Visions for Sustainability

Vision without action is useless.
But action without vision
is directionless and feeble.
Vision is absolutely necessary
to guide and motivate.
(Donella Meadows)

Interactions between different logical levels
produce phenomena unseen at either level.
(Gregory Bateson)

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Increasing communication, promoting awareness, realizing engagement

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Whether we believe they are warranted or not, prestigious awards, at least potentially, reach a wider public, even if only for a limited period of time. One year ago, we pointed to the importance of awarding the 2017 Nobel Peace Prize to the *International Campaign to Abolish Nuclear Weapons*. While the work of this international movement continues, it is clearly difficult to gauge the extent to which greater media exposure has contributed to the achievement of its goals. By the same token, the 2018 Prize, jointly awarded to Denis Mukwege and Nadia Murad "for their efforts to end the use of sexual violence as a weapon of war and armed conflict", is of equal significance. Both for the gravity of the issue in question and because it highlights some critical aspects of the complex and problematic relationship between phenomena and events brought to public attention through media communication, the information conveyed, the impact created and the eventual outcome of this process.

According to the Nobel Committee, both Mukwege and Murad have helped to give greater visibility to wartime sexual violence, thereby making a fundamental contribution to focusing attention on and combating such war crimes. Mukwege is a physician who has spent much of his adult life helping the victims of sexual violence in the Democratic Republic of Congo. His work has had an impact on the lives of tens of thousands of survivors and has inspired people around the world. Murad is a member of the Yazidi minority in northern Iraq and was herself a victim of rape and sexual slavery perpetrated by the Islamic State. She has been widely praised for her courage in speaking out about her personal ordeal as part of a collective drama and campaigning to help other women refuse to remain silent and suffer from shame for the abuses to which they have been subjected.

At the same time, rape is by no means something new in the long list of war crimes perpetrated by humanity. It is paradoxically both well-known and still subject to censorship, that rape also took place on a massive scale in Europe during combat operations in World War II, and that when allied troops entered and occupied German territory the number of women who endured sexual violence is estimated at being up to two million. Only relatively recently, the story of hundreds of thousands of women and girls forced into sexual slavery as "comfort women" by the Japanese army in occupied territories before and during World War II has emerged and been widely publicized, even though such information had long been available, but willfully ignored.

Issues such as campaigning for the abolition of nuclear weapons or ending the use of sexual violence as a weapon both pose crucial questions about whether and in what way occupying the international stage can make a significant difference. More generally, it is an open question as to what extent increasing media communication can lead to more information and facilitate understanding that is then translated into changing attitudes and enabling capillary action, bridging the gap between promoting awareness and realizing focused and effective engagement.

As a further example, climate change and global warming currently constitute perhaps the most widely-discussed environmental issue, although this is only one among many critical questions that involve worsening scenarios. Other issues are also in great need of adequate channels of communication capable of raising widescale awareness of the increasing risks involved. For example, the 1992 Rio Earth summit gave rise both to the UN *Framework Convention on Climate Change* and the UN *Convention on Biological Diversity*, considering each of them to be of equal importance in terms of the threats to sustainability. Subsequently, however, for every twenty examples of media handling of negotiations related to climate change there has been only one concerning talks on the loss of biodiversity. The recent meeting in Sharm el-Sheik with the aim of working on a framework

for new targets, hopefully to be finalized by state leaders in Beijing in 2020, has attracted much less media attention. Moreover, it has been conspicuous for the absence of a number of important countries such as the United States and also expressed current fears for policies in such countries as Brazil, where nationalist governments are denying the very existence of an emergency and moving away from the principles of international cooperation.

While it is by no means the first document to contain such clear warnings, the latest *International Panel on Climate Change* special report furnishes, in its summary for policymakers[1], its most unequivocal and incisive description of the efforts necessary to reach well-defined goals and respect certain timescales. These will, however, require massive efforts in order to be achieved within the necessary deadlines, and this month's climate talks in Poland have done little to move in that direction. A recent study shows how most countries' climate commitments currently still fall far short of the 1.5-to-2.0°C goal set in the Paris agreement of 2016[2]. Furthermore, a study published by *Nature* shows that global carbon emissions in 2018 will have risen by over 2%, despite the urgent need to decrease them drastically[3].

A few days after the publication of the IPCC report, the Swedish Academy announced that the "Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel" – informally presented as the Nobel prize for Economics – was to be awarded to William Nordhaus and Paul Romer for their studies on carbon tax (Nordhaus), and integration between technological innovation and long-term macroeconomic analysis (Romer). In a subsequent interview, Nordhaus argued that achieving "sustainable development" required awareness of the dramatic nature of the situation, the introduction of a carbon tax and appropriate technological innovation. Awareness is necessary in order to achieve recognition of why a carbon tax is essential even by those who do not want it and promote technological changes that will facilitate the transition to a low-carbon world without subverting the overall macroeconomic organization.

Nordhaus believes that people's awareness is in fact now often considerably in advance of the ability of governments to implement the necessary changes. At the same time, while increasing numbers of polls and surveys confirm this rise in awareness at least about climate change and global warming (if not about other major planetary environmental issues), according to the European Social Survey (*European Attitudes to Climate Change and Energy: Topline Results from Round 8 of the European Social Survey*, ESS Topline Results Series 9, September 2018[4]) most people seem to have not yet developed the level of awareness needed in order to achieve the second target indicated by Nordhaus. Carbon tax, either because little known or understood, or perhaps simply because it is a tax (with all the negative connotations this term brings), attracts very limited consensus with respect to other measures, such as subsidies for renewable sources and energy efficiency, in particular under the form of incentives for behavioral changes and banning of less efficient means. Nevertheless, an interesting experiment introduced back in 2008 in British Columbia, whereby a carbon tax introduced by the provincial government putting a price on fossil fuel emissions was accompanied by returning to people through tax cuts all the extra revenue raised, may provide an effective example of how to address the problem.

The papers included in *Visions 10* look at some examples of how such informal agencies as

[1] http://report.ipcc.ch/sr15/pdf/sr15_spm_final.pdf

[2] https://www.nature.com/articles/s41467-018-07223-9

[3] https://www.nature.com/articles/d41586-018-07585-6

[4] https://www.europeansocialsurvey.org/docs/findings/ESS8_toplines_issue_9_climatechange.pdf

media communication in general and more formal agencies such as universities and schools can address questions related both to learning about and taking action to address current issues. Media communication is an essential component of increasing awareness of problems and promoting understanding of specific issues on the part of the general public. The uniqueness and urgency of our current situation has recently been expressed even by Kristalina Georgieva, the CEO of the World Bank: "We are clearly the last generation that can change the course of climate change, but we are also the first generation with its consequences". At the same time, equally important roles must be allocated both to stimulating public debate and, in particular, enhancing young people's engagement. If more than 40 percent of the current global population is between the ages of 10 and 24, then clearly young people must be empowered to be a driving force for their own and older generations. Sustainability cannot be achieved without their direct involvement and they are the ones who risk facing increasingly devastating consequences of climate change. A crucial question is thus that of how to facilitate the process whereby young people move from being the object of education to becoming the subject of their own action.

In "The Anthropocene Media Project. Mass Media on Human Impacts on the Earth System", Leslie Sklair describes an ongoing research project on how the Anthropocene (the geological concept created to measure and name human impacts on the Earth System) is represented in the mass media in local languages all over the world. Data has been collected from online searches of newspapers, magazines and other news media websites from around 100 countries/regions by about 50 volunteer researchers and is being analyzed by years of publication, numbers and types of articles. The analysis shows how issues can be ignored or misrepresented by the media. This is in part because both the scientific and media establishments, together with the business and political interests which underpin them, prefer to reassure the public rather than present the alarming detail of the risks that are clearly being run. There is a need for media communicators and science educators to promote greater awareness of the many aspects of the unsustainability of current human choices and trajectories.

In "What is at stake for scientists when communicating ecology? Insight from the informal communication initiative "Cammini LTER", Alba L'Astorina, Caterina Bergami, Domenico D'Alelio, Emanuela Dattolo and Alessandra Pugnetti, present reflections on an initiative regarding informal communication of ecological research called "Cammini LTER". The research is based on itineraries connecting a number of sites which are a part of the Italian Long-Term Ecosystem Research network. LTER-Italy ecologists walked and cycled together with citizens in order to create a "physical and visible movement" of researchers towards and with citizens, so as to give the public the chance to become familiar with various Italian ecosystems. The focus is on debates and reflections between the researchers themselves and in particular on issues concerning science communication and its relationship to research production, arguing for the need for a cultural shift in this respect. Co-construction and exchange of knowledge are seen as crucial for communicating ecology and creating a shared civic culture, based on mutual responsibility and collective contribution to addressing socio-ecological challenges.

In "Should justice for people come before justice for the environment? Engaging students in debates about environmental justice", Helen Kopnina examines the differences between ecocentric and anthropocentric positions with regard to justice as they emerge from university students' perceptions of the concepts of social and ecological justice. The paper looks at how the students debate the relative values assigned to humans and the environment. Putting justice for people before the environment can be based on evidence that biological conservation can harm local communities, on the idea that the notion of justice itself is framed by humans

and therefore remains a human issue, and also on the assumption that humans have a higher value than other species. Putting justice for the environment first is based on the premise that only an ecocentric ethic guarantees protection of *all* species, including human beings, and thus ecological justice already guarantees social justice. The research demonstrates how for many students there is a convergence of social and ecological justice when human and environmental interests correspond. Ultimately, the common "enemy" of both vulnerable communities and nonhuman nature is seen to be an ideology of economic growth and industrial development.

In "The Contribution of the Capability Approach to the Understanding of Young People's Sustainability Engagement as a Positive Developmental Outcome", Giulia Rossi and Martin Dodman argue the need to recognize how young people's engagement with sustainability includes both civic and pro environmental behaviors, such as environmental activism, that contribute to the development of sustainable communities. This is based on a holistic idea of sustainability, where civic democracy and ecological integrity are strictly interconnected. The lack of empirical studies exploring this kind of engagement among young people can be seen as a consequence of the lack of shared theoretical model that provides a framework for both types of behaviors. The authors show how integrating Positive Youth Development with the Capability Approach can provide a new theoretical model based on the idea that both positive individual and sustainable development are a question of social justice that takes place within specific domains and is related to understanding experience within individual life courses.

In "If Dante had known Phytoplankton. A comparison between literature and science through the didactics of metaphors", Maria Rosaria Vadrucci, Floriana Vitale, Maria Teresa Duggento, Caterina Alberani, Aurora Calò, Giorgia Giancane, Beatrice Barbara Rizzelli, Syria Schipa and Roberto Visconti describe a project involving High School students and the Environmental Protection Agency of Puglia in Italy. In order to promote students' understanding and awareness of an ecological issue, the authors propose an interdisciplinary approach which combines the study of Dante's Divine Comedy and HABs, colonies of algae, simple photosynthetic organisms that live in the sea and freshwater and grow out of control while producing toxic or harmful effects on people, fish, shellfish, marine mammals, and birds. Since HABs can be defined as "bad", based on their negative characteristics, some of these were compared to the sinful souls that Dante and Virgil encountered along their metaphorical journey into Hell. Bridging the gap between humanistic and scientific cultures by integrating literature and science in terms of ecological indicators helps students understand the relationship between the sustainability of human and environmental trajectories.

Much of both media communication and educational enterprise tends to associate sustainability almost exclusively with the environment. While the link between the two is of crucial importance, the ability to recognize sustainability as central to existence is also of vital significance. Our endeavor to promote this recognition depends on an understanding that for all people sustainability is about the relationship between everyone's present and future. At the same time, young people's interest in cultivating that relationship must necessarily be greater, simply because the future will determine much more of the nature and quality of their lives than with older age groups. This is why young people must urgently both become more informed and aware and demand a greater say in the decisions taken today that will have such a bearing on their future in particular. An alliance between the young and the old requires collaborative (working together to help each other fulfill their needs) and cooperative (working together to plan and realize new and common human trajectories) engagement. As many of the papers in this issue show, promoting behavioral change involves motivating personal engagement by linking it to what is feasible and

can be done on a local scale while relating its significance to a global perspective; rendering communication understandable through specific and personally pertinent examples, graphic representations and metaphors that can enhance its impact; fostering critical appraisal of the contents of what is communicated through reflection and debate; creating a sense of community whereby understanding co-emerges, objectives are co-defined and action is co-implemented.

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The Anthropocene Media Project. Mass Media on Human Impacts on the Earth System.

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Abstract.
The Anthropocene Media Project is an on-going research project on how the Anthropocene (the geological concept created to measure and name human impacts on the Earth System) is represented in the mass media in local languages all over the world. So far, data has been collected from online searches of newspapers, magazines and other news media websites from around 100 countries/regions by about 50 volunteer researchers. The data is being analyzed by years of publication, numbers and types of articles. The paper concludes with some observations on the role and responsibility of the mass media in interpreting science for various publics.

Key words. Anthropocene; mass media communication; science, politics and the public

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***Perspective**: Theoretical and research visions*

***Fields**: Earth life support systems, Social Processes and Structures*

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Introduction

The focus of this paper is an on-going research project on how the Anthropocene (the still controversial geological concept intended to measure and name human impacts on the Earth System)[5] is represented in the mass media in local languages all over the world. The Anthropocene Media Project (AMP) started in early 2017, and data has been collected from online searches of over 1,000 newspapers, magazines and other media websites from around 100 countries/regions.[6] To date around 2,500 articles containing the word 'Anthropocene' have been recorded from online searches and of these, about one third have been summarized for further analysis. My aim is that, eventually, when all the results are collected and analysed, an edited book with chapters on geographical areas and thematic issues written by the researchers will be published.

There is an enormous amount of research on how the terms 'climate change' and 'global warming' are being reported in the media all over the world (see Boykoff 2011, Kunelius et al. 2016). However, my suspicion since beginning to study the Anthropocene (in mid-2016) and asking everyone I meet (face-to-face and virtually) about it, is that while many academics, environmentalists, social scientists, humanities scholars, and creative artists do engage actively with issues of the Anthropocene, most educated and cultured elites do not. I also suspect that the mass of the world's population have either never heard of it or if they have, they have no clear idea about it. Lacking the resources to conduct surveys all over the world to test my intuitions, I argue that researching how the Anthropocene is presented in mass media at the local level in local languages might serve to begin to answer my research questions – is the Anthropocene regularly reported in popular media around the world and if so, to what extent can this be considered to be a form of science education? Kahan (2015) explores in great detail and with great finesse the difficulties of all science education and, in particular, communicating the elements of climate change to lay publics. When assessing how the media perform we should bear in mind that communicating the Anthropocene adds several layers of complexity to an already difficult task. It is also important to note the ambiguous nature of the concept - it was debated in academic and elite cultural spheres while it was being contested in the scientific community (as is widely reported in the media the geological gatekeepers are still considering whether or not to accept the Anthropocene in the official nomenclature). It continues to be controversial due to its political and philosophical implications. Hence, global analysis of the Anthropocene in the mass media raises important considerations about the nature of science and more generally, the science-politics interface, discussed in further detail below.

All the researchers are volunteers (mostly graduate students plus a few professors and others), contacted via my personal networks in and around the rapidly growing scholarly community engaged in Anthropocene studies.[7] Most of the volunteer researchers are working and/or studying in the general field of environmental studies and most appear to have found out about the project either from my direct calls for participants, their university teachers (my original points of contact) or through friends working in the same field. Given the nature of the pool of participants the research has had to take its place alongside coursework, finishing off doctoral dissertations, and the day-to-day demands of working in educational establishments. Findings arrived throughout 2017. Raw data consists to date of around 200,000 words – whole articles, many translated from non-English languages in full or in part by volunteer researchers, with summaries, and researcher notes. The point of the research is to find out if and how the Anthropocene *per se* is being reported in the mass media. Almost half of the sources searched had no item that included the word 'Anthropocene' though most of them had articles on climate change (hundreds in some cases). The

[5] For a clear introduction that strikes a good balance between the science and the politics, see Angus (2016); more technical is Steffen et al. (2011); and Malhi (2017) for geological detail, debates and 121 references.

[6] China and the USA were split into regions. Most major languages are covered and multilingual websites provided material on some non-English language media.

[7] According to the bibliographical search engine Scopus, over 2,000 scholarly publications on the Anthropocene appeared between 2009 and 2018.

results so far suggest that on average each source contained between two and three 'Anthropocene' items. However, this masks large differences between places with very large counts (for example, Germany where 276 items were found from 7 sources and France, 165 from 4, compared with many single figure results from many other countries). It is also notable that hundreds of articles on the Anthropocene in the mass media referred to cultural events on Anthropocene themes.

Methodology

The methodology for the AMP is deliberately straightforward, minimizing difficulty and complexity for the volunteer researchers. Participants were asked to access the online sites of at least three (more if possible) newspapers, business publications, and magazines for the word 'Anthropocene' and the names of its two most prominent scientific proponents – Paul Crutzen (usually credited with introducing the concept) and Jan Zalasiewicz (who led the Anthropocene Working Group). The term 'mass media' is used in its broadest sense to mean any source of news that is available in print and/or online accessible to communities at various scales (towns, cities, regions, countries, and language and interest groups within these geographical entities).[8] Wikipedia proved to be a good source of lists of mass media in most countries, as well as country-specific searches. Websites with subscription charges were excluded in most cases. This simple methodology also has theoretical significance. The research aims to show how likely it is that ordinary readers with no special interest in the topic would come across references to the Anthropocene while browsing the daily news and, if they did find such information, what it would be telling them.

Where the word 'Anthropocene' was found in any source, total numbers of items with the word were recorded, along with the years of first and most recent items. The titles and summaries of items were recorded (translated into English where necessary). Many media sources, some of which had devoted considerable attention to 'climate change', never mentioned the Anthropocene at all, and I consider this to be an important finding. Also important is the fact that significant numbers of items did not directly connect the word with the geological (scientific) concept but referenced its use in a cultural context. This manifested itself in the titles of art exhibitions, music, and novels – notably the emerging genre of cli-fi (climate fiction). This phenomenon connects with the related concept of the 'Anthropo-scene', how the geological concept has been taken up in many other cultural spheres (see Lorimer 2017, Sklair 2018). The Anthropo-scene provides an excellent example of the ways in which a scientific concept interfaces with culture, creative arts, and beliefs (see Robin & Muir 2015). Some typical examples of cultural references to the Anthropocene are given below.

The data is being analysed, initially, in two ways. First, by types of items categorized as general explanations of the Anthropocene and its likely effects on human and non-human life forms, connections with specific eco-systems (notably climate change, biodiversity, forests, oceans), disputes within natural and social science communities, and artistic and philosophical expressions of the Anthropocene (the Anthropo-scene). The second criterion of analysis is whether or not the item takes a position on the Anthropocene and, if so, what it is in terms of three narratives:

[N1] Neutral reporting and/or Anthropocene as a continuation of natural processes, presenting opportunities for industry, science and technology, and human/non-human/nature relations;

[N2] Recognition that the planet and humanity itself are in great danger, that we cannot ignore the warning signs but if we are clever enough we can save ourselves and the planet with technological fixes, geoengineering, conservation strategies, etc.;

[N3] Recognition that planetary (including human) survival are at risk, that humanity cannot go on living and consuming as we do now, that we must change our ways of life radically, for example by bringing capitalism to an end and creating new types of societies, or religious/spiritual renewal.[9]

[8] Search engines currently produce over two million results for 'Anthropocene'. Blogs and other social media are excluded from the results of this project.

[9] These narratives are derived from the project findings to date – I have tried to avoid interpreting them in

N1 and N2, often difficult to distinguish, can be characterized as predisposing towards the 'good Anthropocene' (see, for example, Shiue et al. 2014, Breakthrough 2015); while those arguing for N3 tend to be mainly on the anti-capitalist left (see Angus 2016, Sklair 2017).

Preliminary Findings

The majority of media representations of the Anthropocene in the AMP tended to conflate [N1] and [N2], but not all in the same way. We can begin with some typical examples from mass media in various parts of the world of how the idea of the Anthropocene is introduced.[10] 'The Anthropocene, the Age of Humans: People become geological agents: does it mean that a new stage for Earth has begun?' (*La Vanguardia*, Spain, 2016) is typical of a number of long and informative articles with sections on the current geological age; the origin of the Anthropocene idea; debates on the starting date of the Anthropocene; and our place as humans in the Anthropocene. With respect to the consequences for humanity, the tone is neutral, no alarm bells are rung. Also non-committal, is the *Hong Kong Economic Times* [in Chinese]: 'Our footprint leads the Earth to a new geological age: the Anthropocene: Human activity will remain on the surface of the planet for millions of years' (2016). The article explains that the Museum of Tomorrow in Rio de Janeiro has a section on the Anthropocene, showing how human activities have affected the earth since the industrial revolution. It provides visitors information for thinking about what we can do to make a change. *Diario Las Américas* (Miami, Florida) 'The Earth has entered a new geological epoch, according to scientists'(2016) covers standard debates about the Anthropocene, the causes that led to the transition between the Holocene and the Anthropocene, the 'great acceleration' of the mid-20th century as a plausible starting date, with a brief quote from Jan Zalasiewicz about the different markers of the Anthropocene. Once again, while technically accurate, the article sounds no alarms. An article in the *Philippine Daily Inquirer* on the 'Climate Pope' (2015) by the influential Anthropocene scholar Johan Rockström goes further. It explains that the main message of the Pope's encyclical is: 'If we do not change our behaviour quickly, we may well lose the environmental stability upon which our planet—and our lives—depends'.

In France, where the media coverage of the Anthropocene has been both extensive and wide-ranging, we find many references to debates within the scientific community. *Le Figaro*, 'A geological era of which man would be the hero' (2011) cites both Paul Crutzen, and the eminent French glaciologist, Claude Lorius who argues: 'it is not so important that geologists accept or not to define a new era … The real problem is that we are there. The future of the environment in which we live is worrying and too few people seem to be aware of it' – but the tone is bland. *The China Daily* [in Chinese]: 'The 11,700-year-old Holocene epoch is over' (2016) is a balanced account, concluding: 'We're now living in the Anthropocene epoch. In other words, geologically at least, there will be no denying the influence mankind has had on the planet. And it's a hard one to put a positive spin upon, no matter how you frame it.' The range of messages in these typical examples from hundreds of articles offering introductions to the idea of the Anthropocene cluster around the first and second narratives identified above and feed into the general 'concerned citizen' approach to climate change and sustainability, namely that all we need to do is pollute less and find more renewable forms of energy. With the gradual move out of fossil fuels we may be starting to move beyond the situation that I labelled 'The corporate capture of sustainable development' (Sklair 2001: ch. 7), but the growth obsession of politics and business alike (propagated by most proponents and opponents of capitalist globalization) still dominates the discussion as the only way to alleviate poverty. This often appears to be hovering in the background in media representations of the Anthropocene.

terms of academic debates focusing instead on what the lay reader might take from the articles in the media.

[10] The examples following are identified by name and country of source, title of article, and year. While the word 'Anthropocene' may not appear in all the quoted material, it appears in all the articles. Many of the items in the sample are reprints of material first published in European or North American sources.

