, for biodiversity, for producing oxygen, for holding heat, it was not even 10 years ago that the standard model for measuring climate change failed to include the oceans. To me that's amazing. While I may say that the ocean is the heart of the climate system, this was not appreciated in our early models....

Here you have a map of the North Pacific and it is colored for anomalies. If it's really bright yellow and white, then it's unusually warm; and if it's really blue and into icicle white, then it's unusually cold. I show you this because this typifies why ocean is climate. This bottom area towards the equator is a part of the ocean that we typically associate with the southern oscillation; El Nino Southern Oscillation which is referred to as "ENSO." On the top here you have the Pacific



Decadal Oscillation. That's a region where it operates off the Kuroshio current there in Japan. These oscillations are very important for local climate and the productivity of fisheries. These drive local weather events. They occur over a long timescale and in the Atlantic and in other places you have the North Atlantic Oscillation, and the Atlantic Multi-decadal Oscillation. You may have never heard of these things before, but they oscillate over time. You may think of El Nino as something happening from September through January, but the AMO can be in one phase for sixty years. This complicates our understanding of the climate system [because] we're just starting to understand how these oscillations drive our climate system as well as biodiversity and rainfall, tropical cyclones. In the science realm, we are just learning to appreciate these things.

The number of papers published and the number of times these papers have been cited, just since 2010, is an astounding amount. While we know that the ocean is the heart of climate system, we're still learning about how profound and meaningful that is. In just the last sixty years papers on those four phenomena have been cited almost 316,000 times. So our understanding of this [ocean circulatory dynamic] is a rapidly expanding field.

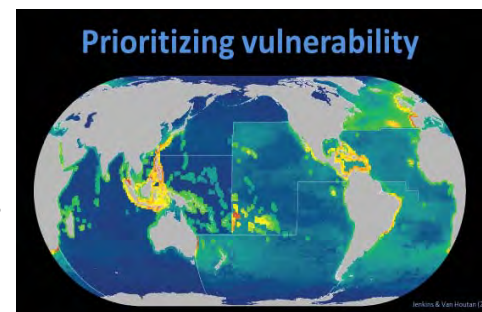
I just joined the Monterey Bay Aquarium staff after working with NOAA for seven years. I was previously a part of the Obama Administration's climate program. That was a mission to identify how the climate system behaved. With a problem as geopolitically profound and immense as climate change, where do you begin? How do we prioritize our efforts? If you want to mitigate impact, how do you do that? As we began, the first paper that we put out studied the Endangered Species Act and [we wanted to identify] how we would incorporate climate science to include aquatic and marine species.

One of the chief topics with which I was involved was a prioritization study because not all species are alike. If we're going to mitigate carbon change and prevent climate impacts, we need to know where to begin. There are many ways to do risk assessments, and one of the things we found is that a species' life history, or reproductive strategies, really matter. So you see elephants, orcas (killer whales as they're sometimes called), big-horned sheep, fur seals, they all have a [reproductive strategy] on the x axis, (this is the most wonky slide I'll show, but I think its really important). You have age on the x axis and time, and the survival rate on the y axis. You can see that most of these

animals at the top survive through their youth and then as they reach adulthood and beyond, there is rapid senescence or death. On the bottom you have a totally different approach. You have fish, sea turtles, molluscs and squids. These are the species that support local fisheries. A lot of the seafood that comes out of the ocean would be these species on the bottom. Then you have another approach that is in the middle. Now that number on the top is 1.5 and on the bottom it is 1:84,000. That's the odds ratio of a particular individual reaching sexual maturity for that species.

You can see if you are given a survival chance of 1 to 1.5 and 1 out of 84,000, I'm going to take the 1 to 1.5 chance of reaching maturity. The animals on the top have a fundamentally different approach. They invest a lot of resources into few offspring. And basically climate change is mitigated through these impacts. They provide milk, apprenticing, shelter; they teach, they do all these things. For the animals on the bottom, the impact of climate is apparent. These have a huge amount of fecundity. A squid could lay billions of eggs, but they never see those offspring ever again. If those oscillation regimes that I just spoke about, the NAO, the NMO, if they shut down, there is massive mortality. But that's not true with orcas, or fur seals, or African elephants. That's because they have a social structure and they invest in their young. What we can say as an analogy to human populations is that we can mitigate the impacts of climate change by investing in the places and the populations that need it most.

If you look at the global scale, we have a lot more data than we had ten or twenty years ago. This is a map of the risk of extinction for biodiversity globally. Where should we focus our efforts? So you can see the Coral Triangle – this is an area that is roughly between the Philippines, Papua and Sumatra. This is an area of global importance to marine biodiversity.



But, if you live here in Northwest Africa, do you care about what's going on in the Coral Triangle? So we regionalized this map, and if you go back, you can see in a regional way where these priorities, might be. Just a few years ago, we didn't have this kind of data. As we learned about priorities and produced risk maps, we could see deeper into the impacts of climate change on oceans. It is important to develop these maps and undertake these kinds of assessments. So last year there was a huge amount of activity at the Paris Climate COP; it was a massive accomplishment. This year Marrakesh is about implementing what happened in Paris.

At the Monterey Bay Aquarium, we are a coastal community at risk from climate change. We are situated right on the ocean. You should come visit us, it's a beautiful place. Our premise is to incorporate science, markets, and policy for environmental solutions, including climate, ocean plastic, and species extinction. And we have this guide called "Seafood Watch" which is very successful. There is even an app which you can download. I'm very excited to report that we now have included in this a greenhouse gas emissions calculator for all of our assessments of fish. If you are going to buy a fish, or you want to eat seafood and you go to the market, it will now include an assessment of climate change impacts in addition to fishery sustainability, to human health and to fair trade.

