Understanding the Risks of Microplastics: A Social-Ecological Risk Perspective

Johanna Kramm and Carolin Völker

Abstract The diagnosis that we are living in a world risk society formulated by Ulrich Beck 20 years ago (Beck, Kölner Z Soziol Sozialpsychol 36:119–147, 1996) has lost nothing of its power, especially against the background of the Anthropocene debate. “Global risks” have been identified which are caused by human activities, technology, and modernization processes. Microplastics are a by-product of exactly these modernization processes, being distributed globally by physical processes like ocean currents, and causing effects far from their place of origin. In recent years, the topic has gained great prominence, as microplastics have been discovered nearly everywhere in the environment, raising questions about the impacts on food for human consumption. But are microplastics really a new phenomenon or rather a symptom of an old problem? And exactly what risks are involved? It seems that the phenomenon has accelerated political action—the USA has passed the Microbead-Free Waters Act 2015—and industries have pledged to fade out the use of microbeads in their cosmetic products. At first sight, is it a success for environmentalists and the protection of our planet?

This chapter deals with these questions by adopting a social-ecological perspective, discussing microplastics as a global risk. Taking four main characteristics of global risks, we develop four arguments to discuss (a) the everyday production of risk by societies, (b) scientific risk evaluation of microplastics, (c) social responses, and (d) problems of risk management. To illustrate these four issues, we draw on different aspects of the current scientific and public debate. In doing so, we contribute to a comprehensive understanding of the social-ecological implications of microplastics.

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1 The Social-Ecological Risk Perspective: Addressing Global Risks

A common risk definition is that "the term 'risk' denotes the likelihood that an undesirable state of reality (adverse effects) may occur as a result of natural events or human activities" [1]. A classical risk analysis calculates the possibility of an adverse event and the potential damage, for instance, an assessment of ecotoxicity of hazardous substances based on dose-response relationships. For "global risks," also termed systemic risks, classical risk analysis is not so easily applicable, since the characteristics of "global risks" comprise complex cause-effect linkages, which are not fully known, resulting in a high degree of uncertainty and ambiguity in assessing the risk. For this reason, consent to risk management strategies is difficult to obtain [2, 3].

Who or what can be "at risk"? In social-ecological risk research, risks to humans and biophysical entities (e.g., biocoenoses, ecosystems) are considered. The causes of risks mostly lie in human activities, since many natural resources and biophysical processes are influenced by societies [4]. In social-ecological risk research, it has become clear that assessment of the risk alone is not sufficient for management and policy decisions [5]. It is also important to consider the risk perception and concerns of different interest groups [6]. In the case of complex risks which are accompanied by uncertainty, it is important to define the degree of tolerability and acceptability in order to find management strategies acceptable to all interest groups [7]. Therefore, a prerequisite for risk management and related policy-making is not only scientific evidence but also an agreement of the different interest groups on how to understand, interpret, and value the evidence.

Hereafter, we will outline the characteristics of global risks from a social-ecological perspective and present four arguments framing microplastics as a global risk.

(a) Global risks are not produced by an extreme event or a disaster but are created in modern societies as a side effect of an "everyday mode" of system's operation [8, 9] and regulation of the supply system [4]. From this understanding, we derive our first thesis, arguing that the risks of microplastics are produced as an unintended side effect of everyday operations in modern societies.
(b) Global risks are complex; thus, no clear evidence of a cause-effect linkage exists or can be proven, due to "intervening variables," "long delay periods between cause and effect," or "positive and negative feedback loops" [10]. These and the state of "not knowing" [8] contribute to a high degree of uncertainty regarding effects, especially in terms of scope and time. Thus, we

argue that the cause-effect linkages of risks associated with microplastics are complex, leading to great uncertainty in their scientific assessment.