The Starting Date of the Anthropocene and the Human/Nature Divide

A theme attracting regular media coverage all over the world is the argument among scientists about the starting date of the Anthropocene, which has important consequences for the credibility of the concept. This has been expressed forcibly in wide-ranging debates around the problematic relationships between humans and nature, the 'end of nature', and the impact of human activity on the planet as a whole and its separate but interdependent eco-systems (see, for example, Hamilton et al. 2015). All these issues are hotly contested and while the arguments are usually portrayed accurately in the media these debates can be seen as a diversion from the main issue of planetary survival. They might also be seen as contributing, however unintentionally, to good Anthropocene narratives and, sometimes, opening a door to Anthropocene and/or climate change denial. This is clearly expressed in the *Financial Times* (UK) 'Muddle over the moment mankind made its mark on earth' (2015) where, even in a well-informed discussion, the issue of planetary survival is blurred: 'If we are indeed in a new geological epoch, the signals are gentler and we are still in the thick of it. Our planet is neither boiling nor frozen, although we may be in the middle of a sixth mass extinction [for which see below]. The whole Anthropocene discussion deserves a wider hearing, not least for its power to inspire… It also poses a question worthy of public debate: do we want our arrival in the planetary logbook to be heralded by the ingenuity of the industrial revolution, or our indifference to plastic rubbish?' At the extreme, we find a climate change sceptic and critic of the Anthropocene, Peter Foster, who writes in the *Financial Post Magazine* (Canada), 'Man as killer asteroid' (2014). He concludes 'Issues such as climate science certainly deserve assiduous examination, but what we have had more of in recent decades is fashionable, ideologically-driven hysteria that has already led to lousy policies and threatens worse. No wonder the public has switched off, and climate negotiators are threatened with extinction.' This last phrase may be a sardonic reference to a best-selling book, *The Sixth Extinction* by the eminent science populariser Elizabeth Kolbert, published in 2014. As Kolbert's book and 'extinction' attract attention in the mass media it is worth further comment here.

Though Kolbert does connect the Anthropocene with the issue of extinction of humanity in her book and other writings, in the media the focus is almost always on threats to wildlife and biodiversity. For example, the *Liaoshen Evening News* (North-east China) 'The Earth may be entering the Anthropocene era' (2010), reports a science magazine article arguing that a sixth biological extinction may occur, in which millions of flora and fauna will disappear. This is a typical way in which the extinction/Anthropocene connection is represented – humans (through resource extraction and excessive consumption) are blamed for these extinctions but humans themselves appear to be exempt from the catastrophic consequences. Kolbert herself is quoted in *Shenzhen Te Qu Bao* (South China) 'Looking at Animals from a Different Perspective' (2017): 'The fondness of lovely animals by humans saved endangered animals like pandas, which is a good thing, but humans should also pay more attention to animals who look less appealing. They are also an indispensable part of the world. This is the reason I didn't talked about penguins, wales or crocodiles, with guilt, I only wanted to talk about bats'. No direct mention here of humanity in peril. In *Česká televize* (Czech Republic) 'Bedřich Moldan (prominent local geochemist and ecologist) comments on climate change impact: Extinction of biological species is a threat' (2015), but his focus is on ocean acidification and damage to coral reef ecosystems. Similarly, *Economic Times of India* (2016) describes Kolbert's book in terms of 'mankind's part in mass extinction in the animal kingdom'. Another review of Kolbert's book in *Suddeutsche Zeitung* (Germany) 'World may lose 2/3rd of its wildlife by 2020, 6th extinction on the cards' (2015) cites a much-publicized report by World Wildlife Fund (WWF). 'There is still considerable room for optimism. Fortunately, we are not starting from scratch. We must create a new economic system that enhances and supports the natural capital upon which it relies … While the prediction of losing two-third of global wildlife population is expected by 2020, the landmark Paris climate agreement (COP21) that would enter into force the same year, is seen as another sign of optimism.' In South Korea, two newspapers

published articles on 'extinction', perhaps reflecting a more general sense of public alarm in the region. From *Joongang Ilbo*, 'Extinction of species due to humans… Is it now the Anthropocene? … The 6th Mass extinction, is it more dangerous for the globe than nuke is…?' (2015), and from *Hangeorae* 'Anthropocene, the 6th mass extinction is more serious than expected' (2017). *Gazeta.ru* (Russia), under the alarming title, 'Man came and destroyed everything. What happened to plants and animals because of human activity' (2015), is a summary of an article from *Nature*, arguing that human activity caused the elimination of plenty of different species, thus accelerating the process of natural extinction'. And humanity?

The *Glasgow Herald* (Scotland) 'We must protect our natural riches' (2015) takes a local issue to illuminate a global problem: 'We live in what some scientists are now calling the Anthropocene era. … It is responsible for global warming and species extinction estimated by some as 1000 times greater than it would otherwise be. In the light of this, one four-month conviction for the killing of one bird may seem small beer. But the court's decision is a welcome reminder that as a species we can recognize that this planet is not home to us alone'. Again, no comment on the fate of humanity, likewise *Aktuálne* (Serbia), 'Animal world faces catastrophe: Who is responsible for mass extinction?' (2016). This catastrophic prediction is briefly linked to the Anthropocene as the new epoch in Earth's history. Both the *Sudanese Business Centre,* 'World on track to lose two-thirds of wild animals by 2020, major report warns' (2016) and *Sabah* in Turkey 'The Earth is under the greatest mass extinction danger since dinosaurs' (2016) highlight WWF's Living Planet Index which shows vertebrate populations are set to decline by 67% on 1970 levels unless urgent action is taken to reduce humanity's impact. But, as usual, the action required is left vague. In the *Seattle Times* 'Pope Francis' environmental encyclical cannot be ignored' (2015), two academics applaud the Pope's exhortation to be good stewards of the Earth. They conclude: 'We have inherited our current predicament from generations past. Now it is up to us, and generations to come, to rediscover the intrinsic value of nature's biodiversity and stop what is known as the sixth mass extinction...A defining feature of the Anthropocene is the rapid extinction of nonhuman species.' This is, at best, a half-truth, opening the door to the 'good Anthropocene' mentality. More seriously, the *Austin Daily Texan,* in a review of *The Sixth Extinction*, 'Extinction makes plea to look at our effects on the planet' (2014) quotes from Kolbert's previous book *Field Notes from a Catastrophe* (2006): 'It may seem impossible to imagine that a technologically advanced society could choose, in essence, to destroy itself, but that is what we are now in the process of doing.' Similarly, 'The extinction factor' *The Daily Star* (Bangladesh, 2010) discusses the belief of the late Australian biologist Frank Fenner, that humans, along with many other species, may be extinct in the near future, due to man-made climate change, with the Anthropocene marking the end of sustainable human life on the planet. But these warnings are few and far between.

The Anthropocene in the Creative Arts

References to the Anthropocene in cultural contexts display a variety of attitudes to the phenomenon. It is rarely explained beyond stock phrases like 'Age of Humans' and 'man's impact on the planet' but there appear to be more overtly dystopian sentiments implied, as will be seen from some of these articles, organized by genre.[11]

Art exhibitions: *Hangzhou Daily* (2014) 'Taipei Biennale, there is a big world in the small play.' The 2014 Taipei Biennale is underway in Taipei city museum of Art. The theme is 'drama and acceleration', and the proposition is 'Anthropocene'. The works of 52 artists from around the world are on display here. *Le Quotidien* (Luxembourg) (2015) 'Casino: durant les travaux, l'activité continue' tells us that 27 young artists from the l'Atelier No Name de la HEAR (Haute école des arts du Rhin) de Strasbourg exhibit their works on the theme of the Anthropocène, or rather on its affects as a principal actor in climate change. *Daily Star* (Bangladesh, 2016) 'Fragments of the Anthropocene: Bengal Art Lounge' describes the works of two artists from Dhaka, from their exhibition about the loss which the onset of the

[11] Descriptions are a mix of researcher summaries and some direct quotes. I give titles and years to help find the original articles for those so inclined.

Anthropocene has caused.

Photography: *Egypt Today* (2017) 'Climate change exhibit to open near Trump's house' reports that the photographer Justin Brice Guariglia will be bringing the catastrophic results of climate change to Trump's own doorstep, in his home at Florida. The exhibit, titled 'Earth Works: Mapping the Anthropocene' at the Norton Museum of Art features images of melting glaciers that Guariglia has collected with NASA while in a mission to Greenland. Guariglia tells the *Art Newspaper* that 'One of the unique things an artist can do is to help shape realities and, at the same time, have a political and social message. Artists today really have to use art to carry an important message forward.' *Maclean's* (Canada) (2016) 'Postcards from the edge of the earth' is also on a photography exhibition chronicling the environmental movement from the 1960s to today. The curator says that the title suggests falling off a cliff, perhaps one that mankind blasted itself. 'Maybe human beings are not the strongest species on Earth. It's something to say, beware.'

Music*: ***Seattle Times (2016) 'Say goodbye to 2016 with a song' reviews the year in music with reference to a Nick Cave song 'Anthrocene' which 'felt appropriate because it wraps up the loss felt this year and the severe impact of humans on the environment. The word Anthropocene was first used instead of the more common Anthropocene in 1992 by science writer Andrew Revkin in his book 'Global Warming: Understanding the Forecast' to describe a geological era significantly impacted by humans.' The *Oxford Mail* (2012), 'Death of Hi Fi create a 'squall' of sound', profiles a local group with four recordings already under their belts, and their new album, Anthropocene. Andy says: 'There's a beauty in darkness in some ways and I get a lot of solace from it. I was probably the only person to read Cormac McCarthy's *The Road* and find it uplifting.'

Opera*: ***DV (Iceland, 2016) reports the contemporary opera UR by Icelandic composer Anna Þorvaldsdóttir based on the idea that Man considers himself above the environment, affecting the Earth in an unprecedented way. 'Because of this, theories have emerged that have us living in *mannöld* (Anthropocene), an epoch of human impact in Earth history. This can maybe be seen most clearly in places where people have lived for thousands of years in a very close relation to the harsh natural forces, like on Greenland where the concept work for the opera was partially carried out. The glaciers are melting, the oceans are acidifying, and the livelihood of animals and human societies is crumbling.'

Dance: *Salzburger Nachrichten* (2016) advertises 'Anthropozän', an urban dance piece based on the influence of Man on the Earth. *Suddeutsche Zeitung* (2017) 'Im Fadenkreuz der Gotter' is a review of a ballet that deals with the end of humans on earth and their self-destruction.

Sculpture*: ***The State Journal-Register (Springfield, Illinois, 2014) is one of many media to report: 'The only way to see this incredible museum in Mexico is by scuba diving'. The installation is of 500 underwater sculptures off the coast of Mexico's Riviera Maya, via the Museo Subacuático de Arte. One exhibit is called 'Anthropocene' and is a sculpture of a Volkswagen made to house lobsters.

Cli-fi (climate fiction)*: ***Seattle Post-Intelligencer (2016) in a review of *Barkskins* by Annie Proulx': 'And if we're lucky enough to survive the Anthropocene we've seemingly wrought, then *Barkskins* will surely survive as the crowning achievement of Proulx's distinguished career, but also as perhaps the greatest environmental novel ever written.' *Times of Israel* (2017) 'Literary Critics Probing the Rise of Cli-Fi Novels in the 21st Century'. 'Cli-Fi, Sci-Fi, We All Cry, The End is Nigh: What Cli-Fi Novels Say About the Anthropocene.' The writer suggests that Adam Trexler led the way with his book *Anthropocene Fictions* in 2015.

Theatre. *Le Soir* (France, 2017) 'The Yes Men: spreading some joy at la Fabrique de Théâtre à Frameries, sponsoring a studio dedicated to the anthropocene.' *Suddeutsche Zeitung* (Germany 2017) 'Hier spricht die Molekulargenetik" (2017) is an article about a dramatist/playwright Konstantin Kuspert who is known for his dystopian (and sometimes utopian) plays and controversial topics. Kuspert talks about the Anthropocene, saying: 'it is outrageous how it is exploited by the media but there seems to be no change in people's mentality.'

Multi-media*: *The Herald (2015) '10 things to do in Dublin this weekend'. Riddle of the Burial Grounds is a free, international exhibition motivated by one of the major problems facing our planet – the markings and warnings around nuclear burial sites.

'Did you know that mankind is entering the 'Anthropocene' era? Nope, me neither. I guess we'll just have to allow the visual arts to educate us further, and Riddle of the Burial Grounds has it covered via the mediums of sculpture, film, photography, documentary, science-fiction, and imagined futures.' This seems a fitting conclusion to this baffling sample from the cornucopia of cultural references to the Anthropocene.[12]

Representing the Science of the Anthropocene to The Public

In terms of media efforts to reflect the best available science on the Anthropocene, it is difficult to decide if the glass is half-full or half-empty. Results from the AMP show that the two most prominent Anthropocene scientists are regularly mentioned – Crutzen (almost always described as 'Nobel prize-winner in chemistry') over 150 times, Zalasiewicz over 100 times. Various science publications (notably *Nature, Science, Anthropocene,* and *Anthropocene Review*) also appear in the media as sources of headline-material research,[13] as do reports from scientific research establishments (e.g. Stockholm Resilience Centre on planetary boundaries) and ecological NGOs (for example, the 2016 World Wildlife Fund's Living Planet Index).

As the media items quoted above show, it is not easy for journalists to find a clear path in reporting Anthropocene stories when the messages coming from scientists themselves is so often ambiguous. Many social science and humanities scholars, unsurprisingly, frame these issues in terms of the relationship between science and politics. Two prominent scholars, Isabelle Stengers and Bruno Latour, engage with the science-politics of the Anthropocene. Stengers (2015) argues that the urge of scientists to publicize the idea of Anthropocene before all the geological markers were firmly established was a risky strategy (necessitated, no doubt, by the fact that no-one really knows how long we have got to 'save the planet'). However, this meant that climate change and Anthropocene deniers could keep the debate going and frame it as a struggle between 'merchants of fear' and 'merchants of doubt'. Latour (2015) keeps this conversation going with the argument that science and politics are both frail human endeavours. Anthropocene politics 'is not a rational debate … [it is] incredibly easy to make *two sides* emerge even when there is only one' (Latour 2015: 147).[14] The opinions of some Earth scientists on the relations between science and politics may be inferred from a paper in the authoritative Geological Society of America journal (*GSA Today*) by the Chair of the International Commission on Stratigraphy and a Commissioner of the North American Commission on Stratigraphic Nomenclature who argue: 'The drive to officially recognize the Anthropocene may, in fact, be political rather than scientific' (Finney & Edwards 2016: 4).[15] As far as can be established, over 90% of scientists accept the reality of Anthropogenic climate change while about 50% of the public do not (Cook *et al*. 2015). While I have not come across any research on public attitudes to the Anthropocene *per se* it seems obvious that this disconnect between scientific research and public opinion is at least partly due to the way in which both climate change and the Anthropocene are represented in the media and that the media are not entirely responsible for the confusing messages that appear in newspapers, magazines and online.

The first results from this project (to end 2017) suggest some potentially important lessons for science educators on the role and responsibility of the mass media in interpreting science for various publics. This, obviously, will involve not just the 'bare facts' of science (if such can ever be said to exist) but putting science in a context that the lay public might have a reasonable chance of understanding. While the names and views of Crutzen and Zalasiewicz appear frequently, few

[12] Robin L., Avango D., et al. (2014) discusses major multimedia Anthropocene events in various cities in great depth. See also Sklair (2018).

[13] For example, a paper by Zalasiewicz and colleagues in the magazine *Anthropocene* in 2016 arguing that plastic waste would be a major marker for the Anthropocene in the future, was picked up by media all over the world.

[14] Here I borrow from my review article of seven books on the Anthropocene (Sklair 2017).

[15] Professor Finney, described as 'the biggest critic of the Anthropocene idea', is quoted eight times in the sample, in newspapers from England, the USA, India, and France.

others made it into double figures. Elisabeth Kolbert (author of *The Sixth Extinction*) with 44 mentions, Gaia Vince (*Adventures in the Anthropocene*) with 28, and Diane Ackerman (*The Human Age*) with 22 – attracted far more media attention than most Earth scientists. In the case of reporting on the Anthropocene (and particularly the threat of extinction of humanity) the media are forced into the unenviable choice between 'merchants of fear' and 'merchants of doubt', between pessimism and optimism, between highlighting the need for radical economic, social and political change or hoping that human ingenuity will solve the problems of planetary survival. While some of the media coverage tries to have it both ways, most of it promotes the optimistic option – narratives 1 and 2 in my formulation. Narrative 3 - that capitalism, the international system of competing states, and the obsession with 'economic growth' are the problems not the solution – is rarely discussed. The key idea of degrowth is almost entirely absent from mass media coverage.[16]

While there is, of course, good reason to give the people hope, it is not surprising that the mass media, largely owned by big business and generally dependent on advertising revenues, downplay the risks of the Anthropocene. As I noted above, climate change and individual eco-systems (atmosphere, oceans, forests, soils, etc.) attract much more attention than the Anthropocene and the totalizing concept of Earth System science, that is conceptualizing the planet as a complex system, not simply the sum of the parts of each individual eco-system. Generally speaking, there is little sense of urgency in the reporting of the Anthropocene in the mass media. As I suggested above the 'good Anthropocene' (as expressed in narratives 1 and 2) is predominant. The AMP provides substantial evidence of the potential for the creative arts to intervene in science education (or, at least, consciousness-raising) in general, and the Earth Sciences in particular. This may have been seriously neglected (or at least under-estimated). As noted above, many articles on the Anthropocene in the mass media refer to cultural events.[17]

Finally, knowledge about and a serious appreciation of the potential dangers of the Anthropocene may provide a useful gateway for relatively uninformed publics into a variety of issues that are ignored or misrepresented by the media. It is understandable that both the science and media establishments and the business and political interests which underpin them would tend to lean towards reassurance rather than desperation in portraying the perils of the Anthropocene – often hinted at but seldom spelled out in its alarming detail. However, in the opinion of many Earth scientists this is a high-risk situation, probably not for most people living at present, possibly not even for their grand-children or their great grand-children, but almost certainly for generations to come. This is a reality that citizens and policy-makers, mass media communicators and science educators need to grasp – the issue of human survival is at stake.

References

Angus, I. (2016) *Facing the Anthropocene: Fossil capitalism and the crisis of the earth system.* New York: Monthly Review Press.

Boykoff, M. (2011) *Who Speaks for the Climate? Making sense of mass media reporting on climate change.* Cambridge University Press.

Breakthrough (2015) <https://thebreakthrough.org/index.php/dialogue/past-dialogues/breakthrough-dialogue-2015>

Cook, J. *et al*. (2015) Consensus on consensus: a synthesis of consensus estimates on human-caused global warming. *Environmental Research Letters* 11: 1-6.

D'Alisa, G., Demaria, F. and Kallis. G. (eds) (2014) *Degrowth: A Vocabulary for a New Era.* London: Routledge

Finney, S. & Edwards, L. (2016) The 'Anthropocene' epoch: Scientific decision or political statement? *GSA Today*, 26, 3–4 (March-April): 4-10.

Hamilton, C., Bonneuil, C. & Gemenne, F. eds. (2015) *The Anthropocene and Global*

[16] See D'Alisa et al. (2014). This idea is so threatening to the status quo that my PC automatically changes the word to 'edgrowth'.

[17] For evidence of the efforts of early Anthropocene proponents to bridge the 'two cultures' problem, connecting science with the arts and humanities, see Sklair (2018).

Environmental Crisis: *Rethinking modernity in a new epoch.* London & New York: Routledge.

Kahan, D. (2015) Climate-Science Communication and the Measurement Problem. *Advances in Political Psychology*. 36 (Suppl. 1): 1-43.

Kunelius, R., Eide, E., Tegelberg, M., Yagodin, D. (2016) *Media and Global Climate Knowledge: Journalism and the IPCC.* New York: Palgrave Macmillan.

Latour, B. (2015) Telling friends from foes in the time of the Anthropocene. In Hamilton et al., eds. *op cit.*: 145-55.

Lorimer, J. (2017) The Anthropo-scene: A guide for the perplexed. *Social Studies of Science* 47(1): 117–142.

Malhi, Y. (2017). The Concept of the Anthropocene. *Annual Review of Environment and Resources* 42: 77–104.

Robin, L. & Muir, C. (2015) Slamming the Anthropocene: performing climate change in museums.
reCollections <http://recollections.nma.gov.au/issues/volume_10_number_1/papers/slammingtheAnthropocene.>

Robin L., Avango D., et al. (2014) Three galleries of the Anthropocene.
Anthropocene Review 1: 207–224.

Shiue, I., Samberg, L, et al. (2014) Future Earth Young Scientists Conference on Integrated Science and Knowledge Co-Production for Ecosystems and Human Well-Being. *Int. J. Environ. Res. Public Health* 11(11): 11553-11558.

Sklair, L. (2001) *The transnational capitalist class*. Oxford: Wiley-Blackwell.

Sklair, L. (2017) Sleepwalking through the Anthropocene (Review article). *British Journal of Sociology* 68 (4): 775–784.

Sklair, L. (2018) Globalization and the Challenge of the Anthropocene. In Rossi, I. ed. *New Frontiers of Globalization Research.* New York: Springer.[forthcoming].

Steffen, W., Grinevald, J., Crutzen, P. and McNeill, J. (2011) The Anthropocene: conceptual and historical perspectives. *Phil. Trans. R. Soc. A* **369**: 842-867.

Stengers, I. (2015) Accepting the reality of Gaia: a fundamental shift. In Hamilton et al., *op cit*.: 134-44.

ORIGINAL PAPER

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What is at stake for scientists when communicating ecology? Insight from the informal communication initiative "Cammini LTER"

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Abstract.
What is at stake for scientists when communicating ecology? This is the basic question tackled in this paper, that we explored through reflections about an initiative of informal communication of ecological research called "Cammini LTER": itineraries connecting a number of sites belonging to the Italian Long-Term Ecological Research network (LTER-Italy). LTER-Italy ecologists walked and cycled together with citizens creating a physical and visible movement of researchers 'towards' and 'with' citizens, aiming at providing the public with the opportunity to get familiar with Italian ecosystems, from the sea to alpine tundra. We address here the debates and the critical considerations among researchers themselves, stimulated by the overall experience, with focus on some relevant issues pertaining science communication, and even research production, evidencing the need for a cultural shift, which go far beyond the national context and the LTER – Italy network. Using a participant observations approach, through researchers' words used to describe - formally and informally - the experience, we report and comment here the main narratives emerged, showing different attitudes of LTER researchers in Cammini towards the society and the role of ecology in it. Relationship and knowledge exchange appear crucial for communicating ecology, which can thus become an opportunity for building new qualities of knowledge and for creating a shared civic culture, able to make all players feel mutual responsible and contribute to the solution of particular socio-ecological challenges.

Key words. Long-term ecological research, LTER-Italy, Cammini LTER, Informal science communication, Science and society.

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Introduction

Human beings are changing, everywhere in the Planet and at an exceptional rate, their relationships with the natural environment (Millennium Ecosystem Assessment, 2005). This has placed importance on the study of society-nature interactions, and the present environmental problems are considered not only ecological but also socio-ecological and cultural. Indeed, the way human societies interact with their environment has consequences not only on ecosystems, but also on social systems themselves and on human wellbeing. Social justice, economy, national security, and human health are actually considered as environmental issues, since they basically depend, to different extents, from structure and functioning of ecosystems across the globe (Lubchenko, 1998).

According to the socio-ecological approach, ecological research becomes also a cultural process, not only a scientific one, entangled within historical social values (Haberl et al., 2006). For ecosystems and biodiversity to become more culturally valued by society, scientists and citizens need to be reciprocally engaged and reconnected, starting from their territories, developing more intimate relationships with and, ultimately, taking care of them (Folke et al., 2011, Jamieson, 2011).

The relationship (*sensu lato*) is indeed the heart of many concepts in ecology, including those concerning indicators of sustainability, which have moved from an approach focused on "problems to be solved" to one addressing the "origin of the observed relationships". Concepts such as carrying capacity, ecological footprint, and ecosystem services are all metaphors used to describe relationships between human society and nature, and the dangers of excessive exploitation. However, they remain mainly abstractions and conceptualizations, and new methodologies, especially in the communication and education frameworks, need becoming more embedded in the culture and in the daily experiences (Gray & Colucci Gray, 2018).