Thank you very much.

Dr. Charlie Kennel

San Diego, California



Thank you, Kyle, for a fine introductory presentation. ...

My task is to try and explain why the oceans don't get any respect in climate circles. Or more formally, why it is that the centrality of the oceans to the climate is not adequately recognized in either the COP assessments or the actions that they recommend.

The way to present this is actually to provide a little bit of the history of how scientists got into the climate business. And actually it's a long story.

In the 1860's, at the beginning of what we would now call the industrial era, the British scientist John Tyndall discovered the two most important greenhouse gases: water vapor and CO₂.

And in the 1890's the Swedish physicist Svente Arrhenius recognized, by that time we already had thirty years of industrialization, and he recognized that the carbon dioxide that we humans were putting into the air, had the potential for warming the climate.

This was thought of as an odd ball remark, and it didn't get much attention. The reason was that people all assumed that the ocean could take up all the carbon dioxide that we were putting into the atmosphere. They had measured the solubility of carbon in distilled water – carbon just went right into it – so they thought that the oceans were so big that human civilization couldn't possibly affect them. This attitude even extended into environmental thinking that the oceans could absorb any insult that human civilization could throw at them.

Until about fifty or sixty years ago, this was the prevailing view. The oceans were so big that they could absorb just about anything. Of course nobody lived in the ocean and nobody knew what was going on below the surface except a few trained oceanographers.

The story began to change when the greatest Scripps Institute director of them all, and my immediate predecessor, Roger Revelle, started working with a chemist named Hans Seuss. They thought that, just to do their homework, they ought to measure the solubility of CO₂ in sea water which is filled with salts. It turned out the salts buffered the solubility and it did not look as though carbon dioxide would be sucked into the water – which meant then that as human civilization was putting CO₂ into the air, it would stay there for some time and they thought it would be about 20 years time. But in fact the molecules we put in today would still be there around 100 years from now.

Well, this is a theoretical computation. The next question was, is the CO₂ concentration in the atmosphere actually increasing? Oceans can't take it all up, so where is it going? It must be staying up in the air.

At this point Roger Revelle hired a young post-doc from Cal Tech named Charles David Keeling. Keeling was the only person in the world at that time who could measure the concentration of CO₂ in the atmosphere with enough precision to actually detect how it evolves, how it changes with the seasons as the trees grow and then release it, in the Northern hemisphere particularly.

So Keeling started his measurements in 1957. By 1960 he saw an upward trend in the concentration of CO₂. And even though it was a barely distinguishable result, it meant that the atmosphere was less consistent than what you would have expected from our industrial civilization. It was about a year or so later that Revelle actually informed President Lyndon Johnson in person of the implications of this result.

So you can not say that at least some people in the United States were not aware of the problem from a very early time. Now, Keeling's work was very controversial. It took about 20 more years for people to accept it. The formation of the first COP Panel in 1988 is in some sense an international recognition of the acceptance of the significance of Keeling's measurements of rising carbon dioxide.

The scientific community was more alert than the policy community. By 1970 they decided to try to model and forecast the climate, including this driver of change in it. They started where they knew how to make forecasts – this was with the techniques used in weather forecasting, which is basically about the very thin ocean of air in which we all live. Of course legislatures and law makers don't live under water, they live on the land and making predictions through the air was the first and most important thing that they could do. And this then set a bias in the thinking that has continued throughout the development of the COP assessment process.

Until only recently have we actually come to full appreciation for the global impacts, not only that the ocean has on climate, but on the impacts human beings have on the ocean.

First of all, the ocean can't withstand all the insults we are throwing at it. And even the 30% of the CO₂ that they do absorb is now decreasing the pH and increasing the acidity of the global ocean in every place, and as you have probably have read, this is beginning to present a threat, not only to the shelled lives and corals, but more profoundly to some of the species of phytoplankton that generate the oxygen that we breath.

And so we now have the global issue of increasing ocean acidification. The other thing that has happened within the last 20 years is it has become possible to measure how much heat our activities are putting into the ocean. We now know that 93% of all the energy that the greenhouse effect is adding to the earth climate system, 93% of that ends up in the ocean. But it has been a slow and long realization. It took a long time to get to this stage and it is still the case that thinking about oceans is not sufficiently instrumental for effective policy.

I think that I'll leave it there and then we'll try to figure out as a panel some recommendations for your thinking.

Dr. Richard Miller

Omaha, Nebraska, USA

It's difficult to follow two distinguished scientists and actually talk a little bit about science. I am a theologian who teaches in systematic and philosophical theology. I have spent a great deal of time over the past decade studying climate science with special attention to the forecasted impacts and their implication for the human community.

What I'd like to do today is extend an invitation. I can't pretend to speak for all religion. I come from a particular place, and I operate and think within a particular religious tradition. I come from the United States and the tradition which I operate is Christianity, and more particularly I am part of the Catholic community. So I'm not going to speak for all of religion. What I'd like to do is offer an invitation for those of you from various religious traditions to maybe take up some of my insights and reflect upon them within your own traditions. I will try not to go too in depth into Christian theology; rather, I will speak on a more general level, though I will remain within monotheistic forms of thinking, so that my arguments can be more easily adapted to other religious traditions.

