

# The Great Simplification

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Nate Hagens (00:00:02):

You're listening to The Great Simplification. I'm Nate Hagens. On this show we describe how energy, the economy, the environment and human behavior all fit together and what it might mean for our future. By sharing insights from global thinkers, we hope to inform and inspire more humans to play emergent roles in the coming Great Simplification.

(00:00:28):

Today's guest is recently retired professor of Environmental Science and Technology, Mario Giampietro, from the Catalan Institution for Research and Advanced Studies in Barcelona, Spain. I knew of Mario's work back when I was getting my PhD on an acronym called MuSIASEM, which stands for Multiscale Integrated Analysis of Societal and Ecosystem Metabolism. Mario has an academic background in chemistry, biology and social sciences and has authored or co-authored over 100 academic articles and written many books on sustainability, energy analysis and agriculture, including *The Biofuel Delusion* and *Resource Accounting for Sustainability Assessment*. I have found that biophysical analyst, perhaps especially Spanish ones, are able to speak truth to power and I think you'll see what I mean by that in this conversation with Dr. Mario Giampietro. Saludos, Mario, good to see you.

Mario Giampietro (00:01:53):

Hi, nice being here with you.

Nate Hagens (00:01:56):

Congratulations on your recent retirement.

Mario Giampietro (00:01:59):

It's a big event.

Nate Hagens (00:02:02):

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So I am now blessed having this podcast that suddenly I get to have conversations with all the people that 15 years ago when I was getting my PhD were the rock stars in the fields of biophysical economics, including you. You were one of the icons in the field and here we are.

Mario Giampietro (00:02:30):

Yeah, we're not too many, let's put it this way.

Nate Hagens (00:02:34):

Yeah, there's not too many. That's true, but I have had quite a few of them on my podcast. So let me ask you, why is it there are so many Spanish people who are energy and collapse aware of systems versus the total global population or is that just my small sample size?

Mario Giampietro (00:02:56):

No, it is true that especially via the lead that they have a big group called G... Because this is a Spanish acronym, it is about energy and development, sustainability, something like that. They're the first one making accounting of the resource use and this resonates with Barcelona where I am located, where they had basically the first big group of ecological economists which were Joan Martinez Alier... Even though Martinez Alier and the group here, they didn't do much of accounting. They were making the economic part of the story, the importance of considering the... But they were not getting into the... But this led to sensibility in Spain with the work on Naredo, Naredo was another important person that works a lot. They had Margalef and ecology, who was a sort of Odum. So there was a sort of background that made possible to have this school evaluated. As a matter of fact, they came three or four weeks ago in Barcelona because we're trying to check the common point of our approach and their approach.

(00:04:31):

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But then there are people really buying farms, small farms because they are waiting for the catastrophe of implosion. It's kind of like the billionaire in the United States they are waiting for the collapse.

Nate Hagens (00:04:50):

It's a lot of people are now aware of this. The world has caught up to the biophysical story that you've been saying for decades. So let's get into your work. One of your main projects has been an acronym MuSIASEM, I'm not sure how to pronounce it but it stands for Multi-Scale Integrated Analysis of Societal and Ecosystem Metabolism. So I know you're just a retired professor and you're used to teaching PhD students, but can you briefly explain to our non-academic viewers for the most part what this work really is about?

Mario Giampietro (00:05:31):

I think that this is something different. No, really different in the sense it's an attempt to use complexity to do quantitative analysis. At the moment it is embarrassing, people doing quantitative analysis use differential equation like Newton, like 100 years ago. And what is the problem with differential equation? You have only one timescale. Okay, so let's imagine you are comparing the evolution of China and Europe over 50 years. If you're using data of one year, the one using in economic models, whatever, you can not get changes like population structure. In China now they have 60% of adult because of one child policy and we have 40% of adults. They work 2,500 hours per worker per year, we work 1,700. So basically China has almost the double of our work per capita in the economy than us. Unbeatable. No, you cannot do anything against this.

(00:06:39):

Of course in 40 years they will become all retirees and it'll be a major problem. And probably they will not accept to work 2,500 hours per year, then you cannot see these things if you are using one scale only. Okay, if I see with a microscope on your face, I cannot see your nose no matter what. You know that. We have to learn how to combine different scales and different narrative and

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different representation, like the one in medicine. In medicine you have the x-ray, you have MRI, you have the blood test, you have a lot of different tests. Nobody would think about mixing all these numbers in a single mega equation with 1000 variables to describe how you are, no? So what this MuSIASEM does is relational analysis. You have one lens at which you see something. Then with another lens you see how the liver works, in another you see the whole body how you are doing.

(00:07:50):

Then you establish a relation between the characteristic of one view to another to another. And this is possible, you can say, "If this is in this way on the border there has to be another way for this other piece." So we have like four different lenses. One lens looks at the effective interaction, the daily life of a household. So the household you may have with kids, retired of all the adults and they have to do things. So you can describe how much time, energy, technology is allocated. So you have the total for the household and now it's allocated across the different things. Then you can redo the same at the whole household sector and you will have an election. And then you see the desirability of your state. Then you have another level we call macro scope and then you have the whole economy.

(00:08:58):

So the household sector is a part of the paid work sector in which you have agriculture and for each of these you can go smaller and smaller using the... And for each of these you can see how much electricity, fuel, but then you are building a Sudoku because the electricity of all the sector must be total within and across. Then we have another is called mesoscope, that is how much you're importing because if we are not considering the import, people are just wasting time. When you say, "We are dematerializing in Europe," no, we are using, embodied in what we import, 140 million workers equivalent. So our workforce is embodying what we import. We import 70% of the feed. We import 85% of the energy. So they are talking about, "We are dematerializing," but within the

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border of the country not including. And the last one is the microscope is the primary flows outside, inside what we are getting from the nature and dumping in nature.

(00:10:15):

And this can be though done at the local level. So you can have the environmental pressure that will be how much supply capacity, how much sink capacity you need from nature and compare it with the characteristic of the ecological fund that you are affecting and then you can see the impact. So what happens is you have all these four things. No, we did that. We have been working now for 30 years. We have data. What is fantastic is that you have benchmarks. So I can say, "Give me a population, okay. How old is this urban/rural? How many are retired?" blah blah blah. And then you say, "Okay, you want healthcare, what type of healthcare do you want? The type of healthcare of Sweden or Norway or Romania? Or?" And then you start putting together the piece and you can say, "Okay, if you do this at this level of analysis, you will need these type of things."