(c) Global risks are characterized by a specific vibrancy which affects other linked entities or systems. This can lead to impacts in systems other than the risk-producing system. Such linking may involve natural processes (such as ocean currents, wind) and social processes (like communication, practices). Therefore, we argue, thirdly, that microplastics are vibrant, affecting not only ecosystems but different social, political, and economic spheres.

(d) Global risks are differently perceived, interpreted, and framed, which is an impediment to management strategies. This may be due to the presentation of different kinds of evidence, leading to competing views, or to conflicting interpretations of the same evidence, producing what is referred to as ambiguity [10]. Hence, we argue, fourthly, that microplastics are an example of a complex problem, due not only to uncertainty regarding their negative effects but also to competing views on how to combat the problem.

In the following sections, these four arguments are elaborated by taking into account different aspects of the recent scientific and public debate on microplastics.

2 The Plastic Dilemma and Everyday Modes of Risk Production

Microplastics emerged as a scientific topic about 10 years ago and recently came into public awareness when the debate focused on their release from cosmetic products and potential abundance in human food [11–15]. But are microplastics really a new phenomenon or can we regard them as a newly discovered symptom of an old problem, the problem of plastic pollution? As indicated in the quotation below, microplastics, called "plastic particles," were recognized as part of the problem of plastic pollution in coastal and oceanic waters in the 1970s, though the associated adverse consequences were considered as minor compared to other contaminants:

> At the present levels of abundance of plastic particles in coastal and oceanic waters, adverse biological consequences would appear to be minor compared to the deleterious effect of other contaminants such as petroleum residues and other chemical wastes. Increasing production of plastics, combined with present waste disposal practices, will undoubtedly lead to increases in the concentration of these particles in rivers, estuaries, and the open ocean. [16]

Plastic has been known as a factor in environmental pollution—symbolized by the plastic bag—for a long time. Looking at newspaper headlines dealing with the environment-plastic nexus, it becomes clear that plastic waste in the environment has been perceived as an environmental problem at least since the 1970s (see Table 1 for *The New York Times* headlines).

Table 1 Recurring headlines from *The New York Times*, selected from the period 1970 to 2015

18.02.1973	*Ocean pollution—the very dirty sea around us* Report on scientific surveys discovering pollution at sea. Among other kinds of trash, plastic litter is mentioned as plastic fragments and plastic bottles
25.12.1984	*Deadly tide of plastic waste threatens world's oceans and aquatic life* Report on the first international conference of marine biologists on the issue of "plastic waste in the oceans" held at the University of Hawaii in Honolulu. The article describes plastic waste as a *new and insidious form of pollution*
28.02.1992	*Biologists cite plastic bag in whale death* Article about a humpback whale washed ashore who swallowed a plastic bag, probably the cause of death as stated by researchers
22.06.2008	*Sea of trash—pollution in the world's oceans* Essay on plastic pollution in the oceans describing concrete examples, causes, effects, public perception of the issue, and measures to fight the problem from the 1980s to the 2000s
12.02.2015	*Study finds rising levels of plastics in oceans* Article about a scientific study of the growing amounts and the sources of plastic waste entering the oceans. Nations are urged to *take strong measures to dispose of their trash responsibly*

Although this visible (waste) problem has resulted in a number of new technologies for waste disposal and policies for its regulation, such as the German Law on Circular Economy [17] (see [18] for further discussion), the European Directive on Packaging and Packaging Waste [19], or the European Waste Framework Directive [20], the current debate on the environmental consequences of plastic waste shows that we still have not managed to find effective solutions. But why is it so hard to tackle the problem?