I will also be approaching the ethical question, especially in this case an ethics of the oceans, in terms of its foundation in the imagination. Paul Ricoeur, one of the great philosophers of the 20th century remarked that "too often we think in ethics of a will submitting to what should be done, when we really should be thinking of an imagination opening up." Without an opening up of our imaginations to grasp what we are setting in motion through the burning of fossil fuels and the felling of forests, we will not come to terms with our ethical responsibility. This is especially true for the long term effects of our actions. What the sciences are revealing stretches our imaginations, but our culture, at least in the developed world of the West, does not support the opening up of our imaginations to the long term implications of our actions; rather, our cultures diminish our time horizon. We are always on, in a rush, and absorbed in the present and our technology amplifies this. The advent of Twitter is a good example. We are so busy that one of the emerging forms of communication is Twitter. People do not have enough time to read a lengthy email or longer analysis of a situation, now we communicate more and more with Twitter, which limits what we can communicate to 140 characters. We're busy. We're rushing. We are absorbed in this moment. But the effects of our actions on the climate system have very long time horizons.

According to the climate scientist Alvaro Montenegro¹, in his study on the long time horizon of carbon dioxide, most studies of the future impact of anthropogenic CO₂ on the climate system, focus their attention on the next few decades or at most on the end of the 21st century. So what do we talk about in terms of temperature increase? We talk about 3 degrees Celsius and 2 degrees Celsius, and



¹ Alvaro Montenegro et al, "Long Term Fate of Anthropogenic Carbon," *Geophysical Research Letters* (2007) vol. 34, L19707, 1–5 at 1, doi:10.1029/2007GL030905.

we talk about 2100. This restriction is due to ‘computational costs’² in running computer models and ‘our capacity to think in terms of one human life time, which is supported by the political deliberations on climate change.’³ The computation costs, I’ll leave that to the scientists. Here I will focus on the latter reason; namely, that our concern is limited by what we can imagine or what is comprehensible for the public – that is one human life span. This time horizon then affects our discourse so that when we talk about climate change, we talk about mitigating climate change for our children. And that’s true, but our effects are much greater than that. And if our effects are much greater than that, then we have to open our imagination so that we can come to terms with our ethical responsibilities.

According to David Archer, the leading researcher on the long life of CO₂, 50% of the CO₂ emissions we release today will be absorbed by land and vegetation. 25% of that will last a thousand years; 12% of that, according to Archer, will probably last 10,000 years, and 7% of our CO₂ emissions will last 100,000 years. So Archer maintains that the mean lifetime, when we look at that hundred thousand plus years of CO₂ in the atmosphere is 30 to 35 thousand years.

If we talk about dealing with climate change for future generations and we understand a generation as 25 years, 35,000 years is 16,000 generations. So our effects are much greater than one lifetime. And so our ethics needs to take that into consideration. But our ethics are constricted by our focus on the short time.

Now let me talk a minute about the thermal inertia of the oceans and the distinction between short term and long term positive feedbacks. Nearly all of the heat (93%) from the greenhouse effect is absorbed by the oceans. There is a lag time between the cause, increased greenhouse gas emissions, and the effect of increased temperatures because the oceans take a long time to warm. We are about 1 degree Celsius warmer than preindustrial times and we have probably about 0.6 degrees Celsius that’s locked in the oceans already. So we are not yet experiencing the full effect of our emissions.

There are also feedbacks in the system that increase the warming caused by the human caused increase in greenhouse gas emissions. Let us look at the example of Arctic sea ice. As you increase warming, you knock out sea ice and change the albedo of the arctic by moving from white sea ice that reflects a great deal of the sun’s energy back to space to a dark ocean that absorbs most of the sun’s energy. This greater absorption of heat leads to the loss of more sea ice and more of a dark open ocean. This leads to the loss of even more sea ice and so on, a vicious circle. In our policy debate on climate change, we have privileged the short terms feedbacks, which include water vapor, clouds, aerosols, and sea ice disintegration.

But Dr. Jim Hansen and others have argued, quite persuasively, that there are long term feedbacks like “ice sheet disintegration, vegetation migration, and the release of greenhouse gases like methane and CO₂ from soils, tundra, and ocean sediments.” Thus when we talk about three degrees

² Toby Tyrell, John G. Shepherd, and Stephanie Castle, “The Long-Term Legacy of Fossil Fuels,” *Tellus Series B: Chemical and Physical Meteorology* (2007) vol. 59, no. 4, 59: 664–672, at 665.

³ Montenegro, Long Term Fate, 1.

Celsius by the end of the century the ultimate warming, what scientists call equilibrium warming, could ultimately be as high as 6 degrees Celsius. Jeffery Kiehl did a review of the scientific literature on long term feedbacks and he argued that if we continued with business as usual, a 4 to 7 degrees Celsius world by the end of the century could lead to an eventual warming of 16 degrees Celsius

What I've tried to indicate here is that we've privileged the short term perspective in all sorts of ways and this is reinforced by habits and patterns of thinking and acting that permeate our culture. In privileging the short term, we have shielded ourselves from the true extent of our actions; we have blinded ourselves to the depth of our responsibility for climate destabilization.

The religious imagination as it is expressed in religious traditions offers a possible corrective to the diminishment of our time horizon. First, religions offer us a sense of transcendence – a sense that reality is not limited to space and time, or this particular moment; a sense of a horizon that's much greater. So this sense of transcendence can open us up to a larger way of thinking. It can be a corrective to our fixation on the present. And this sense of transcendence undergirds most religions.

Second, in many religions we trace our founding prophets, sages, back over a thousand years and we recognize that the events of the past still engage us. They form the world in which we think, the context in which we think, the framework in which we orient our lives. The point is that the great figures or prophets of the past inform our life today, thousands of years later. Implicit in this fact is the possibility of recognizing that our actions today will have affects thousands of years ahead of us. Implicit in our sense of the importance of past actions that extend at least a thousand years into the past is that our actions in the present can be impactful a thousand years or longer into the future. So this idea of recognizing important events in the past opens up the possibility of recognizing the importance of our actions in the present that extends far beyond 2100, way beyond one human life time. This insight is not simply applicable to religions; rather, anyone with a sense of historical consciousness, anyone who recognizes that our current civilization stands on the shoulders of giants who preceded us, can use this recognition to inform their imaginations in order to grasp the depth and extent of their responsibility in the present. What is unique about religions in developing this awareness is that religions, in their practices, constantly return to their founding texts and founding figures.

