

**Scene on Radio: Capitalism**  
**Episode 9: At the Tipping Point**  
**Transcript**

**John Biewen:** Ellen, remember John Fullerton, from the very top of Episode 1?

**Ellen McGirt:** Oh, who could forget? The one-time rising star at JP Morgan, who had a complete change of heart about capitalism as we know it?

**John Biewen:** That guy.

**John Fullerton:** You know, it wasn't like a single shock event. It was this, like, rolling awareness that, oh my God, you know, everything that I believed in is actually profoundly destructive.

**John Biewen:** You may remember *this*, too – Fullerton talking about one of the things that led to that realization, after the shock of the 9/11 attacks.

**John Fullerton:** And, and that got me reading books that, as I always say, bankers don't read...

Music

**John Biewen:** We didn't get to *this* in Episode 1, but here's what John said next:

**John Fullerton:** Probably the most, single most impactful book was this book called *Limits to Growth*, that was written in 1972, if I remember correctly, by a group of system scientists at MIT. The lead author was Dana Meadows, who unfortunately passed away way too young....

**John Biewen:** Donella Meadows – who often went by Dana – is one of those people who, well, most people today have never heard of her, but she looms large in certain circles – in her case, among people concerned about the health of the natural world and those talking about systemic economic change.

**Ellen McGirt:** Any American around in 1972 stood a good chance of at least seeing her mentioned on the news, along with her husband, *Dennis Meadows*.

**John Biewen:** 1972 – it was a time of growing awareness about threats to the environment. Rachel Carson's *Silent Spring* had come out a decade before. The first Earth Day was in 1970. But *The Limits to Growth* was making a different kind of case.

**Ellen McGirt:** Most of the environmental concern in those days was about air and water pollution, damage to natural habitats – as John Fullerton put it: “save the whale, save the owl.”

**John Biewen:** By contrast, the MIT group that included Dana and was headed by Dennis Meadows offered a sophisticated, systemic analysis of the world, and of humanity’s biggest, overlapping problems.

**John Fullerton:** And they pretty much laid out what was going to happen if we kept doing what we're doing. You know, the book was translated into many languages. I think I remember reading it sold millions of copies. And no one believed it. In fact, they spent the rest of their career being ridiculed by the world.

Music

**Ellen McGirt:** All right, just in case there’s any question why we’re talking about this book in a series about capitalism, the title, *The Limits to Growth*, offers a big clue. Throughout this series we’ve seen how a capitalist economy depends on growth – and more growth, and more, and more.

**John Biewen:** As John Fullerton says, the growth imperative is at the heart of capitalism’s “fundamental algorithm.” But how can growth go on forever? A *never-ending* increase in extraction, production, and consumption, with

endlessly growing waste and emissions from all of the above? Is that possible, let alone desirable?

**Ellen McGirt:** After all, we only have the one planet.

Theme music

**John Biewen:** From the Kenan Institute for Ethics at Duke University, this is Scene on Radio Season 7: *Capitalism*. Episode 9. I'm John Biewen.

**Ellen McGirt:** And I'm Ellen McGirt. We've been exploring the world's dominant economic system and how people shaped it over time. And what to do, now that a growing number of people think capitalism, in its current form, is doing more harm than good.

**John Biewen:** In this episode: a piece from guest producers Katy Shields and Vegard Beyer. It's adapted from their excellent three-part series, "Tipping Point: The True Story of the Limits to Growth." Katy Shields, welcome.

**Katy Shields:** Thank you John and Ellen. It's good to be with you, John and Ellen.

**Ellen McGirt:** Katy, your podcast project started when you read that certain book, right?

**Katy Shields:** Yes. Ellen, Like John Fullerton, I was floored by it. In my case, I was attending a talk by a climate scientist, not long after the Paris climate talks in 2015 had concluded. And the scientist was talking about how the Paris Agreement didn't go far enough, because it didn't address the fundamental root cause of the crisis: our fixation with economic growth. And he showed a chart from the 1972 book *The Limits to Growth*, which was based on a two-year study by a group of scientists at MIT. The study took a deep look at problems that were starting to plague industrial societies - like inequality, urban decay, pollution, resource depletion. It used a new form of scientific modeling called systems dynamics, which explores how different elements of a system, like our economic system, interact and influence each other and how that may play out over time.

**John Biewen:** We're gonna hear about the conclusions of their study, but give us a headline version for now?

**Katy Shields:** Well, the study explored various scenarios, but the most famous is what came to be known as the standard run - this is the chart the climate scientist showed me. The chart plotted humanity's trajectory from the start of last century to the end of this one. And what it showed was nature starting to *rapidly* decline from

around the 1970s, while at the same time, pollution *really taking off*. And then, a tipping point, somewhere in the first few decades of this century, where the cumulation of these impacts leads to a fall in food supply and then a sharp fall in the population – by around 2050.

**Ellen:** Ugh, Katy. Are we talking about the complete collapse of civilization, or what did they envision?

**Katy Shields:** Dana Meadows later described it not as a complete collapse of civilization. But certainly the end of what we could call our *industrial* civilization, because we had overshot the ability of our earth system to sustain us and our lifestyles. And what really shocked me was, the scientist plotted the actual data from the 70s to today – and we are heading for that outcome. So my first question was: why, why have I never heard of this? And then, of course, why did the world clearly not heed its message?

**Ellen McGirt:** Your background is in economics, is that right?

**Katy Shields:** Yes, I had studied economics and worked for many years as an economic consultant. When I became aware of the climate crisis, I went back to university and studied environmental economics. That's how I came to be attending this talk. But throughout my entire education, including my later studies, I had never

come across *The Limits to Growth*. And I couldn't let it go. So I started to research what had happened, and I discovered that actually it had been economists, folks from my field, who had been among the book's fiercest critics. And also had been among the most influential in convincing the powers that be, in the United States and elsewhere, that they could ignore this profound warning and go on with business as usual.