(00:11:08):

How are you producing them, are you importing or not? If you are not importing, how are you producing? What are the technological that we call the sequential pathway, extraction, and blah blah blah, till you do it and then you can calculate. And then how does it work? This you can do one diagnostic to see how your country is different from another. So you can really see they are using more electricity because they have hydro. Or they are using more of this in Poland because they have coal. You can explain the differences and then you can run scenarios. What if we want to cut 70% of... Yes, let me see how you do it because you have things to do. You have a list of things to do and let me see how you can cut 70% of emission.

(00:12:01):

So it is very open in the sense we call it a deliberation support because it's not even a decision support, it's bringing you up in the sense you start looking at

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the fact that there are a lot of implications, a lot of concerns and how to... I cannot do in English, prioritize concern unless this is...

Nate Hagens (00:12:28):

So in order to make good decisions we have to understand the problem first?

Mario Giampietro (00:12:33):

Yeah, that we don't.

Nate Hagens (00:12:34):

Yeah, right.

Mario Giampietro (00:12:38):

At the moment we are operating on policy ledger, the circular economy. Circular economy is against the law of thermodynamics. We are making fun of the people that were believing to the flat earth but believing the circular economy is the same level. This is against the law of thermodynamics. We are a metabolic system. This is the system. We must take from our environment and dump into the environment. It is against anything known that we can close the loop inside.

Nate Hagens (00:13:11):

So can you expand on that, why do you use the word metabolism in your core title of your work?

Mario Giampietro (00:13:18):

Because again this will go to the heart of energetics. Transformation of energy really, really belong to the complexity issue. First of all, energy doesn't exist. It's a semantic concept. You have plenty of forms of energy but electricity is not energy for your car or for a person. We cannot eat electricity and the same way ham is food for us but not for an Islamic person. So there is no energy-

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Nate Hagens (00:14:00):

Nor for a car.

Mario Giampietro (00:14:01):

Nor for a car. So first of all there is no energy. And second, when you get to the issue of how to use and transform energy, you have to always do a process of auto catalysis. It is not input, output, it is chicken, egg. Okay, let's give you an example, a cow goes to a pasture to get energy. First of all, you start with you must have energy. The cow has to move muscle and see the things and know how to eat grass. Then you get grass, grass is not energy for a cow, it's the primary energy sources. It's only after you are digesting this you get carbohydrate and other things and move the cow. So in this very simple example, you have three type of energy end users, the mix of energy carrier: information, and technology, the muscle. Second, a primary energy like for us would be oil, coal, or wind, or sun.

(00:15:06):

And then you have energy carrier: electricity, fuel. These things are different. Old people that do analysis to energy: energy in, energy out. And you do not have these numbers, these numbers do not exist. They make sense only if you are analyzing them inside an auto catalytic loop. How much you need to do that? Do you have enough capital or technology to do it? How much... This type is totally missing and I think this has been the big disaster of energy analysis in the '70s and '80s. I'm old enough to remember I was in the States and the dream of net energy analysis was the EROI part. In reality, it is not that simple because in the energy general investment you don't have a size, first of all, then you have a flow that is not fun.

(00:16:08):

Then there is no distinction between primary resources and energy carrier because if you have an output larger than an input someone has to pay, that is the primary resources is not included in the EROI analysis. So what I'm saying...

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Okay, I don't want to get technical because maybe people cannot understand, what I'm saying is that energetics is the ultimate complexity problem and unfortunately this has been totally missed because when in the '80s the energy analysts white flagged saying we are not producing anything useful, there are papers on Science saying, "Is net energy of any use?" Then the economic energy analysts get in that they do not have any idea what they're talking about and then they are running the show now.

Nate Hagens (00:17:04):

So on this question then your point is that comparing energy is not only apples and oranges but it's apples and oranges and pears and plums and kumquats and-

Mario Giampietro (00:17:18):

Within the process of either selling it or either eating them, there is a larger context.

Nate Hagens (00:17:24):

Yeah, no I understand and agree with that, which means that not only are you talking about complexity theory but this is a complex thing to understand and explain to people. And society doesn't like complex things because we just like to parse things into dollars or euros and we make decisions on that and this is not easy to do with what you just said.

Mario Giampietro (00:17:52):

It is something that should start in school, it should start in school.

Nate Hagens (00:17:57):

How would we do that?

Mario Giampietro (00:18:00):



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I think that they should change the way we teach things at school because all the energetics, metabolism, these are all... Let alone the discussion on multiple scales, this idea that we have only one scale is absurd, no? Depending on, again, if I'm using a microscope, if I'm using a telescope, if I use my eye, if I use x-ray, I see different things and which one is the real one? Por favor? Pardon? All are real. It depends on how I am looking at them. So this is something that deserves a reflection, let's put it this way.

Nate Hagens (00:18:42):

I totally agree, but before we do that we have to even teach young people what energy is and why it's important to our lives. We're still not even doing that.

Mario Giampietro (00:18:52):

No, but we are victim of the success of economics. This is the point, we are intoxicated. Because if you imagine we have a discipline, I work with Kozo Mayumi which is a professor of economics. So I respect the category of what I'm saying. But what I'm saying is that economics assume that absolute scarcity is impossible because it works with price. If you have price there is a modest scarcity, so you can use technology to trade the things. But if you have absolute scarcity, you no longer have price, you don't have a market, you have either war or solidarity but you don't have market. So we are using a science, they assume the absolute scarcity is impossible to study absolute scarcity, how to avoid it. Guys, no, economics is not capable of comparing the size of economic process to the size of ecological process.

Nate Hagens (00:20:07):

Would that ever change?

Mario Giampietro (00:20:09):

I don't know, you know the normal science and post-normal science. Now when you have a big success, discipline became normal. Nobody questions the

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assumption. So the physicist give us the atomic bomb, so whatever they say now that before the big bang they was nodding that with the boss on our life will change drama. Everyone believes it even though maybe it is not that clear and economics made possible for us to create money out of nothing, the financial operation and this is our life standard depend on this. So nobody now is questioning economics. This is a discipline that delivered to society.

Nate Hagens (00:20:56):

Well, the discipline of economics was born on the backs of the carbon pulse and ironically was unaware of the carbon pulse.