When we think of the oceans, if we go into a 4 degree Celsius world, a world with CO2 levels of 600 parts per million, then according to J.E.N. Veron, a distinguished coral reef scientist, the coral reefs won't survive. We will create a mass extinction event, and following the great mass extinction events of the past, it took coral reefs 4 million years for their biodiversity to recover. That's roughly 160,000 generations. To avoid this, a rapid reduction in CO2 must begin immediately. In short, to develop a proper urgency for the present, we must develop a sense of our responsibility for the deep future.

My invitation to all of you then is to reflect upon this basic insight and find creative ways to take the patterns of thinking, reflecting, and praying within your tradition that are attentive to and informed by the deep past to aid in developing patterns of thinking, reflecting, and praying that are more attentive to the deep future and our responsibility for the deep future.

Thank you.

Dr. Nigel Crawhall

Cape Town, South Africa

I'd like to start off with the opening lines of a famous Buddhist chant in the Theravadin tradition:

“Buddho susuddho karuna mahannavo” (The Buddha, perfectly pure, with ocean-like compassion)

In the opening prayer The Buddha is referred to as having ocean-like compassion, and I think as you hear the presentations by the scientists, you'll realize that we have to act compassionately. And sometimes we can get paralyzed by the complexity and enormity of the ocean's story. The reality is we've already triggered the time bomb. We've already set off the fuse, and there are some things we cannot go back on, that we cannot stop.

Within the Buddhist tradition we always say, “the moment for enlightenment is only in the present. It can't be in the past and it can't be in the future.” It's only now can we understand the capacity for ourselves to act, to bring about change.

Today I'm speaking to you not actually as the Director from the Secretariat of the Indigenous Peoples of Africa Coordinating Committee (IPACC), that is my honorable work, but I'm also part of the International Network of Engaged Buddhists (INEB). Part of my reaction to all this information [about climate change] was to get involved in the International Union for the Conservation of Nature (IUCN) and create a specialist committee that deals with religious and spiritual involvement in biological and climate issues.

I'm not a scientist, I'm a social scientist. The story I'm going to try and recount to you is related to a feedback event after COP21 which was held in Sri Lanka where we were meeting with inter-religious networks. There on the top left [of the screen] you have President [Maithripala] Sirisena of Sri Lanka who is trying to earnestly have an island approach to climate change insecurity in a country that has just come out of a 30 year civil war and is just about to head into the nightmare of facing climate change. Our event involved a number of religious leaders, and included the Venerable Athuraliye Rathana who was one of the Buddhist delegates and Sri Lanka Parliamentarians at COP21.



If you have or have not followed COP21, the Paris Agreement was obviously our biggest breakthrough in 22 years in a cooperative agreement for the planet. The oceans were left out almost completely and it tells you how little understanding there is at the COP about the role of the oceans.

So I'm going to try and tell you a science story though I'm not a scientist. This presentation is one that I do for religious leaders to help them understand what we do regarding climate change, so I'm just touching a little bit more on some of the story that you've heard already. We look at global warming as our main concern, focusing on how atmospheric change is causing changes in terrestrial temperatures which is leading to ocean warming. However, the real issue for us to consider today is the absorption of the CO² by our oceans and it's shifting the oceans' chemistry to release ever greater amounts of acid into the system and thereby undermining one of the foundations of life on the planet. [Note: Ocean acidification is a normal process, so long as there is a normal amount of CO² in the atmosphere. With increasing levels of human-driven CO² emissions, the oceans must absorb this, triggering a chemical process that creates higher than normal levels of acidity.]

You've heard some of this stuff already, but the key thing to understand is that the ocean is a base. As we release excess carbon dioxide, the chemistry of all living things is changing that are in the ocean. Basically everything that forms a shell is having that shell burnt off it. Therefore everything has to reorganize its energy system to cope with this new context. Krill which is a foundation of the oceanic food chain is one of the example [of shell forming beings which are impacted by acidification]. Krill are almost invisible to our eye and yet its fate is changing the entire planet's lives.

So what happens: CO² interacts with water. Carbonic acid is released into the ocean. The effect is to increase acidity and decrease the alkalinity of the ocean's normal ph, which should be a stable base. The overall effect is the oceans across the planet are shifting from their more alkaline ph towards a more acidic character which is impacting on all the oceans. Again, pardon my science, and we have eminent scientists on the panel but we have to also have the courage to learn some of this stuff and share it with our congregations and the people who work with us.

I have a slide that shows how the ocean cannot stop absorbing the CO². We see here a 30% absorption of the CO² by the oceans. As we double, triple and quadruple atmospheric CO² that has to be absorbed by the ocean, we see a process that goes on for thousands of years and it's completely unstoppable. Once we release those emissions there's no other way for them to be absorbed other than by the massive oceanic lungs of the earth.

One of the things I've learned by coming to the COPs is that one billion people rely almost exclusively on marine protein. For three billion people, most of their livelihood is from ocean marine resources. I want to be blunt with you because that's part of our job as religious people: three billion people in today's population are going to run out of food....

I have not been to a single marine fishing community that has told me that their fish stocks have gone up. I've met lake-based people who are seeing their fish stocks go up. All ocean based people are seeing their fish stocks go down. In 2012, I helped coordinate a dialogue on fishing communities from ocean countries around the world [at the IUCN World Conservation Congress]. I was fascinated to hear from fishing people all over the world relate the same message as I hear in Cape Town – that where communities have not been involved in coastal conservation and ocean based conservation, they turn to narcotics as their primary secondary economy.

