

The Future Is Calling Us to Greatness

with Michael Dowd + 56 Experts



Why Science Literacy is Essential

with J. Marshall Shepherd

Big ideas from this session:

- Communicating the compelling science of climate in ways people can hear and take in
- The American Association for the Advancement of Science (AAAS) 'What We Know' campaign
- The difference between weather and climate — how we know and why this matters

Michael: Marshall, thank you so much for being a part of this conversation series, *The Future is Calling Us to Greatness*.

Marshall: Thank you for having me and I am happy to talk with you.

Michael: Cool. Could you please just begin by giving our listeners and viewers a sense of who you are and how you came to this whole topic and your current involvement?

Marshall: Sure. I am the director of the Atmospheric Sciences program at the University of Georgia. Prior to coming to the university, I was a scientist at NASA Goddard Space Flight Center for many years, working on missions to study planet earth, its weather and climate.

I recently had a stint as president of the American Meteorological Society, which is the largest and oldest professional society in the field of weather and climate related sciences, so I have been very much immersed in this topic of weather and climate and climate change. I've even published scholarly peer review journal articles on the topic, as well.

Michael: That's great. Fabulous. Nice, concise introduction. One of the reasons why I wanted you to be a part of this series is that I found that your voice in the AAAS "What We Know" Campaign, the little videos that you all did were just priceless. I recommend those to people all the time.

Could you say a little bit about the AAAS and that particular campaign, "What We Know?"

Marshall: Yeah. “What We Know,” I was invited to be a part of the AAAS Campaign during my tenure as AMS president and what I think is most valuable about that particular series is AAAS is the largest science professional society in the world and for them to weigh in conclusively on what we know about the climate change, human contributions and its impact on risk in our society, I think that was a game changer, it moved the meter.

They had some of the key scientists in our field, key spokesmen involved, so I was happy to be a part of it and I think I really advise everyone to take a look at the report that we produced, as well as some of the little video vignettes that are available on the website.

Michael: Yes, I completely agree. Connie read the whole report and I just read the summary. In fact, I also interviewed Susan Joy Hassel recently, who is just a fabulous science communicator.

Moving into this topic, *The Future is Calling Us to Greatness*, first of all, from your experience both in terms of the science of climate change and your involvement in the American Meteorological Association and weathers, the people who report on weather, some people aren't clear, what is the distinction between climate and weather? Can you say a little bit about that?

Marshall: Yeah. It's interesting how people confuse weather and climate all the time. I can't tell you how many times in the winter if it's snowing or cold, I'll say, what are you guys talking about, climate change or global warming? It's snowing and I say it's winter.

We will still have winter in a climate that is warmer, we will still have snow storms and cold days. Weather is, as I describe it, is your mood and climate is your personality, so on any given day you could be in a bad mood and that says nothing about your personality.

I think people confuse the notion of what weather and climate is and unfortunately, even some in our field do. There are some members of our community, particularly our broadcast meteorologist community that are somewhat skeptical and I think that's because weather on a day to day basis, have not perhaps in some of the curriculum that they've had for weather and meteorology course or had some of the background in climate.

I come out of a very traditional meteorology program at Florida State University, so I know the kind of curriculum and courses in a typical meteorology course and it really is somewhat truncated when we talk about climate science and climate modeling.

That is something that people are trying to fix and educate on, so I think we are making some progress.

Michael: That was what I was going to ask you is that in the last several years, I've begun to notice again from the outside some progress among weather forecasters.

I know Jennifer Francis did a presentation to a whole group of meteorological reporters, especially those in the broadcast media and there is often confusion and I wonder if you would be willing to say a little bit about we getting into the jet stream as one of the factors in this melting of the Arctic as contributing to this loopiness and that yes, polar vortexes this past winter, there were people saying, "How can this be climate change?"

If you could say a little bit about those patterns.

Marshall: Jennifer Francis and her colleagues published some work several years ago, suggesting that the jet stream is getting wavier and loopier because of melting in the Arctic.

I think it's plausible, I don't know if it's completely conclusive yet but I think there are more and more scholarly papers coming out to support their general conclusion, so the National Academies of Science recently released a report from a quick study that they organized on that very topic. So I think the science is heading in that direction.