Mario Giampietro (00:21:06):

Yeah, maybe when the pulse will be over we will have a different economics. I'm not saying that all economics is useless. Fantastic and moreover economics did a huge contribution to ecological economics. What I'm saying is that as long as we have the American dream as the myth that give us a group identity, there is nothing we can do. Unless we get into a real discussion of the fact that the American dream that 10 billion people on this planet will have the same living standard of United States and everyone believe it is what keeps together, glues together people, until we believe this there is nothing we can do and we will remain trapped into economic narratives.

Nate Hagens (00:22:02):

Getting back to my question, what is the relevance and importance of the word metabolism in your acronym, does society have a metabolism and why is that important?

Mario Giampietro (00:22:15):

Of course, the society has a metabolism. The metabolism implied that there is an auto catalysis. The system is capable of getting the energy and the resources that it is consuming to express function. It's made of different parts so

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you have multi-scale things. You have the liver is operating as a liver but at the same time is a part of the larger system. And moreover in that case you have a group auto catalysis if the different parts work for each other. Look, what we do in the society, you have that the household is reproducing human activity. Then you have the agriculture is producing energy for the humans, the endosomatic energy. Mining is producing energy material for the exosomatic parts, the machines, the infrastructure. Then you have the manufacturing that is building the exosomatic device. And then you have the service sector that is generating institution and taking care of the human fund. So you have five organs.

(00:23:34):

I'm telling you, we don't have time, this is exactly like the structure of an ecosystem. So if you're using the standard, the Latin talking of rational analysis, you can define that a society is expressing a metabolic pattern exactly like an organism even though people believe that this is absurd... It is.

Nate Hagens (00:24:02):

So in my own life and behaviors I have difficulty choosing things to override my own metabolism. How do societies choose when we have a metabolism or don't we choose?

Mario Giampietro (00:24:20):

Look, the society has a list of things to do and then you can have the list from statistics. Statistics is the state of how a society learn how to describe itself. So what does the society do? There is a part that produces humans' household and the part that stabilizes the economic process. Then within the economic process you have agriculture that does food. The agriculture is divided in animal production. Every time you go down there are the final cause, if you're using relational analysis, why you have to do what you are doing. Then of course the society can decide to change the type of final cause, that we became vegetarian we don't produce animals anymore. Or can decide to change the priority over the different things because unfortunately people do not know how

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things work. But in a society 100% of the time, 92% goes in not working. So we are operating all the society with 8% of our time, 700 hours per capita per year. If you divide the hours of work by the population, it depends on where you are, it could be 750, 800.

Nate Hagens (00:25:48):

And that includes babies and old people and-

Mario Giampietro (00:25:50):

No, the babies are on the other, I'm telling you the working time in the paperwork.

Nate Hagens (00:25:55):

Okay.

Mario Giampietro (00:25:55):

Okay, so then 60% of this go into service, you see? Then you don't have time to do real things. This is why we are importing and making the things because for the energy, all the energy that we consume in one year is generated by eight hours of work, I repeat, eight hours of work.

Nate Hagens (00:26:16):

Because of our subsidy from fossil hydrocarbons?

Mario Giampietro (00:26:19):

Yeah, of course, the idea is that you divide the energy consumption of a country by the hours of work in the energy sector. Eight hours. If we had the fossil energy like Saudi Arabia, we have to work more because we have to do the extraction, the refining and things. In Europe we are just getting energy carriers and we print money to pay for it and of course we may... And the same for agriculture, this is why you have tractors. Why we have industrial agriculture is because you are producing all the food that you are eating in a year with 40

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hours in Europe, in the states, much less. In the states they are producing like tons of crops per hour. This is unthinkable talking about a circular economy if you were serious about respecting the natural cycles. I'm telling you the people do not know we are intoxicated by money. We cannot appreciate the importance of biophysical constraints.

Nate Hagens (00:27:31):

Which is why I invited you to be a guest on this show because you've been telling this story for 40 years and very few people are listening. But now suddenly with Ukraine and Russia and now recently Israel and people are worried about Iran and the Straits of Hormuz. People are starting to understand that money and technology are not the primary drivers. That it's ecosystems and energy and materials that underpin all this money and stuff. So your ideas still might germinate and bear fruit.

Mario Giampietro (00:28:10):

Let's hope.

Nate Hagens (00:28:11):

Yeah, so you also work on complexity, emergence, and adaptive cycles, which is another topic that people don't know much about and I've not had anyone on the show talk about adaptive cycles. Can you briefly explain what an adaptive cycle is and why those are relevant to our current global situation?

Mario Giampietro (00:28:38):

Yeah, the adaptive cycle the idea comes from Buzz Holling who is a theoretical ecologist. And I would say that theoretical ecology is by far the discipline that got into the evolution because everyone talks about evolution but... And then this require a little bit to get into complexity, a complex adaptive system is not only a material thing, that it is not only tangible part That it also is not tangible, how do you say, semiotic, let's put it this way, part. So this was the

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Simon, the father of complexity, the first one, was saying, "Okay, we are in a situation which are recipes. They're making processes. They're making recipes." Then PIGO gene started saying there are genetic information that can make an organism or phenotype that make genetic information. So basically you have... And then this has been extended to human society by Luhmann the famous sociologist, German sociologist, he said what is a society? It's a bunch of communications. They're used to stabilize a bunch of interactions. They're used to stabilize communication.

(00:29:59):

We can go into it just five seconds using bio-semiotic, is in reality you have on the top the meaning of things, types, the communication and the bottom you have token instances of things. So basically you have the semiotic up here so you have represent, it will be the communication, actor, there will be interaction and then you have interpretation. So in the cycle you are interpreting your action, moving from instance to type to have better communication. And then, having better communication, you interpret the better communication to have better interaction and then you move from type to instance. So you have that this cycle is a continuous resonance between type and instance, instance and type. Margalef is a famous ecologist in Spain, called it the ecosystem send message to themselves into the future in the sense you are giving a genotype in a specific area, they do something, they organize an ecosystem. In this organization some phenotypes are eliminated and some are amplified.