## Music

**John Biewen:** So, you teamed up with Vegard Beyer, a communications strategist based in Germany, to make *Tipping Point*, this podcast series. You've said that one treasure you found, in your research, was an unpublished draft memoir by Dana Meadows about the writing of *The Limits to Growth* and the response to it.

**Katy Shields:** That's right. She went on to become a leading figure in the environmental movement. These days she's often called the mother of systems thinking. But she died unexpectedly in 2001, before she could see her early work vindicated or learn just quite what a legacy she would have.

**John Biewen:** All right, Katy. Take it from here and we'll talk a bit more on the back side. Katy Shields, with this episode about the most important book you've probably never read, *The Limits to Growth*.

## Music

**Katy Shields:** Cambridge, Massachusetts. It is the summer of 1969 and 28-year-old Donella Hager Meadows, Dana to friends, is preparing to graduate. A self-professed child of the Sputnik age, Dana was on track for an illustrious career in science. She already held a chemistry degree cum laude from the esteemed Carleton College and was about to become a doctor in biophysics at Harvard. Dana's fiancé, college sweetheart Dennis Meadows, was also preparing to graduate that summer from the pioneering Computer Science department, Massachusetts Institute of Technology.

**NASA countdown voice:** Two, one, zero...

**Katy Shields:** That summer, as NASA astronauts readied their spacecraft for the moon and artists and musicians prepared to descend upon Woodstock, Dana and Dennis, with two newly minted PhDs, sold their car, and bought two plane tickets to England. As Dana recalled, “we were out for adventure. We intended to drive to India and back, climbing mountains and kayaking wild rivers along the way.” They were setting out for a year-long trek along what was commonly known as the Hippie Trail, traversing over land through Europe and on into Western and Southern Asia.

## Music

**Katy Shields:** They drove and slept in their rusty Land Rover or camped out in deserts, jungles, mountains and villages. As Dana recalled, “we were often received



with hospitality beyond belief, extended with dignity and grace by the poorest people we had ever encountered.” Yet, her years of academic training could not prepare Dana for what was to be a life-changing experience for this idealistic young couple from the American Midwest. “I started the trip a technological optimist,” she later wrote. “I thought science could solve all problems. We didn't have to drive far into East Asia to run into problems that my training couldn't solve. For the first time in our lives, we were face-to-face with malnourished children and with open sores of smallpox. We saw galloping soil erosion and sewage running in open drains along streets. We began to wonder about the causes and consequences of poverty. As the Land Rover bounced painfully over miles of dusty desert, we tried to make sense of what we were seeing.”

What they were seeing was already familiar to Aurelio Peccei. This charismatic, tanned, silver-haired Italian industrialist was quite simply on a mission to save the world. The couple had not heard of him as they finally made their way onto what we now call Sri Lanka, but that was about to change.

**Sound:** Aurelio Peccei talking in Italian

**Katy Shields:** Born in Turin, Italy in 1908, the young Aurelio was an adventurous polyglot. He had studied in Paris and Russia and was busy setting up the first Fiat motoring factory in China, when war brought him back to Italy. He joined the resistance, was captured, imprisoned and endured torture by the Nazis for almost a year before his comrades aided his escape. When the war ended, Aurelio helped rebuild Italy as the powerhouse of Europe, going on to head several of its major

corporations. But as Aurelio would later write, his time in captivity, living and surviving alongside men with nothing but their own convictions in humanity, impacted him profoundly: “It is perhaps from the experiences of that period”, he wrote, “that I began to be convinced that latent in man is a great force for good, which awaits liberation, and that modern society has yet to discover the way of liberating it.”

In the following decades, as Aurelio traveled the world, he became increasingly concerned about modern society's rising tide of problems, and, despite his earlier hopes, man's seeming inability to tackle them. In 1968, a year before Dana and Dennis Meadows set out on their trip to Asia, he gathered in Rome some of his most distinguished friends – businessmen, scientists, political advisers from around the world – to discuss what he called the *Problématique*, a complex nest of “Continuous Critical Problems” such as poverty, inequality, racism, crime, war, pollution, and resource depletion. To Aurelio, they were symptoms of an increasingly connected, growing and industrializing world economy, and they could not be solved by national governments working in isolation. Here is Aurelio talking to journalists around the time of that first meeting:

**Aurelio Peccei:** Today, for the first time in human history, there is one mankind, not scattered civilisations in their own environments, with their own faith, but a vast humankind which will have to decide all together where we want to go.

**Katy Shields:** Aurelio's passion, charisma and deep concern for humanity helped convince the 30 or so men he had gathered to form a loose think tank, which they named the Club of Rome. After that meeting, they agreed to reconvene within two years with a plan for tackling the problems. And so, as Dana and Dennis were making their way back to Europe in June 1970, the Club of Rome assembled once again, this time in Bern, Switzerland, to discuss what to do about the *Problématique*.

**Hugo Thiemann:** The Swiss personalities, they were bankers and so on, didn't understand what he wanted to do.

**Katy Shields:** The original members were joined by some of the world's most distinguished scientists and economists. Yet, as founding member Hugo Thiemann, who is speaking here, put it, they struggled to interpret Aurelio's vision. After hours of talks, still no one had a solution for dealing with the problems in a connected way. Well, almost no one.

**Hugo Thiemann:** There was a tension. Nobody knows what will happen. And beside me was sitting Jay Forrester.

**Katy Shields:** Born on a cattle ranch in Nebraska in 1918, Jay Forrester showed a genius for invention at a young age, while still in school he built a wind-powered generator for his family's ranch. Jay would go on to study at MIT, where he designed feedback control systems for the naval ships used in Pearl Harbor. Later

he developed flight simulators, created the first ever computer animation, and invented Random Access Memory, which helped usher in an era of powerful modern computing. But it would be what he did with that computing power that he'd be most remembered for, and what would eventually lead him to become involved with the Club of Rome.