From the social-ecological risk perspective, the environmental implications of plastics can be understood as an unintended side effect produced by modern societies through their normal mode of operation [9]. Plastic products are an integral part of our everyday lives and their consumption is largely inconspicuous. For instance, plastic used in food packaging does not satisfy a demand for plastic but a demand for fresh food. Plastic packaging in the medical sector guarantees aseptic medical products, and plastic bags are an easy way to transport our shopping [21, 22]. These are just a few examples of how plastic products have penetrated our society, contributing to the environmental accumulation of plastic waste. The biggest share of plastic waste is produced by plastic packaging of consumer goods [23]. The environmental risk is thus created in a decentralized way by our everyday lives and not by an extreme event or disaster. To manage the problem, we would need to reconsider our everyday practices and transform our habits and routines in respect of how we produce, use, and dispose of plastic products. Changing everyday habits and routines is certainly challenging. However, it is noteworthy that these routine practices, now referred to as the "throwaway culture," were learned by our society in the not-so-distant past. After Bakelite—the first truly synthetic polymer—was invented as a substitute for natural resources such as horn, ivory, or tortoiseshell in 1907, plastics were soon substituting other materials and used to produce multiple objects. In the first half of the twentieth century, plastic materials enacted a new way of life: first, durable everyday plastic items, like combs, nylon stockings, radios, and telephones, led to "mass culture"—a "democratization of material goods" [24]. Finally, the translation of plastics from the laboratory to the beverage and food packaging industry paved the way for a "throwaway culture." An article published in the late 1950s in the journal *Modern Packaging* captures the shift from a material considered as durable to an ephemeral product:

> The biggest thing that's ever happened in molded plastics so far as packaging is concerned is the acceptance of the idea that packages are made to be thrown away. Plastic molders are no longer thinking in terms of re-use refrigerator jars and trinket boxes made to last a lifetime. Taking a tip from the makers of cartons, cans and bottles, they have come to the realization that volume lies in low-cost, single-use expendability. . .consumers are learning to throw these containers in the trash as nonchalantly as they would discard a paper cup—and in that psychology lies the future of molded plastic packaging. (n.a. 1957:120 in [25])

The plastic material was coded to be become waste after a short period of use; its use and meaning were changed. This new way of consuming and throwing away metamorphosed into a normal feature of ordinary everyday lives, a practice that is taken for granted nowadays [21]. In the last 50 years, plastics have become *the* workhorse material of the global economy and led to enormous progress for modern societies [23]. And that is the dilemma: society benefits from the attributes of plastic products (they are lightweight, inexpensive, and durable), and at the same time, mass production and durability lead to growing amounts of plastic waste accumulating in the environment [21, 26]. Although plastic has been perceived as a pollutant for a long time, and environmental awareness continues to grow, the per capita consumption of packaging is still increasing [27], so that with the increasing accumulation of (micro)plastics, the associated risks are growing.

3 From Macro to Micro: Unveiling the Complex Side Effects of Plastic Pollution

In recent years, scientific and public debates on plastic pollution have shifted from the visible waste problem to microplastics, an invisible form of plastic pollution. Though already detected in seawater in the 1970s [16, 28–33], it was not until the 2000s that small plastic particles, previously described as pellets, fragments, spherules, granules, etc., were labeled "microplastics" [34], which propelled their scientific career. Since then, the number of studies has grown exponentially (see Fig. 1). With the rising number of studies, microplastics have been discovered in more and more ecosystems, whether deep-sea sediments or freshwater environments [35, 36]. These studies have demonstrated the vast extent of microplastic pollution and its ubiquitous and persistent character and accelerated further research on the sources, environmental fate, and biological effects of microplastics. However, the number of studies is not only the result of a growing scientific interest in a "new"