With respect to the latter, the interface between ecological science and society requires to be reframed, for instance, thoroughly reconsidering the way scientists communicate and engage with society (Groffman et al., 2010). This could be implemented for instance by merging the prevalent cognitive and rational approach of ecology as a science with a more emotional one, which is the core of the "affective ecology", a branch of the ecological thought dealing with emotional relationships between human beings and the rest of the living world (Barbiero, 2011; Barbiero, 2014).

Many ecologists are involved in communicating science to the public and in addressing societal concerns about environmental issues. Evidence to the latter respect comes from a variety of sources and is motivated by different reasons, such as (i) improving public understanding of science and informing and educating the public, (ii)influencing policy, (iii) proposing solutions to environmental problems (Pace et al., 2010).

Scientists' ideas of public communication are object of investigation since two decades at least, showing different attitudes towards the public, ranging from deficit model to more inclusive forms of interaction. The practices of communication (i.e.: the ideas of public, of science and of communication) are considered relevant for understanding the way scientists frame and shape the communication process. Reflecting on them is therefore necessary, "being scientific understanding of publics just as relevant as public understanding of science" (Lévy Leblond, 1992). While it is generally recognized that communication activities can be important for the public, less explored is the importance and the impact that such activities may have on scientists themselves.

In this paper, we wish to reflect on how researchers perceived and represented the relationship with society within the context of the informal science communication initiative called "Cammini LTER": a series of trails, performed by walk or by bike, promoted starting from 2015 by the Italian Long-Term Ecological Research network (LTER-Italy, www.lteritalia.it),

with the aim of making people aware of what ecology and LTER activities are. In Italy, school-education in the field of ecological science is quite inadequate and opportunities for discussion between society and experts of environmental problems, also at the local level, are rare. Science communication in Italy primarily targets people with high-level education and, when addressing the general public, ecology is only a secondary issue. The concept of ecology is therefore quite often unknown or misinterpreted: the word ecology is mainly linked to sewage disposal or to "green" or organic commercial products, ignoring the existence of ecology as a science that study nature, its functioning and the way it sustains our lives.

During Cammini LTER, scientists, as the ancient "story-tellers" on the road, shared experimental works and ecological studies with people met along the itineraries and at the LTER sites, which were landmarks of each trail. Cammini were imagined as a sort of Via Francigena (the ancient medieval pilgrim route running from Canterbury to Rome) of ecological research and they were integrated in a long-lasting tradition, where walking is considered the most intimate way to engage with landscape, offering privileged insights and knowledge into both places and self (Solnit, 2000).

The reflections we present herein focus only on LTER scientists, on the principal motivations and drivers for their engagement with the public and on how they have been discussed and might have been reframed along the trails. Through researchers' words, which were used to describe - formally and informally - the experience, we report and comment the main narratives emerged, showing different attitudes of LTER researchers in Cammini towards the society and the role of ecology in it. Reflecting on how scientists perceive the relationship between science and society can be a fundamental starting point for developing a more open, empathic, responsible and collaborative ecological communication and relationship with society, which may lead to a deeper awareness of the role of each actor in the managementand care of the territory.

1.1. LTER-Italy and the initiative

Long-Term Ecological Research (LTER) aims at better understanding, analyzing, and monitoring changes in ecosystem patterns and processes over extended periods of time, typically decades. LTER is organized in networks of sites and platforms - at the national, continental (i.e., European, LTER-Europe: http://www.lter- europe.net/) and global level (ILTER: www.ilter.network) - where comparable approaches and meaningful interpretations of on going ecological processes are developed (Mirtl et al., 2018; Mollenhauer et al., 2018). The distinctive trait of the LTER networks is the integration among research sites and platforms, where long-term ecological observations are maintained, also in the perspective of creating a legacy of well-designed and documented knowledge for future generations. Since more than a decade (Singh, Haberl, Chertow, Mirtl & Schmid, 2013; Mirtl et al., 2018, Dick et al., 2018), the integration of social sciences in LTER has become one of the main priorities. Socio- ecological research is conducted in national LTER networks worldwide, aiming at collecting and synthesizing both environmental and socio- economic data and to involve a broader stakeholder-community so as to define research priorities (Haberl et al., 2006; Mauz, Peltola, Granjou, van Bommel & Buijs, 2012; Dick et al., 2018). The LTER networks therefore represent an appropriate and suitable context where new and different forms of communication and public participation and engagement could be experimented.

LTER-Italy (www.lteritalia.it) belongs to LTER- Europe and ILTER since 2006. It involves many national scientific institutions (National Research Council, universities, other national research institutions), scientific societies and public agencies. It is made of 79 research sites, from the terrestrial, freshwater and marine ecodomains representative of the main Italian ecosystem typologies (Figure 1).

LTER-Italy researchers planned and realized, starting from summer 2015, an informal science communication initiative called Cammini LTER (i.e. "Trails LTER"): researches walked and cycled along itineraries, which connected two or more LTER sites, aiming at making the public more familiar with the components, conditions and changes of Italian ecosystems, from the sea to alpine tundra, i.e., wherever LTER is active.

During each leg of the trails, which lasted from four to ten days, informal events and communication activities were carried out, in tight connection with the territories that were largely heterogeneous both in size (from big towns to small villages) and audience (from school children to elderly people, from lay people to territorial managers, such as foresters, ecological and alpine guards, local environmental associations).

Figure 1. Map of Italy where the 79 LTER-Italy research sites are evidenced. The colours of the dots correspond to the main ecosystem typologies: Blue=marine, light blue= freshwater, light green=transitional water, green=terrestrial. The red spots indicate the sites reached by Cammini LTER in 2015. The main features of the sites can be found on DEIMS, the LTER-Europe repository for research sites and datasets (https://deims.org/)

1.2 The trails

This paper focuses on the three Cammini LTER that took place, two by walk and one by bike, during summer 2015. Their main features and the itineraries are reported in Table 1 and Figure 2.
"Mesothalassia" (literally translated from the Ancient Greek "a land between the seas", http://www.lteritalia.it/cammini/mesothalassia; D'Alelio, 2016), launched the initiative. It was a bike-tour, which crossed longitudinally the whole Italian Peninsula, from the Adriatic to the Tyrrhenian coasts, and connected two LTER sites (Figure 3): the Coastal dunes (https://data.lter-europe.net/deims/site/lter_eu_it_020) and the Gulf of Naples (https://data.lter-europe.net/deims/site/lter_eu_it_013), on the Adriatic and Tyrrhenian coasts, respectively. The tour followed the courses of two rivers (Ofanto and Sele) and touched different inland-water environments, in addition to the marine ones: river mouths, brackish and freshwater lakes, lagoons, and springs. The main theme of Mesothalassia was actually water as a resource, in terms of food and energy production, biodiversity maintenance, and ecosystem functioning. The team included a total of 10 bikers, with different background (science, education, communication). About 200 bikers in total, distributed along the different legs, joined the team. More than 500 people attended Mesothalassia events, which included different formats. The events took place both at research centres and public spaces: the cooperation with local institutions (e.g. WWF Oasis, the Gargano National Park, several local authorities and citizen associations) was crucial for their organization.

Table 1. Main features of the trails Cammini LTER (see also Figure 2)

Trail name	Trail Type	Trail Period and duration (days)	Trail Length (km)	LTER sites included in the trail	Number of legs	Main themes	Organizing Institutions
Mesothalassia An ecological bike tour from the Adriatic to the Tyrrhenian Sea	icycle trail	28/6/15-/7/15 (11)	600	Italian Coastal Dunes; Gulf of Naples	10	Aquatic ecology and plankton	Stazione Zoologica Anton Dohrn, University of Molise
The adventure of biodiversity On the Central Apennines, from Monte Velino to the Gran Sasso	alking trail	29/7/15-08/15 (4)	70 (36 by walking)	Apennines - High elevation Ecosystems	5	Biodiversity, geology and landscape ecology	National Forest Service (now Carabinieri Biodiversità)
Pink…Blue…Green…! Eco-relay trail through LTER sites from Monte Rosa to Lake Maggiore	alking trail	23/8/15-/8/15 (6)	164 (62 by walking)	Western Alps; Mountain Lakes; Southern Alpine Lakes	8	Aquatic ecology, socio-ecological aspects, geology and landscape	REA-CNR, ISE-CNR, Jniversity of Torino DISAFA

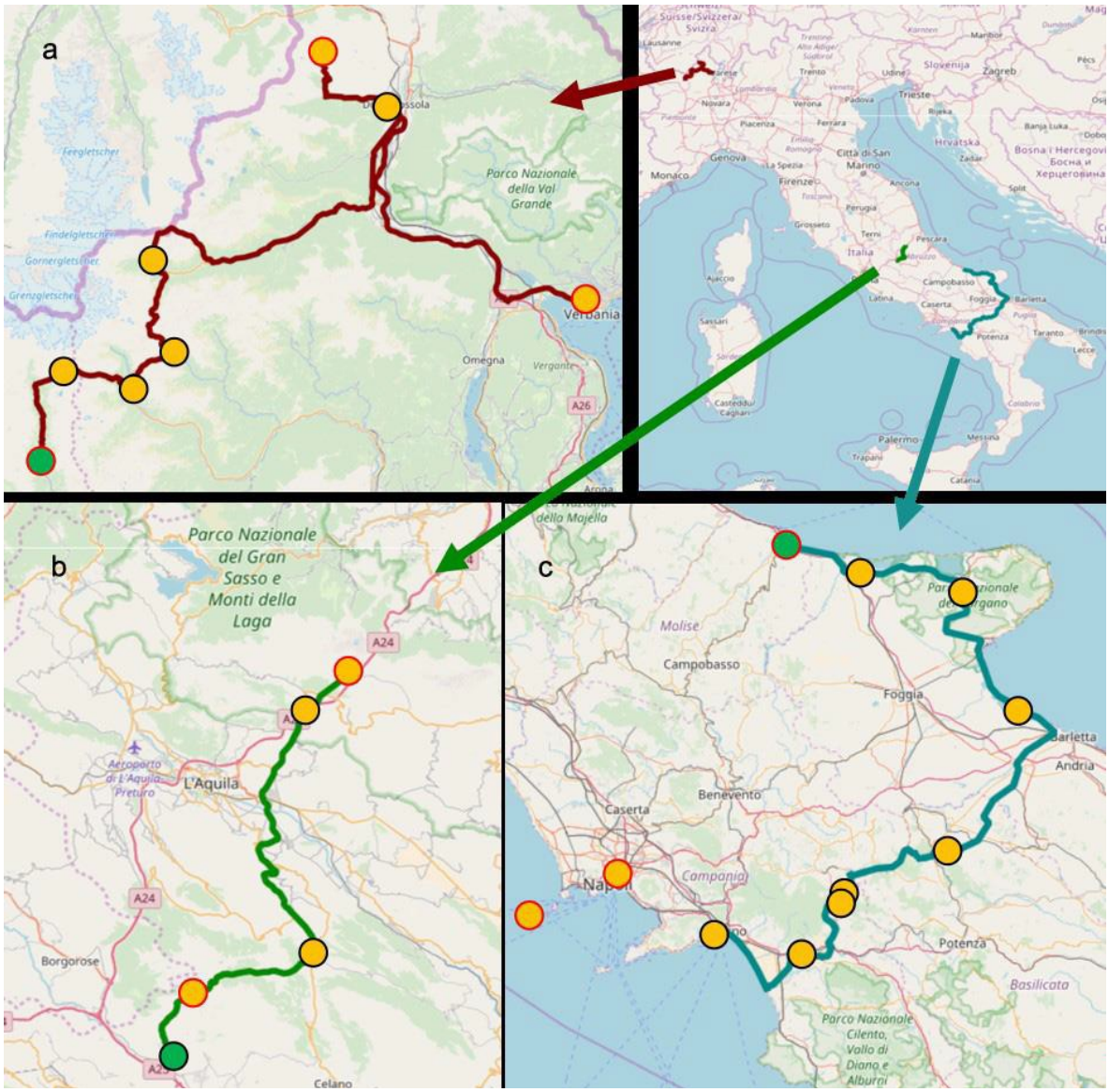

Figure 2. Map of Italy with the localization of the three Cammini LTER. a. "Pink…Blue…Green!"; b. "The adventure of biodiversity"; c. "Mesothalassia". The yellow dots indicate the stage of each leg, the green ones the starting points, the red outer circles the LTER sites. Created on Inkatlas. © OpenStreetMap contributors (openstreetmap.org).

"The adventure of biodiversity" (http://www.lteritalia.it/it/cammini/gransasso) was carried out within the LTER site "Apennines – High elevation Ecosystems (hiips://data.lter - europe.net/deims/site/lter_eu_it_001), in the Abruzzo Region, connecting, in four days, Mount Velino with Gran Sasso d'Italia, the tallest mountain in the Apennines (Figure 3). The trail crossed the typical landscape of the internal mountains in the Apennines (from mixed and beech forests to high altitude grassland) and two Natural Parks (Sirente-Velino and Gran Sasso e Monti della Laga). Researchers involved citizens in vegetation surveys, geological observations

and bird watching. A final "BioBlitz" took place at Gran Sasso: in practice, scientists, non-professional naturalists and volunteers executed a 24-hours field intensive study, working together to identify vegetal and animal organisms, thus contributing to an inventory of the biodiversity in the area. The last walking tour, Pink…Blue…Green…!"(http://www.lteritalia.it/cam - mini/ rosa; Criscuolo, Carrara, Oggioni, Pugnetti & Antoninetti, , 2018), consisted of six legs, from the Alps to the subalpine great-lake area, and connected three LTER sites (Figure 3): High elevationsites in the Northwestern Alps (https://data.lter- - europe.net/deims/site/lter_eu_it_019, Mount Rosa, Angelo Mosso Scientific Institute), Mountain Lakes (hiips://data.lter - europe.net/deims/site/lter_eu_it_009, Lakes Paione) and Southern Alpine Lakes (https://data.lter-europe.net/deims/site/lter_eu_it_008, Lake Maggiore). Both naturalistic and cultural diversities along the route were remarkable and the socio-ecological aspects were tangible: populations living in lake areas or in the ancient alpine villages, witness ages of challenging alliance between man and nature. Researchers joining the trail were mainly terrestrial ecologists with expertise in high altitude areas, limnologists, geologists, and Volunteer Geographic Information (VGI) specialists. During the trail, Citizen Science, in its contributory version (Socientize Consortium, 2014), and VGI activities were launched, through the use of two VGI apps to collect either biological or abiotic observations (http://www.lteritalia.it/content/ citizenscience; Criscuolo, Carrara, Oggioni, Pugnetti & Antoninetti, 2018). At the three LTER sites people were invited to join the LTER sampling-activities focusing on soil and vegetation, lake waters, and even laboratory analyses of aquatic organisms (i.e., plankton and benthos). Nearly 200 hundred people joined the evening communication events, organized at the end of each leg, and dealt with topics of high relevance for the territory, in a fruitful dialogue with local authorities and citizens associations.

Materials and methods

In order to reflect on the different ideas of LTER scientists about the relationship between ecology and society, we explored the materials produced in each trail, i.e.:

communication material used to officially present the initiative (brochures of the trails and print releases);

communication materials produced for social media (blogs and daily reports written by scientists during the trails, Facebook reports, tweets);

video and audio interviews with some scientists in the course of Cammini. A total of 20 interviews was carried out;

video and audio records of spontaneous and free conversations among researchers.

All the conversations were carried out in Italian and then translated into English to be reported in this paper.

We used a participant observation approach in the process of data construction (Strauss, 1987). Authors took part to the initiative and partly organized it acting both as participants and observers, according to the participatory action research (PAR), an approach to research in communities that emphasizes participation and actions, aimed at understanding the world by trying to change it, collaboratively (Chevalier & Buckles, 2013).

Figure 3. Pictures of the LTER sites that were reached by Cammini LTER. From left to right and from top to bottom: Coastal Dunes and Gulf of Naples (Mesothalassia), Mount Velino and Mount Gran Sasso (The adventure of biodiversity), Monte Rosa - scientific institute Angelo Mosso, Lake Paione, and Lake Maggiore (Pink…Blue…Green…!).

By comparing initial motivations declared in the official description of the initiative (such as statements from press releases) with following narratives emerged during Cammini, we explored if and how the initial main drivers for engagement with the public might have been reframed along the trails. In this comparison, we were particularly inspired by: (i) works supporting "reflexive conversations" among scientists who communicate science and scholars who study science-communication practices and (ii) models aimed at contributing to a more effective public engagement for sustainability (Salmon & Priestley, 2017). We were also inspired by studies exploring the ways in which communication with the public is talked about by scientists (Davies, 2008) and the role to this latter respect of non-traditional forms of interactions with the public, such as emotions, art, use of sites and places, etc. (Davies & Horst, 2016). We finally refer to previous inquiries on scientists' practices and perceptions of science communication carried out by some authors of the paper, arguing that when scientists communicate they do not confine their action merely to facts but also interests, views and beliefs of what science is and these issues should be integral part of the message (L'Astorina, 2011; L'Astorina, Cerbara, Valente & Avveduto, 2013).

The leading idea of these above-mentioned works is to consider communication as a relationship among actors, the result of a co- construction, where all participants bring their imaginaries (of science and of society) and negotiate the sense of their relationship. In our analysis, the focus is mainly on the meaning that such conversations, which explore researchers' motivations in engaging with the public in informal and itinerant activities, might have for the scientists themselves: "What is at stake for scientists when communicating ecology?" was our driving question.

In order to identify key themes and concepts in scientists' narratives, we used discourse analytic approaches affirming that "language is not simply a neutral medium for generating subject knowledge, but a form of social practice that acts to constitute as much as to reflect social realities" (Silverman, 2000; Flick, 2002).

The outcomes are quite diverse and complex, both for the heterogeneity of the materials themselves and for the different range of views, talks and ideas of the researchers. Despite this complexity, three main issues were identified during conversations, which will be presented and discussed in the following sections, supported by quotes from the researchers' words.

Results and discussion

The need to engage a wider audience in the existence, aims and activities of LTER-Italy was the initial driver of Cammini LTER: this was considered a means of increasing the socio- ecological impact of LTER studies and their interactions with the public. Researchers were also motivated by the aspiration to find more involving modalities to share their own experience and activity on the territory, going beyond the separation between scientists and the public. Doing something as simple, accessible, and sustainable, such as walking or cycling together, would create a physical and visible movement of scientists outside their laboratories towards and within society, relying on slow mobility, which promotes intimate relationships between people and nature.

During the three 2015 trails analyzed herein, a big number of communication events were carried out and the chances for dialogue between researchers and lay people joining the trails were very frequent. The informal context in which researchers acted, the unusual guise in which they met people, the intimacy that the trails created, day by day, among researchers and with people, deeply affected the way scientists perceived their relations with the public and the communication priorities. Actually, the whole experience, the events, and the encounters produced

quite unexpected effects on the scientists: they engaged in discussions and critical considerations about relevant aspects and needs of science communication, framing them in the more general context of research-production. From the materials analyzed, which illustrated - like a map - the reflections taking place among scientists, we could highlight mainly a sense of separation between (i) science and society, (ii) scientific and traditional knowledge, (iii) cognitive and emotional approaches. The empirical perception of these separations was evident, as well as the - apparent or hidden - conflicts that they generate and the need to overcome them. Therefore, we organized the following subsections along these three main subjects: (i) the relationship and the hierarchies in science and society, (ii) the need and the challenge of an iterative, two-way communication process, (iii) the potential to integrate scientific norms with emotional drivers.

Reframing the relationships and the hierarchies between ecology and society

The "movement of scientists towards citizens in the society" was one of the most recursive slogans used for promoting the Cammini LTER initiative. This metaphor evocates the image of a distance between science and society, with scientists living "up" in their "ivory tower" and citizens and the public in the "world out (and down) there": the former being a dynamic context where knowledge for society is produced and the latter a static one only making use of the knowledge produced by science. Here is how a scientist describes the Cammini experience in a personal daily blog:

"During the Cammini, we scientists left our labs, descended from our "ivory tower" and met people on the streets, park and greenways, attracting them as long-distance travellers used to get company and hospitality."

The representation of the ivory tower, as a metaphor often used to describe the distance between the scientific world and the society, is specious and not realistic. It is widely recognized that science works together or intertwined with other societal, cultural and historical factors, in a co-evolutive, complex, dynamic relationship (Latour, 1991; Nowotny, Scott & Gibbons, 2001; Sonnert & Holton, 2002). Yet, this metaphor effectively represents a common tendency of the scientific world to claim an autonomous status for science, disjointed from other domains of human activities, where facts are separated from values and those who produce knowledge from those who use it (Guimarães Pereira Â. & Funtowicz, 2015). This is partly due to the fact that science has become a complex and complicated world, evoking the idea of a new Middle Age in which researchers become "logical aliens" to one another, "serial hyper- specializers", with different languages and standards (Millgram, 2015).

Hyper-specialized language can therefore constitute another example of an ivory tower. During Cammini, ecologists recognized that the "science jargon" is one of the main obstacles to overcome for attaining a direct relationship with the public. A lot of attention was then dedicated to discussion on the best format to communicate, whether to use or not presentations, such as PowerPoint formats, or to engage in conversations with people giving more time for reciprocal discussion. Actually, during the organization of Cammini, scientists devoted much effort to produce communication materials simpler and clearer than usual and, at the same time, suitable for effectively transmitting information about basic ecological concepts and, in particular, about LTERs. However, the different kind of public met and the unusual contexts where communication took place made evident, since the very first days of each trail, the need for a more accessible language, but also that simplification was not enough and that the usual mind-set of researchers needed to be, in a sense, dismantled, in order to really enter in dialogue with people (Figure 4):

"We quickly realized that frontal lectures were not suitable for communicating science to a very general public, including people of varying ages and education levels. We abandoned PowerPoint presentations and, instead, we used simple tricks to stimulate the curiosity of the public. Such communication happens more easily while leaving our labs and institutions and meeting people in completely informal contexts."
(from an interview)

"*Comprehending how to (and how not to) get people engaged in science is not an easy task to us, since we must learn from those who know how to do this job. Skills are important in order to better deal with publics, to use the right channels, methods, languages, but maybe we failed in all these aspects."*
(transcribed from a free conversation)

Figure 4. During the trails the meetings with people frequently occurred outdoor, with informal exchanges of opinions and ideas. This picture was shot at the shore of Lake Paione (trail Pink…Blue…Green…!), where people were engaged in LTER sampling activities (Photo by Antonio Bergamino).

