

CAUSES AND PREVENTION OF ECOCIDE

An Expert Interview with Dr. Mark Benecke

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Abstract

We are currently facing the sixth mass extinction in history (Ceballos, G. 2018). Ever since humans registered it, the stocks of all kinds of species have been tracked. Nevertheless, the downward trend remains stable and the severity of the problem continues to increase (Ceballos et al., 2015). Research is crucial, in order to effectively ameliorate the crisis. Therefore, an expert interview has been performed. The main topics focussed on the *relevance and causes of the extinction of species and perspectives and milestones in species protection*. The interviewee stresses the importance of a plant-based diet and adjustments in everyday life. Furthermore, faith in a technological solution was evaluated as unrealistically optimistic. Science journalism was described as ineffective in creating public awareness.

Climate change comes along with a drastic decrease in species. Measurements that were taken since the 1980th show that the extinction of species occurs in nearly every genus and ecosystem on earth (Ceballos et al., 2015). This mass extinction is highly threatening to humans, as it disrupts the nutrient and energy cycles that provide the foundation for all livelihood (Ceballos & Ehrlich, 2018).

Pro-environmental movements are mainly driven by global organizations such as *Fridays for Future* and *Extinction Rebellion*. This movement has begun a long time ago with the first *Earth Day* in 1970 (Cooke, 2021). Despite its long history of existence, climate activism is primarily a concern of the younger generations (Sengupta, 2021). Surveys depict large differences in the level of consternation regarding climate change and its underlying mechanisms (Tyson et al., 2022). Therefore, we expected a lack of knowledge among members of various generations as a meaningful factor for refusing responsible behaviour. Hence, science journalism was thought to be a considerable tool to increase awareness.

Nowadays, a lot of research is dedicated to technological inventions to interrupt the progressing ecocide. Special attention was drawn to gene editing techniques such as gene drive. Gene drive is a form of genetic engineering that makes use of the natural principle of heredity (Hillary et al., 2020). Hereby, transgenic organisms are bred to promote specific gene alterations that eventually manifest in the gene pool of the population. The procedure has already been performed on Mosquitos, fungi, and plants¹ (Marshall et al., 2016)

¹The applications that have been carried out so far were aimed to combat phytoviruses and zoonoses such as Malaria (*Was Sind Zoonosen? | Nationale Forschungsplattform Für Zoonosen*, n.d.).

The aim of this research was to investigate the relationship between the extinction of species and contributing factors. Lastly, different approaches to inhibit and prevent ecocide were thematized.

Methods

A qualitative method in form of a semi-structured interview was used to explore the two main topics of the research. The questions were asked in a flexible manner to allow further deepening of salient aspects. Moreover, the interview was structured in three thematic plots starting off with an introduction of the interviewee, followed by a presentation of the extinction crisis. The third subject matter addressed individual and societal perspectives concerning the problem.

Questions	Probing questions
What is the role of a forensic biologist?	Since you are specialized in entomology: What does an entomologist do?
Why are insects so important? What are the causes of the extinction of insects?	How does the extinction of insects relate to climate change?
What can we, as individuals, contribute to the prevention of further damage caused by climate change/extinction of species?	What role could veganism play in this? Why is science journalism important for solving this crisis?
Are there any novel technological approaches to stop the extinction of insects?	What is the potential of genetic engineering (CRISPR/Cas9)
What is your view on the future of this regard?	Are you rather optimistic or pessimistic?

Figure 2 – Layout of the Semi-structured Interview

Interviewee

The consulted expert was Dr. Mark Benecke. He works as a forensic biologist who specializes in entomology. Besides his laboratory labor, he is an author, politician, educator, and science communicator. He was one of the first scientists in the field of forensic entomology who notably contributed to its popularity. During his career, he investigated cases e.g. Luis Gustavo, the Mummies of Palermo, and the skull and denture of Adolf Hitler.