The basic premise is as we melt more the Polar region, the Arctic region, the difference in temperature between the poles and equator is less. You have what we in science call less of a gradient, and so when you have less of a gradient, the wind, the jet stream is weaker and so you get more likely cycles of loopiness and so you can get stuck in these big high amplitude wave patterns that lead to extremes, like drought, flooding and alike.

The example is I like to use is imagine if you and I were holding two ends of a rope and we were pulling as strong as we could. The rope would be nice and taut, but if we suddenly released the slack on the rope, it would be a lot more loose and wavy, so that's generally what we are seeing as we see this Arctic amplification.

Michael: That's great, because a lot of people in the East who were freezing this past winter weren't aware that Alaska was baking.

Marshall: That's in California as well, not only baking, experiencing extreme drought, wildfires and I heard one person in California say, "We no longer have a fire season, it is year round."

I think these are the types of things happening right before our eyes and we have to look at the fact that it is probably not just natural variability. Indeed, our climate changes naturally. As skeptics like to tell me all the time, "I have three degrees in atmospheric sciences, I certainly know that," but what we also know is just like in major league baseball, homeruns vary

naturally as well but in the year of steroids, we saw longer homeruns and more homeruns. So you had a natural cycle with a human fingerprint on top of it.

Michael: Yes, that's great. Thanks. Marshall, could you a little bit about what are some of the standard questions or skepticism that you hear and what have you found to be the best grounded in science ways of responding to that that's not arrogant but that's also very forceful, that strong?

Marshall: Yes. I have a TEDx talk out there where I talk about slaying the climate zombie theories. I defined these zombie theories as any skeptic theories that just live on in blogs and social media and op-eds, even though the science has long disproven them.

Things like the fact that the sun is causing the changes in climate. We know sun contributes to climate but scientific literature has shown for many years that the magnitude of solar forcing or change that comes from the sun is not at the level of what we are experiencing.

The climate hasn't warmed since 1998 but we tend to not notice that there are several periods in the record where there were periods of pause or even decline but the overall trend has certainly been upward.

If we go into an El Nino in 2014, we may have the warmest year on record after seeing the warmest start to the 2014 on record. That's another one of the climate zombie theories, climate changes naturally. There are hosts that you guys just won't grant money to scientists if you keep this alive.

I tell you right away, I didn't go into science to get rich and in fact, the zeroes involved in our grants are much smaller than the zeroes involved in the companies and the industries that have a lot to lose, so there is a vested interest in the misinformation campaign.

Upton St-Clair said it best, "It is difficult to get a man to understand something when his salary depends on him not understanding it." If we internalize what he is saying there, I think you'll understand why there is a vested interest in misinforming on this topic, just as with the tobacco argument several years ago.

Michael: One of the books that fueled my – I don't know if I want to call it righteous rage but certainly anger in recent years was the book *Merchants of Doubt*, we're talking about some of the same PR companies and some of the same scientists that confused the issue for 50 years on tobacco are now for hire and are working to confuse the issue because of this vested interest, but we don't have 50 years in terms of climate.

It is not like we can afford to not take significant action systemically, not just changing the light bulbs. That's great that everybody can do but we also have to take systemic action.

Marshall: I completely agree and I wanted to add, there are really couple of really good websites out there, Skeptical Science and RealClimate.org. I believe Skeptical Science is SkepticalScience.com. These are sites that have very good, scientifically based refuting of those zombie theories and skeptic theories that are out there.

To answer your question earlier, to the general public, if I am walking through the mall or in a grocery store and someone asked me about, "Do you believe in climate change?" I say that's like asking me if I believe the sun is going to rise tomorrow or if the gravity exists. We are certainly not floating around. Then I give them a discussion in a way that they can consume.

I think one of the reasons we have lost some of the messaging on this is scientists, my colleagues, we tend to talk science in ways that we talk to each other or in our conferences, or in our science journals. My cousin at the mall doesn't understand what PDFs are, they think it's a file format.

We've got to bring the language down to a level they get and understand, so that's generally what I try to do.