For some researchers, communication is not only a matter of style or of "getting the right message across", but of confronting with other worldviews and belief systems, overcoming "tacit hierarchies" between different kinds of knowledge (scientific, lay, expert, local) (Wynne, 2001; Felt, 2016). Adapting the scientific communication methods to other people's attitudes, shifting from the traditional one-way knowledge transfer, towards more collaborative approaches, which include multiple forms of expertise, is a quite challenging task. Walking and cycling side by side with people living in the territories, activated a spontaneous process of crossing cultural barriers, exchanging between different viewpoints, and this experience enriched the researchers' mind sets:

"What happens when citizens and researchers are riding side by side in the same environmental context? Citizens feel curiosity for a group considered elective, distant, and unapproachable. The local cyclists who joined us in Cammini know the territory very well as they ride it very often. However, the fact that they can share the same ride with us researchers, who study those territories from a scientific point of view, activates a mutual learning process, makes the route lighter and richer." (from an interview)

While reconciliation with society may be pursued by avoiding jargon, and communicating ecology can become "telling and sharing stories about the nature", a sort of fracture within the scientific community arises as scientists are being asked to produce excellence research, "to publish or perish": in consequence of this latter condition, those who decide to invest in public engagement are not always perceived as quality researchers. Although communication and public engagement are recognized as one of the three main commitments for science (the so called "third mission"), researchers do not yet feel fully supported by academy in their public- engagement initiatives. During Cammini, this sense of separation within the scientific community itself clearly emerged and was widely debated:

"I know what most of our colleagues think about this initiative: that while they are writing papers, increasing the quality of the research, we are only losing our time. That is to say, what we do is not to be taken seriously into consideration. But they fail in thinking so, as what we do now can have an impact on research itself, everything that opens up to the world is as important as research itself." (transcribed from a free conversation)

Differing to the "publish or perish" view, some scientists in Cammini felt that their career could not be complete and meaningful without including an active and personal involvement with the public:

"During this experience we perceived our research activities from another perspective, which makes more sense to most of us. Without the vital exchange with civil society, the products of our research remain fruitless". (from an interview)

Reframing the what and why of science communication

The main declared goal of Cammini LTER was to experiment new modalities to inform the public about ecological research carried out within LTER network in order to increase the awareness towards relevant ecological themes in Italy. The decision to communicate using informal settings and more interactive forms, was partially motivated by the fact that some scientists promoting the initiative had got already familiar with some findings in the field of science communication, which indicate many forms of communication as ineffective and that values and experience strongly influence how public understands science (Weber & Ward, 2001; Einsiedel, 2008; Niesbet, 2009). One of the main recursive ideas in Cammini was that, in order to be more effective with the public, informal contexts and modalities were necessary; however, what science communication should be and which could be the main motivations and expectations, these were a matter of debate among the group. For some scientists, it was all about "getting the right message across", for others it was a question of "sharing emotions", for others it was about "mutual understanding of reciprocal experiences, knowledge and behaviours". What should then be communicated? It was clear to some researchers in Cammini that not only scientific content Is needed but also sharing identity and the belonging community, to increase the sense of a mutual shared responsibility. The meeting with local associations, engaged in the environmental care of the territories, was particularly relevant to this regard:

"During Cammini we had the chance to meet local associations involved in the governance of the territory: we told them our views and listened to them. Through these encounters, we could recognize the knowledge already present on the territory: a type of knowledge consisting in being present in the territory, guarding it, living in it and developing respect to it." (from an interview)

"The fragility of the territory was evident to all of us, and at the same time the sense of belonging to it, the love and the interest to preserve it … that is also the reason why we do research. This feeling makes us more aware of our (personal and professional) path and also of our responsibility." (transcribed from a free conversation)

Furthermore, scientists were aware that many ecological issues require public understanding and support, since environmental sustainability and governance can only be achieved through collective actions and behaviour changes. Environmental issues are characterised by social complexity: this demands for dynamic science-communication processes, allowing for the expression and integration of different knowledges, through the involvement of various actors from different backgrounds. Scientists can successfully share their views if they also integrate and embrace the richness and diversity of people's representations of nature and landscape (Buijs & Elands, 2013). These concepts became clear to most researchers, when dealing with people bringing different kinds of expertise (Figure 5):

"It is clear that the difference between scientists and the public is in the kind of expertise they have and the language they use: ecological research and environmental protection need all forms of expertise. Scientists should find the way to open themselves to other peoples' perspectives, in order to solve problems." (transcribed from a free conversation)

Members of the general public may actual hold rich mental concepts of ecosystem and biodiversity, although they might not be familiar with the scientific terminology (Fischer & Young, 2007). This was, for example, the case of Walser people – which were met during excursions in the Alps - a population accustomed to live in extreme environments and showing a strong tradition of resilience:

"Ecology is a universal concept, it is not only a scientific one. Looking at how people, especially inhabitants of remote alpine areas, like the Walser minority in Aosta Valley, behave in their daily life, face with environmental risks, often "acting ecologically" and showing resilient behaviours, with no scientific background, helps us recognizing and valuing different knowledges." (from an interview)

Figure 5. LTER researchers meet the local Authorities in Cairano, a small town (around 300 inhabitants) close to Avellino (Campania Region), during Mesothalassia. In the picture everybody is sitting under the tree of the main square, talking about ecology, from different point of views, in a productive and touching mutual exchange of knowledge and visions (Photo by Antonio Bergamino).

Reframing the relationship among knowledge, sensorial experience and emotions

Walking means "opening to the world", with the body and the senses: it is an act that reminds to human beings the humility and the beauty of their condition, and reconnects mind, senses and emotions (Le Breton, 2000). Moving slowly (by walk or by bike) allows a perception of time that we are not anymore used to and opens us to the possibility of observing nature at the right pace, recreating healthy, emotional bonds. It is actually by experiencing this "unstructured time" that researchers came across the last form of separation: the one among knowledge and emotions.

Scientists are emotionally involved in many aspects of their work. A passion for nature is often the reason why many of them enter the field of ecology. The emotional involvement may actually even improve the quality and usefulness of work, by increasing creative problem-solving abilities and a more comprehensive knowledge (Koppman, Cain & Leahey, 2015). This passion does not find a place in the usual process of science production and result publications, where strict rules hamper expressing this important emotional part of the work. During Cammini LTER, scientists instead expressed and rediscovered the strength of passion: speaking informally with people about research moved them back to the initial motivation of their work and to the importance that emotions had – and still have – also in the everyday routine:

"During Cammini, we scientists re-discovered or confirmed the passion that move us in our work: this is not always perceivable in the daily routine, but emerged with new vitality while speaking with people about our researches and seeing our passion reflected in their eyes and words." (from an interview)

It is very important to be in touch with people and actively demonstrate passion when interacting with them: if linked with effective communication, it can reach successfully multiple audiences (Bickford, Posa, Qie, Campos- Arceiz & Kudavidanage, 2012). Moreover, including sensorial experience and emotions in science communication can make the difference in how scientists perceive themselves and the kind of knowledge they produce.

Although communication was aimed at informing about LTER initiatives and current environmental problems, the activity involved other aspects related to the ecological thought, such as affection, emotion, beauty and fascination of the natural landscape. Even if the scientific discourse usually avoids displays of emotion, scientists working in the natural resources sector often feel a strong emotional bond to the natural environment (Curtis, 2011; Curtis, 2012; Bickford, Posa, Qie, Campos-Arceiz & Kudavidanage, 2012). The knowledge of nature is actually not sufficient to know how to appreciate it: this involves mainly the human emotional sphere (Barbiero, 2014). Together with the science of ecology, also the "affective ecology", that part of ecological thought that involves the emotional connection with nature, needs to be developed (Barbiero 2011). Actually, as observed by Harding (2008), establishing an affective connection with the natural world brings with it the desire to know nature at a deeper level: ecological knowledge may stimulate a more intimate relationship with nature, which in turn may stimulate a greater desire for knowledge (Figure 6).

Figure 6. LTER researchers and citizens climbing the Mount Velino (The adventure of biodiversity). Walking together in silence allows the perception of the environment with all the senses, without the need of explanations (Photo by Sarah Gregg).

"Cammini is a material experience, a sensorial one, where not only facts but also values, passions, emotions and other elements, often elided by science, have a voice. Through Cammini we activated all our senses and reconnected knowledge and emotions. We could perceive, together with colleagues and with non-expert, the intimacy link with nature and landscape." (from an interview)

Finally, many people working in ecology often spend a lot of time working on disheartening issues, such as biodiversity decline, climate change, ecosystem collapse, fragility of territories, and feel the need for shifting from communication of problems to emphasizing beauty and wonder of the natural environment. During Cammini, the focus spontaneously moved from the problematic aspects related to ecology to the quality of the relationships with nature and people. This kind of "hearts on" communication can have a further strong benefit in the perception people have of the possible detriment stemming from losing biodiversity and healthy ecosystems.

"It is the mode of walking that makes a difference both in communication among us researchers, and with the public. Walking with people there, where they live, makes us open ears, heart, listen, and we learn to take (information), not only to deliver (them). But this makes also us more visible and less alienated!" (transcribed from a free conversation)

Conclusions

What is at stake for scientists when communicating ecology? This was the basic question that has driven these reflections about the initiative of informal communication of ecological research Cammini LTER. Is communicating just the transmission of scientific issues or is it a process where also values, identities, emotions, trust and responsibility among actors are implied?

These issues, although born in a national and specific context (LTER), could be of more general value, contributing to the debates about science-society relationships. Communication is generally considered a matter of performance, for which skills, practice, ability, predisposition and training are necessary. However, relationship and knowledge exchange are crucial, for which time, listening and mutual understanding are necessary. For the public, an improved understanding of the ecology and of the fragility of the territory where they live and of the research activities carried out on it may support awareness and care. For scientists, a deeper appreciation for the social context of their ecological research provides an opportunity to see how their work is perceived and/or acted upon in practice, but also how other perspectives are present. For both parties, a communicative relationship can help overcome stereotypes and/or bring to a greater appreciation of the others' perspectives, constraints and values with respect to conservation and biodiversity.

Communicating ecology can be an opportunity for building new qualities of knowledge and for creating a shared civic culture, a participative setting, able to make all players feel mutual responsible and contribute to the solution of particular socio-ecological challenges. This appears particularly relevant dealing with the present environmental problems, which are not only ecological but also socio-ecological and cultural.

Cammini LTER, whose realization in 2015 we have described in this paper, could in the future benefit from findings in the ecological psychology and environmental education, where a growing body of literature (Christie, Beames & Higgins, 2016; Nazir & Pedretti, 2015) is re- conceptualizing aims and practices of traditional relationship with the public. Walking and observing in natural environments, indeed, induce changes of posture and visions that do not usually fit into our thought patterns. Looking for the most suitable instruments to respond to the current global crisis on the Planet, and to

foster a sustainability view, also concepts such as "ecological identities", defined as discovering the "sense of self as part of an ecosystem"(Olivos, Aragonés & Amérigo, 2011), "enactivism" as a mode of learning and knowing, considering the fact that "living means first and foremost to be animate, moving" (Gray & Colucci Gray, 2018) should be explored.

It is however not an easy goal. During conversations among scientists, many often complain that science communication activities push them out of their comfort zone, are time consuming and too challenging for most of them being asked to work under the constraints of "publish or perish". As a result of this reasoning, communication, although interesting and stimulating, is a matter to should be left to professional communicators.

Reflections during Cammini convinced us that it is crucial that researchers engage with the public at first hand, reflecting not only on their communication practices, but also on the modern science model of production itself. Through this direct activity and responsibility, own thoughts and reflections involved in this activity can be stimulated and activated. Engagement with the public, where not only scientific content but also values, identities, emotions, trust and responsibility among actors are involved, can result in deeper awareness of the role of each actor in the management and care of the territory and provides an opportunity for discussing the necessity of a new quality of ecological communication and relationship with society, more open, empathic, responsible and collaborative.

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References

Barbiero, G. (2011) Biophilia and Gaia: Two Hypotheses for an Affective Ecology. *Journal of Biourbanism* 26 (1), 1-27

Barbiero, G. (2014) Affective Ecology for Sustainability. *Visions for sustainability* 1, 20-30.

Bickford, D., Posa, M. R. C. Qie, L., Campos-Arceiz, A. & Kudavidanage. E. P. (2012) Science communication for biodiversity conservation. *Biological Conservation* 151, 74–76.

Buijs, A. E. & Elands, B. H. M. (2013) Does expertise matter? An in-depth understanding of people's structure of thoughts on nature and its management implications. *Biological Conservation* 168, 184–191.

Chevalier, J.M. & Buckles, D.J. (2013) Participatory Action Research: Theory and Methods for Engaged Inquiry, Routledge UK. ISBN 978-0415540315.

Christie, B., Beames, S. & Higgins, P. (2016) Context, culture and critical thinking: Scottish secondary school teachers' and pupils' experiences of outdoor learning. *British Educational Research Journal* 42(3), 417–437.

Criscuolo, L., Carrara, P., Oggioni, A., Pugnetti, A. & Antoninetti, M. (2018) Can VGI and Mobile Apps Support Long-Term Ecological Research? A Test in Remote Areas of the Alps. In G. Bordogna. and P. Carrara, P. (eds), *Mobile Information Systems Leveraging Volunteered Geographic Information for Earth Observation*, pp. 53-71, Springer.

Curtis, D. J. (2011) Using the arts to raise awareness and communicate environmental information in the extension context. *Journal of Agricultural Education and Extension* 17 (2), 181-194.

D'Alelio, D. (2016) The Mesothalassia Bike-Tour: (Re)Discovering Water by Riding with Scientists. *Limnology and Oceanography Bullettin* 25, 1-7.

Davies, S. R. (2008). Constructing Communication. Talking to Scientists About Talking to the Public. *Science Communication* 29 (4), 413-434.

Davies, S.R & Horst. M. (2016) Images, Spaces, and Emotions: Non-discursive Aspects of Science Communication. *Science Communication*: 159-185.

Dick, J. , Orenstein, D. E., Holzer, J. M., Wohner, C., Achard, A. L., Andrews, C., Avriel-Avni, N., Beja, P., Blond, N., Cabello, J., Chen, C., Díaz-Delgado, R., Giannakis, G. V., Gingrich, S., Izakovicova, Z., Krauze, K., Lamouroux, N., Leca, S., Melecis, V., Kertész, M., Mimikou, M., Niedrist, G., Piscart, C., Postolache, C., Psomas, A., Santos-Reis, M., Tappeiner, U., Vanderbilt, K. & Van Ryckegem, G. (2018) What is socio-ecological research delivering? A literature survey across 25 international LTSER platforms. *The Science of the Total Environment* 622–623, 1225– 1240.

Einsiedel E.F. (2008) Public engagement and dialogue: a research review. In M. Bucchi, M. and B. Smart (eds). *Handbook of public communication of science and technology*: 173-184. London, UK: Routledge.

Felt, U. (2016) Associating citizens with the scientific process from the start. *Euroscientist*. Special Issue on RRI Implementations. 14/12/2016 Available at: hiips://www.euroscientist.com/public -engagement- in-research/

Fischer, A. & Young, J. C. (2007) Understanding mental constructs of biodiversity: Implications for biodiversity management and conservation. *Biological Conservation* 136, 271-282.

Flick, U. (2002) An introduction to qualitative research. London: Sage.

Folke, K., Jansson, A., Rockstrom, J., Olsson, P., Carpenter, S. R., Chapin III, F. S., Crepin, A-S., Daily, G., Danel, K., Ebbesson, J., Elmqvist, T., Galaz, V., Moberg, F., Nilsson, M., Osterblom, H., Elinor Ostrom, E., Persson, A., Peterson, G., Polasky, S., Steffen, W., Walker, B. & Westley, F. (2011). Reconnecting to the Biosphere. *Ambio* 40, 719–738.

Gray D. S. & Colucci-Gray L. (2018) Laying Down a Path in Walking: Student Teachers' Emerging Ecological Identities. *Environmental Education research,* In press.

Groffman P. M., Stylinski, C., Nisbet, M. C., Duarte, C. M., Jordan, R., Burgin, A., Previtali, M. A., and Coloso,

J. (2010) Restarting the conversation: challenges at the interface between ecology and society. *Frontiers in Ecology and the Environment* 8 (6), 284–291.

Guimarães Pereira Â. & S. Funtowicz (eds.) (2015) Science, Philosophy and Sustainability: The End of the Cartesian Dream - Routledge Explorations in Sustainability and Governance. Earthscan from Routledge.

Haberl H., Winiwarter, V., Andersson, K., Ayres, R. U., Boone, C., Castillo, A., Cunfer, G., Fischer-Kowalski, M., Freudenburg, W. R., Furman, E., Kaufmann, R., Krausmann, F., Langthaler, E., Lotze-Campen, H., Mirtl, M., Redman, C. L., Reenberg, A., Wardell, A., Warr, B. & Zechmeister, H. (2006) From LTER to LTSER: conceptualizing the socioeconomic dimension of long-term socioecological research. *Ecology and Society* 11 (2), 13.

Harding, S. (2008). *Animate Earth*. White River Junction, VT: Chelsea Green.

Jamieson, L. (2011). Intimacy as a Concept: Explaining Social Change in the Context of Globalisation or Another Form of Ethnocentricism? *Sociological Research Online 16 (4)*, 15.

Koppman, S., Cain, S. L. & Leahey, E. (2015) The Joy of Science: Disciplinary Diversity in Emotional Accounts. *Science, Technology, & Human Values 40 (1)*, 30-70.

L'Astorina A. (2011) Researchers as Communicators – A survey on the public engagement of Italian Cnr research institutions. In Valente A. (Ed): *Sharing science - Researchers' ideas and practices of public communication*. Scienza Express Edizioni, Milano, ISBN 978-88-96973-32-5.

L'Astorina A., Cerbara, L., Valente, A. & Avveduto, S. (2013) *Practices and images of public communication by Italian scientists over the years, Critical Perspectives on Making Science Public*, Nottingham

22-23 luglio 2013, Book of selected papers: 75-80.
Latour, B. (1991) The Impact of Science Studies on Political Philosophy. *Science, Technology, & Human Values 1 (1)*, 3-19.
Le Breton, D. (2000) *Eloge de la marche*. Editions Métailé. ISBN 2-86424-351-2
Lévy-Leblond, J.M. (1992) About misunderstandings about misunderstandings. *Public Understanding of Science 1 (1)*, 17-21.
Lubchenko, J. (1998) Entering the century of the environment: a new social contract for science. *Science 279*, 491-497.
Mauz, I., Peltola, T., Granjou, C., van Bommel, S. & Buijs, A. (2012) How scientific visions matter: insights from three long-term socio-ecological research (LTSER) platforms under construction in Europe. *Environmental Science & Policy 19*, 90-99.
Millennium Ecosystem Assessment. (20
05) *Ecosystems and human well-being, volume 1: Current state and trends*. Washington/Covelo/London: Island Press.
Millgram, E. (2015) *The Great Endarkenment - Philosophy for an Age of Hyperspecialization*, Oxford University Press.
Mirtl, M., Borer, E., Djukic, I., Forsius, M., Haubold, H., Hugo, W., Jourdan, J., Lindenmayer, D., McDowell, W. H., Muraoka, H., Orenstein, D., Pauw, J., Peterseil, J., Shibata, H., Wohner, C., Yuk, X. & Haase P. (2018) Genesis, goals and achievements of Long-Term Ecological Research at the global scale: A critical review of ILTER and future directions. *The Science of the Total Environment 626*, 1439-1469.
Mollenhauer H., Kasner, M., Haase, P., Peterseil, J., Wohner, C., Frenzel, M., Mirtl, M., Schima, R., Bumberger, J. & Zacharias, S. (2018) Long-term environmental monitoring infrastructures in Europe: observations, measurements, scales, and socio-ecological representativeness. *The Science of the Total Environ*ment *624*, 968–978.
Nazir, J. & Pedretti, E. (2015) Educators' perceptions of bringing students to environmental consciousness through engaging outdoor experiences. *Environmental Education Research 22 (2)*, 288-304.
Nisbet, M.C. (2009) Communicating Climate Change: Why Frames Matter for Public Engagement. *Environment: Science and Policy for Sustainable Development 51 (2)*, 12-23.
Nowotny, H., Scott, P. & Gibbons, M. T. (2001*) Re-Thinking Science: Knowledge and the Public in an Age of Uncertainty*, Wiley.
Olivos, P., Aragonés, J. I. & Amérigo, M. (2011) The connectedness to nature and its relationship with environmental beliefs and identity. *International Psychology Hispanic Journal 4 (1)*, 5–19.
Pace, M.L., Hampton, S. E., Limburg, K. E., Bennett, E. M., Cook, E. M., Davis, A. E., Grove, J. M., Kaneshiro, K. Y., LaDeau, S. L., Likens, G. E., McKnight, D. M., Richardson, D. C. & Strayer, D. L. (2010) Communicating with the public: opportunities and rewards for individual ecologists. *Frontiers in Ecology and the Environment* 8 (6), 292–298.
Salmon, R.A. & Priestley, R. L. (2017) The reflexive scientist: an approach to transforming public engagement. *Journal of Environmental Studies and Science 7*, 53-68.
Silverman, D. (2000) Analyzing talk and text. In Denzin
N.K. and Y.S. Lincoln (eds): *Handbook of Qualitative Research* (2nd ed). London: Sage.
Singh, S. J., Haberl, H., Chertow, M. R., Mirtl, M. & Schmid, M. (2013) *Long term socio-ecological research: studies in society-nature interactions across spatial and temporal scales*. Springer, xxxvii, pp. 588.
Socientize Consortium. (2014). White paper on citizen science for Europe.
Solnit, R. (2000) *Wanderlust: A History of Walking*. New York, Penguin Books.
Sonnert, G. & Holton, G. J. (2002) *Ivory Bridges: Connecting Science and Society. Cambridge*, MA: MIT Press.
Strauss, A. (1987). Qualitative Analysis. N.Y.: Cambridge University Press.
Weber, J. R. & Ward, C. S. (2001) The Communication Process as Evaluative Context: What Do Nonscientists Hear When Scientists Speak? *Bioscience 51 (6)*, 487-495.
Wynne, B. (2001) Creating Public Alienation: Expert Cultures of Risk and Ethics on GMOs. *Science as Culture 10 (4)*, 445–482.

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Should justice for people come before justice for the environment? Engaging students in debates about environmental justice.

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Abstract.

This paper outlines the main differences between ecocentric and anthropocentric positions in regard to justice, exploring university students' perceptions of the concepts of social and ecological justice and reflecting on how values assigned to humans and the environment are balanced and contested. Putting justice for people before the environment is based on evidence that biological conservation can disadvantage local communities; the idea that the very notion of justice is framed by humans and therefore remains a human issue; and the assumption that humans have a higher value than other species. Putting justice for the environment first assumes that only an ecocentric ethic guarantees protection of *all* species, including humans, and therefore ecological justice already guarantees social justice. This research shows that many students emphasize the convergence of social and ecological justice where human and environmental interests correspond. While not wishing to diminish the underlying assumptions of either ethical orientation, the common "enemy" of both vulnerable communities and nonhuman nature, as identified by students, is an ideology of economic growth and industrial development.

Key words. anthropocentrism, biospheric egalitarianism; ecocentrism; ecological justice; environmental justice

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***Perspective**: Theoretical and educational visions*

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Introduction

Discourse on sustainability involves both ethical and practical aspects. Ethical aspects range from poverty alleviation, to unequal exposure of vulnerable communities to the effects of climate change, and to treatment of animals in industrial production systems. Practical aspects involve political and economic mechanisms of distribution of wealth, the science and climate change mitigation mechanisms, and technological adaptations to food production technologies. Sometimes, ethical and practical questions can appear mutually exclusive. For example, the moral imperative to lift people out of poverty can lead to severe resource degradation as consumption of natural resources by the "bottom billion" increases. Part of this paradox is erroneous assumptions that stem from the early industrial period. As McDonough and Braungart (2002:32) stated in their book *Cradle to Cradle*, the early industrialists had a different view of the world, as for them "natural resources still seemed unlimited and "quality of life" meant high economic standards of living". As a consequence, there was unwillingness to acknowledge that natural resources were not infinite (Dietz and O'Neill 2016). Decades later, economic development logic exported to developing countries has meant that poverty reduction practically led to some form of destruction of the environment, whether this took place through the extension of welfare in capitalist democracies or through industrial development in planned socialist states.

In fact, unsustainable consumption in the rich countries is far from abating and developing countries are eager to emulate this 'progress' (Hansen and Wethal 2014). As Crist (2012:141) has pointed out, while "raising the standard of living" may be convenient shorthand for the ethical objective of ending severe deprivation, it is in fact a "euphemism for the global dissemination of consumer culture" (Crist 2012:141). Up to date, **no effort at radically reducing consumption in rich countries is observed** (Dietz and O'Neill 2016). Thus, ironically, while justice in distribution of natural resources through inclusive economic growth attempts to make "winners" of all human societies, this has simultaneously meant that intergenerational justice – justice for future generations, and ecological justice – or justice between all species – have been endangered. Indeed, to "feed a growing population and enter increasing numbers of people into the consumer class is a formula for completing the Earth's overhaul into a planet of resources" Crist (2012:141).