Results

The extinction of species is closely related to the imbalances of ecosystems. Those disruptions in the nutrient cycle are primarily caused by crop poisons that are widely used for agriculture, dryness, and land use.

“Every creature represents a nod in the circular transmission of energy and if you remove some of these nods, the system collapses, and the energy transmission becomes dysfunctional.”

Regarding prevention, Dr. Benecke stressed the importance of veganism as a fundamental action. According to him, there is a shortage of knowledge about the consequences of agriculture among the general public and climate activists. Mass consumption is another factor that aggravates climate change.

“[Motivation to eat a plant-based diet] is a huge problem, if you talk to the climate activists [...]. My experience over the last five years displayed the fact that land use and water consumption are primarily forwarded by the purchase of animal products as widely unknown — even among environmentalists.”

Science journalism was evaluated as ineffective, as it could only reach educated citizens. The reported anecdotal evidence is that young women are most susceptible to climate-related information.

The interviewee criticizes genetic engineering techniques as highly dangerous and disproportionate to the scope of the problem. The impact of this kind of intervention might have consequences, that go beyond any mathematical calculations and human logic. Even AIs were not capable of considering every possible outcome of gene drive.

“The expense is too high. AI technologies require tremendous amounts of energy, computers, and so on. That is impossible; a technologic-industrial megalomania resulting from the extinction of biologists who used to work with actual ecosystems.”

Discussion

The causal relationship between the food industry and climate change has been demonstrated by several measurements. The production, shipping, and storage of food account for 26% of all greenhouse gas emissions. Additionally, 50% of the world's habitable land is dedicated to agriculture (Ritchie, 2022). Therefore, it is recommendable to incorporate the importance of diet and consumer behaviour in educational approaches.

Especially younger generations are susceptible to alterations in lifestyle with respect to sustainability. According to a survey, concerns about the environment are most prominent among members of Gen z and millennials (Tyson et al., 2022) However, there is an inconsistency between climate-positive attitudes and purchase behaviour. Respectively, only some people who show higher levels of environmental awareness act upon their beliefs (De Barcellos et al., 2011). A study by Smed et al. looked at a psychological protection mechanism named *active information avoidance*. They concluded that imposing facts about CO₂ emissions on people who refuse to receive them, may motivate them to change their consumer behaviour (Smed et al., 2021). These results support the hypothesis that a deficit in education contributes to the lack of action in society.

In contrast to the subjective experience reported by the interviewee, other research corroborates the newsworthiness of science journalism (Olausson, 2009). Global interconnections through social media may provide an efficient platform for propagating environmentalism.

Technologies e.g. gene drive lead to highly polarized debates in the science community. Despite the first attempts to apply the technology to real-life settings, its consequences remain uncalculatable. Editing ecosystems pose a great risk to the natural equilibrium. Thus, extensive testing in controlled environments is vital (Meghani, 2018). We propose to attempt adjustments in political measures and the commercial market prior to contemplating any manipulation of ecosystems.

Finally, the permutation of personal habits, e.g. purchase behaviour, might be a mediating factor in the amelioration of environmental health and interruption of ecocide. Further research should look at the motivational factors contributing to buying behaviour to accelerate the development of strategies that promote sustainability across different generations.

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Interview Script

R1: Let's start with an introduction. What is the role of a forensic biologist?

Mark: I am a forensic biologist, and the tasks depend on where you are deployed. As a biologist, I do a lot of DNA examinations. In the beginning, the focus was more on research. But since the discovery of the genetic fingerprint, there have been a lot of changes, and now we focus more on examining single cells, e.g., finding single skin cells, or transferring DNA. I am a publicly appointed and sworn expert meaning that I get the "strange and boring" cases which are mostly underpaid. This can range from sexual offenses that no one wants to believe to strange deaths, serial acts, and follow-up examinations. Bloodstain pattern analysis is also one of the main tasks, but it is very costly, as you have to reconstruct everything with real blood. Lastly, we also do some kind of "counseling", e.g., when the question is whether a wound could have been caused by an animal, a knife, a gunshot, etc., we then comb through the literature of the past 150 years. Overall, the roles are very diversified.

