



RELEVANCE OF PUBLIC ACTIVE PARTICIPATION TO ADDRESS THE COMPLEXITY OF SCIENCE-BASED ISSUES, SUCH AS BIODIVERSITY LOSS

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ABSTRACT – In the light of the increasingly prominent role played by science in public life, the definition of a space for public participation is a key issue in the current relationship between science and society. This is especially true when science-based issues, which are often ethically sensitive and controversial, are at stake, such as environmental issues. The paper suggests the usefulness of an active role of the public together with researchers and policymakers in both the decision-making process and the activities to be carried out to address the complexity of current science-based issues, with a focus on the anthropogenic loss of biodiversity and the demand for its conservation and restoration.

KEYWORDS: SCIENCE-SOCIETY RELATIONSHIP, SCIENCE-BASED ISSUES, CITIZEN SCIENCE, ANTHROPOGENIC LOSS OF BIODIVERSITY, ENVIRONMENTAL ETHICS.

INTRODUCTION

Science-based issues, which are often ethically sensitive and controversial, such as environmental issues, require a broader assessment than either researchers or politicians alone can provide. Indeed, these issues usually entail accepting a trade-off between different perspectives and values, a choice which has an increasingly strong impact on the life of everyone – including, in some cases, living organisms other than humans. Hence, the necessity to foster a discussion involving a plurality of experts as well as the public in general and the directly affected population.

As David Tilman, a professor in ecology, highlighted concerning the current anthropogenic loss of biodiversity, which is one of the key environmental issues of the 21st century and a topic of growing importance in the public debate¹, “The loss of biodiversity will diminish the capacity

of ecosystems to provide society with a stable and sustainable supply of essential goods and services, but many of the very actions that harm biodiversity simultaneously provide valuable societal benefits” (2000, 210). In addition, note that decisions on which biodiversity conservation or restoration strategy to pursue imply making choices on which values – instrumental or intrinsic – and interests – economic, scientific, aesthetic, philosophical, cultural – to prioritise, as well as which entities to protect or foster – such as humans (poor or wealthy people), non-human animals, plants, species and ecosystems (Jamieson, 2008). In this regard, it is worth underlining the close connection between biodiversity

survival of life forms (Baard, 2022), and the peculiarities of its decline: the unprecedented speed and scale with which this phenomenon has been occurring over the last fifty years, and the type of causes. Precisely, five anthropogenic causes: habitat fragmentation; overexploitation of resources; climate change; invasive exotic species; pollution (Wilson, 1992; IPBES, 2019). The current loss of biodiversity is considered by many scholars to be the sixth mass extinction and an outcome of the Anthropocene epoch (McNeill & Engelke, 2014; Pellegrino & Di Paola, 2018).

¹ There is a growing scientific and ethical concern about the current loss of biodiversity given the value of biodiversity for the well-being and

and the territory in which we and other living beings live: the type of biodiversity found in each territory shapes the territory itself, defining the landscapes inhabitants can enjoy and the resources available to them. Human activities, such as massive deforestation or intensive urbanisation, transform the biodiversity found in a territory, but also change landscapes and natural resources. These transformations are due to human decisions and have an impact on all the life forms, even more so in the current era of the Anthropocene² (Pellegrino & Di Paola, 2018). Whether this impact should be considered good or wrong depends on the different points of view and values or interests that are favoured. Thus, it is crucial to have reasons that are not only good but also shared by all stakeholders for making claims for the conservation or restoration of biodiversity, as decisions in this direction raise conflicts among several aspects that we consider important (Sarkar, 2005).

In the light of this scenario, decisions concerning biodiversity conservation and restoration cannot be made by researchers or politicians alone, but ought to be the result of a broad decision-making process shared by all the stakeholders involved and based not only on scientific data but also on awareness of the underlying values and interests.