Only recently have the finite nature of resources and the vulnerability of the environment been recognized, leading to conclusion that not all economic activity is "good". Indeed, as McDonough and Braungart (2002:32) reflected, if well-being is only judged by increased economic activity, then illnesses that require prolonged and expensive medical attention and toxic spills that need costly cleanup operations are all signs of prosperity. In fact, it is questionable whether the objective of sustainable development of balancing the social, economic and environmental needs is achievable with the present rate of natural degradation (Kopnina 2012; Dietz and O'Neill 2016). In this regard, the triple P (people, profit, planet) objectives are oxymoronic in their goal of maintaining economic growth, fair distribution of wealth and simultaneously preserving natural resources for future generations.

Additionally, assumption that natural resources are infinite and that environmental impact is divorced from the number of consumers have also lead to the misconception that human population growth is not a problem (Kopnina and Washington 2016). After all, as Dietz and O'Neill (2013) point out: 'we need smaller footprints, but we also need fewer feet'. Simplistic divisions in "rich and poor" also tend to underplay the growth of middle classes in developing countries and the environmental impact that the increasing population in poor countries has on both environment and the long-term prospects of these populations (Kopnina and Washington 2016). Thus, both in terms of ethics and practice of sustainability, the cult of economic growth associated with demographic expansion as well as industrial development becomes suspect.

As Kidner (2014) and Poirier and Tomasello

(2017) have argued, advocates of social justice and environmental protection have much to agree upon. Industrocentrism, which places great value on continuous growth and profit, is increasingly degrading the environment and threatening both the humans and nonhumans who are sustained by it (Poirier and Tomasello 2017). Recognizing that industrial development is a common adversary of both social and environmental domains opens up possibilities of bringing both anthropocentric and ecocentric justice advocates together for a mutual cause (Shoreman-Ouimet and Kopnina 2015; Poirier and Tomasello 2017). This realization opens up new venues of education for sustainability, or environmental education (EE) and education for sustainable development (ESD), suggesting ways in which students can be made aware of how to deal with paradoxes of sustainable development (Kopnina 2012) together with the less explored focus on justice.

This paper explores how both the paradoxical nature of conflicting objectives and the shared social and environmental aim of achieving sustainability can be approached through the concept of justice. This exploration will focus on the perceptions of Bachelor students following the course "Environment and Development" that discussed similar issues to those raised in this Introduction. The aim is to contribute to a large field of EE and ESD in exploring environmental and ecological justice in relation to anthropocentrism, ecocentrism and combined perspectives. "Justice" in this paper will serve to highlight both the trade-offs and potential areas of reconciliation between social and environmental aspects of sustainability. Part of the course was reflection on the debate-discussing proposition "Justice for people should come before justice for the environment". The debate took place in 2013, at the conference organized by the World Congress of the International Union of Anthropological and Ethnological Sciences or IUAES (described in Abram et al 2016).

Defining social and ecological justice

In the IUAES congress debate, the proponents of the statement "Justice for people should come before justice for the environment" were Don Nonini, an anthropologist at the University of North Carolina and Amita Baviskar, a professor in the Institute of Economic Growth at *Delhi University.* They criticized conservationists as neo-colonialists who force Western values on traditional societies. The main arguments put forth to support justice for people before justice for the environment was their presupposition that creation of protected areas is a form of neo-colonialism disadvantaging vulnerable communities. Baviskar (2013) implied that more economic development is needed to lift poor societies out of poverty. The 'working poor', Baviksar argued, have their own environmental priorities, such as having drinking water and sewers (Baviskar 2013). Instead, in addition to the challenge of survival and meeting their daily basic needs, the poor have to carry the burden of delivering justice for the environment when most of the pollution and environmental harm is not produced by them but by the rich. Nonini (2013) has focused more on the argument that since humans frame the very concept of justice, justice is and will remain a human issue. Nonini also argued that environmentalists supposedly separate humans from nature. In fact, he argued:

> It is manifestly the case that human beings are one species that participate actively in networks of metabolic interactions with other species. Human beings depend upon other species for digestion, respiration, waste disposal, shelter, protection, etc., and the other necessities of human life. In turn, humans also have acted, not always under specific conditions of their choice, as stewards for the reproduction and continuity of survival of non-human species. They voluntarily promote the survival of species (and networks of species) which they domesticate, cultivate, and protect from incursions by other humans or by non-human species; they involuntarily serve as food and as environments themselves (e.g. in the case of the thousands of species of bacteria that are part of the human micro-biotic environment), as reservoir (e.g. for parasites during part of these species' reproductive cycles), etc. (Nonini 2013, in Abram 2016)

The opponents of the motion, anthropologists

Veronica Strang (2013) of Durham University and Helen Kopnina (2013) of Leiden University pointed out that both communities and their environments are interconnected. They argued that it is actually the indigenous and native cultural traditions, and not colonial regimes, that fostered respect for nature and sustainability. As justice is fundamentally concerned with equalizing relations between those in power and those who are not (Strang 2016), both speakers argued that humans and nature are interconnected. If economy is prioritized, environmental interests are likely to be overlooked, especially in cases when nonhuman species or habitats are seen as economically useless. Thus, it was argued that both types of justice should be achieved simultaneously. The opponents of the motion won the debate by around ninety votes to thirty.

Environmental justice in literature has often morphed into social justice as it concerns itself with equitable distribution of environmental goods and risks among human populations (Schlosberg 2004; Kopnina and Shoreman-Ouimet 2013). Environmental justice attempts to further the cause for social and economic equality, as well as dispel notions of environmental neocolonialism. The concept of environmental justice is intertwined with that of "environmental racism" – the term associated with greater exposure of vulnerable communities to environmental burdens, such as pollution (Kopnina 2014).

Anthropocentrism often entails the position that humans are at the centre of the world, supporting a hierarchical order of life in which human well-being is considered to be the most important and desirable moral objective (Crist 2012: 142). Within an anthropocentric framework, the protection of non-human species is contingent on their "usefulness" (often defined in terms of their economic value) for humanity (Kumar and Kumar 2008).

By contrast, an ecocentric or a biocentric approach recognizes the intrinsic value of non-human species (e.g. Kortenkamp and Moore 2001). The ecocentric perspective denies the conceptual dichotomy between humans and environment, underlying interdependency between species, and acknowledging their equal right to flourish (Cafaro and Primack 2014; Mathews 2016). Derived from this ecocentric perspective, ecological justice (Schlosberg 2004; Wienhues 2017) refers to justice between human and non-human species (Naess 1973), extending concern beyond human beings (Shoreman-Ouimet and Kopnina 2015). Ecological justice supports non-humans' entitlement to their living environment (habitat) and their right to flourish according to the species' own needs (Mathews 2016).

Both social and ecological justice approaches often converge in their critique of industrial development and economic growth, which is associated with industrocentric ideology (Kidner 2014; Poirier and Tomasello 2017). It is recognized that activities such as mining, logging, and industrial agriculture pollute waterways, cause deforestation, facilitate poaching, and impinge upon the lifeways of various human and nonhuman populations who rely on the land for survival (Poirier and Tomasello 2017).

Research strategy and methodology

Between September and October, 2016 the students of the elective course "Environment and Development" at Leiden University College were involved an in-class debate "Justice for people should come before justice for the environment". This debate was styled after the similar debate on the IUAES congress described above. There were twenty-two international students (twelve females and ten males) enrolled in the course. The majority was Dutch (although of different ethnic backgrounds), the rest European, and two students from the Middle East and two from Asia. The course materials and teaching methodology are described in Kopnina (2017). For this particular assignment, the students were asked to watch the televised debate and read a number of articles representing different sides of the debate. Some of this select literature is used in the student assignments discussed below.

All students were told that their honest opinions and ability to be critical (rather than support of a position that may be preferred by the lecturer and author of this article) would

count toward a higher grade. The lecturer acknowledged her own 'bias' in supporting ecological justice, but emphasized that this is personal position and not the 'right' position. The researcher followed European Commission's code of research ethics (Iphofen 2013: 42) in regard to data protection. The students were not asked to sign consent forms in order to not to compromise anonymity and confidentiality (for confidentiality and anonymity in qualitative research, see Saunders et al 2015). Those students who objected to their assignments being used were excluded from this research.

In their essays, the students were asked to define and discuss a number of terms: anthropocentrism; ecocentrism; social, environmental and ecological justice; and biospheric egalitarianism. These definitions could be either based on the assigned literature as well as references of their own choice. Consequently, the students had to explicate their stance as regards the central proposition statement. Although assignments were not submitted anonymously, the text segments used for this research were kept anonymous. Original assignments and information that might enable data to be linked to individuals was kept in a password-protected file. All assignments were pasted into one Word document, which was then searched for recurrent topics. These topics were color-coded and arranged in themes. These themes are now presented and analyzed.

Reflecting on terminology and meaning

Providing a background for a concept of anthropocentrism, one student wrote that the current widely accepted notion of Western anthropocentrism is influenced by the Judeo-Christian doctrine of creation (Colchester 1994; Devall 1980). Simkins (2013) finds evidence for this claim in the Genesis account of creation in the Old Testament, which likens man to God's image and places him at the center of the God-created world. This anthropocentrism, according to student, "fails to recognize one of the most basic principles of human existence – that humanity itself is a part of the environment". Quoting Grey (1993), this student writes, "revered intellectuals have whittled away at the notion of anthropocentrism, such as Copernicus' disproving the centrality of the earth in the universe and Darwin's theory of evolution". Another student noted that anthropocentrism is not universal but culturally variable as it varies throughout "cultures, socioeconomic status, and type of education, which contributes to the complexity of changing worldviews".

A number of students noted that the term environmental justice is essentially related to social justice and the notion of environmental racism. One student summed it up by saying that the term environmental justice term can be misleading as many people think that it has nothing to with humans but with "saving of the environment". However, the student emphasizes, the "concept of environmental justice is anthropocentric".

> Environmental justice is essentially about inequitable distribution of environmental burdens to vulnerable groups. For instance, wealthier people live in a cleaner neighborhood where access to basic needs is not a problem. Also, since they do not have factories in that neighborhood, the air quality is better. Poor people, on the other hand, live where […] factories are constantly emitting harmful gases. Even though the term [environmental justice] has the word environmental in it, environmental justice is a mere means to solving social inequality.

Another student reflected on how the USA Environmental Protection Agency (EPA) defines environmental justice as "the fair treatment and meaningful involvement of *all people* regardless of race, color, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies. Fair treatment means no *group of people* should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental and commercial operations or policies". Evidently, the student wrote, this stance is "extremely anthropocentric".

> At the center of this debate is the word 'justice'. This will have a different meaning to those with a *social* stance, when juxtaposed with those with an *ecological* mentality. This is because it revolves around power relations, which differ depending on the species one considers. For example, justice between people acknowledges discrepancy between human beings in terms of culture, basic rights and autonomy. However, if this same term is applied to both human and non-human species, it is evident that (wo)mankind as an anthropocentric species has generally come first. This is due to the fact that, historically, those (minority groups) with no power were able to expand the parameters of normality in society through affirmative action.

The concepts of ecocentrism are summarized in those assignments that discuss it as a nature-centered system of values. Currently, as a student noted, "humans are far from it" as they relate to the 'natural' environment "through the exploitation of resources it offers, highlighting its 'instrumental value'". Another student wrote:

> *Ecological* stance [largely rests] on eco-centrism i.e. the denial that "a hierarchical division between human-nature realms exists, that grants humans greater intrinsic value than non-human species.

Students noted that the concepts of ecological justice and ecocentrism are related to biospheric egalitarianism, which, as one student wrote, "concerns the rights of other species independent of human interests".

> We, humans, are no different than other organisms living on this planet. We are not greater than any one of them. This means that all of our lives matter. Therefore, it is wrong to think that cows and pigs exist for our consumption. All the living things on this planet have the same rights and value.

Justice for people

Three students explicitly stated that they choose the 'people first' perspective (although the essays of others did express partial agreement with some of the arguments used by these students). Justice for people before the environment was justified by a number of arguments. First, there is evidence that conservation and creation of protected areas can disadvantage local communities. Second, justice is and will remain a human issue. Third, there is a proposition that humans have a different or higher value than other species because of certain inherent qualities.

Regarding the first point, one student extensively quoted Baviksar in her essay:

> Baviskar (2013) argues that in Delhi, where she lives, although securing clean air, water and green spaces is definitely in the public interest, "the greater common good" is "mobilized to exclude and disfranchise large sections of the city's population" (Baviskar 2013). In addition, she states that both the courts and the media had "turned a blind eye to the devastating effects of such projects and urban improvements on the lives of Delhi's under class" (Baviskar 2013). Baviskar further states that most of the air and water pollution in the city is generated by the rich, "by their cars and their sewage" (Baviskar 2013). In this means, we end up with more injustice for people and ironically also for the environment in the name of environmental improvements.

One student summed up the criticism in this way: "Academic anthropological discourse takes a very critical stance towards outsider-involvement in traditional indigenous communities. Not only the promotion of economic growth and consumerism has often been criticized but also the conservationist efforts affecting traditional communities have been negatively assessed by various anthropologists". Here, as the student stated, the "argument is that environmental protection has been warped into a form of western neocolonial imperialism that infringes on human rights and dictates cultural practices in developing countries". Another student provided these examples:

> As Peluso (1993) argues: "some state interests appropriate the ideology, legitimacy, and technology of conservation as a means of increasing or appropriating their control over valuable resources and recalcitrant

> populations". For example, as Benjaminsen et al. (2006) explain, a case in South-Africa where they applied a fixed carrying capacities for land allow wealthier individuals to benefit though exclusive access to land, at the expense of black, poorer, farmers in the region.

Also quoting Benjaminsen and colleagues, another student notes that ecological justice can lead to injustice for native and indigenous communities.

> Policies supporting biodiversity conservation are regarded as much more important than when communities are aspiring to more land in that same area, and that those peoples' needs and rights remain on the margins (Benjaminsen et al 2008). Let alone when these peoples' needs and rights are in conflict with the environmental conservation goals. A supporting example is that of land redistribution in Namaqualand Park (Benjaminsen et al 2008). Local people in the area of the park view the expansion of the Park as "direct and unfair competition" for land that they wish to acquire, as well as it being an indirect challenge to their local livelihoods (Ibid).

Illustrating these misgivings, another student wrote: "if we were to let the justice for the environment prevail fully before justice for the people, conflict would arise and human rights, equality, or standard of living and health will be violated. As human rights violations are against the Universal Declaration of Human Rights, this is thus intolerable". To illustrate the point, two students gave examples. An indigenous community in Nepal had to be displaced because of the expansion of the Shuklaphanta Wildlife Reserve (Ming Lam and Paul 2014). While community members were supposed to be allotted monetary compensation and new land, the distribution disproportionately favoured the rich (Ming Lam and Paul 2014). Furthermore, conservation was said to prohibit traditional practices, as in the case of the Sonahas in Nepal who were restricted from fishing and gold panning (Jonas et al 2014:46). More generally, one student felt that while caring for one's own species is natural, the poorer deserve even greater moral consideration:

> Humans, first and foremost, want to ensure their *immediate* survival. Policies are enacted in the short term to ensure popularity and re-election... As a species, we want to ensure that our lineage continues and are thus biologically driven to reproduce – resulting in the exponential population growth… More help needs to be provided to the poorer people/nations in order to curb this so called need for survival. The vast majority of the global poor live in "rural areas and are poorly educated, mostly employed in the agricultural sector, and over half are under 18 years of age" (World Bank 2016). It is clear that justice and regulations for the poor are essential in ensuring a sustainable future.

Another student reflected that often improving environmental conditions serves the rich and not the poor: "It is obvious that the developed countries, organizations and the current population are able to profit the most from environmental resources and services, whereas developing countries, indigenous people and the future generations will need to bear the burdens". Making a similar point, another student noted that because "no social equality can be achieved among these different groups", which is why justice for the environment should be as important as justice for most vulnerable human groups.

Another student wrote an essay clearly stating that he is a strict anthropocentrist. To explicate his point, the student referred to epistemological anthropocentrism – the Lockean and Cartesian idea that human perception and experience mediate our view of the world and dictate how our judgments are made (Butchvarov 2015). Taking this further, the student continued, the environment, lacking personhood, "has no ability to even perceive reality, therefore humans have to make those judgment for it". The consequences of this, the student stated, is that persons and by extension moral agents are the only entities able to understand or express ethical concerns.

> The concept of 'justice' – for the environment or for people – is thus inherently human. The environment cannot defend itself or evaluate its unethical experiences. Biospheric equality can therefore not be attained fully. There have been

> attempts to include the environment as an agent, such as Bruno Latour's 'Parliament of Things' (Latour 1991), but such institutions always require humans to speak for the environment – with all the problems that entails, such as determining the will of the environment. In summary, justice is thus inherently a human affair.

The student recognizes that "the lives of people are tied to the environment, for some more than others" and thus environment is something that we clearly value, and is a "worthy topic of ethical debate". Clearly, the student continued, the environment has value to some people and that is precisely why it is valuable. However, even if some individuals care about the environment, the idea that intrinsic value does not exist or that nothing has intrinsic value (Sartre 1943) seems to this student the most tenable position. He does, however, admittedly "care deeply about a lot of things; and as an economist I am concerned with increasing utility and individual choice". The fact that he cares about "utility" and "individual choice" that does not mean that these entities have intrinsic value: "There is no metaphysical law or being that declares their value. They are valuable because myself, and others value them. The same goes for the environment".

This is similar to the idea expressed by another student regarding rights: "as rights are usually based on either commonly agreed or authoritative defined moral ideas of what is appropriate". Given that humans do not know if other species have moral feelings, she wrote, "the only source and benchmark for the definition of rights in general and nature rights in particular seem to be human ideas".

The student who defines himself a 'strict anthropocentrist' has also examined definitions of "environment", reporting that according to the Oxford dictionary, it is "the surroundings or conditions in which a person, animal, or plant lives or operates" and "The natural world, as a whole or in a particular geographical area, especially as affected by human activity". While the first definition refers to the more general sense of space and what surrounds any object or being, the second one rather indicates a separation between the 'natural world', i.e. plants and animals, and human beings. This second definition seems to be an oxymoron in itself as the 'natural world' by definition from the same source is something "existing in or derived from nature; not made or caused by humankind", which would include human beings. Thus, the student reasons, it can be concluded that "humans are part of the environment and that justice is both moral as well as culturally influenced and adapted over time". Therefore, according to student, caring about the environment does not mean that the environment has intrinsic value. The student concluded that:

> Justice for the environment could mean that we put long-term environmental gains over short-term human gains. Even if the environment does not perceive that as justice, people who value it may – especially those whose lives rely heavily on, for instance, the Amazon rainforest. Such justice, however, is also automatically justice for people. Justice for people may not always result in justice for the environment, but the reverse is logically always true.

This conclusion reflects the so-called convergence argument in which what people value (e.g. 'environment') means that this is indeed a valuable entity to be protected, not necessarily because of intrinsic value, but because humans depend on and value it.

The third issue is the proposition that humans might have a different or higher value than non-humans because of certain inherent qualities. As one student wrote, while ecological justice consists of the notion that all organisms should have an equal claim over the earth's resources, environmental justice dictates that the 'burden' of environmental preservation should then also be shared. She reasons: "Environmental justice strives to distribute responsibility equally amongst all people. But if animals share the same level of privilege, how could they be excluded from these responsibilities?" Further, she continues, "one could argue that animals are not remotely close to humans when it comes to pollution and environmental degradation". However, animals "do enjoy the earth's resources and, if given the chance,

exploit these to their maximum benefit". This leads the student to inquire: "When one regards justice for the material environment just as important as justice for all animals, how do we expect them to take responsibility for their own overexploitation?" In pondering this question, she reflects:

> The answer is we do not. And this is exactly why I believe animals and humans to be on different levels of intrinsic value. We should strive for a balanced ecosystem that maximizes a beneficial habitat for all species. Justice should be practiced so that humans direct their actions to support this ideal. However, as animals are incapable of doing so and do not have the ethical abilities to consider others, justice cannot favor them. Again, this does not mean that I believe mankind should get a free pass for anthropocentrism... On the contrary, I believe people have a responsibility to preserve our environment in virtue of all organisms. But it does not mean we should share a pedestal with them.

Clearly, the student continues, "mankind is in the position of power and is therefore responsible to make sure legislations govern these relations". However, she reasons, as "animals do not contribute to these practices and are incapable of adhering to universal values, they cannot be held accountable for their actions and, therefore, can also not be treated with the same rights as humans". Nevertheless, the "environment should be viewed as a separate entity and… should be regarded with at least the same importance as humans when it comes to justice".

Another student makes a case for placing humans higher than other living beings by first quoting George Orwell's *Animal Farm*: "All animals are created equal, but some are more equal than others". Even though this book is an allegory on communism, this statement, she writes, beautifully describes the relationship between humans and the environment.

> Even though some people might say that humans and animals are morally equal, that is not the case… There are also practical objections to putting environmental protection before the protection of vulnerable groups of humans. Primarily, I would like to illustrate that humans are of higher moral standing than animals or other species, which leads to one ethical and abstract reason why justice for them should come before justice for the environment. This stems from two main components, namely that only human beings are able to act morally and humans are the only living being with "personhood". We can support the first component by arguing that "Human beings, unlike other animals, are able to reflect on and make judgments about our own and others' actions, and as a result we are able to make considered moral choices" (Guldberg 2011).

The second argument the student uses "stems from the fact that humans have something that animals have not, namely our "personhood". The philosopher Immanuel Kant writes in his *Lectures on Anthropology* (1772-1789): "The fact that the human being can have the representation "I" raises him infinitely above all the other beings on earth. By this he is a person.... that is, a being altogether different in rank and dignity from things, such as irrational animals, with which one may deal and dispose at one's discretion." As Guldberg (2011) argues, "humans are not born with their moral capability, but progress from a very limited understanding to a more sophisticated understanding of morality". This means that our morality stems from how we interact and learn. This means, the student reasons, that "human morality and animal morality are fundamentally not the same".

Justice for the environment

Fifteen out of twenty-two students argued that justice for the environment should come first. Justice for the environment before people is justified by two factors. First, pragmatically, only an ecocentric ethic supports intrinsic values, promising protection to those species that are instrumentally "useless" to humans. Second, an ecocentric ethic already includes humans in the sphere of values and thus ecological justice already guarantees social justice.

Supporting the first idea, one student wrote that shallow ecology – "which sees the equal distribution of resources amongst humans as

more important than the survival of those that constitute these resources" – cannot address environmental problems that are unrelated to human welfare. Although human and environmental interests do converge on a number of matters, not all species have instrumental value to humans. This is evident in the enormous biodiversity loss – at relative low cost to humanity. One student quoted Albert Einstein: "The environment is everything that isn't me", reflecting that some environmental "interests" are independent of human ones – and "in fact it is arrogant to think that all nature is connected to humans as nature can do without us". It is us who "cannot do without nature".

One student wrote that the arrogant worldview of Western nations that prioritize the economy and industrial development over the needs of environment, "is merely an extension of anthropocentrism, where any consideration and/or interest in preserving biodiversity is perpetually linked to human welfare and any use-value it provides us". One of the students quoted Aldo Leopold, who states "a thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise" (in Westra 1998). The student concluded:

> The self-centered nature of humans tends to disregard species that are not seen as useful for humanity. A species should not only be given intrinsic value once it becomes threatened with extinction. Justice for all starts with adequate ecological representation for non-humans.

Another objection raised against exclusive human justice is ethical. As one student wrote: "If "justice is fundamentally concerned with equalizing relations between those who have power and those who do not" (Strang 2016), we should provide justice for those who have less power, in other words also plants or animals".