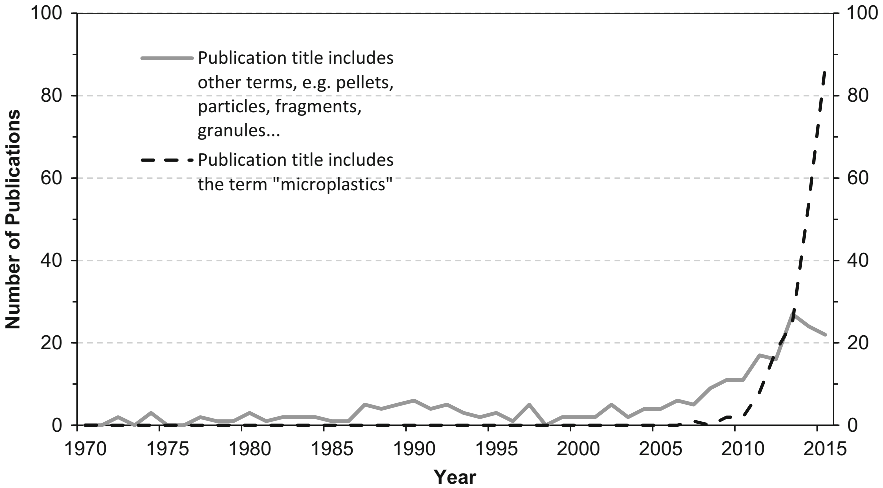

Fig. 1 *Environmental studies on plastic particles from 1970 to today*. The figure shows the rising number of studies in recent years, especially since the introduction of the term "microplastics." Studies were obtained from the search engines "Google Scholar" and "Web of Science." Keywords for the search were: microplastics + environment; plastic particles/fragments/pellets/granules/spheres/fibers + environment

research field—it also indicates the complexity of the problem calling for scientific methods in order to identify and quantify the consequences for the environment and for human health [10].

The traditional approach to environmental risk assessment of chemical substances cannot do justice to the multitude of microplastic particles and intervening variables and, therefore, cannot be applied to determining "safe" or "hazardous" levels of microplastics in natural environments [37]. Microplastics are not a homogenous group of substances, and they stem from various sources. The physicochemical properties of microplastics are as diverse as their sources. They differ in their polymeric composition, their additives, and have various shapes and sizes—all characteristics that can influence their biological effects. Microplastics can be toxic due to associated substances like phthalates and BPA [38], they can result in physical damage due to their shape [39], and they can induce indirect effects after being ingested, such as reduced food consumption due to satiation (malnutrition or even starvation) or intestinal blockage leading to death. Furthermore, biological effects are linked to other environmental contaminants such as persistent organic pollutants (POPs) that are absorbed by microplastic particles [40]. The lack of specific adverse effects leads to great uncertainty regarding predictions of the environmental consequences. These uncertainties were already expressed in early studies of microplastics around 30 years ago. However, despite these knowledge gaps, the problem was addressed pragmatically at that time: microplastics detected in natural waters and proven to be ingested by aquatic organisms were denoted as an "unnecessary contaminant" [33] that is "in all likelihood not beneficial" [41].

Today, pragmatic viewpoints still exist promoting a precautionary strategy with a call for action to reduce the leakage of microplastics into the environment despite evidence on specific adverse effects on ecosystems [42]. Others follow an approach, which Klinke and Renn [43] call "risk based." These studies aim to determine the potential damage of microplastics to provide evidence for the development of risk management strategies. Therefore, they target the existing research gaps in order to reduce uncertainties. But due to the nature of global risks, a broadened knowledge base will reveal even more variables, and it will be hard to achieve clear causality in order to structure the problem. For instance, research on microplastics has discovered even more sources of microplastics [44], and more species that ingest microplastics [45] and exposed methodological questions for assessing the risk, such as adequate detection methods to properly assess and compare the extent of microplastic contamination [46]. This hints at another dilemma: on the one hand, precisely these complexities call for thorough scientific investigation [10], but, on the other hand, exactly these investigations might contribute to higher complexity and greater uncertainty. Finally, the two approaches (risk based vs. precaution based) negotiate the question of how much knowledge is sufficient for action.