Moreover, this broad decision-making process seems to be especially relevant in the increasingly frequent conditions of *post-normal science* in which researchers find themselves operating. These conditions are characterised by disputed and uncertain scientific evidence, plurality of values at stake and urgency of political decisions – such as the case of the challenges posed by the recent Covid-19 pandemic (Funtowicz & Ravetz 1993/2020; Tallacchini, 2020; L’Astorina & Mangia, 2022). As the philosopher Georg Toepfer, whose research interests include the philosophy of biology, pointed out, the concept of biodiversity is a paradigmatic example of this new scientific context given the dimension of uncertainty and the different perspectives of value involved. “First, the investigation of biodiversity has to cope with uncertainties on the factual as well as the axiological or ethical level. We simply do not know enough about the amount and function of biological diversity; we do not know, for example, whether there are currently three or 100 million species of animals on earth, and we do not know how they contribute to the stability of our ecosystems. Second, we do not know how we should evaluate biodiversity: instrumentally or intrinsically. Third, stakes are high because we are currently facing a loss of biological species probably on the level of one of the five

mass extinction events in earth history. Finally, decisions are urgent because this is an irreversible loss and we do not know whether there will be a tipping point when things get worse at an increased speed and scale” (2019, 343).

Based on this framework, this paper highlights the usefulness of an active role of the public together with researchers and policymakers in both the decision-making process and the activities to be carried out to address the complexity of issues related to the anthropogenic loss of biodiversity and the demand for its conservation and restoration, as well as other ongoing science-based issues. This suggestion will be illustrated starting with some considerations concerning the idea of informed social consent, which was raised in bioethical debates, and the proposal of involving citizen advisory groups in the research activities that have such an important impact on public life. Then, the innovative way of producing scientific knowledge called citizen science will be focused on. In particular, the co-creation procedure within citizen science will be highlighted by reporting some benefits which emerged in the Italian environmental epidemiology study “Aria di Ricerca in Valle del Serchio”³.

A SPACE FOR PUBLIC PARTICIPATION

During his years⁴ as chairman of the Italian National Bioethics Committee, Giovanni Berlinguer – a physician and teacher in social medicine with an interest in bioethical issues – worked to highlight all the different positions that emerged from time to time when examining the various controversial issues on which the Committee gave an opinion. A democratic way of proceeding centred on giving voice to all positions rather than that of the majority alone. Moreover, this focus on giving visibility to the Committee’s internal plurality was accompanied by an openness towards dialogue with the various external viewpoints through the promotion of public debates on the issues raised due to developments in biology and medicine.

In this regard, in the 2001 document *Orientamenti per i Comitati Etici in Italia*, Berlinguer suggested that the internal structures of individual states should set up appropriate democratic instruments. They are necessary, he emphasised, both so that citizens are informed about problems and so

² To date, the term ‘Anthropocene’, i.e. the age of the human, has not yet been formally recognised as designating a new geological epoch. This, however, does not diminish the relevance of the observation that we now live in an epoch characterised by the ability of us humans to profoundly transform the Earth system.

³ The authors of the present article participated in the research activities of the scientific project “Aria di Ricerca in Valle del Serchio”, which is a part of the larger European project *Cities-Health*, as reported later in this text. <https://www.ariadiricerca.it/> last accessed April 23, 2024

⁴ Giovanni Berlinguer was appointed chairman of the Italian National Bioethics Committee in 1999 and remained in office until 31 December 2001.

that forms of debate can develop that are relevant to public decisions and implementation measures. Furthermore, Berlinguer put forward the idea of informed social consent, in line with the procedure adopted for medical issues. “It may perhaps be said that the principle of ‘informed consent’, a principle that is universally recognised but which is often emptied of that dialogical content that should characterise the relationship between the doctor and the patient, may also apply, on a broader scale, to the relationship between scientific research and citizens. The creation of an ‘informed social consent’ regarding the priorities of biomedical research, its methods and its applications can help guarantee and promote science, at a time when the scientific advances that are taking place almost on a daily basis raise growing hopes and concerns”⁵ (Comitato nazionale per la bioetica, 2001, 6). This social consensus, we can say, is becoming increasingly urgent in the context of contemporary science, which is characterised by uncertainty regarding the information that is acquired and by the pervasive impact of advances in knowledge and technological innovations on the lives of human beings, and more in general on living beings and the environment. In the light of the increasing relevance of science for the public good, the definition of a space for public participation is a key issue in the current historical phase. Indeed, the problems we are currently facing – from the ecological crisis to the extensive use of artificial intelligence – cannot be delegated to, let alone solved by, politicians and scientists alone, as they are issues that affect the life of every individual (Rufo, 2023).