Michael: That's great. As I think you know, Connie, my wife and I travel all over North America, speaking in churches and colleges, and that sort of thing. We are really focused on helping people see the inspiring side of what science, what an evidential worldview offers in ways that touch, move and inspire them to be of contribution to the future and live with greater integrity, and that sort of thing.

One of the things I found is that a lot of American at least, we haven't spoken too far beyond our borders, but there are a lot of Americans who seem to fall victim to what I would call two major myths that keep people from being in action.

One, myth of perpetual progress. There is no need for me to be involved if things are just going to keep getting better and better. Look at the last century. Then the other is those who get these big issues and for a variety of reasons, either secular or religious, the myth of the Apocalypse. There is no need for me to be involved because the whole is going to hell in a hand basket anyway.

Can you say a little bit about how you might respond to those two camps?

Marshall: Yes, it's interesting, as a person of faith I have given talks on climate change in my church or the church men's ministry retreats and things. I talk about the fact that if you look

at scripture, there is several places where the scripture says that we have dominion and we have a responsibility for stewardship of this planet.

From a faith based perspective, I don't think that god or a supreme eternal being left us to not be involved and it clear states it in the scripture that we should be involved. I often get the question or the comment, "It is arrogant to think that human beings can even change the climate or weather," but then I say we do it all the time.

Do you remember the ozone hole or the steep pollution in the summer time? What about the fact that in downtown Atlanta, it is much warmer than it is out in the rural suburbs. That's because of all the asphalt and concrete.

So, I try to frame this notion that due to technology, modernization and advancement, we certainly have ways that we can change our natural system, we see it all the time but I think it is certainly scriptural that we do not take a passive role. We have an obligation as stewards of this home that we are on right now.

Michael: One of the things that I have been finding pretty effective in speaking to religious audiences and secular groups too but especially religious audiences is that the real issue comes down to do you have an honorable or dishonorable or do we have an honorable or dishonorable relationship to what's inescapably real?

Certainly, whatever we mean by the word god, those of us who use god language, that reality can't be less than fully present in what's inescapably real, so do we have an honorable or dishonorable relationship to the future? Do we have an honorable or dishonorable relationship to nature?

I find that way in bypasses the standard critique, especially in more conservative circles. I am just wondering, I realize this isn't language that you necessarily use but I would love to hear your thoughts, if you have any, in terms of what would a truly honorable relationship to future generations, not just of humans but future generations of all species, what would that look like and how might that contrast with a dishonorable relationship to future generations of all species?

Marshall: I haven't given that perspective much thought but I would say is this, I often think about the notion of – I was watching some movie the other day and I think the earth was under attack and at that point, we quickly dissolved our borders, our enemies. We were all one species, if you will, trying to preserve the earth from this attack by these aliens. I think the movie was *Battleship* or something.

I think that the way I see the future of our planet is the same way. We have all of these corporate entities and various environmental groups and everyone says, "It's a liberal issue,

it's a conservative issue. It's a left-right issue." I often say it's a human issue. This is the only planet we have.

One of the stories I recently read said people have a hard time internalizing a planet or an earth that's just different from the one they are used to. We are already starting to see a different planet than we are used to, so we are feeling the brunt but I have two small kids and I worry about the earth that they will inherit here in 20, 30, 40 years or even their kids.

So I think we have to understand and see the collective challenge ahead of us, rather than seeing it as an Al Gore issue or John McCain issue or left-right, and all those crazy environmentalists.

I think when people start to see that this is a collective threat, the way they saw those aliens in *Battleship*, the movie, then I think we can make progress.

Michael: Yes, I agree. I've got a friend who is really into the whole ET phenomenon, I have not found any evidence compelling on that at all but I often say that I wish it was right, I hoped it was right because that would unite us as a species in ways that we are often not.

Marshall: We saw it a little bit in here in this country after 9-11, for example. We saw at that point everyone rallied together. There was no political party, no perspective, everyone just kind of came together and I see climate change and these issues as that type of an issue, if we can just remove the politics and remove the special interest, and I've actually seen movement on that.