**Jay Forrester:** It was out of discussions with people in industry that I began to look at a different class of problem...

**Katy Shields:** In the early 1950s, Jay had been working as a consultant to General Electric in its engineering department, when its management team approached him to help solve a different problem related to its boom and bust performance.

**Sound: pencil scratching on paper**

**Katy Shields:** Jay used his expertise in building feedback control systems to create a map of all the elements in General Electric's business, such as inventories, workers, overheads and so on, and show how they were all dynamically connected over time, so that the company could spot pressure points and prevent them becoming problems. Working in MIT's cutting edge mainframe computer labs, he then translated his sketches into computer code, creating a new programming language to help simulate and test different management policies. He called this new branch of science Industrial Dynamics. Later, a chance encounter with a former Mayor of Boston led him to apply this new approach to cities.

**Jay Forrester:** In the late 1960s, John Collins came to MIT and by chance took an office next to mine. I said to him, wouldn't it be interesting if we would combine the background that we've had in the corporation with the knowledge of people like yourself in cities and see if we could come to any better understanding?

**Katy Shields:** Boston, like many cities in the 1960s, was suffering from a rise of poverty and racial inequality. Just as he had done for US corporations, Jay created a map of all the important elements of the city of Boston and how they influence the wellbeing of citizens. As in physics, Jay liked to say that every action provokes a reaction elsewhere in the system, or to use the engineering term, feedback. Often policymakers take an action they think will solve a problem, say building more roads to alleviate traffic, but in so doing they make the problem worse by inducing more cars into the city. His resulting book *Urban Dynamics* came to be used by city planners around the world and would later inspire the computer game *SimCity*. Fellow MIT professor Carol Wilson, who happened to be a member of the Club of Rome, thought Jay's pioneering work on modeling complex systems sounded like it could help solve Aurelio's *Problématique*, so he invited Jay to accompany him to Bern that summer. And so on that warm June evening in Switzerland, as Jay listened to the increasingly fraught discussions among the Club of Rome members, he took his knowledge of modeling the dynamics of industries and cities and sketched out the first ever world model right there on a set of Swiss napkins.

**Jay Forrester:** And I told them they could come to MIT and learn more about this, but they would have to come for two weeks or not at all, because I knew that it would take two weeks for them to really understand. And they agreed. They agreed there at midnight that evening that they would come, they would come three weeks from that day.

**Katy Shields:** Jay touched down in Boston at almost the exact same time as Dana and Dennis were returning from their trip to Asia.

Music

**Katy Shields:** Jay Forrester had promised to teach the Club of Rome all about what he called Systems Dynamics. Now he needed help from his small department's best computer scientist to demonstrate their work in action. That scientist was, of course, Dennis Meadows. With a few weeks yet before Harvard would open its doors, Dana decided to accompany him, initially planning on listening to what sounded simply like an intriguing seminar. Jay had transcribed the model that he had started on those Swiss napkins in Bern. He now proceeded to present to Aurelio and the executive members of the Club of Rome, his model of the world system. It comprised five core elements: Population, food, industry, resources, and pollution, and a host of others that interacted with these and each other, like education, health care, investment, and technology.

**Sound: Pencil on paper**

**Katy Shields:** By drawing a series of lines and connectors, Jay showed how changes in one part of the system might impact the rest. Jay put forward that it was only with this complete understanding of the system that one could hope to solve the Problématique.

After two packed weeks of seminars, the Club of Rome was finally satisfied. They offered Jay two million Deutschmarks, around a quarter of a million dollars, donated by the Volkswagen Foundation. It would be enough to kit out an entirely new lab dedicated to Systems Dynamics with the latest and most powerful mainframe computers, and hire over a dozen scientists. But there was a catch. Aurelio, who was now a grandfather, wanted results quickly, within just one year. After that, the Club of Rome intended to set up a permanent think tank in Switzerland to create policy recommendations for the world's governments and help them to implement them.

## Music

**Katy Shields:** For reasons that Jay never made clear, but were likely influenced by the prospect of the work moving full time to Switzerland, he declined Aurelio's generous offer to lead the project.

Dennis, who had been working side by side with Jay, went home that evening and wrote a proposal. He would use Jay's prototype to show what would happen if current trends continued, and create and test alternative scenarios that could help find solutions to mankind's interconnected problems. As he discussed

his ideas with Dana, she decided there and then to give up her hard-earned Harvard fellowship, to help Dennis work on the project. And though her skills would prove valuable in ways she could not yet imagine, to avoid any accusation of nepotism, she insisted on joining the project without pay.

Although he was just 28 years old at the time, the Club of Rome accepted Dennis's proposal. Now he and Dana found themselves conducting the first major attempt to model the world system. Jay Forrester had provided the basic structure, their job was to test it and track down the best numbers to create the scenarios. Over the following months they met with leading geologists, agronomists, chemists, physicists, ecologists, demographers, economists. They studied soil erosion, ozone layer depletion, chemical pollution, acid rain, infant mortality, poverty, malnutrition. They learned about the Earth's mineral deposits and fossil fuel reserves and the energy required to extract them. And they studied the prospects for alternative energy sources like hydrogen, nuclear fusion, and solar power. They met with various experts from the likes of the United Nations Population Division, the World Bank, the National Academy of Sciences, and the newly formed National Oceanic and Atmospheric Administration, whose scientists presented new and worrying evidence about increasing carbon dioxide emissions from the burning of fossil fuels, and how they might lead to dangerous global warming. The team then set about using their data to build their world model.