4 From Ecosystem Health to Human Health: Vibrancy, Uncertainty, and the Feeling of Insecurity

The impacts of (micro)plastics are not limited to the ecosystems where the plastic materials accumulate; the impacts are vibrant, affecting the political, social, and economic spheres, where they induce secondary and tertiary consequences, a typical characteristic of global risks [10]. For instance, studies point to economic effects, such as income loss among fishermen due to plastic debris [47], damage to marine industries [48], and loss of tourism revenues [49–51], which subsequently have social consequences. Today's discussions center on the impacts of microplastics on food for human consumption [13, 14], with possible but yet unknown threats for food safety and human health. Scientific evidence shows that microplastics are present in organisms, such as shellfish and fish, that play a role in human consumption [14, 52].

Microplastics infiltrating food for human consumption induce social processes. The following case from Germany shows the vibrancy of risk traveling from science into public awareness and how uncertain evidence and risk communication trigger feelings of insecurity.

A study commissioned by the media detected microplastic particles in drinking water, honey, and beer and was covered prominently in the German media [11, 12]. The knowledge produced by this study and the coverage of it in the media were contested by consumer protection agencies and food and beverage industries afraid of reputational effects. The studies were repeated by other scientists who could not verify the results, and some explained the identification of microplastics in German beer as an artifact of laboratory contamination [53].

The German Federal Institute for Risk Assessment (BfR), which deals with risks to human health, published a statement saying on the one hand that they could not detect microplastics in honey and beer in their laboratory studies. On the other hand, they stated that the health risk posed by microplastic-contaminated food and beverages cannot be assessed, due to the lack of reliable data and analytical methods [54]. The European Food Safety Authority (EFSA) started taking first steps toward a future assessment of the potential risks to consumers from microplastics and nanoplastics in food, especially seafood. Uncertainty exists, first, about the scope and quality of the contamination and, second, about the negative health effects for the public.

The media reports led to a raised public awareness of health risks, but the risk management authorities could not clear up the concerns, because despite that their studies had not verified the claim of microplastics in honey and beer, the question remains, if negative effects for human health exist. This feeling of insecurity is also reflected in the consumer survey by the BfR [55], which shows that 63% of the respondents had heard about "microplastics in food" and 52% answered that they were "concerned about microplastics in food". This case shows that there are only single observations of microplastics in food for human consumption and no scientific evidence for negative effects for human health exists. No general statement about risk for human health can be made; nevertheless, people are worried since a hypothetical risk has been communicated. Thus, due to the communication about the hypothetical risk, it becomes symbolically relevant in the first place, and a risk for human health is constructed. Therefore, risk communication is a very important aspect of risk management, with regard to the perception and psychological reactions of people who feel they are at risk. To reduce the social amplification of risk, it is important for laypersons that experts address risks and contextualize them in relations to other risks. Research on risk perception has pointed out that public opinion is steered by media reports scandalizing or exaggerating minor risks, leading to the spending of money to reduce them, while other major risks that failed to attract public attention are insufficiently considered [56, 57]. Risk managers should be sensitive to this and not become misguided by media and public concerns.

5 Risk Decision-Making: From Complex to Structured Problems

In the USA in December 2015, President Obama signed the Microbead-Free Waters Act, banning microbeads from rinse-off cosmetics—a success for microplastic opponents and environmentalists. What led to the quick decision to ban them, despite the complexity of the topic, which impedes risk assessment? A prerequisite for policy decisions is the degree of "consensus on the questions policy is addressing," as well as "certainty about the relevant knowledge" [58]. The degree to which a problem or a risk can be structured depends on consensus, values, views, and secured evidence, which includes knowledge of causes and effects. The continuum ranges from structured problems with common values and consensus on strategies and on the evidence, which comprises secured knowledge including clear causes and effects, to unstructured problems with competing values and no consensus on strategies and on the scientific evidence due to ambiguity and uncertainty [58].