(00:31:18):

This change the genotype and this goes on and on. And this could be for human system the same, you are defining social role and institution. Then you get into a social practice, what we do. And then the genius of Luhmann is that then you have a psychic structure that define whether or not you like it. And then it is the psychic structure that on the loop define what communication you like or not. The cancel culture or the political process basically. So you can apply, it's exactly the same for ecosystem and genetic information and for

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societies. But again Nate, these things in school are not... So basically if you start discussing this type of narrative, people really look at you like if you are coming from another planet. But these things have been out for 50 years, what I'm saying is that this is not normal. We have a sort of filter of whatever is uncomfortable. The famous uncomfortable knowledge is kept out of our educational system, is kept out of our discussion of sustainability because I cannot believe that I have to explain auto-catalytic loop or bio-semiotic. This is 50-years-old.

(00:32:51):

It's not that it is a new theory that came out last year, but nobody knows. If you talk about [inaudible], whatever other legends... That's completely ridiculous. Everyone knows, no?

Nate Hagens (00:33:09):

Well, let's move to that. How has our modern societies a preference for reductionism, especially in the academy and science exacerbated the issue that you just outlined, the complexity of working with different scales on what's really important to our society? How has reductionism led us astray from what we really need to focus on?

Mario Giampietro (00:33:41):

Yeah, I believe that this came exactly from this adaptive cycle in the sense you need a society as a very strong group identity, it is very motivated. So what motivated the western civilization? The American dream and the Cartesian dream. The Cartesian dream is whatever we want to do, we do it. It's just a matter of more technology, more innovation, we do it. So this gives a feeling to people that we are in the right society, we are in the right group identity and that of course because of oil this made it possible to have a better standard of living. So basically everyone perceived the American dream and the Cartesian dream as where to go.

(00:34:33):

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What happened was that at this point this was so strong that whatever was going against... You remember the Limits to Growth, something like that, whatever was going against this was considered as dangerous for society. Let's make a step backward. Why do we have science? We have science to get new knowledge, but we have science to stabilize the establishment. Before the French Revolution it's you have to pay taxes. Why? Because the king say so. Why does the king know? Because God points to the king. After the French Revolution it's you have to pay tax. Why? Because the government say. Why does the government know? Because it followed the scientific advice. So we use science to stabilize the establishment. So at this point it is very delicate that... I'm telling you we can go... I retired, I got a big project from the European Union and we were looking at the different narratives used in the sustainability and you're looking one by one, it's all bullshit.

(00:35:48):

They don't make any sense. They are not possible. And then of course when we were discussing because it was European Union that was paying, so they said, "Of course I had people that told me that we cannot go on public saying we know all these are bullshit. We don't have the slightest idea what to do." This is not acceptable in... So what do we have? We have Greta that says that we should stop fossil energy. Okay guys, how do you feed the cities if we stop to use fossil energy. There is a total divide among what people want to do and the idea that you have to have how these will be possible. And these cannot be discussed because as soon as whoever does, not big models, back on the envelope calculation you see that what they are talking about is not possible.

Nate Hagens (00:36:47):

I agree with that. And I think you're pointing out two things though, science still does exist because you are a scientist and you are modeling or have modeled in your career the biophysical reality. It's just the political and economic filter of what science is accepted is limiting science's positive contribution to our future, could I say it that way?



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Mario Giampietro (00:37:17):

Yeah, but in a way this is a tragedy because even my students that have been with me like years as PhD, if they want to get a job they have to go in a project on circular economy. If they want to be published, you have to say yes because, I'm old enough, I remember that at the beginning when I was getting called for research was, we have a problem, do we have an idea? Okay, no, we want to implement this solution can you provide how 10 years later? 10 years later, we are implementing this, can you prove that we are right? Now the science, the way it gets funded changed dramatically. Now basically we are just supporting the claim of the government or the establishment or was, we no longer have a room for maneuvering because I have a model proving that it's not possible. You will not get money no matter what.

Nate Hagens (00:38:17):

Do you have a hope or a fear that once the European Union or the global governments of the world figure out the situation we're in, that you'll be called out of retirement to work with people at Valladolid and other biophysical researchers who actually understand what's going on?

Mario Giampietro (00:38:41):

Look, I believe that they more or less know that it's not working. This is what we got 7.5 million and that probably was to try to check a plan B, to see where the weakness was. No, we were given money to check the credibility of the narrative used for the policy. So it is obvious that they have a sort of inch that... How do you say in English, they feel-

Nate Hagens (00:39:08):

An inkling, yeah.

Mario Giampietro (00:39:09):

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That there is something that is not good. Again, I believe that it is difficult for them, not European Union, all the governments. And I have a fantastic piece of a comedian, the old State of the Union or the old president from the last one to Nixon and before, about the fact that they will fix the energy problems in five years.

Nate Hagens (00:39:41):

Yeah, no, no, no. It's Jon Stewart Daily Show clip. Yeah, I show that to my students.

Mario Giampietro (00:39:46):

It is not Europe. The legitimacy of modern states is based on the fact that they know what they're doing, that they are doing scientific evidence policy.

Nate Hagens (00:40:07):

But my question is there are enough people in the world, it's not a lot but it's still plenty that are working on biophysically informed analysis. That although there are no solutions that are politically acceptable with our current situation, there are a lot of responses and good research and good relevant questions that academic minded people can be working on. So how do we build that bridge or do you think that's too far of a gap to ever bridge?

Mario Giampietro (00:40:44):

Look, I believe that, and this is one of your favorite I really liked a lot, that ecological economics and all that, we didn't manage to generate an alternative narrative to economics to explain the interaction of humans, the environment interactions. As a matter of fact, this bioeconomics narrative is very, very nice about the fact that you have both the institution social practices. The constraints coming from the environment and the constraints coming from the psychic structure and this is how the system goes to an adaptive cycle. It is much better to frame a discussion of sustainability but if you are within the

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economic narrative, you are expressing everything in price and things, there is nothing you can do. You may have information coming from different place but it doesn't fit in the larger narrative. We need a larger narrative in which everyone is feeling comfortable and otherwise you cannot communicate. This is [inaudible], in order to communicate you must have the semi identity or cultural identity or group identity on the person with which whom you are talking.

(00:42:10):

And then we the biophysical analysts are autistic. We are not capable of communicating because we do not share the same group identity with those that are talking within economic narratives. So it is-

Nate Hagens (00:42:27):

Nor the same language.

Mario Giampietro (00:42:28):

Yeah, it is not language, it is more and there is more. So this is a problem because unless we remove the intoxication with economic talking or things, because when you you're using a word, the word comes with a lot of baggage. Look for example, in my institute... It is no longer my institute, I used to until last week, I have degrowth people. I have the headquarter of the degrowth on this planet, but still what do they say? Degrowth. So this is an economic narrative. Either degrow, agrow, postgrow, is the same. You are using an economic narrative. No, we have to do something else. We have to have an economy of care. We have to care for each other. As long as you mentioned the word "growth," then it is very difficult to think about doing things in a different way.