An important feature of the world's system is that it is finite. There is a finite amount of land, of mineral deposits and basic elements like oxygen, which we humans and other species depend on. The Kaibab Plateau in Arizona is one such system. An elevated area bounded by steep cliff drops on all sides, it is almost



impossible for land animals to migrate in or out unaided. Until the late 1800s, the Kaibab was a thriving balanced ecosystem consisting of deer and natural predators such as wolves and coyotes. That is, until cattle ranchers moved in, leading to a drop in native deer numbers. In an attempt to protect the deer, the government allowed hunters to kill the native predators. Recall how in systems dynamics, as in physics, every action provokes a reaction. Jay Forrester referred to this as “feedback”. Negative feedbacks balance or counteract the change, while positive ones reinforce them. Here is Dana, using the language of systems dynamics to explain what happens when the predators are removed:

**Dana Meadows:** The predation rate is part of the negative feedback. By the time the predator population comes down to zero, the balance between the positive feedback and the negative feedback is destroyed and starts generating an exponentially growing deer population. As the food gets depleted, it takes longer and longer for it to regenerate. What happens is it drags the deer population down with it

**Katy Shields:** In other words, the removal of the predators, instead of protecting the deer, had the exact opposite effect. It allowed the deer to multiply to such an extent that they eroded their own habitat. The Kaibab is an example of what happens when we reach the limits of a finite system. As Dana would later write, “When growth is exponential, limits are reached surprisingly quickly. The most common pattern is one of overshoot, beyond the carrying capacity of the environment, followed by collapse.”

The MIT team's research indicated that in the post-war era, and particularly in the United States, various indicators of human activity were also growing exponentially, as Dennis Meadows would later describe when presenting their findings.

**Dennis Meadows:** From a historical perspective, the growth we've witnessed over the last hundred years is absolutely atypical. Global population is doubling every 33 years. Resource consumption is doubling every 20 years...

**Katy Shields:** The MIT team had realized that in order to determine whether humanity could solve Aurelio Peccei's Problematique – the nest of problems of hunger, disease, poverty, conflict and so on – it would only be possible if humanity could also stay within the planet's carrying capacity, the physical limits necessary for sustaining human life. But while growth in population and consumption looked to be depleting natural resources at a growing pace, it wasn't clear that those trends alone need cause concern. After all, thanks to the so-called Green Revolution, which had created a new generation of synthetic fertilizers and pesticides, agricultural yields were still rising, even as more and more land was being gobbled up to make way for suburbs, shopping malls, roads and factories. And though the population was still growing fast, its rate had started to slow from the heady heights of the post-war years. But there was another problem to contend with. Pollution.

**Advertisement voiceover:** For this new insect destroyer contains a lot of DDT, not just a little. The most effective weapon man has ever wielded against insects!

**Katy Shields:** Biologist Rachel Carson began studying the effects of the powerful pesticide DDT when it first came into widespread use in the 1940s. The Nixon administration finally banned the pollutant in 1970, the same year he established the Environmental Protection Agency and the Clean Air Act. The EPA had not arrived from thin air, either, but from a growing environmental movement. The first Earth Day also took place in 1970 and calls to stop destroying nature and clean up America's air, water and landfills were growing. So if the US, by far the world's largest economy in the 1970s, was already clamping down on pollution, was there cause for the team to be worried? Well, for one thing, the stocks of even banned pollutants were still rising, since many, like DDT, accumulate in the environment, often for decades or longer.

**Dennis Meadows:** In most cases where we have data, pollution is also growing exponentially. Lead has been accumulating in the Greenland ice caps exponentially. Freshwater pollution seems to be going up...

**Katy Shields:** Not only that, but it had taken Rachel Carson two decades to prove DDT was harmful to human health, and around another decade for Congress to enact a ban, no thanks to lobbying by chemical companies. The thinning ozone layer, acid rain, global warming, there were a host of other pollutants and problems

the team was only just discovering, and possibly many more going unnoticed. So if bans alone couldn't prevent pollution from rising, perhaps technologies could be deployed to clean them up? After all, America had just put a man on the moon. Well, despite what critics may later claim, the team did indeed account for rising technological progress. Here is Dennis Meadows explaining their approach to technology and the world model:

**Dennis Meadows:** Our project is absolutely not anti-technological. Most of us are in fact, rightly, to be called technologists. One important question is, will further industrial growth permit us to clean up our environments? Certainly, that growth will generate more money for pollution abatement procedures, but will also create more pollution. As agricultural capital increases, food production increases. However, industrial output also causes pollution. Pollution decreases food output and may also have adverse effects on mortality. We can think of technology which abates pollution, but it's likely to be energy and capital intensive, making our resource problems more difficult. Certainly the approaches, the technical approaches to increasing food, have exacerbated our environmental situation.

**Katy Shields:** In short, the team found that technology could solve some problems, but it may well cause others, as had been the case with the Green Revolution. In a growing economy, relying on technology alone was not a surefire way to keep humanity within the planet's limits, and might even push us closer to them. So what

were the chances of solving the Problematique under the prevailing industrial model of the 1970s? The team was about to find out.

Music fades out

[BREAK]

**Australian news broadcast host:** It's not some science fantasy effect from 2001. This electronic display emanating from Australia's largest computer is a picture of the condition, past, present and future of planet Earth...

**Katy Shields:** Some months after they started their work, the MIT team produced what came to be known as the "Standard Run." In that scenario, industry and population continued to grow based on the dynamics of the 1960s and early 70s. For the first few decades, expansion was rapid and the global economy, and with it, pollution, ballooned.

**Australian news broadcast:** From 1980 to the year 2020 pollution really takes off, so by the year 2020 the condition of the planet starts to become highly critical.