President George W. Bush's financial treasury secretary recently wrote a very interesting op-ed, talking about the notion that this is not a Democratic issue, we as Republicans have to step to the plate. I think when you start hearing people like Admiral David Tittley, a very well-respected military man and also seeing our top brass at the Pentagon saying this is a threat, these are issues that real but they also speak to those who perhaps skew a bit more conservative in our society as well.

I think the more and more that type of thing starts to happen, I think we can make progress.

Michael: I agree. Getting beyond this polarized left-right debate I think is vital. One of my heroes in this movement is Bob Inglis, because I love his way of saying that what we most need to do is put all the costs and all the fuels, remove all the subsidies and then watch the free market enterprise solve the energy and climate issue.

Marshall: Let me just say this on politics. I am often time talking with skeptics. People always bring up Al Gore. For the record, I've published over 70 peer-reviewed journal articles

and I have yet to cite Al Gore, so it's not an issue of this is Al Gore's movement or anything to that matter but it's interesting that people will still bring that up to me in debates.

Even most recently in Las Vegas, I think the Hartland Institute had a conference out there and that was one of their big talking points, apparently from things I have been reading on social media.

Michael: You mentioned that you've got two young kids. I'd love to hear, because the title of this conversation series is *The Future is Calling Us to Greatness*, I keep a picture of my three and a half year-old granddaughter by my computer because she is the embodiment of the future calling me to greatness.

What I mean by greatness is of service to the future. Could you say a little bit about how as a father thinking about your children and grandchildren perhaps eventually, how does that motivate you and what are some other things that wake you up inspired to do the work that you do on a daily basis?

Marshall: What motivates me is the fact that I just don't want them to have to deal with a world where they have to worry about the spectre of dengue fever. That was just something foreign to us but that might be a reality in the world that they live in or a world where they are having to import corn and grain, in the way that we do oil now.

These are just issues that will perhaps stress the type of society that they have when they are my age. I don't want to leave that burden on them. I think that the things that we are doing now will see the society that they have in 20, 30 years.

So as an honorable parent and as well as an honorable citizen, it is my obligation and our roles as parents is to raise our children the best we can, give them the best opportunities they can, and so part of that is also leaving them with the best planet that we can, as well.

That's really what motivates me more than anything and thankfully, they get it even at 7 and 10 years old. Kids are not polluted by politics or ideology. They notice things that are going around them. They are in Girl Scouts, Boy Scouts. They are studying these types of things and they are not polluted with the ideology out there, so that is even inspiring and refreshing in itself.

Michael: That's great. Marshall, Connie, my wife, as a science writer, her focus this year has been this whole system migration that because of the rapidity, how fast climate is changing and projected to change over the course of the next 100 years and more that many species of trees are the most vulnerable.

Wind dispersed, no problem, but species that depend upon animals to move their seeds and of course the generation time, it takes 30 years typically for another tree to be bearing fruit or seed, so we really need to assist so many species in moving north due to climate change. That has been her passion, climate, trees and legacies she's been focusing on.

One of the questions that she's invited me to ask all of the participants in this series, and it is a little off the wall but it's really fun to hear responses and I purposely don't tell you about it ahead of time just so that you can think about it.

If you were to invite any three people throughout all of human history to a dinner party, where all four of you are together or if you were to simply have a beer, cup of coffee or a meal with each person one on one, who would those three people be and why would you choose them?

Marshall: That's a tough question but I think one of them have to be Bell Washington Carver, just because as a young child, I was inspired by what he did with peanuts. He was a very interesting scientist and he did so much with just this little peanut and that really inspired me in terms of some of my early science career.

I think it has broader implications too because he was working at the time as an African-American scientist, not with the resources that I have at my disposal now and certainly with different perspectives and viewpoints on who he was as a person, much less as a scientist, yet he's overcome and still succeeded.

I certainly would love to have a conversation with him because I think there are lessons in his struggle that perhaps could be applied to this whole climate change movement as well, or discussion or science and the challenges there.

Otherwise, actually I haven't given it much thought. I certainly would love to pick the brain of people like Martin Luther King. I have always been very inspired by John F. Kennedy. I think he was a visionary and I think in times like we are in today, I think we need a visionary.