The idea of informed social consent can already be seen in the *International Declaration of Human Rights* of 1948, which in Article 27 states “Everyone has the right freely to participate in the cultural life of the community, to enjoy the arts and to share in scientific advancement and its benefits” and later in 1966 within the *International Convention on Economic, Social and Cultural Rights* approved by the General Assembly of the United States, in which Article 15 recognises “the right of everyone to enjoy the benefits of scientific progress and its applications”. However, ever since the formulation of such a right, as the physician and bioethicist Carlo Flamigni points out in an article dedicated to informed social consent, the question has arisen as to how participation should be considered: whether only as taking part in the benefits of scientific advancements or as

real participation in scientific life. In this regard, Flamigni concludes by arguing that “in the literature devoted to this topic, there is convergence on the fact that this right goes far beyond the mere enjoyment of the benefits of scientific progress and certainly includes access to the decision-making room, where so-called ‘scientific creation’ is conceived”⁶ (Flamigni, 2017, 203).

On this point, the reflection that the philosopher Philip Kitcher articulates in the volume *Science in a Democratic Society* (2011) is particularly pertinent. The author, moving from the conception of science as a social institution that serves to solve people’s problems and that has a role in public knowledge, explicitly proposes the objective of achieving an integration of scientific competence with democratic values. Kitcher elaborates a concept of science that is influenced by the philosophical pragmatism regarding the reformulation of a non-positivistic conception of science. The author shows how, due to the complexity of much scientific research, value judgements are deeply rooted in its practice. The central issue, therefore, does not lie in the presence of values in science but in the nature of the value judgements made, the value patterns adopted and the way they are applied, as well as the transparent reporting of all these aspects. Specifically, regarding the relationship between science and society, in light of the increasingly prominent role of science in public life, Kitcher argues that the research agenda should be shaped by the informed ideas of a wider public. In his argumentation in this regard, he advances the thesis of the involvement of citizen advisory groups who represent a wide variety of human viewpoints, who are aware of the situation in particular research areas, and who act as intermediaries between the research community and the public in order to reproduce, as far as possible, a conversation that proceeds through mutual engagement with all potential stakeholders. In addition, the author also promotes informed citizen engagement in matters concerning certification. That is, the stage where new findings are accepted or rejected as part of public knowledge.

ACTIVE ENGAGEMENT IN CITIZEN SCIENCE PRACTICES

In recent years, the idea of taking non-scientists behind the scenes of scientific research is gradually being realised through innovative forms of public participation in scientific

⁵ Italian original text: “Si può forse dire che il principio del ‘consenso informato’, un principio che è universalmente riconosciuto, ma che spesso viene svuotato di quel contenuto dialogico che dovrebbe caratterizzare il rapporto tra il medico e il malato, può valere anche, su scala più ampia, per il rapporto tra la ricerca scientifica e i cittadini. Il creare un ‘consenso sociale informato’ alle priorità delle ricerche biomediche, ai loro metodi e alle loro applicazioni può svolgere una funzione di garanzia e di promozione della scienza, in un periodo nel quale i suoi quotidiani progressi suscitano speranze e preoccupazioni crescenti”.

⁶ Italian original text: “nella letteratura dedicata a questo tema c’è convergenza sul fatto che questo diritto va molto più in là della semplice fruizione dei vantaggi derivanti dal progresso scientifico e include certamente l’accesso alla stanza delle decisioni, là dove la cosiddetta ‘creazione scientifica’ viene ideata”.

research. One example of this, for instance, is the so-called citizen science: a new way of producing scientific knowledge that actively involves citizens and which aims to achieve shared social goals.

In 2014, the expression citizen science was introduced in the *Oxford English Dictionary* with the following definition: “Scientific work undertaken by members of the general public, often in collaboration with or under the direction of professional scientists and scientific institutions”. This definition was subsequently used by the European Commission (2016), which promotes this type of activity in order to increase the capacity of the research agenda to be aligned with the interests of the public and at the same time strengthen public trust in researchers and research institutions (European Commission, 2020). In 2015, key principles were developed to carry out scientifically and ethically sound citizen science projects, respecting the stakeholders involved and taking into account the new demands placed on them (ECSA, 2015).