As one student wrote, anthropological criticism of conservation "wrongly creates a dichotomy between justice for people and justice for the environment". Both long-term and short-term justice for people will benefit from a well-designed approach to ecological conservationism. Even when these "benefits to justice for people are not taken into consideration, the ecological justice paradigm is superior as it takes a more comprehensive approach than the anthropocentric justice for people". Analyzing human-environmental issues from an ecological justice perspective, the student concludes, would positively impact both humans and other species.

Another student wrote that it is immoral to claim that the interests of one species are more important than the interests of other species:

> Just like all other species, we should have equal rights, should equally make use of the earth. This does not necessarily mean that we literally use as much of a certain resource as other species, but harming other species or the environment in order to be better off economically is certainly not justified. The fact that non-human species are not able to verbally communicate their interests does not mean that our interests are superior, which is why justice for people should not come before justice for the environment.

This student further argues: "in order to be moral, humans need to take the responsibility for their actions". Another student reflects this same idea:

> I am not denying the fact that justice for humans is important. However, if we want to save our human race and prevent the negative consequences of the environment, fighting for justice of the environment must be our top priority.

One student argued that precisely because we as humans might have some unique abilities, such as capacity for moral thought or the ability to change their environment on a global scale, this also means responsibility toward nonhumans:

> Humans, after Mother Nature herself, have the largest ability to influence global matters. As such, we have a moral obligation to consider the repercussions for our actions… for other species. However, if we extend compassion to only a selected choice of species, there exists a double standard regarding our intentions, displaying

> how instrumentality and utility-maximization are at the forefront of our concerns. Instead, an analysis of the pure justice demonstrates that if some species are to be treated well, all others should as well.

Regarding the second point that all arguments are framed by humans, one of the students wrote: "Whether it is even conceivable for social scientists to *broaden* schools of thought to include other species while using the same ethical framework as with humans, lays within the capacities of human cognition". Another student wrote: "I don't have to be a female to support feminism or black to support minorities – even if we make values, it doesn't mean that they apply only to us".

One student explicitly addressed the statement by Nonini (2013) quoted in the Introduction, asserting that, contrary to the idea that anthropocentric scientists try to impart, humans and nature are equally reliant on each other, and it is "humans that need nature, not the other way around". The student continued:

> Nonini says that humans are stewards for the reproduction and continuity of survival of other species, which they domesticate and cultivate. He also says that humans protect these cultivated species from incursions by other humans or by non-human species. Of course they do – as these animals and plants are used for human consumption! As Nonini notes, humans – sometimes – serve involuntarily serve as food themselves. Well, how often do humans these days get eaten by tigers or sharks? It is far more likely that tigers are sharks are either killed by hunters, fishers or farmers or incarcerated for human entertainment. The fact that humans host bacteria in their guts (just like all other large living organisms) certainly does not make human bodies and organs into protected areas for wildlife. The relationship between humans and other organisms is largely uneven.

This student also argued that even human burials do not contribute human bodies to the soil for disintegration in order to provide food for the soil. Neither does human excrement contribute to the biological function of the earth, the way other organisms' waste products do. This reflection was based on another subject discussed in the course – Cradle to Cradle and sustainable production.

Convergence of social and environmental interests

Among three students who explicitly stated that humans should come first, two students also noted that justice for people does not mean that the environment will be excluded, as humans need it for their own purposes. Among the fifteen students who indicated that justice for the environment should come first, twelve have also argued that justice for the environment also includes humans. All four students who did not explicitly state their stance indicated that they could not choose sides because there are no sides to be chosen – basically, the environment and humans are interconnected.

While explicating the issue of justice, one student wrote: "Justice for people can be understood as the belief that all people should have equal opportunities and privileges". As such, he reflected, social justice holds that people in the least-developed regions of the world should have equal opportunities to the people in developed areas. The term justice for the environment is somewhat harder to define, as the student further reflected, as "it can be easily confused with (social-) environmental justice". While, "environmental justice refers to the right of all people to have equal access to the environment", ecological justice is distinct as it is "about the rights of all species to be valued equally, independent of their instrumental value". As this student underlined, ecological justice also focuses on the inherent value of all species within a system of ecological interdependence (Strang 2016). Illustrating this interdependency, another student wrote:

> At the rate that we are destroying the environment for our own benefit, we won't be able to benefit from a lot of goods and services. Therefore, now is the time that we put justice for the environment before justice for people to make a difference for the future. Jane Goodall (2005:23) summarizes the first step: "when people acquire a deeper understanding of the natural world, and of the ways their future is being destroyed, they are more likely to care

> and to want to help to save what is left".

In a similar vein, this student argues that we cannot afford to prioritize justice for people over justice for the environment.

> As we are inherently bound together with non-humans and the material earth in collective processes of production and reproduction, we are interdependent in such a way that a disruption for one party theoretically can lead to major consequences for the other parties. Humans are biosocial species that share great amounts of biogenetic material with other species and depend heavily on complex interrelationships with ecological processes. And the scientific evidence is clear: immediate action is needed in order to sustain live on earth for the generations to come. Within the next 40-50 years, if no action is taken, the essential coral reefs that are home to around 25% of the earth's aquatic species will have disappeared.

This relationship between justice for people and justice for the environment, in another student's words, "makes clear that the two cannot be addressed individually". For this student, "if the two types of justice were to be conflicting in certain circumstances, the case should preferably be analyzed from the standpoint of ecological justice". He bases this preference on the fact that "ecological justice in itself already takes into account the entire interdependent ecological system" (Strang 2016). Ecological justice would include human beings, "while the justice for people approach is anthropocentric". Thus, this student concludes, "an ecological justice standpoint could give insights in cases even when justice for people should prevail above justice for the environment, while the justice for people approach would be useless in cases where the environment should reasonably prevail".

Convergence theory (Norton 1991), as summarized by a student, states that while there might be a difference in anthropocentric and non-anthropocentric people, they will eventually have to support similar environmental protection policies. This is mainly because of the fact that in order to "adequately sustain a broad range of human values over time, the ecological contexts on which these goods depend must also be sustained, which can be accomplished through long-sighted, multi-value environmental policy". This means, the student continues, that "whilst taking human's best interest into account, we automatically take care of the environment".

Many students shared this position. One student provided a metaphor to illustrate mutual dependency, reflecting that "we are part of nature" and that "the effects of environmental injustice will eventually affect every single one of us".

> Let a house represent the Earth and let two siblings living in the house represent humans. It is important for siblings to stop fighting for the happiness of the household but what is more important is the house. If the house breaks down, the siblings will get hurt. Just like this, fighting for justice for humans is important for peace of humanity. However, if we do not fight for justice of the environment, the Earth, our home, will ultimately fail us. For nature to become healthy again, it can take thousands of years. Compared to the 4.5 billion years of life on Earth, humans do not even account for one quarter of it. Therefore, we should respect and protect the nature that is around us.

Another student wrote:

> When I cut down a tree to make a chair and therefore harm the environment, I am doing injustice to the environment and it would seem I value justice for people because I harm the environment to achieve personal goals. On a smaller scale, someone might have had a deep relationship with this tree because of memories. In this case, it would have been unjust towards this human as well as the tree for cutting it down.

As one student summarized the argument of supporters of 'people first' justice, because ecological conservation and its advocacy in the current era are predominantly initiated by Western-dominated organizations, it is seen by some as a neo-imperialist agenda that suppresses the rights of indigenous people. Thus, the critics "believe that ecological justice is in conflict with social-environmental justice

for local cultures". What is overlooked by this criticism, according to this student, is the "strong linkage between justice for people and justice for the environment". The student further argues: "In the current age of large-scale pollution, environmental degradation, overexploitation of natural resources and climate change, it is becoming increasingly obvious that the current human interaction with the environment in unsustainable". Thus, these two students maintain that it is the ideology of growth and capitalism that are the main and shared enemy of justice:

> The encroachment of the Western civilization, consumerism and an exponentially growing population has permanently degraded ecosystems and depleted natural resources. Pollution, overpopulation, climate change and deforestation are now threatening us. Non-human populations, on which the humans heavily depend, are facing the same threats.
>
> Thus defenders of social practices criticize western political and corporate imperialism. Although it can be seen that both stances contain valid points, they both treat society and ecology as mutual exclusive, despite the fact that they are heavily intertwined. A bridge between the two is *biospheric altruism,* which goes beyond the instrumental value of non-human species and instead recognizes that species as well as ecosystems are interrelated and interdependent (Sponsel 2014). The growing population, anthropocentric attitudes, and the ever-growing gap in social equality that seems to eclipse consideration for non-human species further aggravates this.
>
> If the ideology keeps focusing on growth that comes at the cost of the environment, there may come a point where there is simply no natural environment anymore to sustain human life. A form of social-environmental justice that strives for everyone to reach the level of environmental appropriation of current Western societies would require many more earths to exist. In that sense, long-term social justice requires justice for the environment. The short-term social-environmental justice can to a large extent be reconciled with ecological justice. For ecological justice to be successful, the big underlying causes of environmental unsustainability will have to be addressed. Many of these issues are related to the unsustainable levels of consumption in Western societies. It is essential that the growth-focused ideologies in developed countries are limited.

Indeed, as this student concludes, "the criticism that current conservationist practices are a Western neo-imperialist practice can be tackled by shifting the ecological justice agenda to more explicitly target Western over-consumption":

> Well-designed conservationist practice are unlikely to severely limit truly traditional practices of indigenous communities. After all, if communities were able to continue practicing certain customs or rituals for centuries, it is unlikely that they were critically damaging the environment on a large scale. Instead, indigenous cultures and practices become problematic when habits or rituals become practiced at a much larger scale, or when newly-introduced post-industrial 'traditions' are invented (Strang 2016). In these cases traditional cultures can become unsustainable and have to be addressed, especially because such cultures are likely to be situated in hotspots of biodiversity (Kopnina and Blewitt 2015). Again, justice for people and justice for the environment go hand in hand here.

Formulating a question that appeared in many essays, one student asked: "If people are a part of the environment does justice for people at the same time mean justice for the environment?" As another student argued, "a destruction of the environment at the same time means a destruction of humans". As this student asserted: "Our ecological crisis shows how harmful it is to prioritize human justice, not only to humans but also to nonhumans". One student outlined two motivations for nature preservation:

> At first sight it appears as if the concept of social justice is legitimizing the exploitation of nature as a necessary evil for the sake of human well-being. However, even from this perspective it is necessary to promote ecological justice in order to sustain a healthy and abundant environment on which humans essentially depend for fulfilling their material basic needs such as nutrition, clothing and shelter.

Thus, the student reasons, it is necessary to promote ecological justice from two different perspectives. One is anthropocentrism, "which stresses humanity's dependence on sufficient resources" and the need to "sustain a healthy environment for the benefit of both present and future human generations". Another one is ecocentrism, which acknowledges "intrinsic values and interconnectedness of all living beings".

A win-win scenario is illustrated by the case discussed by one of the students in examining the 'TakeCare' program in Tanzania by the Jane Goodall Institute (JGI). According to this student's analysis, the program proved that an integrated approach to poverty alleviation is possible while simultaneously conserving forests (Goodall 2015).

> The program aimed to increase the quality of life of communities surrounding the protected Lake Tanganyika park. Cooperation of the villagers was gained through appointing Tanzanian locals that addressed and respected the locals' needs, such as an increased food production and improved health facilities. Furthermore, JGI tried to stimulate environmental awareness by the conduction of micro-credit programs, especially for women, such as tree nurseries, and granted scholarships so that girls would stay in school, and family planning information is available in each village. Similarly, in 2008, JGI started to help the villagers surrounding Gombe National Park to generate land-use maps, and due to the good nature of their communication, the villagers agreed on a buffer zone around the park for forest regeneration purposes. The buffer also surrounds the water source of the village, protecting the supply. After ten years, the results are looking promising: many trees have grown either out of seeds or from the stumps that were still in the ground, and have now reached a height so that chimpanzees can settle once again in the buffer area.

However, some students have noted that anthropocentric motivation is not enough to protect the environment because functionally "useless" species will suffer.

Adding complexity

The same student considers that assigning value to all species might be difficult in practical terms, reflecting that treating all other animals like humans "would likely be too much of a dramatic shift". However, he continues, "making a concerted effort to be compassionate with other species should increase global justice for all".

> Although it may feel natural for us to be more inclined to interact with certain animals, usually for our own pleasure or satisfaction, this attitude is in itself problematic because it signifies the existence of an instrumental value we have for other animals. A large proportion of environmental concerns are often bound with concerns for human health.

In discussing complexity, another student reflects that convergence theory has its limitations. As Minteer and Manning (2000) explain, J. Baird Callicott and Laura Westra have rejected the validity of Norton's thesis, refusing to believe that his model's contextual appeals to a plurality of human and environmental values will be able adequately to provide environmental protection. Minteer and Manning argue that, instead of defending 'a priori' or intuitively held moral foundations, environmentalists might better draw upon citizens' value of pluralism in a practical engagement of the alternatives available within policy discourse. Adding a further nuance to the idea of plurality in perceptions, two students wrote:

> That is not to say that all humans overlook the value of the environment. Within my own community, I have encountered neighborhoods who value the importance of green space and welfare of plants and animals.

> It is important to consider the concept of equity and understanding that not all societies have the same values. As such, it is imperative to realize that not all societies strive to 'develop' and 'modernize' to the level that many western countries have reached.

In relating to the question of "developing" and "modernization", a student reflected that while we can all agree that human "wants" created by the market economy are to blame for the expansion of consumerism, the definition of

basic needs and associated justice is more complex:

> But what are humans' basic needs? I believe that everyone more or less agrees that it is basic human need to have enough food every day […], clothing and a roof to sleep under. When it comes to these needs, I don't see two people disagreeing on them. Thus, these needs must be met even before considering environmental impacts that are associated with these people meeting their basic human needs. Then, once their rights are met, it is vital that environmental justice follow.

In reflecting on trade-offs, one student wrote that ironically, "while in social justice poor states should be allowed to pollute the environment just like rich states did", this social justice in relation to carbon emissions actually leads to environmental injustice – climate change – that affects us all. Also reflecting on climate change, another student wrote:

> The more topics such as climate change and sustainable development are discussed, the more we realize that our interests are not always aligned with the interests of other species. Some of us think we should strive for sustainability up to the point where our interests and the interests of other earthly species conflict with each other, while others think that striving for sustainability per definition means that we take other species into account, even if that means we need to put aside our own interests.

Illustrating how complex trade-off can be in choosing between different species, one student wrote that it is not easy to know where do we draw the line. In 2016, a 17-year-old gorilla named Harambe was killed at the Cincinnati zoo to save a boy who fell into the enclosure. This event turned into a widely-publicized debate on what was the right (and wrong) thing to do. While the student noted that some people were outraged by the death of a gorilla, if they had let the boy die, people would have been outraged as well. The student provided another example:

> Now let's compare this situation to occurrences in relation to roadkill (Desmond 2013). We always put our own safety on the road before the safety of animals. Although it still varies depending on the type of animals... Why is the answer on what to do in the roadkill situation so easy (humans before animals), yet when it comes to Harambe, which is about one animal, becomes a worldwide debate? Where is the line? Why are some animals more important than others? One cannot always be ecocentric or anthropocentric, thus a balance needs to be found between the two, whereby ethics and personal believes and involvement would also play a large role. Therefore, choosing what is right and wrong becomes a difficult decision to make.

As one student wrote in the case of climate change, some trade-offs involve complex ethical choices:

> Developing countries are allowed to emit more GHGs than developed countries because developed countries had already emitted GHGs in order to develop. Therefore, it is just to let developing countries continue emitting GHGs… If we keep going on this trend, eventually all of us will be negatively impacted.

Following up on the example of climate change, another student reflected that "once corporations are involved in something then the law is quick to follow". However, in the case of climate change, "our economic actions have been guilty of creating the problem in the first place". Also, the scale of corporate expansion and industrial production has made issues ranging from addressing climate change to biodiversity protection difficult to address at the local level. In relating to the issue of scale, one student stated:

> While probably not many would suffer from the removal of one tree, humans would suffer from the removal of multiple trees. Therefore, whether doing justice to the environment or people first, is a question of scale.

Thus, the challenge is to "balance the necessity to supply a growing number of humans and the earth's limited ecological capacities" as the "anthropogenic destruction of nature had

increased over time". It remains unclear, the student noted, what ecological justice means in practice that on what concrete principles and norms is the ecologically just lifestyle should be based. Another student looking at the 'biological' side of the human predicament underlined the complexity of choices, noting that "when looking at population biology, it is essential to have a stable population and reproduction". Our population, his reasoning proceeds, has expanded to such an extent that "there is a humanitarian crisis with regards to distribution and access to basic needs… The human species will suffer in the long run as a result of environmental degradation". Another student doubted whether any kind of ecological lifestyle can provide seven and a half billion people with enough food and shelter to stay within ecological limits.

Compromise: Simultaneous provision of justice

Related to the issue of social equality, as one student argued, is the opposing idea that far from under-privileging the poor, in fact, it is precisely the poor that benefit from better environmental protection. He stated that the "poor suffer most from the effects of globalization and environmental degradation. This is the result of how unpredictable weather patterns driven by climate change are destroying homes, crops, and livelihoods by forcing the poor onto marginal plots of land, resulting in deforestation, soil erosion, and depletion". Thus, he continues, the very physical survival of the poor is immediately linked to environmental integrity.

> During the debate on the same topic Nonini (2013) said that justice for nature is inextricably related to justice for people. Even though he was in favour of the motion he clearly presented how the environment is intertwined with the humans and vice versa. Thus we can also say that since the two are so much interconnected, why should we separate them in our justice systems and especially why should we decide upon a hierarchy… Simply thinking about *what* the environment is for human society it becomes clear that we actually thrived because of […] resources. Justice for the environment means justice for people. Strang (2013) even argues that "rather than promoting justice for people we should promote justice for all". Justice for all is certainly a better approach when considering that human beings are as a matter of fact as much part of the natural world as any other species on this planet.

Promoting justice for all is also based on the idea that far from being a Western neo-colonial idea, environmentalism and respect for nature is actually a universally shared 'indigenous idea', as this student wrote that empirical evidence demonstrates that the (intrinsic) value of the environment was recognized in all states prior to colonization and indigenous respect for their natural surroundings. As this student wrote:

> Baviskar (2013) argues that the discussion surrounding environmental justice is fundamentally neocolonial as northern states continue to control southern states by imposing developmental constraints on post-colonial economies for environmental reasons. However, if we look at the case of India, there are certain cultural traditions, which enshrined environmental preservation long before British occupation. Norton (1984) provides the example of the traditions of Jainism and Hinduism, both religions which […] promoted the preservation of all life, both human and non-human, for the sake of spiritual development…The deep ecology movement of the 1970s was largely dependent on indigenous traditions of natural preservation. Many indigenous cultures practice an animistic spirituality that incorporates humanity into nature (Devall 1980). Therefore, by pursuing an ecocentrism, the global population is adopting indigenous values rather than trying to eradicate them. There is ample anthropological evidence, which demonstrates the universality of environmental conservation. Therefore, justice for the environment should come before justice for people, in order to guarantee a more sustainable and equitable global society.

Other students produced similar observations:

> The arguments used by advocates of [justice for people first] often revolve around the idea that justice for the environment is upheld by Western 'neocolonial environmentalists'. The reality, however, is that justice for the

> environment and non-humans is supported all over the world. And indigenous communities e.g. the aboriginals were known to live in peace with their environment and non-humans (Selin 2003).
>
> The demands of humankind as well as the needs of the environment should be simultaneously met. It is unjustified to place humans above non-humans, as both are equal. Justice can only reach the next step if non-humans are also included within this valuation.

Simultaneous provision of justice depends on the realization of the "common enemy" - as one student put it – "common forces that are responsible for environmental degradation, namely industrial development, economic growth and human population expansion". Another student wrote:

> We are the primary decision makers concerning what happens to *our* environment since we have the capability and the power to adjust, deteriorate and revive *our* environment. If humans are rational beings, we should be able to address and effectively solve the (environmental) problems that we have brought upon ourselves. With the exponential rate that our population is growing, more people need to realize that we still live on an abundant earth (Crist 2012), and we are not able to extract resources at the rate that we are doing now. Thus, we must aim towards "reducing human impacts on the global environment" (Crist 2012). Most of our necessities have already been realized, and everything else that we consume and need can be considered as luxury goods… As we have also become a society that values money more than the environment, in combination with population growth… we will soon reach a point of no return.

In seeking compromise, however, one student argued that while win-win scenarios are certainly desired, convergence is not always possible. Without justice for those that cannot talk human language, non-human interests are likely to come in last. At the moment, as the student reflected, "no compromise can be reached as long as humans only take from nature and give nothing back". If humans are really part of nature, nature should also have rights, "otherwise unity of all species and simultaneous provision of justice is only academic".

Discussion

Most students in their essays mentioned convergence theory and simultaneous provision of justice, assuming that human and environmental interests basically correspond. Those students that openly chose an anthropocentric stance used some of the same arguments that students supporting justice for environment, namely human dependency on nature. There were some marked differences between the arguments as well. While 'people first' essays included the argument that preservation of nature might come at the expense of vulnerable communities, 'environment first' essays emphasized that without prioritizing the environment the same vulnerable communities are going to be disadvantaged the most, as environmental disasters – form climate change to deforestation – have a greater impact on poorer people. The interdependence of human and environmental interests was emphasized by majority of students, many of them concluding that both social (so-called environmental justice) and ecological justice should be achieved simultaneously. Students that chose people first have also emphasized that since justice and the very idea of intrinsic values are human concepts, they should be applied to humans. Countering this, a student supporting ecological justice noted that even if humans frame all ethical arguments and values it does not mean that these values apply only to us. Adding further nuances, other students argued that assigning intrinsic values may be more complex than just stating that everybody, humans and bacteria, for example, have equal value, and that indeed, practically, some animals might be more "important" (at least form human point of view) that others.

While the majority of students chose an 'environment first" perspective, the justification of their choice was often anthropocentric – the fact that people need the environment after all and that since all species, including humans, are interdependent, justice for the environment will

also guarantee justice for people. More critical students, however, cast doubt on the pre-supposition that humans and other species are interdependent, as it was noted that humans need nature but nature does not need humans. As some students observed, pragmatically, without prioritizing the environment, non-human interests are always likely to always come last.

The writing assignment demonstrated the complexity of environmental orientations within the anthropocentrism-ecocentrism spectrum. The question of justice, variably associated with the ideas of fairness, responsibility or rights, presented a particular challenge in cases where hard choices and trade-off rather than easy win-win scenarios that emphasize congruency of interests were perceived. Human and environmental interests are precariously balanced, as illustrated by students in cases reflecting on human basic needs and protected areas, or the shooting of a gorilla at the zoo to protect a child.

The greatest convergence of perspectives was in identifying industrial, developed, capitalist society with its cult of economic growth as a culprit in the deterioration of both human and environmental well-being. As one student put it, “A form of social-environmental justice that strives for everyone to reach the level of environmental appropriation of current Western societies would require many more earths to exist”. Thus, while convergence between anthropocentric and ecocentric positions is unlikely, as instrumentally “useless” species are likely to be condemned to extinction without recognition of their intrinsic value, convergence of interests addressing the *global injustice* of environmental degradation and displacement is certainly a worthy cause. It is certainly reason for hope that the students documented in this research recognize and mostly support this cause.

References

Abram, S., Acciaioli, G., Baviskar, A., Kopnina, H., Nonini, D., Strang, V. 2016. ‘Special Module: Plenary Debate from the IUAES World Congress 2013: Evolving Humanity, Emerging Worlds, 5–10 August 2013’. Involving anthropology: debating anthropology’s assumptions, relevance and future. *Anthropological Forum*, 26(1): 74-95.

