



The Encyclical Laudato Si' and the current horizons of scientific research

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Your Excellences, Cardinals, and Chancellor Sorondo, thank you very much for this opportunity to talk about the scientific impact of Laudato Si. I shall show you, by some examples; it is already having a profound impact on our thinking about how to solve the climate change problem.

Let me just give you a brief introduction: the earth goes through cold and warm periods, and I'm showing you the graph for the last 50 thousand years. Over the last 6 thousands years, we are in a warm epoch, it is called Holocene, and people point this out to point that the earth's climate is already changing, why should we worry about the small change. The reason that scientists like me are worried about this small change is that we are already in a warm epoch, stable climate, and now we are pushing it beyond the scale, and if this continues over the next few several decades, we will be pushing the climate system to a scale we have not seen, at least in the last 50 to 100 thousand years, and how large is that climate change in the future? We are expecting the system to go beyond 1.5 degree warming in fifteen years, this is from the pre-industrial, the planet is already warmer by 1 degree. In less than 35 years, we are going to go past 2 degree warming, and so on and so forth, so the question is, how is that climate going to look in just 15 to 30 years? The reason we can't see so clearly how large or how catastrophic that is going to be, is that we're seeing massive feedbacks. I'm showing you data on the arctic sea ice from 1980 to 2012, in less than 22 years, you see a large gaping hole showing up in the bottom one, so as the sea ice melts, it lets the sunlight go to that darker ocean, and we are seeing enormous heating of the ocean. It is so large that it is equalling to 250 billion tonnes of carbon dioxide, that heating of that massive amount is already occurring, and I'm just giving you one example. There are several such feedbacks happening and we don't know how deep that cliff is when we pass 2 degrees, so it is in this context we should judge the Paris agreement and the role religion can play.

Influenced tremendously by my participation in this Pontifical Academy in the last 10 years, I see an alliance between science policy and religion forming to protect the environment. In a sense, this alliance is being forged by the church, with the two Pontifical Academies. It is my personal hope, and now I must say that many scientists are coming around to this view, that this alliance will play a major, if not a dominant role in solving the climate change problem. Of course we need the Paris agreement and others, but what we lack is public support for the sort of massive action we need to stop this warming. So I said it was my experience of the Academy, I think the most singular meeting I have seen in my ten years, is this meeting organised by this Academy of Science with the top glaciologists, and physicists and chemists in the world. In our concluding statement: "if we want justice and peace we must protect the habitat that sustains us. The believers among us ask God to grant us this wish". I have never seen such a statement in a scientific document, so in that sense it just changed my view.

Moving on, to me as a scientist, the chapter which really made me fall off my chair is the chapter on integral ecology. It talks about that we have to understand the interaction between natural systems and social systems. By the way, none of our models have this interaction. This December, a union of 50,000 scientists, meeting in San Francisco, there we are going to talk about how do we put the social systems in our models. So that's a tremendous impact and just to quote there from Laudato Si; "The cry of the earth should be heard with the cry of the poor". To me, if I need to pick one phrase from Laudato Si, it would be that.

Let me give you an example: if you look at the disparity which Laudato Si talks about, a billion of us, we live as if there is an unlimited access to fossil fuels, we contribute over 60% to the climate pollution. Compare that with the poorest three billion who lack access to modern fuels, even for cooking. Their contribution to climate pollution is 6% or less, but we all know that when what we are experiencing, when droughts, floods and heat waves intensify, and they will, these three billion have no way to cope with it, so they are innocent bystanders to the wealthy 1 billion's unsustainable consumption. So after that plenary meeting we held a joint meeting between the Academy of Sciences and the Academy of Social Sciences; there are many Nobel laureates here and at that meeting, and they all tell me that it is the most historic meeting they have ever attended, and see the conclusion we came to: "drive for growth in profits and GDP have encourage behaviour that is at odds with

pursuit of the common good. Sustainable relationship with nature requires change in attitude toward nature and towards each other". We can't leave the three billion, and say, they are just living in villages, lets keep going. That's what we implied there, and contrast that with what the encyclical brilliantly in chapter three identifies the fundamental problem. It talks about technology and the economy, there is a nexus between them, and the technology is such that it assume infinite natural resources, infinite fossil fuels, infinite minerals, infinite everything and that Economies coupled with growth, and the wealth it creates is only for a few. This is what Laudato Si says.

It then suggests a solution which is captured in the next one: it says we need a paradigm shift to the stewardship paradigm, we become good stewards of the planet, and technology recommends a circular model that recycles, nothing is thrown away and the economy puts forth work for everyone, this is the primary goal, and then it asks for, in terms of well, not only GDP but also natural resources and social capital. In our Academy meeting in 2014, our economists said that when we look at wealth we have to include natural capital and Laudato Si adds social capital to that. This, I think, would form a tremendous scientific paradigm to understand the interaction between humanity and nature and this was a quotation from an article Chancellor Sorondo and I wrote. I'm showing these to indicate to you how science is now embracing religion to solve this climate change problem. They invited us to write this so what we say there is that we need to bring in other religions, and other moral and political leaders and Laudato Si already calls for that. In its preface it brilliantly says this encyclical is for believers and non believers alike, so it's not singling out one community.

So I want to conclude, and this is about COP-22, my personal proposal that is consistent with what we have heard already, we focus on the intergenerational equity, the three billion we have left behind and so there are two steps we can do: we need to bring immediate relief to climate change. The Paris agreement focuses excellently on carbon dioxide, but if you mitigate emissions of super pollutants, these are a thousand to two thousands times more potent than carbon dioxide, we have an opportunity to cut the projected warming in the next few decades by about 50%, just p the poor some time to cope with it, and I'm pleased to say that last week our Californian governor Jerry Brown already passed a law into bill. The second is we have got to provide access to clean energy to the bottom three billion. Many talk about this, but it is still in the talking stage, and we have costed this, and it comes to \$80 per person among the top one billion, so it is not a huge amount we need, and it will also cut down the air emissions and it will save at a minimum two million lives per year lost to all kinds of air pollution. I hope through the church's work, we can push this agenda forward and get that support. As far as providing them clean energy access, the technology is there. We do not have to invent anything new.

So let me conclude with this need for an alliance between science policy and religion. Laudato Si already says that a new dialogue which includes everyone, and it says that the solution we all know, just not technological solution, we need a societal transformation. Just to give an indication how it has already impacted scientific thinking, last months after Laudato Si, I led a team of 50 science professors from the University of California and we published ten solutions, and if you see our solutions number two and three, it says societal transformation is fundamental. That is what is in Laudato Si, and what was in a series of meetings held at the Academy. The second is what I call 'cradle to grave education to be good stewards of the planet', and I think, again in this Academy last year, academician Pierre Léna organised a terrific meeting on education. The third is my personal reason why I think this alliance is key to solving the climate problem: we need massive public support to take drastic actions to the extent climate change has become a huge moral, ethical issue because of this impact of this three billion who had little to do with this, and its impact on generations yet to be born, so it is much easier to discuss these moral and ethical issues in a religious setting. I also want to mention one thing my college Jeff Myers has said: we need to reimagine the role of religion in the service of human species, humanity, but human species, in the service of life itself, this also was clearly prescribed in Laudato Si. Thank you very much.