**Katy Shields:** But with limited measures to use resources more judiciously, a rise in consumption combined with exponential growth in pollution started impacting food supplies and then of course human health.

**Australian news broadcast host:** Pollution is going to become so serious that it will start to kill people! So the population will diminish, and at this stage, around about the year 2040-2050, civilized life as we know it on this planet will cease to exist.

**Katy Shields:** They were not talking about the end of life as we know it, but as Dana herself later explained:

**Dana Meadows:** if we run into those limits, what will happen will be a collapse of our system, not necessarily the Earth system, but the industrial system.

**Katy Shields:** Now, you may expect the team to have been alarmed by this finding. After all, it meant a child born in the year 1970 could live to see the breakdown of modern civilization. But, as physicist Jorgen Randers, just 25 when he worked on the project, explained:

**Jorgen Randers:** I was a very young man and naïve in the sense that I thought that once we told the world, that the planet is small and that it's a great challenge for humanity to fit a large population and a large economy

onto this tiny little planet. I had thought naively that the world would listen and say, yes, clearly this is good advice and we're going to follow this advice.

**Katy Shields:** So the team set about figuring out what that advice could look like. The team simulated ten new scenarios. One with unlimited mineral resources, another with faster rates of technological progress. In a third, a complete switch from fossil fuels to nuclear energy, and so on. In most scenarios humanity flourished initially, as the economy expanded, incomes rose and nutrition and health improved. But even where the population eventually stabilized, exponential growth and consumption caused humanity to use up more and more natural resources or to produce more pollution or waste at rates too fast for the Earth to absorb them and regenerate. This eventually caused humanity to overshoot the Earth's capacity and, like the Kaibab deer, to suddenly collapse. In each scenario, collapse came within 50 to 100 years. Dana later recalled in her memoir-how Jay Forrester had once explained to her why this was bound to happen, why humans simply can't keep pushing back all limits, like those on resources or pollution, while still trying to grow the human economy indefinitely on what was essentially a finite planet. Making the system bigger and more complex simply creates new and often more wicked problems, making it impossible to solve the Problematique.

“It's growth,” Dana concluded.” The problem is how to control and stabilize growth before the system hits limits. Our solution,” she realized, “must be to choose our own limits or let nature choose them for us.”

Music

**Katy Shields:** So the team tried a final scenario. They investigated how much land, resources and income would be needed to afford everyone around the world with sufficient food, water and necessities for a good life and tested ways to provision this without surpassing the Earth's limits. Solutions like renewable energy and efficiency technologies, organic agricultural techniques and regulations to ensure products last longer and can be easily recycled. They also made provisions for investments in education and family planning, and changes in how people live, work and travel to help protect nature, reduce land use and curb urban sprawl. This time they ran a scenario with limits to growth. The solution worked.

Still, the team found that it would take some decades to reach a so-called equilibrium society, one in balance with the earth's carrying capacity. Because of the natural delays in making changes to our industrial processes, our policies and laws, cultures and traditions, the sooner we started on that path, the better our chances of success. This didn't mean that some things couldn't continue to grow. Without the problems of economic growth, Dana and the team envisaged that people would be free to focus on more fulfilling activities that did not put too much pressure on the earth. Activities like science or sports and culture. It was a marked departure from the American dream of the 1950s, but by the late 60s, awareness of mankind's impact on our earth was growing and a counter-cultural revolution was taking place. Indeed, when Dana was later asked about what gives her hope about this proposal, she said:



**Dana Meadows:** I'm very hopeful in this country that the mechanisms do exist for this kind of cultural change. In fact, I think it's already happening. I think we're one step, one contribution to a change which is indeed taking place, largely among young people who are trying many experiments, some of which may turn out to be very useful in an equilibrium society. And I think the thing what encourages me, I work in a university with some of these young people, is that they are discovering that the alternate lifestyles that they're trying are not sacrifices and they're not unpleasant and in many ways they're more satisfying and their lives are more fulfilling than they, let's say, than they would have been if they followed the pattern which we have come to regard as the cultural pattern of America. And it's this which gives me great hope. I don't think we're calling for a great sacrifice, I only think we're calling for a slightly different way of looking at things which could in fact lead to many benefits.

**Katy Shields:** Nonetheless, their proposal could have profound implications. If the economy were to eventually stop growing it would mean future income and technologies would need to be redistributed more fairly within and across countries. Starting with the richest nation, the United States. Just how that may be achieved, how America and other rich nations could be convinced to follow such a path? That, the team thought, was a job for the Club of Rome.

“It is our conclusion that the overwhelming task of the Club of Rome is to identify and implement that set of policies which will permit us to negotiate an orderly transition to a stable world.” It was with these words that Dennis ended his

presentation of the MIT team's main findings at the annual gathering of the Club of Rome in Montebello, Canada in the spring of 1971.

“The Club members listened politely, spoke kind words,” recalled Dana, “and went back to discussing the world's problems as if each was unrelated to all the others and as if there were no limits. As they took upon each problem they called on growth to solve it. Energy shortages? We need more oil discoveries, more nuclear power. Poverty? More economic growth. Hunger? More food production. Urban slums? More housing. Pollution? More economic growth so we can afford pollution control.”

That was when Dana first realized that the problem was not recognizing the Earth's limits, but as she later wrote, “the ideology of endless growth itself as a solution to postponing limits more or less indefinitely.”

“Back at MIT the next day, our frustrated team met,” recalled Dana. “They didn't get it, we said.” At stake was not just the legacy of their work, but to Dana, the future of humanity. As she later wrote, “Part of me was still in the villages of India and in the deserts and the remnants of forest and the choking cities. I was trying to ensure that the future would be decent for the people there and people everywhere. For the life of me, I couldn't see what was wrong with that.”