In the case of the adoption of the Microbead-Free Waters Act, different actors were involved in "structuring the problem" [58]. Scientific evidence on the pathways into and the abundance in the environment was provided in strong collaboration with activists. For example, the NGO 5 Gyres Institute published the first microplastic pollution survey of the Great Lakes region in collaboration with the State University of New York in 2013. The concentration of microplastics found in the Great Lakes was higher than that of most samples collected in the oceans [59]. The studies were covered by the media, and the argumentation chain presented was quite clear: the microbeads threaten our lakes and rivers, stem from our cosmetic products, and slip through the sewage plants [60–62]. A clear scientific narrative was established and presented by scientists and activists to big personal care companies. The short "viewpoint" paper by Rochman et al. titled "Scientific Evidence Supports a Ban on Microbeads" [63], comprising a simple calculation of the number of microbeads and their route into the environment, was clearly aimed at strengthening this scientific narrative.

At the same time, environmental and ocean-protection NGOs campaigned for a ban on microplastics in cosmetics. Their campaigning methods included shopping guides that listed all producers using microplastics in their products and the app "Beat the Microbead" which could be used to check whether a product contains plastics. This app was launched by two Dutch NGOs in 2012 and further developed for international use by UNEP and another environmental NGO in 2013 [64]. With the guide and the app, tools were provided which enabled consumers to reduce their use of cosmetic products containing microplastics and to become more aware of the issue.

In the cosmetics industry, the evidence presented by the coalition between scientists and activists was not seriously contested. Global players like Johnson & Johnson, Unilever, and other multinationals announced that their products would be plastic-free within the next few years and that they would use natural substitutes instead. Since then, many more companies have pledged to phase out microplastics, motivated by reputational or environmental concerns.

With the detection of high amounts of microplastics in the Great Lakes, on the doorstep of the USA, the campaign against microplastics was boosted and entered the governmental arena, with several US states passing laws banning microbeads in cosmetics in 2014 and 2015 (e.g., New York, Illinois, California).

In March 2015, legislation to ban microplastics in cosmetics was introduced in the US Congress. How well the problem was structured by then is reflected in the speed with which the bill was passed: In March, it was introduced in the House of Representatives; in December, it was reported on and amended by the Committee on Energy and Commerce, and on the same day it was passed by the House of Representatives. Only 11 days later, it was passed by the Senate unanimously and was signed by the president 10 days later on December 28, 2015 [65]. The "Microbead-Free Waters Act of 2015" (H.R. 1321) prohibits "the manufacture and introduction or delivery for introduction into interstate commerce of rinse-off cosmetics containing intentionally-added plastic microbeads." The law specifies a phase out, starting with a ban on manufacturing the beads from July 2017 on, followed by product-specific manufacturing and sales bans in 2018 and 2019. The law bans only rinse-off and not leave-on products (eye shadow, face powder). Still, the ban can be regarded as a first step toward reducing the emission of microplastics. In Europe, industries have also pledged to phase out the use of microplastics, and Cosmetics Europe, the personal care industry's trade association, though highlighting that the "vast majority" of microplastics come from other sources than personal care products, issued a recommendation to discontinue their use in rinse-off cosmetics, and announced its intention to collaborate closely with regulators. By doing so, they were "addressing public concerns" [66].

At the science-policy interface, interest groups like environmental organizations did play an important role as brokers, but nevertheless further points were also decisive for the structuring of the policy problem. First, clearly structured evidence of cause and effect was presented and was not confused by other conflicting facts (other sources of primary microplastics and secondary microplastics as major sources were almost totally excluded in the US debate). Second, a ban on microbeads in cosmetic products did not constitute a financial risk or any other threat to the personal care sector, since alternatives existed and a change in production was implementable in the set timeframe. In addition, it gave the cosmetic industry the possibility to shape its sustainability profile and to emphasize value sharing with the consumer. This may be a reason why the presented evidence was not contested.