Nate Hagens (00:43:37):

So like Giorgos Kallis and them are in your institute?

Mario Giampietro (00:43:41):

He used to be my neighbor.

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Nate Hagens (00:43:44):

Oh, okay. I didn't connect you were in the same university. Obviously that makes sense.

Mario Giampietro (00:43:50):

We were in the same building.

Nate Hagens (00:43:51):

Same building. And Julia as well?

Mario Giampietro (00:43:54):

Julia, what's the last name?

Nate Hagens (00:43:57):

Steinberger?

Mario Giampietro (00:44:03):

Yeah, she's not in the institute-

Nate Hagens (00:44:03):

Oh, maybe she collaborates with Giorgos? So does this get at something in your work that you call quantitative storytelling?

Mario Giampietro (00:44:09):

Yes, this is the thing that we propose because when you're doing something very complex there is no way that you can have the ultimate uncontested proof.

They said that the smoking was not dangerous for the health for 40 years, The Merchants of Doubt. In a sense you can if you go on a scientific based evidence, you pay scientists to prove that the results are not accurate and it is not enough it is impossible to win. So we say, okay, when we are talking about these things, we propose that we are having narratives. We have narratives and

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we put numbers to prove them. I'll give you an example, now in Europe we do recycle cooked oil. Okay, recycled cooked oil, if you go around you're going to Stockholm, this bus goes on recycled cooked oil, we save the planet, blah blah blah. It's okay, but how much cooked oil are we having like five liters per capita per year.

(00:45:16):

Okay, we can collect two. When collecting and transforming became one oil biodiesel liter per person per year. And we are consuming 1000 between gasoline. So what we are talking about and we have a lot of cooked oil and why is that? Because there is a fraud they are importing palm oil. So they are actually cutting the forest in Indonesia to have the bus in Stockholm run. And what happened? We don't need models. We don't need no models, it is a narrative. The narrative is this, there is not enough, look, these numbers are this. That's it, let's do something else. We don't need an accurate number with two decimals. So we use this in the sense we tell a different story. And the quality of the story is whether you feel that this is convincing or then you can check on your own the numbers because it's totally transparent.

(00:46:22):

It's not about doing these models that... And then we call it quantitative storytelling. And I think that is to me especially for having a deliberation with people, is because if you would force all these people to have magic models that they'll decarbonize Europe in 20 years of the model you see, the model knows, you can imagine in 20 years you have to build thousands of millions of windmill to new factories all in 10 years and the reduction go down. We should have a peak of emission incredibly high but all the scenarios go down. So if rather than having mysterious models, we will force people to tell their story and they put numbers on the story, it will be easier to check the quality of the discussion.

Nate Hagens (00:47:16):

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So then you would need focus groups of people to hear the stories.

Mario Giampietro (00:47:20):

Yeah, there is a lot of participatory process. You may have even citizen juries even better, like in the trial with people say in favor, people against.

Nate Hagens (00:47:32):

But then you get to the human behavior section and authority bias and all those other things because your quantitative storytelling may be absolutely true, but it's also threatening and a little scary and there's no easy answers. So people will reject hearing it even if it's accurate.

Mario Giampietro (00:47:52):

Yeah, but it's already happening, Nate, let's face it. People do not want to hear about it. It's much easier... It is... I don't know, of course especially for kids, I'm old so kids are young people, 25 years, it is difficult because it's their future and they want to do but they are totally disempowered. If I am in a society in which technical innovation and market business models define my future, I do not play any role. And this is why they are taking pictures of themselves just to prove that they are alive, they are part of the story because they are not part of the story. They are not building the common identity, young people are completely out and this is a tragedy.

Nate Hagens (00:48:46):

Yeah. No, I agree with that. So it is my belief that one of the most underutilized resources in our world today is young people, smart civic-minded graduate students at universities around the world who can contribute meaningful and relevant research to this what I call the human predicament. Except as you said earlier, most universities are reductionist, energy blind, under the throttle of economic theory. So as a recently retired, very recently, last week, biophysically literate professor, can you suggest to any university people listening to this

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program, what are some questions or core areas of research should these young humans who are in their early 20s or mid 20s and agree with what you're saying, what are some good areas of research that we need orders of magnitude more people looking at?

Mario Giampietro (00:49:59):

There's for sure energetics, the thermodynamic and non equilibrium, all the discussion of the similar system, complex system theory, hierarchy theory, the implication of scale because we imagine that it is only one scale and it is not. All what we are talking about there are scales that go from molecules, chemical reaction to geologically, whatever. We don't have a slightest idea. You have different disciplines that do not talk to each other because they see different things. So they are living in parallel universes. So what I'm saying, and bio-semiotic for instance, this is unbelievable how powerful it is.

Nate Hagens (00:50:44):

I'm sorry to interrupt, can you define bio-semiotics because I'm not even sure what that means?

Mario Giampietro (00:50:49):

Because at the beginning we had the semiotic, the use of sign, the interpretation of sign in the language, blah blah blah. And then at a certain point comes this bio-semiotic, 1907, really very old Von Uexkull. And then this was about how the living system managed to generate sign and use sign to reproduce itself. And then this is a general process that is happening on all levels. And then this is where you get into the adaptive cycle. As soon as you have a sign, you have a type that is not material and why this is-

Nate Hagens (00:51:39):

Sign, S-I-G-N?

Mario Giampietro (00:51:42):

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Sign, yeah, something that means something. So in reality you have an information carrier that will be DNA, a word, whatever, which has a meaning. So the issue is how to generate the meaning. You can generate the meaning if you have what is called a functional cycle, something that depend on interpreting right design in order to survive. And basically this is the way life works and how a human system works and so on is exactly the same. It is pretty much established but again in scientific terms they are on the border because they're not considerate. I went to Copenhagen to the latest gathering and it was like a reporter, this kind of... They're not considerate like serious scientists and nobody knows why, because in my view it's probably the most interesting field at the moment.