The concept of citizen science is constantly evolving, and many definitions have been given (Cavaliere & Kennedy, 2016; Eitzel et al., 2017). A main feature is the active engagement of the public, which can take place at various levels: from mere data collection to maximum involvement, i.e., active participation in all stages of the research activity. In the case of a research study, from the identification of the questions to be investigated, the outlining of the study protocol and its implementation, to the interpretation of the results and their dissemination. Note how the highest level of involvement is desirable for democratic participation. When researchers and members of the public collaborate in all phases of a study or research activity, these citizen science studies/activities are defined in the literature as co-created (Bonney et al., 2009; Froeling et al., 2021).

The following section will report some benefits that emerged from the co-creation dimension within the Italian participatory environmental epidemiology study “Aria di Ricerca in Valle del Serchio”. The aim is to provide some points for reflection in the direction of considering the co-creation modality as a useful tool to be employed in addressing the complexity of issues related to biodiversity loss as well as ongoing science-based issues.

BENEFITS OF THE CO-CREATION APPROACH

“Aria di Ricerca in Valle del Serchio” is an environmental epidemiology and citizen science study, whose objective is to measure the frequency of kidney failure in an area affected by potentially polluting production activities (De Marchi et

al., 2022). It was part of the larger European project *Citizen Science for Urban Environment and Health* (acronym *CitieS-Health*) which ran from 2019 to June 2022 in five European countries – Italy, Lithuania, the Netherlands, Slovenia, and Spain⁷. Each research group adopted the co-creation procedure to conduct a pilot study on environmental pollution and health.

Since this was an environmental epidemiology context, the right to health regarded public health in general. In particular, the study carried out in Italy (in Valle del Serchio, Tuscany) concerned the right to public health of a community living in a place where potentially polluting production activities are present. All the phases of the study were carried out with the active involvement of the local population, which resulted in certain benefits that do not always emerge in traditional research contexts (Ficorilli, 2022).

A first benefit is having identified and implemented a participatory approach between researchers and citizenship, in which the following points were identified in an inclusive and shared manner: what good needs to be pursued, how it should be done, what possible consequences can be considered to be morally and socially acceptable. For example, in the first phase, the citizenship participated through public meetings and public events in outlining the research objective. In this way, the investigation focused on a public health objective considered relevant by the local community – and not only interesting from a scientific point of view.

Another benefit concerned the application of the principles of research ethics. In fact, the research group, which included researchers and members of public, was particularly scrupulous about the specific characteristics of the research context. We can cite, as an example, the phase of results interpretation in which the citizens, including some local administrators, showed particular care in assessing the impact that the results would have on the community in which they themselves live. They were, on the one hand, particularly open towards fostering the community’s awareness of the results obtained, which show some criticality even though they are not yet solid results. On the other hand, they were also cautious in disseminating the results so as not to cause unjustified alarm.

Finally, there was also a benefit concerning transparency in what was being done and would be done. In this regard, the possible uncertainty regarding the results that would be obtained from the survey was clearly explained from the outset. This uncertainty was due to the small numerical size of the population involved and the weakness and/or lack of information on the population’s exposure to risk factors for kidney disease. At the same time, the importance

⁷ <https://cordis.europa.eu/project/id/824484>; <https://citieshealth.eu/> last accessed April 23, 2024.

of conducting a scientific investigation aimed at public health prevention was emphasised. Another example refers to the phase of outlining together with citizens the contents of the information sheet concerning participation in the study. In that document, particular attention was paid to making explicit reference to the value of storing and using the personal data and biological samples that would be collected in coded form. On the one hand, this represents a value for researchers considering the difficulty in re-contacting participants to collect further information necessary for the study. On the other hand, there is value also for the participants who, thanks to this codification, have a guarantee that their biological samples and data will be stored and used anonymously, and at the same time have the possibility of exercising a series of rights, including the right to request the return of individual results. This clarity is not always enforced in traditional research contexts, where time-consuming and technical language is often used.