Recently published studies (e.g., [67]) have shifted the focus to land-based sources and the degradation of plastic waste in the oceans and other environments, enhancing the circle of responsibilities from single industries to complex processes of supplying, consuming, and waste management. In this context, it has turned out that cosmetic products as a source of microplastics play a much smaller role than previously thought [68, 69]. In this context, the ban on microbeads is only a tiny drop in the ocean. The complexity of plastics in the environment is becoming more and more obvious and poses a great challenge to risk assessment and management. Against this background, it seems that the Microbead-Free Waters Act was adopted in a window of opportunity in which the problem was perceived as well structured—the scientific evidence was clear to all interest groups, there was consent on the trade-off between the benefits of microbeads in cosmetics and the hazards they pose to ecosystems, and multiple alternatives for microbeads in cosmetics were available (physically and economically). Thus, the case of the USA can be regarded as an example of using a well-structured problem for policy-making, while most of the problems related to plastics are in fact unstructured, e.g., due to competing views of multiple interest groups.

6 Conclusion

Increased research on (micro)plastics has developed the picture that (micro)plastic pollution is ubiquitous. Microplastics have been detected in rivers in Europe (e.g., Danube, [70]), as well as in lakes in Mongolia [50] and the USA [59]. They cross state boarders, passing from rivers into lakes, and finally into the global common, the ocean. They also cross the boundaries between single organisms, accumulating in the food web. From a social-ecological perspective, the risk induces a vibrancy and resonance in socioeconomic, political, and public spheres. Thus, the theses we have presented and their corresponding data clearly identify microplastics as a global risk, leading to the following conclusions regarding further research areas:

Based on an understanding of the risks posed by microplastics as an unintended side effect of the everyday mode of societies, the global dimensions of production and distribution patterns need to be researched in more depth. In many countries of the Global South, a new middle income class with a high demand for plastic products is growing. Relations between the Global North and the Global South need to be addressed more adequately, regarding the production, distribution, consumption, disposal, and leakage into the environment of plastic-packaged products like fast-moving consumer goods.

Due to the complexity of the microplastics phenomenon, its assessment is difficult and requires further scientific investigations to establish the evidence in order to properly address the environmental risk. The same holds true for the assessment of the human health risks. This uncertainty impedes risk management decisions, but nevertheless action is required despite a lack of clear evidence, because microplastics are perceived as a threat by society. Therefore, as the complexity of the phenomenon may never be entirely resolved, future research should also focus on the question of how to handle uncertainty and manage complex global risks.

Although it is common sense that plastics should not be allowed to accumulate in the environment, much less consensus exists regarding the strategies needed to achieve this. As Shaxson [58] points out, the question “How can we make plastics sustainable?” is just too broad and unstructured to enable all the interest groups to speak with one voice. Strategies to combat pollution range from reuse, green chemistry, designs for recycling, improved waste management, standardized labeling, education, cleaning programs, and sustainable consumption. Not a single strategy is required, but each sector needs to be active. However, current debates show that responsibilities are often shifted elsewhere. Thus, identifying the risk producers is not straightforward, as some voices do not regard plastics as the source of the problem but rather their improper disposal; other voices emphasize the design of the plastic material, and yet others target consumer behavior. Risk management is about the negotiation of evidence and values. We should not stop at symbolic goals, like the G7 Action Plan [71], but move on to binding regulations. Research should focus on developing and testing mechanisms to call risk producers to account, for example, with the integration of costs in the benefits, extended producers’ responsibility, cost of inaction analysis, etc.

To conclude, we reflect on the risks of microplastics for ecosystems and our health, by drawing on the questions Beck once asked:

> How worried should we be? Where is the line between prudent concern and crippling fear and hysteria? [8]

Concerns about microplastics in our food and subsequent health effects, triggered by media reports, lead to social risk amplification, which may be disproportionate to other risks associated with plastics, such as environmental accumulation or the endocrine effects of plasticizers. There is no need for "hysteria" (to quote Beck). Nevertheless, we should take the (micro)plastics issue as a serious symptom of human-made environmental change. Plastic pollution is a visible example of how society and nature interact, and it unveils our relationship with nature. What kind of nature do we want and how do we want to live? We have to explore the intersections between global risks, power relations, and societal relations with nature if we want to bring about their sustainable transformation.

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