(00:52:42):

And then what is very good about biosemiotic is that basically you can see that you have values that came from passion, from feeling and then you get norms again from the rational part. And then you cannot imagine to run a system only on rational behavior more than norms. You have to include how the formation of values is influencing that. So in my view this is much, much richer than what we have at the moment. At the moment we have really something sad, economics is sad. You don't have a room for a feeling, you don't have a room for environment, really it is not getting anywhere.

Nate Hagens (00:53:30):

So in a perfect world just speculate and imagine that universities around the world start thinking about scale, have a lot more questions and research on energetics and bio-semiotics and thermodynamics and we start to create a better map of our reality. What could universities look like in 10 or 20 or 30 years and what contribution could they make to a peak and descent of the carbon pulse?

Mario Giampietro (00:54:07):



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But I believe that what they could do is to involve the society in the formation of new group identity because again, this is not about technology or business model, it's about forming a new group identity. We have to move from producing and consuming goods and services to taking care of ourselves and nature. So people have to understand this, has to feel, this is the point, it's not about explaining it's about explaining this on issues that are relevant for their life in the way that they start feeling it. So this is the issue because otherwise it remains on the top. It's like the... I have a lot of students that are, I would say vegetarian, eating vegetables coming from Peru in refrigerator airplanes. But then they have three mobile phones, they go they vacation on skiing on St Moritz. And there are symbolic things that I don't think that being vegetarian at the moment is a threat from the banking system.

(00:55:29):

People do not make the connection because moreover if you frame the discussion we need more technical innovation and more business models, you are saying we need to give more money to the banks. I'm not sure that this is the right strategy to get out of the trouble where we are now, but it seems that nobody makes these connections at this moment.

Nate Hagens (00:55:55):

So at the core of what you just said is we're not going to change until we feel the need to change. And hopefully that can be scientifically and biophysically informed or maybe there are some break glass plans from universities like your own lying around.

Mario Giampietro (00:56:15):

Where the disciplines start including in the discussion that there is this aspect, the feeling and the role of emotions because otherwise I don't think that nothing happen with just information. And moreover you are telling them there is no problem, we can do it. Yes, we can, more technology and then you say you have to radically change your behavior. Why should I? Because it is... But the

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study is so absurd at the moment, we are doing innovation to stabilize the social practice. It's ridiculous, imagine we have cars. Now we don't want to have cars anymore, we have hundreds of millions of cars. Now what do we do? Hundred of millions of cars electric, Jesus, abolish the private property of cars and then they must share otherwise they're going to go. This is change of social practice. No, they changed technology to keep the same social practice. This is a famous Italian novel, the Gattopardo, that after the revolution say, "But you changed everything so everything remained the same." It's exactly the plan now, we are doing all these things to keep the status quo.

Nate Hagens (00:57:34):

So you mentioned that Giorgos who is a friend of mine was in your same building. What do you think about, you mentioned it briefly before but what do you think about the degrowth, post-growth growth debate beyond they're all using the terms of economics. Do you have an opinion?

Mario Giampietro (00:57:57):

Degrowth, I believe it was a provocation basically. And of course it was not very easy to communicate. As a matter of fact, since they moved from degrowth to post-growth, they got money. They got their millions and immediately as soon as they move from degrowth to post-growth because post-growth at least is more reasonable in the sense, because if you do degrowth you say more or less of the same. We do not want the same, we want something else. So to me, post-growth is much better. As a matter of fact, I told them several times to go to post-growth. Again, I see that there is not an alternative in terms of grand narrative about how humans organize themselves and how they interact with the environment, let alone considering the fact that different societies are competing with each other to train. So the economic narrative is not good. We have to look for something else where to accommodate the discussion.

(00:59:18):

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And it is crucial the role of feeling because if you have a description of how a society works without explicitly having a place where human emotion, feeling, aspiration, dreams, taboo, fears are acting, that is basically where they affect policy, political processes, we do not have it there is completely separated. No? It's irrational behavior.

Nate Hagens (00:59:51):

A friend of mine who's been on this program a few times, Nora Bateson, lives in Sweden. She does these things called warm data labs, which is to present a scientific overview of some problem but then integrate it with the feelings and responses of the people in the room. And it's iterative and emergent and that's kind of what you're talking about in a way.

Mario Giampietro (01:00:19):

Yeah, that's good. The importance is that the data coming about the sustainability should be integrated on different aspects. Like again, the medicine, how is your liver, you must have information about all your organs before making a discussion of what we do. Because if you do this only one part of the story is much better than nothing of course, but it would be important to have a narrative that can get all the aspects of the problem together. And then on that you are asking the reaction of the people.

Nate Hagens (01:00:54):

Could this happen at universities that you have representatives from different disciplines and departments meet once a week, and have this warm data discussion about how their discipline contributes to this larger backdrop or is it just-

Mario Giampietro (01:01:11):

They should do that. The only problem, look, I tried to do that in Naples about waste management. So we had a fantastic model on the different network of

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process. And then of course as soon as you do that you show that what the politicians say is not possible, either one party or another. So what happened, when we arrived to the fact that we want to have an open meeting at the university with the activists, the concerned citizens, and the politicians, and the people running the waste management system, and the politicians didn't want to come because of course you have to have... This is the problem, we are getting in a serious problem, the future doesn't exist. The future is created by us. So when you have a problem you cannot have them map what to do, the target things because you have to discuss with people what are viable, desirable, feasible things.

(01:02:25):

In general, parties are defining themselves on solutions. So this makes it difficult to have a deliberation because you should say, okay, in what the party A is saying there are good ideas but this is rubbish, and what party B is saying there are good ideas, this is rubbish. And parties, maybe at least in Naples when we tried, were not willing to do that. We were really unlucky because they had the election in less than one year, so it was a delicate moment. But this is the point in general, at the moment we have roadmaps. Everyone has roadmaps, nobody checked whether these roadmaps are possible and what they mean for other people. So rather than starting with roadmaps, we should have some sort of platform in which people could deliberate about pros and cons or different solutions. And I believe that this should be done by university. Yes, or it could be done by government or whoever of the different possible actors.

Nate Hagens (01:03:33):

I'm trying to do it in a small way with this podcast I think as you were speaking. So let me ask you a hard question, but with an academic link. So you use in your MuSIASEM, multi-scale integrated analysis, but it's very difficult for humans to optimize more than one variable at a time. And a lot of people now are concerned about keeping GDP growing, but we're also concerned about

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equality and we're also concerned about emissions and carbon. So is it possible to optimize more than one variable at one time?