R1: Since you are specialized in the field of entomology: How does this connect to your usual job?

Mark: I had my first encounter with insects on corpses when I was studying genetic fingerprints in the Institute of Forensic Medicine. The corpses themselves were not so much of interest to me because they were not the main reason I was there; it was more of a coincidence since they put all biologists inside the same basement of corpses. And since insects were the only animals there, I took a closer look at them. My early publications tend to focus not on the post-mortem interval of a corpse, but more on what you can actually find around the corpses. One time I found hoverflies, which seemed to not have a significant meaning for forensics, because back then we did not know that you can determine the post-mortem interval of a corpse e.g., through the age of the insects around it. There were people who had done it before for sure, but there was no one I could ask. The only people I could turn to about this topic were some old colleagues, one of whom wrote the manual of forensic entomology; he did not work in any specific cases, but only summarized what could theoretically be applicable. Other colleagues were not so much interested but focused more on the dieback of trees. This means that I was on my own, which was not necessarily a bad thing because this meant that I had to find out for myself the forensic and judicial applications.

R1: So you were one of the first forensic biologists that took a closer look into entomology?

Mark: I would say that I was the one who re-introduced the topic into Central Europe. The topic was brought up by me in my first ever smaller publication in a journal. Then, in congresses, some

older colleagues in forensic medicine were also interested, especially in the application of entomology in determining the post-mortem interval of a corpse since their conventional methods were not so effective. Other colleagues had more doubts since their expertise was in medicine and not in biology. But they encouraged me by referring me to other colleagues from other countries who had also done some research into this. I had also already come into contact with many colleagues from the US, where the topic was already getting more popular, especially through media and tv-series. This international exchange between different colleagues from different countries led to the propagation of this whole idea. I was also probably the first one to ever hold a presentation on this topic at the 'BKA', the Federal Criminal Police Office of Germany. However, I was not the one who came up with this idea. There are numerous exemplars and books* dating back to the 1800s that already introduced the topic of entomology. I would say that I am definitely one of the first generations of scientists who have brought advancements into this field. This is also due to the many international courses that I gave.

R1: Why are insects so important, and why are they dying?

Mark: We live in a huge network of life that includes e.g., bacteria. Humans are said to be on the top of the food chain, but underneath is this pyramid, which really is just a network full of animals. Insects and articulata in general make up the main portion of life on Earth. Put into technical terms, you could say that every creature on Earth makes up one single node participating in the circular biological energy transmission on Earth. When you take out one node, the whole system will fall apart, and this is what we are experiencing right now. The decline of insect populations is mainly connected to three reasons. The first would be the use of pesticides, in particular insecticides. These are very durable, and when you ask your grandparents about DDT (Dichlorodiphenyltrichloroethane), they will tell you that this insecticide was very feared and the apparent cause for the thinning of bird eggshells, as there were no insects to be eaten. Current pesticides are much stronger than before and are prohibited in most countries. The second reason would be a draught. This has experienced a rapid surge in the past three years; we can see that all the draught- and warmth-loving species have migrated from the Mediterranean through Northern Europe. All the other species that are a bit more moisture- and shade-loving do not survive. The last and most important reason is the massive land use and the fact that land is used for industrial purposes; including industrial plantation and industrial use and manufacturing of "animals". This applies not only to insects but to all life. It has only recently become more "popular" to talk about insects in this sense. Birds, for example, are also vanishing. You can again ask your grandparents to describe what a stroll through the forest sounded like years ago; it was almost like a symphony concert whereas nowadays, the

world has become quiet and devoid of life. Rainworms are another example: they are becoming smaller and declining. To me this is a strong indicator that we are living in a total collapse that has already happened. We must act very quickly now.