Just remember there is a massive social implication when fishing economies collapse. Our job as religious leaders is to understand the science, but also the enormous social consequences of what

we're looking at: No food, forced migration, complete restructuring of the economy, young people without jobs, and young people looking for some economic way to survive. The drug trade is an obvious option for some coastal communities. In South Africa, I live in the valley of Hout Bay behind Table Mountain. We've watched fish stocks collapse around Cape Town and now the Chinese gangs illegally export abalone which is poached from our coasts and they trade drugs to the young people. Our province is swamped with cheap synthetic drugs brought in for resale and use by impoverished coastal communities who have no other economy. The consequences are challenging.

If we do not urgently cut CO² emissions immediately, we risk a collapse of the marine ecosystem. If we trigger the collapse of the marine system, I do not see how it is possible for the human species to survive this process for all the reasons you know. It's not a pretty scenario. It's a stressful scenario to understand the consequences of our actions. When I first attended COP14 in Poznań, Poland, I was completely devastated by the science I heard. I realised that it doesn't help us to look the other way. Buddhism has taught me that the path to enlightenment starts when we accept the inherent suffering in life. That may sound grim, but it is through embracing truth that we find courage and wisdom. Our duty is to look directly at what the problem is and try to create some kind of social methodology

One of our conclusions in the Sri Lanka dialogue was to ask the government to dialogue and have an integrated approach. We cannot stop the acidification that is already going to happen, but we can look at as much reef protection as possible, stopping the dredging along the bottom of the oceans, protecting the ecosystems of the lagoons, doing as much mangrove restoration as possible, but also looking at terrestrial and coastal runoff to identify integrated ecosystem strategies and to involve the communities themselves in coming up with solutions.

Most of the religious leaders we are dealing with in Asia and Africa are already experiencing drought, flooding, increasing disease, food insecurities and forced migrations. Many of our religious leaders do not understand the underlying causes and struggle to grasp the scientific models which indicate a picture of where we are going.

When we went to Korea last year for the Interreligious Climate and Ecology (ICE) network congress in Seoul, we had fantastic participation by religious traditions from Korea and the region. They said to us, "Well, we don't experience climate change in Korea. It's not an issue on the agenda."

This is a society that lives substantially off of marine resources. Korea has one of the top research centers on ocean acidification and there was not a single religious leader who knew anything about ocean acidification. This tells you that there is a disconnect between the science community and the people of faith who provide wisdom and guidance.

I'm going to stop at this point. I feel like I've piled a lot of harsh and rough realities onto you, but I think as religious people the pain of the world is something with which we have to engage; something within which we have to find the light within that pain.

As I started with that chant: *Buddho susuddho karunamahannavo* (The Buddha, perfectly pure, with ocean-like compassion), if the Buddha is my messenger, telling me that compassion is the only way to live in this earth, I know that is also the message of Islam, Christianity, Judaism and Hinduism. We need to work as a team to have that compassion motivate us to change our behavior today.

Mr. Mark Bryant
Birmingham, UK

It's such an honor to be able to be on a panel with so many prestigious scientists and religious leaders and I'm proud to be able to represent the Islamic Foundation for Ecology and Environmental Sciences, or IFEES/Eco-Islam as it is more commonly known.



My name is Mark Bryant and I've been working with IFEES/Eco-Islam for nearly a decade now. In my day job, I am the development officer for a research center in Cardiff University called the "Center for Study of Islam in the UK" which takes a social science approach to studying the everyday life experiences of Muslims living in the UK. My work with the Islam UK Centre also involves raising cultural awareness training and inter-community cohesion. This ties in well with the environmental work that I do because I find that tackling climate change and other environmental challenges are excellent platforms for drawing together people of different faiths and backgrounds, as well as non-religious groups. I find the environment a powerful tool as people are becoming increasingly aware that we need to work together if humanity stands a chance.

I have my own long association with the sea. As a young scuba diving instructor, I worked for the Oceanography Research Institute based in Durban in South Africa.



I am grateful to my panelists who have so clearly outlined the science behind the plight of our oceans. The work I want to address ties in with points Nigel has made about the importance of working with local communities to protect the marine environment and in some way trying to slow down the damage until we start to do something more positive about climate change.

I want to speak to you now about some work that has been done by IFEES - EcoIslam that had a dramatic role in tackling the unsustainable destruction of coral reefs on Misali Island, near Pemba in the Zanzibar Islands on the east coast of Africa. This was achieved by initiating an attitude change through raising awareness amongst the predominately Muslim fisherman of their religious obligations to and for the environment. Fishermen had been dynamiting the reefs and that is a very destructive method of fishing. This project involved educating local Islamic leaders about the strong environmental ethic inherent in their faith. It's a concrete example of the ways in which IFEES (Eco-Islam) has been able to turn the spiritual into the practical.

When I do my own teaching to young Islamic people about the environment, I use a nice big blow up globe that is made from photographs that NASA has taken from space. This globe represents a picture closer to the reality of what our planet looks like from space – more than conventional globes with political divisions. I'm always struck by what a truly watery world we live on and how obvious it is to me that the effect of climate change on the planet is going to have a massive impact on our oceans.

Indeed, as we've learned here today, the reality is that our ocean ecosystems such as coral reefs are under increasing pressure from climate change. There's evidence that we raising sea levels,

changing the chemical make-up of the oceans, including acidification, reducing oxygen levels, and increasing ocean temperatures, etc. These in turn impact the balance of ocean ecosystems and in the case of coral reefs are leading to destructive impacts such as coral bleaching and the loss of biodiversity including the complete destruction of vast areas of coral. There is no future for coral reefs if we carry on in the way we are going.