Mario Giampietro (01:04:23):

The easy answer is no. As a matter of fact, I am in Barcelona because I came here in '92 because they had a good center for multi-criteria analysis. So I was trying to link multi-criteria analysis of my type of models because every time you change something in the lens, you change one indicator on the other diagram. But when you get on the bottom line it's okay, you have this representation on the multi-criteria space and then how to weigh the different factors. In reality, the criteria performance are mapping onto concerns. So at the center point you have to map the concerns of people. This is impossible, you cannot do it with software. I am concerned for my daughter, another person who doesn't have kids does not have the same concern that I have and so on. So this idea that you can optimize multi-criteria things is absolute, but even the people doing multi-criteria will tell you because the real issue is when you get to the weigh these factors, how to weigh the different factors for the different criteria.

Nate Hagens (01:05:33):

But that at its core is what society faces right now. We have been optimizing one variable which is dollars and profits, and now we care about ecosystems and future generations and equality and other things. So we're flying blind into that.

Mario Giampietro (01:05:51):

Yeah. No, because we are continuing to try to solve the problem with optimization, find the best possible way that... These things do not exist. You have to negotiate, you have to deliberate, to understand the problem of the others and the others have to understand your problems. At that point you can find a solution, but the solution has to be created, co-produced. So what the

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scientists can do is helping the society in this process, not tell the society what is the best thing to do. This is ridiculous.

Nate Hagens (01:06:30):

So how do we bring governance on these issues, whether in Barcelona or in Spain or in the United States or even something broader like the European Union. How do we bring governance back towards a perspective that can actually look at the full scale of the issues we face? Is that possible? Can it be done with our current structures of government?

Mario Giampietro (01:06:55):

Personally, I don't know. I think that it's not possible with the current structure of people that we have. People are used to not getting into this type of discussion. So they hope that there is someone else that knows better. This is why the subject cannot say we don't know better. Like with the COVID, you remember the COVID? They didn't have an idea what to do, but of course they cannot say it. This is cultural, we have to learn as a society to take decision under uncertainty. And our culture is not based on this, our culture is based on NASA, the things they know or they have a computer. And then this makes it difficult to have a healthy or quality governance because people want someone else that know better to tell them what to do.

Nate Hagens (01:07:54):

In my opinion, and this opinion began to be shaped 15 years ago when I was getting my PhD and you are one of those people that knows what's going on. And so I will put you on the spot on what to do. What types of policies given what you know about energetics and thermodynamics and complex adaptive systems, might you recommend that governments start adopting whether on a local, regional, or national scale? Not to put you on the spot in your fresh retirement.

Mario Giampietro (01:08:25):

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Look, I really don't know. What I believe is completely irrelevant. I cannot decide for other people. There are people that can say I prefer to do this and die rather than do that, and that maybe for me would be more reasonable. What I would say first to stop wasting money on this technical innovation that is, I don't know, gravy train, maybe that's all about getting money. Look what happened with the energy vendor in Germany, this was very interesting. They want to do alternative energy. They spent 300 billion. After 300 billion they're producing electricity exactly like before. Peak loader and the intermittent, since there are no storage cannot cover much. So basically they have been building an enormous amount of intermittent power capacity that is not used. So the idea is rather than putting 300 billion given to the usual multinational, is say, "Okay, I give to all the towns 100 million each one."

(01:09:37):

If they came out with some plan to do something, maybe something good here and there came out in the sense, stop to do a mega plan especially since they are not particularly good at making the plans or at making the analysis. Rather try to have emerging solution from the bottom that can be readjusted, because the more you go to a regulation, big plan, big money, first of all, the more the lobbies get in and they will get the money. And second, at the moment we do not have good understanding, good analysis, a good plan let alone roadmaps. I would save money and try to use it in a different way.

Nate Hagens (01:10:26):

So that's what we need first and foremost, is a better understanding of the problem and then inform people at the local levels and give a portion of the money that would've went to some multinational to try.

Mario Giampietro (01:10:39):

Well, you want to change social practices, you don't want to change technology to keep the social practice we are doing now. This is exactly the opposite of what we have to do.

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Nate Hagens (01:10:51):

Yeah, I understand that.

Mario Giampietro (01:10:53):

But then this has to be done at the lab because when you do a social practice, with an s only, you are affecting your neighbor. You don't do it as an individual. It is not a behavior, a social practice, it is something which is within a household which is a functional type. So if you are a mother of two, you are not having a behavior. If you're a single or a mother of two it's not about behavior, it's about you are forced to do different social practices. You see then this is another legacy of economics. We don't have the behavior to change. We have to think what are the social practices that are acceptable, not acceptable, the people like or don't like. And this implies interaction with the others, it is a social construct.

Nate Hagens (01:11:47):

Yep, our relationships with others with the natural world are just totally not part of our economic system right now. Dare I ask you your opinion on Europe's plans to scale hydrogen and green hydrogen, is that another waste of resources or what are your thoughts?

Mario Giampietro (01:12:10):

Compared with the electric car, I believe hydrogen is much better. Is much better because you can store it, you can use wind, whatever, you eliminate the problem of intermittency. For Europe it would be the salvation because if they go with electric car, China will produce them, they're dead. This will be the last industry in Europe gone. It's also easier to transport. It is very difficult to handle, so maybe the idea would be to do hydrogen and with hydrogen, do other synthetic fuels and then use that. I really don't know how is the state of the technology. I know that especially in Germany, they are investing a lot of money because it's about surviving in terms of automotive industry. But if I



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would suggest, I would suggest more to do that rather than the electrification of the economy. The electrification of economy is very, very complicated. Look, half of the labor in the energy sector is in the energy grid. Even though it's giving only 30% of the energy use half on the work because it's complicated in maintenance.

(01:13:28):

And especially if we start going through low density area, I believe that liquid fuel, so things are easier to handle. But again, I don't know the state advancement of the technology in hydrogen production.

Nate Hagens (01:13:49):

I have some final questions that I ask my guests. Dr. Giampietro, you have thought about and are working on these issues as a career, you understand what we face with the carbon pulse and energetics, et cetera. Do you have any personal advice to the watchers and listeners of this program given this time of what's happening in the planet, what some would call a polycrisis?

Mario Giampietro (01:14:16):

Yeah, I would say to be curious, trying to be informed as much as possible, trying to look for alternative resistance, to check also what is happening outside the mainstream. But I agree that it's very, very, very difficult. Very, very difficult because the establishment... It is not conspiracy of course, but it is not easy to try to get alternative information in this situation.