## Music

**Katy Shields:** Their contract with the Club of Rome called for a book based on their model. They had been working on a technical report, as Dana put it, “documenting every equation in the meticulous format that Jay Forrester drummed into his

students.” But that failure to convince the Club of Rome meant the end of that project. It meant there would be no new institute for them in Switzerland to develop the policy recommendations they hoped the Club of Rome's A-list members would take to world governments.

Dana was not giving up. She was not only a hotshot scientist but a talented writer. During her travels she had filled six journals with short stories and musings on her adventures. She decided to write a report to the Club of Rome. Not the technical report, but, as she put it, “a staple in the upper-corner essay,” reinforcing their findings. “We thought that clarity and perhaps some repetition were all that would be needed,” she recalled. The responses that came back were a foreshadowing of what the world's reaction would be, wrote Dana. Renowned British economist Jeremy Bray called their work “naive” and complained that technology had not been given the treatment it deserved. “I do not think minor emendations would put the report into a form in which I could agree with the conclusions,” he wrote.

## Music

**Katy Shields:** Dana had set out simply to distill the essence of the complex body of work she and her team members had tried but failed to convey in Montebello, hoping that with some clarity and repetition, as she put it, she could change their minds. But she now found herself engaged in an intellectual battle with these men of the world, some of whom saw their report as a means to finally corral world leaders into action. While others feared the club's elite reputation was about to be ruined by the work of these idealistic young scientists. Dana's report grew to the

length of a short paperback. It was this book that would be known as *The Limits to Growth*. Though some, like Bray, could not be satisfied with the changes, Aurelio Peccei was sold.

**Aurelio Peccei:** It is so obvious in a way, so simple to consider that we cannot continually and exponentially go as we are doing now. Nothing in the world, nothing in life goes continuously.

**Katy Shields:** According to Dana, as far as Aurelio was concerned, this report, not the technical report nor any second phase in Switzerland, this was what he'd been waiting for. The following summer, the United Nations was planning its first-ever conference on the environment in Stockholm, Sweden. Every world leader would be there, and Aurelio wanted this report in their hands. All they had to do was find a publisher. It so happened that several months before they had presented to the Club of Rome in Canada, Dennis had taken a research trip to Washington to a conference of the Overseas Development Council. At dinner that evening Dennis found himself sat next to the charming, keen-witted Washington publisher Donald R. Lesh.

Music

**Katy Shields:** There's not a lot about Don's backstory in the public domain, possibly because he was a spy. Don Lesh had been working at the US embassy in Moscow in the late 1960s when he was expelled on espionage charges. In 1970 he

would come to sit on Nixon's National Security Council before resigning just months later in protest at the US invasion of Cambodia. With partner Bill Watts, also a former spy, Don had formed Potomac Associates, whose stated goal was to conduct, quote, non-partisan research to heighten public understanding on significant contemporary problems of national and international significance.” However, it's debatable as to how bipartisan they were able to be. Their names later turned up on Nixon's infamous enemies list. When Aurelio said he needed a book and fast, Dennis gave Don a call. He loved it. In November 1971, Dennis signed a contract with Potomac.

**Sound:** printing press

**Katy Shields:** “Publication in the normal fashion for Potomac Associates meant copies for selected policymakers,” Dana recalled. She had presumed Aurelio's 5,000 copies would mainly be sent to government administrators, until she got a phone call from Don Lesh telling her that her book would be sent to the heads of states of all nations, all members of European parliaments and the US Congress, all United States governors, all ambassadors to Washington and to the United Nations and key journalists around the world. “I almost dropped the phone,” she recalled. From that moment on, wrote Dana in her memoir, Aurelio called, cajoled, arranged, suggested, pushed, persuaded, until six months later, *The Limits to Growth* was published in the glare of international attention. Here is Dr. Benjamin Reed, then President of the Wilson Center, part of the Smithsonian Institution in Washington, which hosted the first presentation of their book:

**Benjamin Reed:** Each of you who accepted our invitations should have received a copy of the Club of Rome MIT study as contained in the Potomac Associates book, Limits to Growth.

**Katy Shields:** There had been one problem. Finding scientists to review their pioneering and complex model proved harder than envisaged. Indeed, it would be another two years until their technical report finally passed peer review. But with Dana's book almost ready to hit the shelves, Dennis agreed to present their technical findings at a small gathering of scientists in Washington, in hopes of gaining some credibility.

**Dennis Meadows:** On behalf of the MIT team, I'd like to say that we're very pleased to have this opportunity to meet with you this morning. When we first mentioned the possibility of coming to Washington to talk about the project, I envisioned in my mind an informal gathering of thirty or forty people around a table.

**Katy Shields:** At least, that's what Don Lesh had told him. But the well-connected former spook had somewhat bigger plans.

**Benjamin Reed:** Good morning, ladies and gentlemen. Let me say how very pleased we are to welcome our distinguished guests here today. This is the

first full-dress U.S. presentation of an 18-month study of global limits to growth by an international team of 17 scientists...

**Katy Shields:** “We must have looked absurdly young,” Dana recalled of that day on March 2nd, 1972, when she and Dennis and their MIT teammates took to the podium of the Smithsonian Institution in Washington. In the audience were some 250 congressmen, senators, ambassadors, industrialists, and of course scientists, plus several radio and television news crews.