R1: Which species and ecosystems are affected most?

Mark: It is a total collapse. 28 years ago, the entomological society of Krefeld started weighing insects and determining species. Four years ago, they made a publication stating that within 25 years, three-quarters of the insects living in a nature reserve have completely vanished. This was first met with doubts as many said that this was impossible. Others said that we can experience it first-hand just by looking at how there are no insects on our windshields anymore. I also gave a lecture at the World Fly Expert Congress in Namibia, where colleagues also first downplayed the gravity of the situation as it might be more of a “German thing”. Colleagues in Scandinavian regions have also reacted by telling me that this affects birds more. But some birds eat insects and even rainworms. Three years later, the collected data had spread and was non-negligible at this point. Then, a study came out in the Science journal that showed that insect populations are declining with an average loss of 9% per decade. Now when we take 9% of whatever is left, and keep deducting 9% of whatever is left next, this will quickly result in zero at the end, as this is not a linear, but an exponential decay. I decided to collect all data concerning the collapse of different species. The newest report that I have found that no one wrote an article about, states that all ants are dying. Reading about this was indescribable, it felt like things could not have gotten worse, but then I was wrong. I was intrigued and asked myself why are ants now affected by all this. Are ants not supposed to be the strongest animals? The animals that would survive a Nuclear War? This is true, as you could put ants through a scanning electron microscope and they would still survive. And as it turned out, the last measure revealed that ants have shown the strongest decline. This is a strong indicator of a total collapse. They are entwined just in the middle of the whole pyramid-like network of life, and them being the most affected shows that something must be wrong. This also shows that all other species have already declined so far as to where it does not seem significant anymore. I also collect old reports and save old books all over the world so they can be restored. Another example is butterflies. When I look around, I question myself where all the butterflies went. There is no focus on one particular species, this total collapse applies to all life. You notice that most animals do not exist anymore in a particular region and that they are not or are far less observed. And with worms, you can measure them: Dig into the soil, pull them out, and see how big they are. With butterflies, it’s easy anyway, because you can simply notice that they are barely around anymore. You don’t even have to measure it. Mammals, for instance in Africa in regions, that are not well investigated, you can just count. For example, in one region – that

was done by one of my colleges of the museum König in Bonn (that's a Leibniz institute by now) – they just drove there about ten years ago and counted every single individual, drove back a few years ago and did exactly the same. Let's say she counted 500, that's doable. In the end, there are 200 left, just as an example. That's no big deal if the animals are big. You can also use night cameras nowadays, wild cameras. That's fairly simple. You can chip animals, and see how long they live and where they are. And you could have a look in person. Regarding marine animals, it is more difficult. Oftentimes, they are counted by diving, also by private companies. Or sometimes – that's brand new – they offer it to tourists. From the camera materials, you get a lot of data. Even that is possible these days.

R2: All right. You mentioned that a plant-based diet might be a crucial aspect of targeting that problem in the future. In general, what can we as individuals do?

Mark: Well, let's put it like this: Plant-based diet is the absolute basis. Anyone who does not do it already is not a serious conversation partner if they insist they cared for the environment. That's a huge problem if you talk to the climate activists. My experience over the last five years displayed the fact that land use and water consumption are primarily forwarded by the purchase of animal products as widely unknown — even among environmentalists. I would say it has improved during the last two years though, but that took blood, sweat, and tears. One had to explain the link between diet and climate change first, although those two things are directly connected, speaking of land use and CO₂ for butter and beef for instance. All of this heats up our atmosphere, right? Now we face the problem of permafrost which sets free the methane, which has also been known for many years. The second thing that can be deducted when looking at the data, is that we need to break the everlasting wheel of mass production to obtain higher profits. Maybe we should think about making less profit and therefore maintain a more or less liveable existence, how about this? History has shown many times how cultures collapsed because of weather and climate circumstances. Not to mention various wars. That was simply hideous. Imagine the chaos that is gonna be set off then. So, in my opinion, there are circumstances where being stingy is simply not worth it; where you cannot save in a sensible way, because it wouldn't pay off in the long run. For example, I only own one pair of shoes for private purposes and two times the same outfit. I don't need to go shopping every year. Of course, that's not for everyone and some may think that's freaky. But frankly, I don't give a shit. I don't want to proselytize anyone here, but we can all get a bit creative. And substantial consumption reduction and plant-based food (which is even healthier and only brings benefits) is a step everyone can take easily. The important part is that it needs to happen immediately. There is no time to babble and relax. Stop rambling now!