Nate Hagens (01:14:56):

And what about your students and young people generally, what do you recommend your students or 20 something year olds listening to this program? Do you have advice for young humans?

Mario Giampietro (01:15:08):

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Yeah, my advice has been to avoid the [inaudible]. They do not have to do things because the others do, that it is on fashion or because it's the only way that I have to get a job. Maybe you will get a job in the next four or five years, but probably in 20 years you will not be on the edge of what is needed. We are experiencing a major change in our situation. And of course if you start doing things that at the moment are not on fashion, maybe they will be the one needed in 10 years when you will be on the top of your career. I understand that it's difficult for young people to go against the wind, but I'm not sure that going with the wind at the moment is guaranteeing you a good job in 20 years.

Nate Hagens (01:16:09):

So when I taught my class at the University of Minnesota, I told my students that in the future they would simultaneously be thanking me and cursing me. Is that the same story with your former students?

Mario Giampietro (01:16:23):

Yeah. No, I had a very, very nice... The last PhD student, they said they was asked to do a drop in a different place said, "When you experience MuSIASEM you never get back." He doesn't want to go to conventional analysis now. It is difficult. It is difficult, you will have to go against the wind. On the other hand, I believe that as scientists we are really privileged. We are paid for doing what we like doing. So it is like a priest, like a vocational career. You have to do what you think has to be done really. And at the moment, I'm telling you it's really embarrassing if you see the things from a big picture, the sustainability science is really, really sloppy.

Nate Hagens (01:17:21):

Yeah. No, I'm aware of that. Mario, what do you care most about in the world?

Mario Giampietro (01:17:28):

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This is a one million question, I would say effective interaction. To be able to have an interaction that we can have a feeling on and stop to marketize everything, that we have to have a price. Whatever you do you have to pay for or whatever, to have a more personal relation that we manage in the family, outside the family, in the community, wherever we go, even across different countries, to always have some sort of affection in the type of interaction that one does. And this is something that is jeopardized at the moment. No, we have more-

Nate Hagens (01:18:12):

Agency, would you call that agency, for people to have agency?

Mario Giampietro (01:18:18):

Effective agency.

Nate Hagens (01:18:25):

Yeah, effective agency.

Mario Giampietro (01:18:26):

There has to be some effect, some sort of you in it.

Nate Hagens (01:18:27):

Yeah.

Mario Giampietro (01:18:27):

This would help a lot.

Nate Hagens (01:18:30):

If you had a magic wand and there was no personal recourse to your decision and you're also retired, what is one thing you would do to improve the future?

Mario Giampietro (01:18:44):

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Again, this is like what I would do really doesn't matter because it's my personal opinion. I don't feel so arrogant to decide for the life of other people. I would like to have people that are more reflexive, that's for them. I would have a way of reflexivity to appeal to reflect what they are doing, because at the moment this is something that we are losing pretty much, that people do things without having this idea why they do that.

Nate Hagens (01:19:21):

So we should be more proactive and reflective instead of reactive.

Mario Giampietro (01:19:25):

Yeah, and respect the others also know that. And since I'm Buddhist, in the others I include also animals and the rest of... We should respect more.

Nate Hagens (01:19:38):

I knew there was a reason I always liked you, respect for animals is something I-

Mario Giampietro (01:19:45):

We have to respect. We got to respect everything. I don't want to be now in public about all these tattoos, you have to respect your body. The body is not yours, you got it. You got it and then you have to live it in the best possible condition. You'll not write on animals, why should you write on yourself? I don't know. We don't respect not even ourselves, this is the problem.

Nate Hagens (01:20:13):

So if this has been a great introduction to you and your work, sometimes I have my guests come back for a second podcast six months down the road where they take a deep dive in some topic that they're an expert in, but it's a little bit esoteric, but it's also relevant to human futures. Is there any topic that you are just passionate about that if you were to come back you could take a deep dive and explain it to the viewers?

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Mario Giampietro (01:20:43):

Oh yeah, for sure. The extinction of farmers, this is amazing. I've been in Japan for one month. The average age Japanese farmers is 70, listen to this, 70. They do not have agriculture anymore. In Europe it's 60. If you go wherever you go, the farmers are gone. They are going. I spoke in Argentina at the meeting on the... Basically there they no longer have farmers, they have people that make exploitation from the city. They rent 3,000-4,000 hectares. They go there with tractors and things. But the rural communities and farmers are disappearing all over the planet and nobody cares, this is fascinating. If they were, I don't know, lesbian, gender bill, whatever, will protest about the fact that this community is going but that the farmers are going is completely irrelevant for the urban civilization that we are living in.

(01:21:47):

This would be really something. This deserves not one hour because urbans believe that the food comes from the supermarket and whatever else happened before doesn't matter. And the farmers are not economically viable period. In the international market with the pressure that they have, they need subsidies otherwise they don't even do it well with subsidies.

Nate Hagens (01:22:19):

1% of Americans in the United States are farmers and only 1% of them are growing food they can actually eat as opposed to soybeans and things like that. I may take you up on that and come back. So let me ask you final question. It's around dinnertime in Barcelona.

Mario Giampietro (01:22:37):

Yes.

Nate Hagens (01:22:37):

Can I ask you what... I love coming to Spain, what are you going to have for dinner tonight? Do you have an idea?

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Mario Giampietro (01:22:44):

No, I think eggplants for sure, maybe chicken, rice. I don't know, I didn't check that.

Nate Hagens (01:22:55):

Okay. Will you have some olives aceitunas?

Mario Giampietro (01:22:57):

Olives to start, yes. It's very popular here.

Nate Hagens (01:23:00):

Yeah.

Mario Giampietro (01:23:00):

Aceitunas.

Nate Hagens (01:23:05):

It's great to talk to you. Thank you for your time.

Mario Giampietro (01:23:08):

Yeah, thank you very much for having me. It's been fun.

Nate Hagens (01:23:09):

And congratulations on your retirement and I think the world is still going to need your expertise, professor.

Mario Giampietro (01:23:16):

I'm not sure. The autistic scientist. Okay, thank you very much. It's been fun.

Nate Hagens (01:23:23):

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for more information on future releases. This show is hosted by Nate Hagens, edited by No Troublemakers Media and curated by Leslie Batt-Lutz and Lizzy Sirianni.