As we've already heard, the negative effects of climate change on our ocean is compounded by human activities. These typically include pollution, over-fishing, habitat destruction, and so forth. These effects can manifest themselves at the local level in ways that will directly impact those coastal environments that local residents depend on for a healthy diet and a stable ocean environment.

I would like now to present a short video about the work that was done in Zanzibar among the local mosques. I put this forward as a case study of how working with local people and identifying the issues that impact their immediate lives can make a huge difference. This will also demonstrate how work like this can in turn lead to people at the local level to advocate for change in their behavior and with regional leaders and even national governors.

Click on the link below to see the video

An introduction to the study on Muslims and Ocean care
"Saving the Ocean: The Sacred Island" (30 second preview video)
<https://www.youtube.com/watch?v=O8JaoGtFaMs>

The Misali project: The Story of Islam, its Mosques and Oceans (47 minutes)
<https://www.youtube.com/watch?v=kgE1qWiabCg>

I hope that this video has demonstrated how effective it can be to illicit change when one makes the effort to tap into the motivations of the people that you're trying to reach. In the case of Misali Island, the vast majority of the population are of the Muslim faith. So, in this instance, it was faith which motivated the people and most profoundly influenced their change in attitude.

In the UK, research on Muslim communities has shown that they're more religiously motivated than comparable non-Muslim populations. In deed, it was best put by one of the fishermen in Misali who, when interviewed, reportedly said: "It is easy to ignore the government, but no one can break God's law."

I hope you see that I'm using a Muslim example here, but that this model could be carried over to other faiths and their congregations. To me the main message when taking a bottom up approach is to first take the time to understand what motivates the people to whom you are reaching out. Then identify how the changes to be made positively impact them in their own communities.

Sadly we have a long way to go. I was recently the guest of somebody relatively high in the Tanzanian government at his beach house. We were drinking coffee



and looking out over the ocean. It was a bit of an idyllic scene with islands dotted in a shimmering sea and an isolated man in a small dugout canoe who was fishing. Then, suddenly, my attention was taken by this large 'thud' that came over us from out at sea. I looked out and noticed how a big plume of white water came up dangerously close to the dugout canoe. It was obvious the guy was dynamite fishing.

Our host turned around to me and said, "here, you can see the extent of the problem we've got. This is within sight of the President's palace!" So, yes, there is indeed a long way to go.

Unlike the standard globes defined by borders and names the NASA globe I mentioned makes a powerful impression of the oneness of the ecosphere we call home. No one group or region working to improve the environment can improve their lot in isolation. Perhaps this is the greatest test of the worthiness of our species - to be seen in terms of how we treat one another and the world on which we live. The global nature of the issues makes it imperative that we work together to avert disaster. Different faiths often emphasize the importance of the individual been able to stand in front to their Maker and be judged. Maybe we will be asked by God or perhaps by history "how did you acquit yourselves as a species?"

As things stand at the moment this is this is a question I would not like to have to answer.

Thank you very much.

Action Recommendations

Fred Krueger

Thank you to each of the panelists. Next, we are now going to hear from each panelist again.

Each will provide solutions to the plight of the oceans. These recommendations will address three dimensions of the ocean problem: Recommendations on how you can be part of the solution, recommendations on how you and your country can be part of the solution, and perhaps most importantly for our present context, recommendations for the COP process itself.

Kyle Van Houtan

Thanks a lot Fred. So one of the things I wanted to say following up on my remarks earlier is that now that we are here in Marrakesh, the science has more of a seat at the table than it has ever before. And by just assuming that and incorporating that into the process so that it's science and businesses and policy solutions together, not just any one of them alone, I alluded to our Seafood Watch Program at Monterey Bay Aquarium and how that really uses those approaches. But my main point is that the ocean needs to be at the forefront in the discussion of the climate system itself and that it is the front line for impacts on climate change.

If you are not talking about the ocean, you are not talking about climate change. It is the fundamental driver, it is the heart of the climate system.

Charlie [Kennel] and I were talking last night at dinner about five key metrics of the ocean climate system that we should be paying attention to.

Charlie, do you want to present that?

Charlie Kennel

Thanks, Kyle. If I can beg your indulgence and that of the audience because I think I owe you an explanation of why I so easily yielded to Mr Krueger and his invitation to participate in this COP panel. And it was because of one of the most extraordinary scientific conferences that I have ever attended.



This was a conference organized by the Pontifical Academies of Natural and Social Sciences. That took place in May of 2014. As it turned out, it laid the technocratic foundations, if you will, of Pope Francis's great encyclical on climate. We didn't know that it would have that affect, but because he did, it was the most impactful scientific conference I had ever attended.

I think the most important thing is for me to relate to you how the discussion went. We were about 46 experts drawn from the natural sciences to the social sciences. We had seven Nobel Laureates in top economics, and we considered everything from climate change to ecological change to sustainability, to human trafficking, to climate displacement, the impacts of climate and environmental degradation on human beings. And we were each given an hour to give our speech, and we had a very long conference, very hard working. Then there was more than an hour or so of reaction from the audience. So it went very slowly. And the first two days what we found were all these great technocratic experts admitting at the end of the day, they had never seen a problem larger than this in their own field. The problems looked almost insurmountable. A wave of pessimism spread around the room. At that point then the mood changed. The mood change was started by a colleague of mine named Nancy Noltan and also Jeffrey Sachs, who was U.N. General Secretary Ban Ki-moon's climate adviser. Jeffrey got up and said, "You experts have no right to be pessimistic. You're all upset because you see all these big problems, and you can't solve them with the tools that you have in hand. But if you lose hope, then everyone else will. And you have a special capacity and that capacity is to identify national solutions in the small that look like they would work, and it's your job to try and make sure that they come to the attention of the world and that we can try to scale them up."