**Benjamin Reed:** Let me introduce now Dr. Dennis Meadows, member of the MIT faculty and assistant professor of management and system dynamics.  
Dennis. (Applause)

**Dennis Meadows:** Well, good morning. During the last year, a group of us at MIT, the principal members of which are with me here today, have been looking at exponential growth of our global social and economic system. We've been attempting to understand what causes population and capital growth over the long-term and where they may be leading us. We've been led on the basis of this work to five basic conclusions: There are physical limits to growth, which, given current trends, are very likely to be encountered even during the lifetime of our children. Second, the most likely outcome of running into these limits if we continue to ignore them and instead base our short-term policies on the assumption of continued growth, is that we'll overshoot those limits and collapse. That there will be an

uncontrolled decline both in population and industrial capacity. That won't take place at the same time around the world. It will certainly take different forms. It will be more or less severe in different societies, depending on what happens between now and then and on the level of industrialization. But in each case it's likely to be extremely traumatic. The third conclusion is that we appear to have a viable alternative to this outcome, one in which population and material production could be brought into balance with a finite environment and with our resources. A fourth conclusion is that it's realistically going to take a period of 50 years, 100 years or more to reach that alternative in an orderly fashion. And finally, and I think this is extremely important, every year we delay beginning to form our goals and moving towards them makes an orderly transition to this stable situation much more difficult, and it decreases our ultimate options.

**Katy Shields:** The first to react to Dennis's presentation was Elliot Richardson, Secretary of State for Health and Education, and one of President Nixon's closest members of cabinet.

**Elliot Richardson:** Thank you very much, Mr. Reed, Dr. Meadows, ladies and gentlemen. I can say one thing very clearly and very emphatically, and that is that I believe all of us, all of us in the United States, and I think indeed every world citizen, are indebted to the Club of Rome. The study is too thoughtful, too thorough, too significant, and the consequences of ignoring its implications too disastrous, if we should be wrong in underestimating them.



**Katy Shields:** The team could hardly have hoped for a better endorsement. And these were not just empty words. Shortly after the conference, Elliot Richardson's office announced a public inquiry into limits to growth in the United States.

## Music

**Katy Shields:** It seemed like their gamble to publish the book had paid off. All the late nights and weekends doing research in the lab, days and months of endless writing and rewriting to convince the elite members of the Club of Rome, or at least some of them, that what they had to say was not stupid and naive but profound and urgent. Aurelio's pulling in of every connection to every leader he had ever made in his decades of doing business around the world. And finally, the ex-spy Don Lesh's slick propaganda campaign that had brought the great and good of politics, industry, science and media to Washington that day. The richest country in the world was considering shifting its goal from undifferentiated economic growth to ensuring first and foremost that its population would have the means for long-term prosperity in a stable and healthy environment. The only question now was, how would the world outside react?

**Edward P. Morgan, ABC News:** Across the Charles River at MIT in Cambridge, a team of scientists built a global computer model on paper to measure long-term trends. They found, and this is the core of their startling book, *The Limits to Growth*, that the way things are going now, the planet

can support us for less than 100 years. It may be nearer 50. This is Edward P. Morgan, ABC News, Cambridge, Massachusetts.

**Katy Shields:** Thanks to Don's extensive PR efforts, the team made that evening's primetime news. And the next day, many of the leading titles had their stories splashed across the front pages. "Mankind Warned to Curb Growth or Face Catastrophe," ran one headline. "Will Growth Kill Humanity?" "To Grow and to Die." "Prepare to Meet Thy Doom." "Farewell to Civilisation." With few exceptions, most had gone for the apocalyptic headline, with hardly any taking the time to read or report on their solution for an equilibrium world. It was as Club of Rome member Jeremy Bray had warned. They were being branded as doomsayers.

Music

**Howard K. Smith, ABC News:** One of the fashions of our time is intellectual pessimism, scholarly predictions that the apocalypse waits just around the corner. The most fashionable recent piece of pessimism is a report from the computers of MIT saying that economic growth must stop. Well, the report is cockeyed. We've got real things to worry about, but the much hoopla'd report of the Club of Rome is not one of them. Economic growth and technical advance are not the villains of our future. They're the heroes that can save us. I'm Howard K. Smith. Good night.

Music

**Ellen McGirt:** Katy, that's a pretty bleak note on which to end and step out of your narrative.

**Katy Shields:** Yes. That was not by any means the final word on *The Limits to Growth*, but in those early days, that reaction by Howard K. Smith was all too representative of the establishment response.

**John Biewen:** The news media, the political establishment. It is striking to hear about someone like Elliot Richardson, a member of the Nixon cabinet, who was willing to listen and take the report seriously. That's the same Elliot Richardson who would resign the next year from his job as Attorney General, in protest of Nixon ordering him to fire the Watergate special prosecutor.

**Ellen McGirt:** So he was consistent in having principles and caring about the truth based on actual evidence.

**John Biewen:** But so many people, even those who were part of the Club of Rome, which had sponsored the report, just seemingly could not grasp that the solution to this complicated set of problems was anything other than more growth – essentially, making more money to throw at the problems, and making that money through the same mechanisms that were causing the problems!

**Katy Shields:** Right. And as I said at the top, that was especially true of economists. Jay Forrester, the systems thinker who was so important in this story, later remarked on what he called the “bitter and emotional attacks” from many economists. Some corporate executives actually reached out to the research team and said they understood the report and believed it, but that they were helpless to act. They couldn’t be expected to do things differently given the pressures on them to compete and grow the bottom line for their companies. So they felt it was up to politicians to force the issue by changing the laws and the rules of capitalism.

**Ellen McGirt:** Hmm. You go on to describe how Dana and Dennis Meadows, and everyone associated with *The Limits to Growth*, would become almost a laughingstock, the backlash to their message was so strong.

**Katy Shields:** Yes. But though she was personally hurt and saddened by the backlash at the time, Dana Meadows didn’t let it stop her continuing the work they had started. After *Limits to Growth* she and Dennis moved to Dartmouth to continue their research on world systems, and Dana also taught classes in systems thinking. And together they set up an international network of scientists to promote collaboration in the field of what Dana and others termed ‘sustainability’. And she worked to educate the public too: she wrote a newspaper column for many years that was nominated for a Pulitzer Prize and earned her a MacArthur Genius Grant. And she also taught environmental journalism at Dartmouth College. But it was only later, after she died in 2001 at the age of just 59, that her ideas started to be taken seriously by influential people. The first chapter of an unfinished textbook she had

begun writing was posthumously published as the book "Thinking in Systems", which has become very popular across many different disciplines.