CONCLUDING REMARKS WITH A FOCUS ON BIODIVERSITY LOSS

In the light of the benefits outlined above, it seems plausible to argue that citizen science practices, especially in the sense of co-created practices, constitute particularly appropriate spaces for public participation. Indeed, this type of active engagement fosters an informed and transparent conversation, and shared choices among all potential stakeholders on ongoing science-based issues, which are often ethically sensitive and controversial. Such issues require a broader assessment than either researchers or politicians alone can provide. A debate involving a plurality of experts, as well as the public in general and the directly affected population in particular, is therefore necessary. This is also true in matters pertaining to the current anthropogenic loss of biodiversity and the demand for its conservation and restoration.

Consider, for instance, the different positions and controversies that the creation of large wilderness areas that are free of significant human disturbance may raise to protect many endangered species. The pursuit of such a conservation objective may conflict with the interest that local communities may have in accessing and using the resources in those areas for their own benefit. This interest becomes particularly relevant when the community depends heavily for its survival on the biological resources that it is intended to preserve. In some cases, local communities may be subject to forced displacement to establish and maintain intact natural habitats. As the philosopher of biology Sahotra Sarkar underlines, “Since these strategies are necessarily at least in part coercive,

we should have strong ethical justifications for our actions” (2005, 46). In addition, this “human cost often generates political opposition, which can be inimical to biodiversity conservation” (ibid., 44). On the other hand, the management of such protected areas may require the downsizing of a predator species to prevent it from driving a predated species to extinction, thus conflicting the survival interest of the species with the survival interest of individual non-human animals (Jamieson, 2008; Pollo, 2011).

A different situation in which conflicts may arise regards the implementation of wind farms to produce renewable energy. Wind turbines compete with many animals, plants, ecosystems and natural landscapes. One has only to imagine of the extent of the territory occupied by the blade bases, the impact of the blades themselves on the flight of birds, the changes to the territory required to ensure access to the installations—for example road construction and the felling of forests or other types of plants. Wind energy, in short, almost always comes at a price in terms of diminishing biodiversity and radical changing landscapes. However, one objection to all this, supported by many, is that alternative energies are still a necessary and indispensable improvement on the road to ecological conversion or transition (Pellegrino, 2021).

Another example concerns the composite framework when assessing biodiversity regarding food, and how best to preserve and foster it. In this regard, the philosopher Andrea Borghini addressed the question concerning the nature of the criteria for inclusion in conservation effort by focusing on the portion of the living realm that he calls “the edible environment”, that is “not simply those plants and animals [...] that were domesticated for human consumption, but also the thousands of species that are regularly consumed by some human population and that are regarded to some degree as wild” (2019, 417). Among other things, Borghini argued that “the diversity of the edible environment is deeply entrenched with human cultures, so that the criteria for biodiversity measurement must reflect human perspectives within different societies, embedded in the conceptions of plants, animals, and dieting” (2019, 431). Moreover, he pointed out that preferences for certain forms of life over others are based on multiple values – e.g., food sovereignty, food security, gastronomic pleasure, and intrinsic value. Therefore, in addressing issues of biodiversity conservation and promotion in this regard “It is important to explore how such values differ across societies and whether convergence over a few selected values is a desirable goal, or if lack of convergence is actually more fruitful for the purpose of the biodiversity of the edible environment” (ibid., 431).

Faced with such complexity embedded in issues related to biodiversity conservation and restoration, we suggest that their identification, understanding, evaluation and management may be facilitated by adopting a participatory

approach in which the public is an active subject together with researchers and policymakers in both the decision-making process and the activities to be carried out. Indeed, the active role of the public fosters the inclusion of the different points of view which are involved; transparency regarding the values, interests and priorities at stake; the identification of shared objectives and values; and the enhancement of the public's scientific and ethical knowledge and skills. All these aspects are relevant to balancing, in an ethically and socially approvable manner, losses and gains, which any choice in the conservation and restoration of biodiversity inevitably entails; as well as evaluating how to fairly distribute the impact of such choices among present and future individuals (Kitcher, 2011).

As zoologist and wildlife conservation policy and practice expert John G. Robinson points out, in order to have successful biodiversity conservation programmes, it is essential that the design of such programmes takes the local social context into consideration. Indeed, Robinson declares “If opposition to a given conservation approach is sustained, if local stakeholders are disenfranchised, and if the benefits of conservation do not outweigh the costs over the long term, then that particular conservation approach will ultimately fail (Robinson, 2011, 963).

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