So the next phase of the conference, the next two days, were devoted to people talking about promising solutions: things that look like they might work if we could only do it. That went on for several days and the mood changed. Then a Sunday intervened and that gave us time for further thought. And then at that point they asked the last question: "If you postulated that you could be entirely successful with the scale up of these solutions they would go home with, would we solve the problem of the continuation of human existence and civilization on a planet that supports us?"

And the answer came out: "We're not sure. We're not sure." What else will be needed? And the answer was nothing that has been discussed at this conference will be required, but there will need to be a huge modification of the way human beings think about their relations to each other and also to the environment.

The general hypothesis was that societies that take care of their people will also take care of the environment. And if we don't do that, then we're all dead. And it was very compactly summarized by my close colleague, 99 year old [name obscured on tape at who just simply said, "It will take a miracle of love."

So that's why I'm here. As to indicators, the important issue is to make sure that climate remains in the forefront of thinking for those people who are developing, particularly here at COP, who are developing policies that hopefully can also develop globally. And also to keep climate in the forefront of the minds of the public. And for that you need very compact ways of expressing the changes that we're seeing. And the only indicator that science has invented yet that has had any potency with the public has just been a concept of the global average surface atmospheric temperature: "So, we're going to shoot for two degrees. We're going to promise to develop it, well, we won't stop there, we'll go to 1.5 [degrees C]."

We're going to blow through that in the next 10 years in reality, but we're not absolved of the problem by trying to go back to it. So we think about it in terms of temperature. But in fact the atmosphere only has 2% of the energy; 93% of the energy is going into the oceans and 50% of all the energy that human beings have put into the planetary system since 1860 came in the last 20 years. So

this shift in the understanding of the centrality of the oceans to forecasting the climate only came in the last 20 years. So now the issue is how to bring the oceans into the same forefront of thinking that influenced the direction of the negotiations and that will influence public thinking.

So I have one suggestion. If we had one indicator, I would take [ocean] surface temperature because it affects us all, but if we had two, then I would add in ocean heat content which we can now measure.

Then, if we had five [indicators] for that subset of the community at a slightly different level that will be responsible for saying to the world, “How are we doing in managing the oceans?” You, Mr. President, you need to know about temperature and heat content, but your science advisor needs to know how we’re doing with the oceans. And so here are the five that I think I remember:

- ◆ The sea surface temperature: easily measurable by continuous satellite measurements since about 1971.
- ◆ Ocean heat content, now reliably measured since about the year 2000.
- ◆ After that, sea level rise: it affects everybody, it’s different every place but global sea level rise is an index of the risk that coastal communities and fishing communities and so forth will face.
- ◆ Ocean acidification, one of the reasons that we have mentioned, and finally,
- ◆ Ocean oxygen content, because it’s that oxygen content that sustains the life in the ocean and in the coastal ocean where fishing communities need to live and to prevent the social destruction that will follow-that is following- from their collapse.

So I think there are at least five things that those of us who are concerned with the oceans need to tell the science advisors of the presidents of every country, and two things that we tell the presidents.

Kyle Van Houtan:

The reason that we wanted to give you five metrics is that every time you go to your physician, you walk in, they take your heart rate, take your blood pressure, take your temperature, they get you on a scale and take your weight, and they ask you how tall you are. So they take five measurements every time you go to the doctor, but so far we have one metric for climate change.

The planet is sick. We need real indicators. We need something more complex than just surface temperature. So if your physician after decades of evidence based medicine takes five things every time you go to the doctor, we should be measuring the climate system similarly and in a complex way with more than just surface temperature.

Richard Miller

Part of the big problem, and this was particularly driven in the United States, was the concern about domestic economics; that in no way could economic growth be restrained, even if only a few percentage points were involved. The whole discussion became about a cost- benefit analysis. This placed the whole discussion on an economic footing. The basic idea became that we can't mess with the economic system in any way. It can't be restrained in any way - even temporarily. Then what happened is that there was a push for this position: free market fundamentalists, I call them; neo-liberal capitalists. You couldn't do anything about the problem unless you had absolute scientific certitude. ...



This problem seems overwhelming you can think to give up, but one thing that I always find incredibly helpful is that in religions there is an ethic, a sense that I am responsible for myself towards the Transcendent. And so I have a responsibility to myself and to the world, and that is enough to live an ethical life and that is enough to live a decent life to put it that way.

Nigel Crawhall

We're running out of time now, but here are three suggestions:

One is get your own national religious counsels directly on your NDC planning committee. We've got now a number of African church counsels directly meeting on the planning for our national policies. So do that.

Next, educate your clergy and congregations on ocean science. They need it immediately. They're going to miss the point, they're going to miss what's going down the pipeline at them.

And you need an integrated ecosystems resilience plan. It's neither just oceans nor just terrestrial. It needs an integrated approach. Particularly when we have a coastal-terrestrial interface.

In terms of paralysis, the Buddha's first teaching was on suffering and his last one was on everyone must achieve enlightenment. If you want to get closer to God and closer to Nirvana, then you educate yourself on this and you educate the public and you act now, and that will get you to your religious goal as well as to a sustainable world.



Mark Bryant

Just prior to COP21 in Paris, Dr. Fazlun Khalid, Director of the International Foundation on Ecology and Environmental Science (IFEES – or EcoIslam), convened the drafting of the Islamic declaration on global climate change.