Baviskar, A. 2013. *Hallsworth Plenary Debate*. https://www.youtube.com/watch?v=oldnYTYMx-k

Benjaminsen, T.A., Rohde, R., Espen, S., Wisborg, P., & Lebert, T. 2006. Land reform, range ecology, and carrying capacities in Namaqualand, South Africa. *Annals of the Association of Amarican Geographers, 96*(3), 524-540.

Benjaminsen, T. A., Kepe, T. and Bråthen, S. 2008. "Between Global Interests and Local Needs: Conservation and Land Reform in Namaqualand, South Africa." *Africa: Journal of the International African Institute* 78(2):223-44.

Butchvarov, P. 2015. *Anthropocentrism in Philosophy*. Berlin: Walter de Gruyter Books.

Cafaro, P. and Primack, R. 2014. Species extinction is a great moral wrong, *Biological conservation* 170: 1-2.

Colchester, M. 1994. *Salvaging Nature: Indigenous Peoples, Protected Areas and Biodiversity Conservation.* Diane Publishing, United States.

Crist, E. 2012. Abundant Earth and Population. In: Cafaro, P. and Christ, E. (ed.): *Life on the Brink: Environmentalists confront Overpopulation*. Athens: GA: University of Georgia Press. p. 141-153.

Desmond, J. 2013. *Requiem for roadkill*: *Death and Denial on America's roads*. In: Kopnina H, Shoreman-Ouimet E (eds) *Environmental Anthropology: Future Directions*, New York and Oxford: Routledge, pp. 46–58.

Devall, B. 1980. “The Deep Ecology Movement”, *Natural Resources Journal,* 20: 299 - 322.

Dietz R. and O’Neill D. 2013. Enough is enough: building a sustainable economy is a world of finite resources. San Francisco: Berrett-Koehler Publishers.

EPA. Environmental Protection Agency, "Environmental Justice." https://www.epa.gov/environmentaljustice.

Goodall, J. 2015. Caring for People and Valuing Forests in Africa. In G. Wuerthner, E. Crist and T. Butler (eds), *Protecting the Wild: Parks and Wilderness*, *The Foundation for Conservation*,

Washington, London: The Island Press, pp. 21–26.

Guldberg, H. 2011. Only humans have morality, not animals. *Psychology Today.* Retrieved from https://www.psychologytoday.com/blog/reclaiming-childhood/201106/only-humans-have-morality-not-animals.

Grey, W. 1993. Anthropocentrism and Deep Ecology, *Australiasian Journal of Philosophy* 71(4):463 - 475.

Hansen, **A.** and Wethal, **U. (eds.) (2014)** *Emerging Economies and Challenges to Sustainability: Theories, strategies, local realities*. New York: Routledge.

Iphofen, R. 2013 Research Ethics in Ethnography/Anthropology. European Commission (http://ec.europa.eu/research/participants/data/ref/h2020/other/hi/ethics-guide-ethnog-anthrop_en.pdf)

Jonas, H., Roe, D. and Makagon, J.E. 2014. *Human Rights Standards for Conservation: An Analysis of Responsibilities, Rights and Redress for Just Conservation*. IIED Issue Paper. IIED, London.

Kant, I. 1772-1789. *Lectures on Anthropology.* In Cohen, A. ed., 2014. *Kant's Lectures on Anthropology*. Cambridge: Cambridge University Press.

Kidner, D.W. 2014. Why 'anthropocentrism'is not anthropocentric. *Dialectical anthropology*, *38*(4): 465-480.

Kopnina, H. and Shoreman-Ouimet, E. 2013. "Preface." *Environmental Anthropology: Future Directions*. New York: Routledge.

Kopnina, H. 2012. Education for Sustainable Development (ESD): The turn away from 'environment' in environmental education? *Environmental Education Research,* 18 (5): 699-717.

Kopnina, H. 2013. *Hallsworth Plenary Debate*. https://www.youtube.com/watch?v=oldnYTYMx-k

Kopnina, H. 2014. Environmental Justice and Biospheric Egalitarianism: Reflecting on a Normative-philosophical View of Human-nature relationship. *Earth Perspectives*. 1: 8.

Kopnina, H and Blewitt, J. 2014. Sustainable Business: Key Issues. New York: Routledge.

Kopnina, H. and Washington, H. 2016. Discussing why population growth is still ignored or denied. *Chinese Journal of Population, Resources and Environment*, 14(2): 133-143.

Kopnina, H. 2017. Teaching Sustainable Development Goals in The Netherlands: a critical approach. Special Issue: Environmental and Sustainability Education in the BENELUX region. *Environmental Education Research*, http://www.tandfonline.com/doi/full/10.1080/13504622.2017.1303819

Kortenkamp, K. and Moore, C. 2001. Ecocentrism and Anthropocentrism: Moral Reasoning About Ecological Commons Dilemmas, *Journal of Environmental Psychology* 21: 261 - 272.

Kumar, M. and Kumar, P. 2008. Valuation of the ecosystem services: a psycho-cultural perspective," *Ecological economics* 64(4): 808-819.

Latour, B. 1991. *Nous n'avons jamais été modernes: Essai d'anthropologie symétrique*. Harvard, MA: Harvard University Press.

Mathews, F. 2016. From biodiversity-based conservation to an ethic of bio-proportionality. *Biological Conservation*, 200:140-148.

McDonough W. and Braungart M. 2002. Cradle to cradle: remaking the way we make things. London: Vintage Books.

Ming Lam, L. and Paul, S. 2014. Disputed Land Rights and Conservation-led Displacement: A Double Whammy on the Poor. *Conservation & Society*. 12(1): 65–76.

Minteer, B.A. & Manning, R.E. 2000. Convergence in environmental values: An empirical and conceptual defense. *Ethics, Place and Environment, 3*(1): 47-60.

Monbiot, G. "Is Protecting the Environment Incompatible with Social Justice?" The Guardian. February 13, 2012. https://www.theguardian.com/environment/georgemonbiot/2012/feb/13/protecting-environment-social-justice

Naess, A. 1973. The shallow and the deep: long-range ecology movement. A summary, *Inquiry,* 16:95–99.

Nonini, D. 2013. *Hallsworth Plenary Debate*. https://www.youtube.com/watch?v=oldnYTYMx-k

Norton, B. 1991. *Toward Unity among*

Environmentalists, New York: Oxford University Press.

Norton, B. 1984. "Environmental Ethics and Weak Anthropocentrism", *Environmental Ethics* Vol. 6, pp. 132 - 148.

Peluso, N. L. 1993. Coercing conservation?: The politics of state resource control. *Global Environmental Change, 3*(2): 199-217.

Poirier, N. and Tomasello, S. 2017. Polar Similar: Intersections of Anthropology and Conservation. *Animalia*, 1-17.

Sartre, J.-P. 1943. *L'Être et le néant: Essai d'ontologie phénoménologique*. Paris: Gallimard.

Saunders, B., Kitzinger, J. and Kitzinger, C., 2015. Anonymising interview data: Challenges and compromise in practice. *Qualitative Research*, *15*(5):616-632.

Schlosberg, D. 2004. Reconceiving environmental justice: global movements and political theories. *Environmental politics*. 13(3): 517-540.

Selin, H. ed. 2003. *Nature Across Cultures*. Science Across Cultures: The History of Non-Western Science. Dordrecht: Springer Netherlands.

Shoreman-Ouimet, E. and Kopnina, H. 2015. Reconciling Ecological and Social Justice to Promote Biodiversity Conservation. *Biological Conservation*, 184: 320–326.

Simkins, A. 2013. Anthropocentrism and the Place of Humans in the Biblical Tradition, *Journal of Religion & Society* 9:17 - 29.

Sponsel, L. E. 2014. Human Impact on Biodiversity: Overview, In *Encyclopedia of Biodiversity*, Waltham, MA: Academic Press 4:137-152.

Strang, V. 2013. *Hallsworth Plenary Debate*. https://www.youtube.com/watch?v=oldnYTYMx-k

Strang, V. 2016. Justice for all: inconvenient truths and reconciliations in human and non-human relations. In *Routledge Handbook of Environmental Anthropology*. Ed. by H. Kopnina and E. Shoreman-Ouimet. Oxford, New York: Routledge.

Westra, L. 1998. *Living in integrity: a global ethic to restore a fragmented earth*. Lanham, Maryland: Rowman & Littlefield.

Wienhues, A. 2017. Sharing the Earth: A Biocentric Account of Ecological Justice. *Journal of Agricultural and Environmental Ethics*, *30*(3):367-385.

World Bank. "Poverty Overview." Accessed Web. 19 Oct. 2016. <http://www.worldbank.org/en/topic/poverty/overview>.

Wang U (2012) Report: 180 Solar Panel Makers Will Disappear By 2015. Forbes. http://www.forbes.com/sites/uciliawang/2012/10/16/report-180-solar-panel-makers-will-disappear-by-2015/. Accessed 17 May 2017

Washington H 2015. *Demystifying Sustainability: Towards Real Solutions*. Routledge, London.

WEF (World Economic Forum) 2013. Energy Harnessing: New Solutions for Sustainability and Growing Demand http://www3.weforum.org/docs/WEF_EN_EnergyHarnessing_Report_2013.pdf Accessed 17 May 2017

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The Contribution of the Capability Approach to the Understanding of Young People's Sustainability Engagement as a Positive Developmental Outcome.

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Abstract.
Young people's engagement with sustainability includes both civic and pro environmental behaviors (e.g. environmental activism) that contribute to the development of sustainable communities. It reflects a holistic idea of sustainability, where civic democracy and ecological integrity are strictly interconnected. The lack of empirical studies exploring this kind of engagement among young people may well be a consequence of the lack in the literature of a shared theoretical model that provides a framework for both types of behaviors. By integrating Positive Youth Development with the Capability Approach, the aim of this paper is to provide new theoretical input as a way of filling this gap. The proposed model is based on the idea that both positive individual and sustainable development are a question of social justice that takes place within specific domains and is related to understanding experience within life courses.

Key words: Positive Youth Development; Capability Approach; Young people; Engagement; Sustainability

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***Perspective**: Theoretical and educational visions*

***Fields**: Human sciences, social processes and structures*

***Issues**: Young people and sustainability engagement*

Introduction

Young people's civic engagement is one of the main issues dealt with in the literature on Positive Youth Development (PYD). Several studies have explored the relationship between civic participation and wellbeing among adolescents (e.g. Albanesi Cicognani, & Zani, 2007) and the processes at both individual and community level underlying young people's participation in community civic life (e.g. Rossi et al. 2016).

Youth engagement can be defined as meaningful participation and sustained involvement by young people in activities whose focus is on something outside themselves (Pancer, Rose-Krasnor and Loiselle 2002, 49). In the literature on PYD, the label "civic engagement" covers all those behaviors that benefit other individuals or the whole community, such as voluntary work in civic associations. However, those behaviors that have positive consequences on the environment are often not included within that category (Rossi & Dodman, 2015), but are rather labelled as "pro-environmental behaviors". This separation in the literature, as well as in educational projects on sustainability, reflects the distinction between the environmental and the civic dimensions often present within our society. Nature is considered as something separate from daily life, to be experienced on particular occasions which differ from those which characterize civic engagement. However, the core principles of sustainability (such as those expressed in Agenda 21) propose the opposite perspective and strongly emphasize the interconnection between civic democracy and ecological integrity as one of the main points on which policies need to focus in order to develop sustainable communities. Gardner and Stern (2002) have indeed underlined that the most effective actions for the environment, are those on a collective level, when people organize to pressure Government and industry to act for the common good. Understanding the interdependence of both dimensions has increasingly come to be seen as crucial.

The aim of this paper is to give new theoretical input to the issue and in this respect the integration of the PYD model and the Capability Approach appears particularly significant. The following paragraphs will propose a way of linking theoretical frameworks through this approach, emphasizing how their integration can contribute to the understanding of young people's sustainable engagement, taken to necessarily mean the integration of the civic and the environmental dimensions of sustainability.

Positive Youth Development and Sustainable Engagement

PYD is an approach (Sherrod, Busch, & Fischer, 2004) based on the idea that every young person has the potential and the capacity for successful and healthy development (Lerner, 2005). The plasticity of human development is what allows for systematic changes throughout the life course and it is a function of the bidirectional exchanges between individuals and their multilevel contexts. Lerner et al. (2005) conceptualize PYD through five constructs, the five "Cs": Competence, Confidence, Connection, Character, Caring (Figure 1), which lead to the potential for a sixth C: Contribution. A young person who manifests the 5 Cs will be more likely to contribute to self, to family, to community and to civil society in more positive ways. It follows that being part of a context that promotes the five "Cs" constitutes an opportunity for the positive development of both the individual and the community, since the given contexts and relations are mutually beneficial.

Five Cs	Definition
Competence	Positive view of one's actions in domain specific areas including social, academic, cognitive and vocational. Social competence pertains to interpersonal skills (e.g. conflict resolution). Cognitive competence pertains to cognitive abilities (e.g. decision making). School grades, attendance and test scores are part of academic competence. Vocational competence involves work habits and career choice explorations.
Confidence	An internal sense of overall positive self-worth and self-efficacy; one's global self-regard, as opposed to domain specific beliefs.
Connection	Positive bonds with people and institutions that are reflected in bidirectional exchanges between the individual and peers, family, school and community, in which both parties contribute to the relationship.
Character	Respect for societal and cultural rules, possession of standards for correct behaviors, a sense of right and wrong (morality) and integrity.
Caring and compassion	A sense of sympathy and empathy for others.

Table 1. Definitions of the Five Cs of Positive Youth Development (Lerner et al., 2005)

A lack of longitudinal studies makes the testing of all the assumptions of the model difficult (Lerner et al., 2005; Eccles and Gootman, 2002), but a considerable amount of empirical evidence has shown how such factors are important in understanding young people's civic engagement. Eccles and Gootman, (2002) provide a more detailed analysis of these factors, but there is a lack of studies that directly refer to PYD in dealing with sustainable engagement. However, many aspects of the model have already emerged as being important in the literature on the environment and young people. For example, Riemer et al. (2013) and Chawla & Flanders Cushing (2007) developed both a framework and a model for engaging young people in environmental change by directly referring to the literature on civic engagement. The model proposed by Rossi & Dodman (2015) also includes many aspects which overlap with the PYD, considering the community as an arena where sustainable practices can develop through learning processes of assimilation and accommodation triggered by interacting with its public spaces and with other inhabitants. These processes are seen as promoting knowledge-building, communicative, methodological-operational and personal and social competences which together constitute a capacity for individual and joint orientation, the ability to understand certain situations and act in a conscious way in order to engage them and work towards given objectives (Dodman, 2016).

At present, for each of these models further studies that provide adequate empirical evidence are still necessary.

The Capability Approach and Sustainability

The Capability Approach (CA) is a model of human development that has its origins in the field of developmental economics and focuses directly on the quality of life that individuals are actually able to achieve through the expansion of their capabilities (Sen, 1985, Nussbaum, 1988). It addresses the inadequacy of *growth* as an indicator of the quality of life because this fails to show the condition of people who suffer from deprivation (Nussbaum, 2003) and provides an alternative paradigm in terms of *poverty reduction* (Sen, 1992). CA goes beyond previous meanings ascribed to the concept of development, which is now defined as people's freedom to engage in valued social activities and roles. Capabilities are considered as those freedoms that can be enjoyed, what people are "able to do and be", given both individual capacities and environmental opportunities (Nussbaum,

2000).

Nussbaum (2003) lists 12 central human functional capabilities that must be satisfied at least at some level that is adequate to afford people a life worthy of the dignity of a human being:

1. *Life*: being able to live to the end of a normal human life-span, not dying prematurely, or being reduced to a state whereby one's life is not worth living;
2. *Bodily Health*: being able to enjoy good health, including reproductive health, to be adequately nourished, to have adequate shelter;
3. *Bodily Integrity*: being able to move freely, to be secure, and having opportunities for sexual satisfaction and reproduction;
4. *Senses, Imagination, and Thought*: being able to use the senses, to imagine, think, and reason, and to do these things in a way informed and cultivated by an adequate education, being able to do these things in connection with experiencing and producing works and events of one's own choice;
5. *Emotions*: being able to love, to grieve, to experience longing, gratitude and justified anger;
6. *Practical Reason*: being able to form a conception of what is good and to engage in critical reflection about the planning of one's life;
7. *Affiliation*: (a) being able to live with and towards others, to recognize and show concern for other human beings, to engage in various forms of social interaction and (b) enjoying the social bases of self-respect and non-humiliation;
8. *Other species*: being able to live with concern for and in relation to animals, plants, and the world of nature;
9. *Play*: being able to laugh, to play, to enjoy recreational activities;
10. *Control Over One's Environment*: (a) *political*: having the right and being able to practice political participation, protection of free speech and association; (b) *material*: having property rights and being able to hold property, having the right to seek employment, enjoying freedom from unwarranted search and seizure.

Some authors have emphasized the close relationship between CA and sustainability, since both deal with the issue of social justice. For example, Holland (2007) argues that the environmental dimension is a matter of basic equity and must be considered as an independent "meta-capability", since environmental resources are indispensable for enabling all the other capabilities. Ballet et al. (2013) consider Nature as the mediator of social justice among human beings in terms of access to natural resources: "sustainable development guarantees for both present and future generations an improvement of the capabilities of wellbeing (social, economic, or environmental) for all, through the aspiration of equity on the one hand - as intra-generational distribution of these capabilities - and their transmission across generations on the other hand" (p.6).

In this respect, both positive youth development and the capability approach are clearly linked to the idea of sustainable education as "an educational culture […] which develops and embodies the theory and practice of sustainability in a way which is critically aware. It is therefore a transformative paradigm which values, sustains and realizes human potential in relation to the need to attain and sustain social, economic and ecological wellbeing, recognizing that they must be part of the same dynamic" (Sterling, 2001:22). Realizing human potential and wellbeing are thus part of a dynamic that depends on a facilitating environmental dimension and can as such be represented in terms of Lewin's (1936) equation which sees human behavior as a function of the relationship between a person and her/his environment: human potential + wellbeing = *f* (person, environment).

The Capability Approach, Positive Youth Development and Sustainable Engagement

Shinn (2015) has already provided a theoretical linking between the central human functional capabilities of Nussbaum and the features of the social settings fostering positive youth development proposed by Eccles and Gootman (2002). At the same time, Nussbaum's central capabilities can also be related to, and in most cases overlap with, the five "Cs" of the PYD model.

In this respect, the domain of *competence*

partially coincides with the capability based on *senses, to imagine, think, and reason*. Lerner et al. (2005) refer to three kinds of competences: social, cognitive, and vocational, which are based on the skills of perceiving through the senses, to imagine, to think, and to reason. Nussbaum refers to being able to use one's mind "in connection with experiencing and producing works and events of one's own choice, religious, literary, musical, and so forth." (Nussbaum, 2003:41).

Being able to access and express efficaciously one's own inner world through the senses, imagination, thought and reasoning, allows the development of a positive sense of *Identity* and *Self Worth*, which overlaps with the domain of *Confidence.* Lerner (2004) defines this as a sense of overall positive self-efficacy, and the capability that derives from this includes being able to produce self-expressive works, the freedom for general self-expression and religious practice (Nussbaum, 2003), which are all important components for the development of *Self-integrity*. The main instrument through which young people can learn to express themselves is experience. Just as the expert is one who experiences, children who have the chance *to play* and to handle new situations and roles will be more likely to develop a sense of self-awareness concerning their inner worlds and their ways of expressing it, and this will continue through adolescence into young adulthood. This process of expression can be linked to the relationship between life course and narrative (*gnarus* = expert, s/he who experiences) in terms of the interaction between the prospective and retrospective dimensions of development and understanding our lives and creating coherence (Cohler, 1982). If narrating is building knowledge by telling the story of experience, then narrative knowledge is both built on experience and still encoded as experience. It is knowledge as process, understanding a world in which things happen and people act in particular circumstances, knowledge mediated by the verbal language of ongoing contextualised experience (Dodman, 2014).

The domains *Caring* and *Compassion* overlap with the capability *Emotions*. Feelings of empathy and concern are secondary emotions allowing the recognition of one's own and others' inner state, which is essential for the development of human association.

Connection overlaps with the capability *Affiliation.* The establishment of positive bonds with people and institutions implies the social basis of self-respect and non-humiliation and the opportunity to belong to a community. In both the accent is on the mutual benefits that individuals and communities receive by interacting with each other.

The domain *Character* includes the capability of *Practical reason* and can be considered as an extended version of *Political control*. Elements pertaining to the moral sphere such as personal values and social conscience, together with a sense of integrity, are considered the components of an individual's character (Lerner, 2005), allowing on the one hand the integration of the person into community life and, on the other hand, critical reflection on one's own life plan. Such reflection within both personal and civic areas leads to building an adequate knowledge of both personal and community's moral norms and a consequent reciprocal beneficial relationship.

As Shinn (2015) has already emphasized, on the one hand, CA includes two capabilities that are not mentioned in the literature on PYD: *play* and *other species*. On the other hand, the Positive Developmental Settings proposed include the analysis of all those micro-social contexts, such as family, school, and community, where individual development concretely takes place. We can identify references to different contexts such as Nature in CA and the microsystems identified in the literature on Youth Civic Engagement. The interaction between these contexts becomes crucial in the understanding of youth engagement with sustainability for two main reasons. Firstly, following Shinn's proposal, consideration of all those microsystems in which the person is daily embedded is fundamental, since they are the mediating structures that exist between individuals and society (Berger and Neuhaus, 1977) and that allow people's empowerment. Secondly, the literature on

pro-environmental behavior and environmental activism has emphasized how having experience in Nature during childhood is one of the strongest predictors of such behavior in adult life (Gifford and Nilsson, 2014). By integrating the two models, we can develop a new one that includes all the contexts and processes that are factors leading to young people's engagement with sustainability (Figure 1).

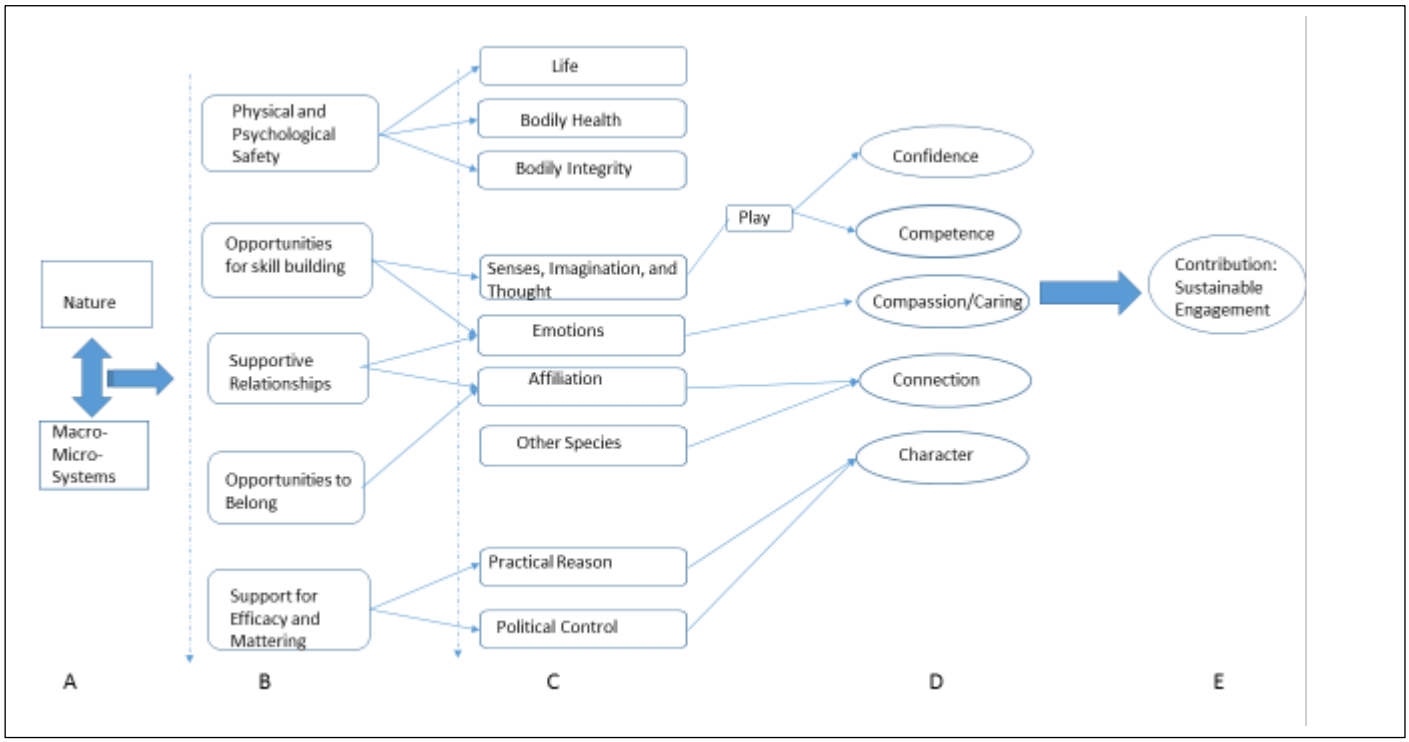

Figure 1. The Capability Approach and Positive Youth Development in the understanding of Sustainable Engagement as a Positive Developmental Outcome

Key. Letters preceding each step correspond with letters beneath the columns.