R2: I could imagine that a lack of scientific information in the general population caused by misinformation through politicians contributes to this situation. How would you evaluate the role of science journalism in this context?

Mark: Classic science journalism is useless because it only reaches the social class of educated citizens who are able to understand the terminology and have a basic understanding of biology and chemics. I know many science journalists and I also published in renowned newspapers such as the Süddeutsche. This had absolutely no effects. For the past five years, I have traveled the globe to give presentations about climate- and environment-related topics. After all of this, I'd claim that I mainly reached young women and people who are already interested in the subject, for instance, members of climate and animal rights organizations. Berlin is supposed to achieve climate neutrality until 2030 and I support the people who run those campaigns. Even they say: "Okay Mark, but please spare us the veganism lectures." They are mostly involved in energy consumption issues. Some of the videos my wife and I post seem to have an impact and others don't. I guess we just sow some random seeds and see what sprouts and what prevails permanently.

R2: Great! Since you often hear those ideas when talking to people that don't want to change, we are interested in your opinion on technologies such as gene editing techniques.

Mark: What exactly do you mean?

R2: Well, for instance, CRISPR for rebalancing ecosystems.

Mark: Ah okay, got it. That's an ancient fantasy that occurred first around 1880. Back then people also believed they could solve problems with technology. The fallacy is that in contrast to nowadays, nature was still intact at that time. Hence you could actually solve a lot by using technologies, such as steam engines and internal combustion engines. Things that were built at that time had longer durability, but sooner or later you realize that the roots of the trees grow through or that the bridges deteriorate as they do in Germany a lot at the moment. Back in the days when I was studying CRISPR didn't exist. Around that time, the first transgenic animals were invented, followed by Mullis' polymerase chain reaction. Frankly, I know a lot of scientists: I interview Nobel prize winners as well as self-proclaimed high-class scientists who think they were geniuses and everyone in between. I just want to mention this for you to know that I have seen and been around a lot. I recently visited a microplastic lab in Vienna where a former student of mine is working – she doesn't even get paid, isn't that crazy? Never mind, there are absolutely no technological solutions. I can give you a few examples: a) microplastic is mainly

produced by tyre abrasion and not by straws that are blown into the ocean, as many people believe. The current state in March 2023 is you cannot prevent those microparticles from infiltrating the human body and brain. Impossible. There is no technology or idea that could help with this. b) CRISPR. You cannot modify ecosystems using this technology. That would be a bit as if I'd wake up one day and had the convincing dream that I can make Germany climate neutral in one year. That's how megalomaniacal this is. Ecosystems are incredibly complex systems that go beyond the human mind if you consider all the tiny little niches for energy and material exchange. Even on the human body or behind your wardrobe, not to mention the free wild – this simply evades any descriptiveness, and tackling it requires way too much effort. Not even AIs can do so and I am not saying this because I don't appreciate AIs; quite the contrary. That's not a question of opinion, this stuff is measurable. The expense is too high. AI technologies require tremendous amounts of energy, computers, and so on. That is impossible; a technologic-industrial megalomania resulting from the extinction of biologists who used to work with actual ecosystems.

R2: Got it. Can you give us a small glimpse into your personal view of the future? Are you optimistic that humans can change or will we continue as always?