This document serves as an excellent example of what I feel should be done going forward. The declaration can be used, as the voice of the best religious and scholarly minds in Islamic Environmentalism, to put pressure on world leaders and religious leaders. In other words, it can be used in a top down approach. It does not end there however. Current work that has been done by IFEES/EcoIslam is working to build a tool kit around the Islamic Declaration to help religious leaders on the local level to teach people about their responsibility to the environment.

What we have there is the embodiment of the top down but also a bottom up approach. At the same time, as I've said, I think it's very important to look at what motivates people. There is a sense that one can trample over people by coming at them with what you believe are the solutions. You need to understand what they need, what they want and what they know. So, I believe one has to listen to people and understand their own situation. Although climate change is a global issue, to them it's not necessarily important. And until you can deal with their local issues you're going to have a problem getting people to understand the global implications.

One of the most important things in Islam, but which is not unique to Islam, is the importance of good manners. To me from, a faith perspective as a Muslim, I can only experience God through his creation. The only way I can reach God is through that which He has created. I believe to disrespect that creation is disrespecting God. I think environmental responsibility is good manners. Good manners to respect our planet that we have been given by whatever or whoever we feel has put us here.

I urge the Muslim community to move towards making climate change and damage to the environment more specifically implemented within the laws of our faith. At the same time, I urge that we work with all humans with whom we share this planet to ensure it a habitable world for generations to come.

Fred Krueger

Thank you very much. This has all been most insightful. We have enough time that we can take three quick questions without a pause in between, and then we'll have a wrap up from our panelists.

Any comments or questions that you'd like to make?



Question #1

Hi, I'm Selima. I'm from Rabat, Morocco, and I viewed some documentaries talking about how producing and eating meat around the world has a great impact on climate change. What do you think about that?

Why should we continue eating meat, killing animals and everything from the religious view? What do you think about this? Why wouldn't we stop doing that to fight climate change?

Question #2

Yes, Archbishop Seraphim from Zimbabwe.

Thank you very much. We know that the first local initiative for addressing climate change was presented in 1992 and there followed a recommendation in 1994. It's always the same story about how we address climate change that we are very late to take action. So until the 20th century, I don't like to use this terminology but this is the only way to describe these things, "the oceans were the common toilet for humanity." Now how do you think that we can mobilize our communities for stronger national legislation for protecting the oceans? Unless we have strong legislation on the national level, we cannot achieve international legislation or stop the pollution. Thank you.

Question #3

Hello, I'm Lindsay Cook from the Quaker United Nations office in Bonn, Germany. We did a two page summary of the 5th IPCC assessment report for the negotiators. We've been working with the IPCC to try to make it more personal, and my question for you is, can you recommend a booklet that you have seen which is very simple, very honest about the science that one could put through the door of their neighbor to help engage and then motivate them into action? That's what we're searching for, a really honest simple engagement of what's happening scientifically.



Fred Krueger

We have three questions to answer: How are we going to integrate concern for food and diet into religion as a means for addressing climate change; How can we mobilize our communities into greater respect for the oceans; and What tools do we have such as a booklet that can communicate the urgency of the ocean issue to the larger society?

Any comments?

Nigel Crawhall

This is a very simple one: on ocean acidification the IUCN has three different IUCN basic pamphlets for decision makers. They're all available online. You can google IUCN Ocean Acidification, you'll get all three reports and IUCN will provide them for free to your country. I've used them in Sri Lanka and South Africa. They're easy to read, good science, and you understand what the issues are about.

<https://www.iucn.org/content/ocean-acidification-facts-and-figures>

Charles Kennel

I'd like to take on the issue of how do we alert our government leaders to the issues in respect to the oceans. One of our graduate students who was here, Natalia Gallo, just completed a very interesting analysis that illuminates the difficulty of the problem of doing this. And what Natalia did was examine the 190 nationally defined contributions to greenhouse gas mitigation that was emitted in response to the Paris climate treaty. And she asked how many of these involve ocean actions; how many involve actions for mitigating climate change. And she found a very small minority of the INDC's actually considered the oceans in a serious way. The group that did so in a serious way won't surprise you, it is the small island nations. And we normally think that they are doing so because they are the most threatened, but it also turns out it is because of the law of the sea ...

Kyle Van Houtan

There is a religious basis for a call to mercy and that advocates vegetarianism. It largely talks about animal cruelty.

The next thing I'd say is the USDA produced a report in 2007-2008 on individual contributions to greenhouse gas emissions. It argues that food consumption may be your largest contribution to climate change because of everything that goes into it, particularly something like beef because we are sometimes feeding them fish, wild caught fish! We're also feeding them grains, a lot of water in there too, and a lot of agrochemicals go into that. So it's a great impact, probably your number one contribution to climate change globally.

Richard Miller

I would just add to that the one good thing about dealing with the food issue is not only it's important impact, but it's something you are constantly aware of. So while climate change seems something that is abstract and remote, if you can tie it educationally to the food you eat, then it's not remote. It becomes practice which is a very important thing.



Charles Kennel

I get this question quite frequently, and there are multiple causes to climate change of which methane emissions from ruminant animals is a significant factor, and it's something we can do, but it wouldn't solve the problem by itself. So while everybody would undertake that, the problem would still not be solved. But there's a greater impact of your doing it than just simply that, perhaps the technical impact is the smaller one. The personal witness and the communication of symbolic acts like that actually spreads human motivation quite a bit and the important thing is to get leaders and industries and so forth also to work very hard to reduce their emissions. And I think that the impact on human thinking of your so doing exceeds the impact of the directive impact on climate.

Fred Krueger

Thank you to all the panelists, and thank you for attending.

A special thank you to the organizational sponsors of this panel. These include the Earth Day Network, the National Religious Coalition on Creation Care; the Monterey Bay Aquarium; and the new Interfaith Oceans organization.

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// Applause //



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