As I mentioned, I spent 12 years of my career at NASA. I recently visited the Kennedy Space Center down in Florida and just watching his challenge to go to the moon, I am sure people disagreed with that and said, "Why are we going to invest dollars when we have things we are struggling with at home?" but if you look at the emergence of the space program and what that effort did, we are sitting here using technology that benefited from that vision right now and others things all around us.

I think those are types of people that really stimulate my curiosity from past times.

Michael: That's great. Just speaking a little bit more personally, I am just curious and I am sure our viewers and listeners would be curious too, what was it that woke you up or inspired you? When did you decide – if you could share a little personal story – how did you decide to get into science and find the inspiration there?

Marshall: I was always into science as a young kid but a bee sting is what got me into meteorology to be honest with you. I was catching bees in my car as a young kid and got stung and I wanted to be an etymologist at that time studying insects that was my career goal.

I got stung and found out I was deadly allergic to bee stings, so I said okay, plan B. I was always interested in weather, so I did a science project, can a 6th grader predict the weather and I made weather instruments from things around the house and did a little weather observation and modeling in my community that did really well at the Science Fair in Georgia and the rest was history.

I knew I wanted to be a meteorologist but I didn't want to be a weather forecaster on TV, I was more interested in the science, the how and why. So, interestingly enough, me and a colleague, Fred Bortz, the physicist, actually just wrote a book on my sixth grade science project experience for kids.

If you want to learn about weather and have elementary age kids or grand kids, *Dr. Fred's Weather Watch*, take a look at it because we really tried to convey what I experienced as a sixth grader in that book.

Michael: *Dr. Fred's Weather Watch*.

Marshall: Yes.

Michael: Fred Bortz and Marshall Shepherd. It's available on Amazon and [Barnes&Noble.com](https://www.barnesandnoble.com).

Marshall: Fabulous and I forgot to write down, what were those other two websites that you said were particularly good in responding to skeptics and that sort of thing?

Michael: Yes. [SkepticalScience.com](https://www.skepticalscience.com), I believe or maybe dot org, and [RealClimate.org](https://www.RealClimate.org). Those are science sites run by science colleagues, climate scientists and Skeptical Science actually has the top 30 zombie theories or skeptic arguments that you often hear and it lays out on different websites how they have been debunked or why they are not credible.

I often call upon those and I deal with a little of some of them in my TEDx talk as well, *Slaying the Climate Zombies*, but not at the depth of those particular websites.

That's certainly an easy title to remember, Slaying the Climate Zombies. Connie and I watched that and it is excellent. Anybody watching this conversation, do put that in the Google and watch that TED talk, it is great.

Marshall, could you say just a little bit about what you see that's being done? Again, individuals are doing things all over and that is inspiring but what are some of the things that you see us doing systemically that you think are a good thing that should be done more of, perhaps faster but good things, and what are the things that you perhaps don't see being done yet but really need to?

When you look two, three, four, or five years or ten years out, if you were to write a prescription for society, what would most significantly or fast, quickly move us in the right direction? What would you offer?

Marshall: It may be a different answer than what you are expecting but the thing that really I focus on and I think will help move us forward is upping just general science literacy of the public, because right now much of our public is at about an eighth grade science level of understanding and so things like the fact that it can get cold in a desert at night is counterintuitive to them or the fact that in winter time, actually the earth is closer to the sun here in the northern hemisphere, believe it or not.

When science literacy is low, it causes people to fall for anything in terms of the messaging that's out there and frankly also some of these people with eighth grade science literacy are getting elected into positions.

There was an elected official I believe in Kentucky that recently said the earth and Mars have the exact same temperature, even though Mars doesn't burn coal. That's scary and that person is an elected official, and we know that the temperature of Mars averages about minus 81, whereas we are at about 57 degrees.

So if we can increase science literacy, we can arm the public with information that they can see or hear things like that are – in some cases elected official are saying – and they immediately dismiss them. So, I think that's one thing and I think there are efforts ongoing to do that.

Another thing, I just spent a week at a conference in Atlanta, talking about the urban heat and the fact that cities are warming even fast than surrounding areas, and we are in an urbanized society now. By 2025, 65 percent of the world's population will live in cities. So the urban heat and added to greenhouse gas more will be an issue.