Mark: Well, no one knows that. You cannot predict the future. As I told you I talk to younger people for the most part because I kinda gave up on discussing with elderly persons. Of course, I talk to them about it when I am invited, but they only give reasons why they cannot change, blablabla. Or, as you said before, they refer to technologies. For instance, there is a technology that can get some of the CO₂ out of the air. They presented this a few years ago in the 'Greifswald' forest. Thus, we have the machines prepared, but what's the point here? Do you want to bind all the CO₂ on earth now? How is that supposed to work? Who is gonna pay for this, considering the fact that we cannot even afford solar panels for our roofs? Honestly, why don't we have a law about that? Sure, the production of solar panels is also based on fossil energy, but this could be a major step anyways. If you look at the early literature, there has been criticism of capitalism - Marx and Engels and so on and Rosa Luxembour and Klara Zetkin, who were involved in the feminist movement. And then the first female scientists; maybe you know that the woman who found out about the greenhouse effect was married to a lawyer. Comparing how long it took for their work to induce change, I must admit that this happens faster nowadays. In the meantime, you cannot stop certain processes fast enough. I usually don't get involved in things like climate protests, but I support them by taking videos and pictures so that people remember these events. I sometimes wouldn't even believe that those events happened without the pictures. The younger kids tend to believe that anything can happen by holding a demo plate and wishing. But once you analyze their personal habits, you would first need to

tell them to change their own lives. If we take a closer look at the communal level where you could achieve a lot in theory, one realizes that they tend to skip organizational steps. In Cologne, for instance, they used former plans to extend the subway network. However, it would have been financially and ecologically more efficient to keep the tram on the streets and restrict the car traffic instead. But once the concept has been manufactured, no one is willing to change plans again. The fact that people cannot keep up with changing circumstances has always been an issue for all environmentalists and activists. They have to deal with our ecosystem which is driven by mass production. The second point is that humans are exposed to structural constraints. That's why the organization 'Letzte Generation' - whose members are getting imprisoned now by the way – believes that we need a revolution. Personally, I am a bit more careful when it comes to revolutions because revolutions usually don't work out the way they are supposed to. So I prefer to not make any predictions. My wife and I are simply supporting the good forces and knowledge and we try to create connections between various members of society. In the end, no one knows what's gonna happen in the future.

R2: Thank you very much. This is it for the interview.

- *This interview has been translated from German to English*

Personal Description

Who: Mark Benecke

Profession: forensic biologist, science journalist & communicator, author, activist, politician, educator



Career:

- graduated high school in Cologne
- studied theater science, german, biology & psychology at Universität zu Köln
- doctorate about genetic food prints
- earned qualification in forensic medicine in USA (FBI academia)
- worked as educator u.a. in USA, Vietnam, Columbia
- worked for *Office of Chief Medical Examiner* in Manhattan
- participated in several tv shows/channels e.g. *National Geographic Channel*, *History Channel*, various true crime shows
- published several books
- guest publisher for *Forensic Science International* (journal)
- membership in science association *Gesellschaft zur wissenschaftlichen Untersuchung von Parawissenschaften*
- takes part in *Annals of Improbable Research* (Nobel prize committee)
- membership in board of *ProTattoo*

Most popular cases:

- 1997/8 homicide of pastor wife -> found the critical evidence for murder
- death of handicapped lady -> identified cause of death: neglect by the nurse
- studied scalp & denture of *Adolf Hitler* (in cooperation with *FSB*)
- investigated the case of Columbian serial killer *Luis Garavito*
- studied *Mummies of Palermo*

Politics:

- member in Die PARTEI
- Landtagswahlen NRW 2010, 2012, 2017 -> top candidate
- federal election (Bundestagswahlen) 2013, 2021-> top candidate for NRW
- mayor elections Cologne 2015 -> 3rd place
- European election 2019 -> 25th place
- spokesman of LEAP (Law Enforcement Against Prohibition) Deutschland e. V. -> legalization of drugs