**John Biewen:** Her influence is enormous now. So many people we've talked to for this series, people thinking about and working for economic change, cite her work and *The Limits to Growth* as pivotal in their thinking. And let's point out that systems thinking – as in the work of Dana and Dennis Meadows and their team, and folks like Jay Forrester – is the polar opposite of reductionist thinking, which we talked about in episodes 3 and 4.

**Katy Shields:** Exactly. Instead of honing in on a narrow slice of the world, comparing, say, just two metrics, like CO<sub>2</sub> and growth of GDP, you're trying to get a bird's eye view of the whole system, how everything fits together and how changes in one part of the system affect another part, and then another. And some of those impacts will produce feedback effects elsewhere. This leads to a completely different understanding of a problem and what to do about it. What Dana and her colleagues understood was that growth beyond the boundaries of the planet's life support systems would eventually lead us into serious trouble. They urged us to start trying to figure out where those boundaries lie, so that we could create an economic system that can work within them. And now other important researchers and thinkers have picked up the baton. Most notably Swedish scientist, Johan Rockström. In 2009 he led a global team of around 30 interdisciplinary scientists in measuring key environmental limits, below which lies the so-called "safe operating space" for humanity. These limits include things like the amount of CO<sub>2</sub> in the

atmosphere or the amount of pollution we can allow to enter our oceans. This is Rockström speaking at the Beyond Growth Conference in the European Parliament in Brussels in 2023.

**JOHAN ROCKSTRÖM:** For the past 15 years we've identified nine biophysical systems that we have scientific evidence that they contribute to regulate the stability and resilience of the Earth system. And unfortunately the conclusion is that six of the nine are outside of the safe space. We're continuing to move in the wrong direction. It's not enough to just phase out fossil fuels. We also need, even for a safe climate landing, to come within planetary boundaries. This is the only chance for us to hold on to 1.5.

**Katy Shields:** Rockström has mentioned in interviews how much of an influence Dana and Dennis Meadows had on his own work.

**Ellen McGirt:** There's also a new breed of economists now, who've been influenced by *Limits to Growth* and incorporate its lessons into their models – very much unlike traditional, neoclassical economists.

**Katy Shields:** Yes. Maybe the best known is Kate Raworth, the British economist. She invented Doughnut Economics, and published a book with that title in 2017.

**Kate Raworth:** So let me start with this doughnut, the one doughnut in the world that actually turns out to be good for us, because I've learned that pictures are powerful...

**John Biewen:** This is Kate Raworth giving a talk in the Netherlands. She visualizes her economic model as a doughnut-like ring. The ring represents the sweet spot, where all of humanity, and our economic activity, can live and thrive.

**Kate Raworth:** So that the hole in the middle is the place where people are left falling short, without the resources that they need for healthcare, education, food, water, housing, energy, mobility. We want to leave nobody in that hole, get everybody over the social foundation into the doughnut. But, and this is a big but, we cannot collectively overshoot the outer rings, the ecological ceiling, because there we begin to tip our planet out of balance with our pressure on resources. We cause climate change. We acidify the oceans, create a hole in the ozone layer, create catastrophic levels of biodiversity loss and ecosystem breakdown...

**Katy Shields:** And Kate Raworth is not alone – a new generation of economic scholars is now calling for an end to our dependency on growth.

**Ellen McGirt:** Some are calling for degrowth.

**Katy Shields:** Right. Calls for degrowth have been published in reputable outlets like CNBC and the Harvard Business Review, and by the World Economic Forum, but anyone critical of growth, is still likely to be smeared by *mainstream*, or neoclassical, economists. They still hold the most influence over the political debate. It's like *The Limits to Growth* was this watershed moment where economists, instead of embracing these advances in modeling and this new understanding of how our economic system interacts with the natural world, chose to just keep operating as if the economy is some separate entity. Which is tragic given the number of young people who study economics each year.

**John Biewen:** It seems like the question is, will enough people with influence get the message in time, or feel enough pressure, to change course – and build economic systems that can last, in place of the one that's leading us toward collapse.

**Ellen McGirt:** Let's give the last word to Dana Meadows, speaking in 1992:

**Dana Meadows:** This is the question that will be foremost in a sustainable world, to ask, where are we going, really? What is this progress for, what is this growth for, what is this economy for? What is this planet for and what is our purpose on it? The questions we flee from, especially in the public arena. Nobody wants or needs growth. What people want or need is material



sufficiency, long-term security and sustainability, equity, and a purpose larger than accumulating material things. That discussion itself, I think, will make the difference between the two kinds of futures that we've talked about here today. Thank you. (Applause)

Music

**John Biewen:** Next time: we go to West Africa, and western Europe, to look at the chocolate trade. And to ask, about those extractive colonial practices that launched the first capitalist economies a few centuries ago: did they ever end?

**John Biewen:** This episode was produced by Katy Shields and Vegard Beyer. Story editing by Vegard Beyer and Loretta Williams. To hear more, you absolutely should go listen to the entire series, *Tipping Point: The True Story of *The Limits to Growth**, at [tippingpoint-podcast.com](http://tippingpoint-podcast.com) or wherever you get your podcasts. Sound editing by Anna Magdalino. Original music by Nora Beyer. Additional music by Michelle Osis and Lili Haydn. Our website is [sceneonradio.org](http://sceneonradio.org) where we post transcripts. This season is produced in partnership with Imperative 21. The show is distributed by PRX. Scene on Radio comes to you from the Kenan Institute for Ethics at Duke University.