I think one of the things that needs to happen is that cities can do things right now with green facing, high albedo surfaces, etc. to cool cities and that will actually have more of an immediate impact in the short term than a climate action plan that might reduce the city's carbon footprint. So while the carbon action plan or climate action plan needs to be done, there are these in cities other things that are causing problems in terms of the climate of the earth with heat stress, morbidity, flooding, so these are things that I would like to see us think more about too, some of these things that we can do on a short scale.

As you eluded to, the large scales changes that will thwart global climate change have to come at the large, national and international level in terms of policy changes. That is going to take a bit more time, I fear.

Michael: I fear, as well. One of the things that I am trying to do now is to encourage people to simply learn more about the issue. There is different ways and I know you don't go into policy issues but one of the things that I am always encouraging people to do is to learn more about Bob Inglis's work, for example, Energy Enterprise, to learn more about how we can put a fair price.

The idea that we can continue to allow the free or subsidized polluting of the commons, we just have to cease that at some point and anything that we could do to do that I think is a good thing.

Marshall: Sure.

Michael: Marshall, if you were speaking to a young person who is just overwhelmed, they are scared, frankly. They are looking at the science, they are looking at some of the people who are predicting doom and gloom but you don't even have to go that far to nonetheless get deeply concerned.

What would you say to a late teenager or 20-something that would be inspiring, and then if you have any resources that you are aware of. So these are actually two questions. One is what would you say to a young person? The second question is if I am 35, 45 or 50, or 60 years old and I want to up my science literacy, if I am watching this conversation and I think, he is right, I really need to up my own science literacy, are there any resources that you find particularly helpful?

Marshall: Sure. What I would tell to the young 17-year old, the 21-year old just out of college is they are in a Twitter age, as am I. My Twitter handle is @DrShepherd2013, if anyone wants to follow me on Twitter, but what I would tell those kids is go viral.

There is a lot of information that goes viral. If you have a passion, if you have knowledge about climate science or science, don't just keep that with you. The more you spread the word in the ways that you all communicate in your generation, the better.

There is a lot of polluted information out there in social media and in other circles. I often say we've got to find the signal and all of the noise. So, the generation of the 17 to 25-year old, they are very savvy and using emerging technology and social media. They've got to find ways to use that for good on this topic.

For the more seasoned citizen, I would suggest websites like Climate Central. I am on the board of Climate Central. It's a very fact-based organization that's putting out information on climate in a very objective way, we are non-biased.

Also, actually with [Climate.gov](https://climate.gov), which is the National Oceanic and Atmosphere Administration's climate portal, it is very informative as well. I would also ask the citizen, when they listen to someone on the news or in an op-ed that's writing on that topic, do the research and find out if that person is actually an expert on that topic, has published research on that topic and how they are funded.

You will be surprised at what you might find. I have a PhD but if I go on *CNN* and I am talking about the latest methods on cooling nuclear reactors, I am not credible even though I can say I am Dr. Marshall Shepherd. I see that quite a bit in the realm of science, particularly in climate science.

A lot of people are speaking but they haven't even published a paper on that topic or really don't know much about it. They are just talking party lines.

Michael: Yes. A book I read I think two summers ago by Shawn Lawrence Otto, the book is titled *Fool Me Twice: Fighting the Assault on Science in America*, and it was very interesting because I read the book and then I got together with Shawn afterwards and I have been in communication with him quite a few times since, what I found so valuable about that book is that in the same way that religious people, not just Muslims but many different religious traditions, they really react very strongly, negatively, if you diss or disrespect their scriptures, what they hold as holy.

I find myself feeling the same way. For me, I hold evidence as holy. For me evidence, I actually consider it modern day scripture or divine revelation that every fact discovered by a scientist is reality, god revealing truth.

I find this sort of rage but again, it gets back what you were really inviting us all to do is to up our science literacy, not just on the topic of climate but is there any other resources that you found useful and that you would recommend in terms of how someone can become just more science literate in general?

Marshall: Yeah, I think there aren't that many resources. I think there is bits and pieces there but I like to recommend things that are in collective spots, because you are right, it's not just climate science. People have very limited backgrounds on things like statistics and probabilities.

I find for example that when I say there is an 80 percent chance of rain, people will probably grab their umbrella but they really don't know what that means, they just think it's a chance of rain when it actually means 80 percent of the area.

So, I think things like probability, statistics and just basic math, these are things there are sources out there. I can't really cite any collective sources but I think the more important point that I am trying to convey is even if you don't understand something and I see this often, even if it's beyond your grasp of understanding, don't dismiss it because you don't understand it, call it a hoax or over-simplify down to your level of understanding and then get it completely wrong.

That's what I see quite a bit of in our society, as we just saw with the example of Mars and earth supposedly being the same temperatures, it's just not true.

Michael: Thank you. The last question I just want to is again countering a common misperception in America. Sometimes, I think it's caused by certain media outlets that have a strong vested interest in or supported by the fossil fuel industry, there is many other psychological reasons I think. People often won't let in bad news or scary news if they can't see some way through.

A poll I read not long ago said that something like 40 percent of Americans believe that the science community itself is divided on the issue of climate. You and I both know that's not the case, so if you could just say a little bit about that.

Marshall: In AAAS, what we know it cites a figure that 97 percent of climate scientists are in consensus. Now, if you throw in scientists from all fields, whether they are experts in climate or not, you might get a lower number and I think that's what people cite but if I want to have heart surgery or to have a heart procedure done I am going to trust what the cardiologists say.

So, I think that people who are studying science of climate, if you look at Naomi Oreskes's work who published the book *Merchants of Doubt*, she also has some scholarly papers where she looked into the peer reviewed scientific literature and found very little in the published peer reviewed science literature refuting the consensus position on climate change.

Yes, if you look at the science there is a clear consensus and there is a very strong agreement but if you listen to Twitter or the op-eds that are written, I can't help the public for

feeling that way. That's what they see, particularly those who spend their day consuming only one source of information and I think you know what I mean there.

Michael: I do. My mother consumes that source, too. Marshall, thank you so much. Is there any last word of inspiration or just anything, anything you would like to say? Again, I am interviewing a whole wide range of activists, scientists and people involved in this whole theme of mostly climate but really some peak oil theorists as well and I am trying to focus on the inspiring side, the sense that the past that if we have a deep time perspective, we recognize that the past – again, speaking metaphorically, but it's a useful way to think – the past is rooting for us and the future is calling us to greatness.

Anything you want to say in conclusion on this theme?

Marshall: I think we are generally smart people and a smart society, and I think technology and science has actually provided, afforded us with the ability to address challenges that arise.

I think that we do have to get our head out of the sand, I think we've got to move beyond the partisanship of science and move towards a collective understanding that certain things are collective threats to the human species in general, but I think we will.

I sense that we are seeing. One of the things that is really optimistic is I've traveled around the world and much of the rest of the world is already there, I think the United States is a bit behind but we are getting there. Some of the rhetoric, some of just conversations that I have with people, they are seeing that things are different now.

They are asking questions like, "What can I do? What can we do?" and the more we get those types of questions, I think it bodes very well for the future.

Michael: Are there any major reports? Like when you look at the next year or two out, what's coming down the pipe that most of us may not be aware of?

Marshall: We had report-itis in 2014 because we did have the IPCC come out, as well as the National Climate Assessment and even the AAAS report as well. I think this was the year for the major climate reports. I think there will be minor reports coming out of various organizations, professional societies, etc. but places like Climate Central and the Climate.gov website, they are generally right on top of those types of new reports, as they come.

I personally don't know of anything that's coming in the next two years that I am involved with or aware of.

Michael: Thanks. Marshall, thank you so much for taking the time to be a part of this series and thank you for your ongoing work in educating the public, not just about climate but really

about science and encouraging all of us to become more literate in science and then apply that to our lives, so thank you.

Marshall: Absolutely. Thank you for having me and this is right on time because my battery is going low.

Michael: Okay, good.

Marshall: Okay, take care.

Michael: Thanks Marshall. Bye-bye.