A. Settings
B. Features of positive developmental settings
C. Central human functional capabilities
D. The 5th Cs of Positive Youth Development
E. The 6th C, Contribution: Sustainable engagement

Conclusions

Despite the fact that many documents consider young people as an important target group within the promotion of sustainability (e.g. Agenda 21), few studies explore which social conditions may foster youth sustainable engagement (Riemer et al., 2013; Rossi & Dodman, 2015). Sustainable engagement can be considered as the integration of civic and environmental behaviours, an active and critical participation within community life and in policy making. Current ecological problems have indeed been clearly recognized as collectivist problems, and strictly related to the social hierarchy developed by political and social systems (Bookchin, 1985). Therefore young people's sustainable engagement must imply all those behaviours that both directly (such as buying local products rather than those produced by multinational corporations) or indirectly (such as writing or signing a petition) contribute to the

development of social justice.

The literature dealing with sustainability based on CA emphasizes how the presence of the environmental dimension in our daily lives is a question of social justice. CA underlines the idea that personal development is a question of freedom to choose and to pursue a life project, given both internal and external constraints. The environmental dimension can thus be considered as a "meta-capability" (Holland, 2007), since its presence allows the fulfilment of all the other freedoms to be exercised. If we apply CA to the understanding of youth engagement, then a number of needs emerge that point to directions for further research. Firstly, the lack of the pro-environmental dimension in the literature on both youth civic engagement and PYD. Secondly, the lack of studies considering Nature as an eco-social setting, even within the city, where young people's development may achieve positive outcomes. Thirdly, the lack of analyses that consider engagement towards sustainability as a positive developmental outcome.

In this respect, integrating CA and PYD could provide new input in the understanding of youth engagement with sustainability. The interaction between Nature and micro-social systems emerges as the context within which all those mechanisms leading to engagement may develop. Such a perspective is coherent with the model of Civic Ecology Education developed by Tidball and Krasny (2010), where "environmental education is seen as a part of ongoing social and ecological processes, including as contributing to virtuous cycles and feedbacks between the social and biophysical aspects of the environment, as fostering ecosystem services and human health, and as one among a number of drivers of social-ecological system processes" (p.12). Sustainability is based on social justice in which the union of the civic and environmental dimensions support a positive development at both individual and societal levels in terms of understanding and building life courses based on awareness of human potential and wellbeing and the coherence between environmental engagement and their realization. In terms of young people's development, this will necessarily involve a capacity for critical and divergent thinking, imagining and contributing to the achievement of alternative pathways and new, more sustainable, trajectories.

Some current empirical evidence concerning youth civic engagement and based on a community psychological perspective has identified which bridging processes and mechanisms across different social domains (school, neighbourhood, community programmes) may promote youth civic participation within the community arena (Rossi et al. 2016). Future research should also consider the natural spaces within the city as an important social setting to explore within the overall perspective of the integration of both environmental and civic engagements as positive developmental outcomes.

References

Albanesi, C., Cicognani, E., & Zani, B. (2007). Sense of Community, Civic Engagement and Social Wellbeing in Italian Adolescents. *Journal of Community & Applied Social Psychology, 17,* 387–406. doi: 10.1002/casp.903.

Ballet, J., Koffi, J.M., Pelenc, J. (2013). Environment, justice and the capability approach. *Ecological Economics, 85*, 28-34. doi:10.1016/j.ecolecon.2012.10.010.

Berger, P. L., & Neuhaus, R. J. (1977). To empower people: The role of mediating structures in public policy. Washington DC: American Enterprise Institute for Public Policy Research.

Bookchin, M., (1985). *The Ecology of Freedom: The Emergence and Dissolution of Hierarchy*. Montreal and New York: Blake Rose Books.

Chawla, L., and Flanders Cushing, D. (2007). "Education for strategic environmental behavior." *Environmental Education Research, 13* (4), 437-452. doi: 10.1080/13504620701581539.

Cohler, B. J. (1982). Personal narrative and life course. In P. Baltes & O. G. Brim (Eds.*), Life span development and behavior* (Vol. 4, pp. 205–241). New York, NY: Academic Press.

Dodman, M. (2014) Language, its technology and sustainability. *Visions for Sustainability* 1, 09-19.

Dodman M. (2016). Knowledge and

competence. Key concepts in an educational paradigm for a sustainable society. *Visions for Sustainability,* 5, 15-27.

Eccles, J. S., & Gootman, J. (Eds.). (2002). *Community programs to promote youth development*. Washington, DC: National Academy Press.

Gardner, G. T. & Stern, P. C. (2002) *Environmental problems and human behavior.* Boston: Pearson Custom Publishing.

Gifford, R., Nilsson, A. (2014). Personal and social factors that influence pro-environmental concern and behavior. A review. *International Journal of Psychology*, 1-17. doi: 10.1002/ijop.12034.

Holland, B. (2007). Justice and the Environment in Nussbaum's "Capabilities Approach". *Political Research Quarterly (XX)*, 1-14. doi: doi:10.1177/1065912907306471.

Lerner, R.M., Lerner, J.V., Almerigi, J.B., Theokas, C., Phelps, E., Gestsdottir, S., Nuadeau, S., Jelicic, H., Alberts, A., Ma,L., Smith, L.M., Bobek, D.L., Richman-Raphel, D., Simpson, I., DiDenti Christiansen, E., von Eye, A. (2005). Positive Youth Development, Participation in Community Youth Development Programs, and Community Contributions of Fifth-Grade Adolescents: Findings From the First Wave Of the 4-H Study of Positive Youth Development. *Journal of Early Adolescence, 25*, 17-71. doi: 10.1177/0272431604272461.

Lewin, K. (1936). *Principles of Topological Psychology*. New York: McGraw-Hill.

Nussbaum, M. (1988). Nature, Function, and Capability: Aristotle on Political Distribution. In *Oxford Studies in Ancient Philosophy*. Oxford, UK: Oxford University Press.

Nussbaum, M. C. (2000). *Women and human development: The capabilities approach.* Cambridge, UK: Cambridge University Press.

Nussbaum, M.C. (2003). Capabilities as Fundamental Entitlements: Sen and Social Justice. *Feminist Economics, 9 (2-3)*, 33-59. Doi:10.1080/1354570022000077926.

Pancer, S. M., L. Rose-Krasnor, and L. Loiselle. (2002). "Youth Conferences as a Context for Engagement." *New Directions for Youth Development, 96,* 47–64.

Riemer, M., Lynes, J., & Hickman, G. (2013). Engaging youth in environmental change. A model for developing and assessing youth-based environmental engagement programmes. *Journal of Environmental Education Research*, 1-23. Doi: 10.1080/13504622.2013.812721.

Rossi, G., Dodman, M. (2015). Understanding Young People's Engagement with Sustainability. An Ecological Approach. *Journal of Academic Perspectives, 4*, 1- 12.

Rossi, G., Lenzi, M., Sharkey, J., Vieno, A., Santinello, M. (2016). Factors associated with civic engagement in adolescence: The effects of neighborhood, school, family and peer contexts. *Journal of Community Psychology, 44(8),* 1040-1058. DOI: 10.1002/jcop.21826.

Sen, A. K. (1985). *Commodities and capabilities*. Oxford: North-Holland.

Sen, A. K. (1992). *Inequality reexamined*. Oxford: Clarendon Press.

Sherrod, L.R., Busch, N., & Fischer, C. (2004). Applying developmental science: Methods, visions, and values. In R. Lerner & L. Steinberg (Eds.), *Handbook of adolescent psychology* (pp. 747-780). Hoboken, NJ: John Wiley & Sons.

Shinn, M. (2015). Community Psychology and the Capabilities Approach. *American Journal of Community Psychology, 55*, 243-252. Doi: 10.1007/s10464-015-9713-3.

Sterling, S. (2001) *Sustainable Education – Re-Visioning Learning and Change*, Schumacher Society Briefing no. 6, Green Books, Dartington.

Tidball, K. G., & Krasny, M.E. (2010). Urban Environmental Education From a Social-Ecological Perspective: Conceptual Framework for Civic Ecology Education. *Cities and the Environment, 3(1)*, 1-20.

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If Dante had known Phytoplankton. A comparison between literature and science through the didactics of metaphors.

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Abstract.

This project, conducted with Classical High School students, was developed under the "Alternating School and Work Experience" program (Italian Law n. 107/2015) between the "G. Palmieri" High School of Lecce and the Environmental Protection Agency of Puglia (ARPA), Department of Lecce, in Italy. In particular, this paper describes the "HABs' world" allegorically, in terms of one of the most famous examples of Italian literature, the Divine Comedy. Harmful algal blooms, or HABs, occur when colonies of algae, simple photosynthetic organisms that live in the sea and freshwater, grow out of control while producing toxic or harmful effects on people, fish, shellfish, marine mammals, and birds. Since HABs can be defined as "bad", based on their negative characteristics, some of these were compared to the sinful souls that Dante and Virgil encountered along their journey into Hell. It is argued that such integration of literary and scientific contexts in terms of ecological indicators helps students understand the relationship between the sustainability of human and environmental trajectories.
Key words: Phytoplankton, Harmful Algae Blooms (HABs), The Divine Comedy, Dante Alighieri, ecological indicators

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***Perspective**: Educational visions*

***Fields**: Earth life support systems*

***Issue**s: Ecological indicators*

Introduction

Phytoplankton, also known as microalgae, are the basis of several aquatic food webs. They are autotrophic organisms able to fix carbon dioxide and water for synthesizing organic matter and oxygen. Sometimes, however, their roles are more sinister. Occasionally, under the right conditions, the algae grow very fast or "bloom" and accumulate into dense, visible patches near the surface of the water. "Red Tide" is a common name for this phenomenon where certain phytoplankton species contain pigments so that the human eye perceives the water to be discolored. Blooms can appear greenish, brown, and even reddish orange, depending upon the type of organism, the type of water and the concentration of the organisms. A small number of species produce potent toxins that can be transferred through the food web where they affect and even kill the higher forms of life such as zooplankton, shellfish, fish, birds, marine mammals, and even humans that feed either directly or indirectly on them.

Other algae are nontoxic, but they use all the oxygen in the water as they decay, clog the gills of fish and invertebrates, or smother corals and submerged aquatic vegetation. Other microalgae discolor water, form huge, smelly piles on beaches or contaminate drinking water. Collectively, these events are called harmful algal blooms, or HABs. However, awareness of their existence in nature and of their dangerous consequences is not widespread outside the scientific world.

The following project, conducted with Classical High School students, was developed under the "Alternating School and Work Experience" program (Italian Law n. 107/2015) between the "G. Palmieri" High School of Lecce and the Environmental Protection Agency of Puglia (ARPA), Department of Lecce, in Italy. It was developed as a learning project starting from the knowledge and skills already possessed by students, since they are included in their overall study plan, and using them to facilitate the understanding of the new scientific topics encountered. More specifically, the point of departure was a well-known work of Italian literature, the *Divine Comedy* of Dante Alighieri, that was metaphorically linked to the scientific topic proposed to the students: HABs and their effects on human health.

Metaphors are persuasive in our languages and conceptual systems. Metaphors may structure the way we perceive situations, events and topics. Therefore, metaphors may influence our way of understanding them. Furthermore, if we are able to restructure the frame through which we perceive a problem by generating alternative metaphors, we may be able to discovery new perspectives and new solution to the problem (Marshall, 2009).

This paper shows how the project describes the “HABs’ world” allegorically. Since HABs can be defined as “bad”, based on their negative characteristics, some of these have been assimilated to the sinful souls that Dante and Virgil encountered along their journey into Hell.

The project

The project is based on three study sheets that involve analysis and interpretation of characters or salient moments and events of the three *Cantiche* of the *Divine Comedy*. The purpose is to create links with the microscopic aquatic organisms found in the phytoplankton communities. Such organisms are known to the scientific community in particular for their important role as producers of energy and oxygen as well as for their unbelievable variety of forms, colors and functions.

Study sheet 1: *If Dante had known Phytoplankton, part I: Harmful Algal Blooms (HABs).*

The study sheet was developed based on reading and action research activities together with analysis and interpretation of events or characters of the first *Cantica* of *Divine Comedy* in order to identify particular allegorical links with the world of the HABs.

The students

The study sheet was worked on by a group of six 16-17 year-old students during the 2016-17 school year.

The topics

The study sheet was characterized by a high level of multidisciplinary interdisciplinary content that encompasses the following

topics: Italian Literature, Biology, Geography, English, and History**.**

Time and resources

The study sheet was developed over a period of 75 hours, corresponding to the duration of the activities envisaged by the alternating school and work experience program. The activities were carried out in the water biology laboratories of the ARPA Puglia Department of Lecce. Two tutors of the Agency supported the students' activities in all the phases of the project.

Learning outcomes

The envisaged learning outcomes concerned the design, by the students, of a narrative process that reconstructed the nodal points of *Divine Comedy*, during the first stage of Dante's journey in the afterlife. Starting from analysis of the text in its rhetorical complexity (from the cosmological references, to the imagination of Dante expressed in 'figures'), the students constructed a map of events and characters so as to link them to comparable events and characteristics of HABs within the marine environment. Specific products of this intended meaningful learning process were the creation of a hypertext in Italian and the preparation of a manuscript for a scientific journal in English.

Prerequisites

In order to work through the study sheet, the students needed to possess knowledge about:

1. The historical period in which Dante lived, his biography and the framework of his works.
2. A critical-hermeneutic perspective on the *Divine Comedy* in terms of its geographical, thematic (the journey as a redemptive mission, the imaginary: supporting themes, the symbol characters and their meaning) and symbolic (the concept of 'allegory' of *profetia ex eventu*, of 'aerial body' structures.
3. The structure of plant cells.
4. The organization of living organisms.
5. Various forms of representative expression, from dramatization to depiction and drawing by using Power Point presentation and other programs

Teaching methodology and resources

A range of different teaching methods were used: lecture sessions, working in tandem, cooperative learning, problem-solving and action research. The resources provided for the students were the text of the *Divine Comedy* with comments (Jacomuzzi et al., 2014), together with texts from various sources, textbooks and scientific articles on HABs included online resources. In addition, the students were free to make their own decisions both concerning the choice of reference sources and the modes of expression. Tutoring was provided for all the activities by two specialist technicians of the agency.

The activities

The preparation of the study sheet involved the following activities:

1. The tutor summarized the approach based on learning through developing competences, focusing above all on the 'experiential' aspect of the teaching/learning process and clarifying the concept of 'competence' as 'knowing how to act', that is, of knowledge built and used in order to resolve a problem). The tutor emphasized the central role of the student who becomes the 'learning subject' in terms of autonomy and responsibility.
2. The tutor illustrated the *work experience program*, and the importance of starting from the given knowledge already possessed by the students, that is subsequently enriched by building new and more specific knowledge. This included reference to the *mission* of Arpa Puglia in the field of protection and conservation of aquatic ecosystems. Tutors on specific toxic microalgae topics carried out a series of lectures and laboratory experiences, concerning the taxonomic position, the morphological characteristics, the geographical distribution, types of toxins and their possible effects on human health. Finally, the role of Arpa Puglia in monitoring and controlling the diffusion of HABs in

marine and freshwater ecosystems was also illustrated. Each input session was followed by laboratory experience during which students were able to observe some HABs, using the most appropriate observation techniques.

3. Through a cooperative learning approach, the tutors and students decided together the particular perspective to be assigned to each phase of the study, with contributions from the tutors concentrating on details concerning especially microalgae. By activating their given knowledge, the students identified various characters and events in the *Divine Comedy*, considered significant for the purposes of the project. The tutors advised them on how the choice among the events and the key characters selected could be connected to characteristics of HABs.
4. The students engaged in an interesting and intensely-participated discussion about the proposed combinations, demonstrating a notable ability to work together in tandem and adopt a problem-solving approach. As a result, they were able to locate, within Hell, the selected HABs and characters of the *Divine Comedy* and to describe through a short text the reasons for their choices.
5. Images of microalgae and pictures on Inferno were then selected from various on-line bibliographic sources.

The learning experience

The idea of the ARPA Puglia tutors to work on linking Dante's Inferno and HABs arises from the need to find an effective way to integrate learning projects and the student's school study plans in terms of knowledge and skills development. In this respect, working through the study sheet clearly enabled the students to:

- improve research skills aimed at investigating a topic through different sources;
- organize and sort the information acquired in a conceptual map of the world of HABs;
- formulate sustained analysis of episodes, characters and songs based on a motivated critical interpretation;
- produce written texts of different types and complexity.

At the end of the experience, the students considered both motivating and emotionally engaging the way in which reactivating their knowledge of Dante and the *Divine Comedy* in order to facilitate the understanding of a topic completely new to them, that of HABs and their effects on man and aquatic environment. In particular, they found it highly stimulating to be able to develop autonomously their own learning space, open to new input from various external sources, and produce a text they constructed as the basis of their own learning process.

Learning products

The students developed six themes on particular species of HABs (Hallegraeff *et al*, 2003) and associated them with the characters of *The Divine Comedy*. The products are described below. They were included in a hypertext of Dante's Inferno.

1. Dante in the gloomy wood (Canto I) & *Pseudo - Nitzschia spp.*

We started with the writer, Dante Aligheri, who began his allegorical trip in a wild dark forest, in a complete delirium, as described in the following lines:

Nel mezzo del cammin di nostra vita	When half way through the journey of our life
mi ritrovai per una selva oscura	I found that I was in a gloomy wood,
ché la diritta via era smarrita. (1-3)	because the path which led aright was lost. (1-3)
io non so ben ridir com'i' v'intrai,	I cannot well say how I entered it,
tant'era pien di sonno a quel punto	so full of slumber was I at the moment
che la verace via abbandonai. (10-12)	when I forsook the pathway of the truth; (10-12)

The image presented of the Author is of a person lost in the gloomy wood. This can be associated with the species *Pseudo - Nitzschia spp.* (Figure 1).

Figure 1- *Pseudo - Nitzschia spp*. and Dante in the gloomy wood

Pseudo-nitzschia species are bilaterally symmetrical diatoms. Their cell walls are made up of elongated silica frustules. Silica frustules contain a central raphe, which secretes mucilage that allows the cells to move by gliding. Cells are often found in overlapped, stepped colonies, and exhibit collective motility. *Pseudo-nitzschia* species can be found in coastal regions worldwide.

Some *Pseudo-nitzschia* species are capable of producing the neurotoxin domoic acid (DA), which is responsible for the neurological disorder known as Amnesic Shellfish Poisoning (ASP). Harmful algal blooms (HABs) of *Pseudo-nitzschia* can cause diseases and death in many marine creatures, as well as the humans, who consume them. Shellfish become contaminated after feeding on toxic *Pseudo-nitzschia* blooms and can act as a vector to transfer domoic acid to humans upon ingestion. Effects can be as minor as vomiting, cramps, and a headache, or as severe as permanent short-term memory loss, coma, and death.

These symptoms are similar to the state of being lost affecting the author of the *Cantica* from the beginning of his allegorical journey.

2. Paolo and Francesca (II circle - V poem - "Luxurious") and *Noctiluca scintillans*

Going on his trip, Dante found himself in a dark place, where a terrible storm raged constantly and dragged the damned, beating them from one side to the other of the circle. Dante understood they were the "luxurious", who flew forming a wide flock similar to the stornellis when they fly in the sky. Among them there were two souls moved by the wind as in life they were moved by passions: Paolo and Francesca. They are described in the following lines:

La bufera infernal, che mai non resta, mena li spirti con la sua rapina; voltando e percotendo li molesta. (31-33)	The infernal hurricane, which never stops, carries the spirits onward with its sweep, and, as it whirls and smites them, gives them pain.(31-33)
Intesi ch'a così fatto tormento enno dannati i peccator carnali, che la ragion sommettono al talento. (37-39)	I understood that to this kind of pain are doomed those carnal sinners, who subject their reason to their sensual appetite.(37-39)
Amor, ch'al cor gentil ratto s'apprende prese costui de la bella persona che mi fu tolta; e 'l modo ancor m'offende. (100-102)	Love, which soon seizes on a well-born heart, seized him for that fair body's sake, whereof I was deprived; and still the way offends me.(100-102)
Amor, ch'a nullo amato amar perdona, mi prese del costui piacer sì forte, che, come vedi, ancor non m'abbandona. (103-105)	Love, which absolves from loving none that 's loved, seized me so strongly for his love of me, that, as thou see'st, it doth not leave me yet. (103-105)

In this case, the species *Noctiluca scintillans*, with its enchanting luminescence in the night and the red or pink trails colored in daylight, well represents the souls in love of the two characters described by Dante (Figure 2).

Figure 2 - *Noctiluca scintillans* and the souls in love

Noctiluca scintillans is a marine dinoflagellate. It is a large (about 1–2 mm in diameter), spherical, gelatinous single-celled organism enveloped in a thin pellicle. It is one of the most commonly occurring bioluminescent organisms in coastal regions of the world. *N. scintillans* does not appear to be toxic, but it accumulates and excretes high levels

of ammonia into the surrounding area. The scintillating effect of *Noctiluca*'s bioluminescence, which is most conspicuous at night during a bloom (population increase), was historically a mysterious phenomenon, frequently contributing to what was called "burning of the sea" or "sea sparkle" by sailors and coastal inhabitants. In daylight, instead, such blooms form a thick scum across the sea surface, visibly red or pink.

Noctiluca scintillans can therefore be linked to the indissoluble passion that Paolo and Francesca left behind them.

3. Cerbero (III circle - VI poem – "Greedy") & *Dinophysis/Prorocentrum lima*

Later, in the third circle, in which Dante included "the greedy", an eternal cold that fell constantly, mixed as dirty water and snow. It forms on the ground a disgusting mud, from which an unbearable stench arises. This image is described in the following lines:

Io sono al terzo cerchio, de la piova etterna, maladetta, fredda e greve; regola e qualità mai non l'è nova. (7-9)	In the third circle am I, that of rain eternal, cursed, cold and burdensome; its measure and quality are never new. (7-9)
Cerbero, fiera crudele e diversa, con tre gole caninamente latra sovra la gente che quivi è sommersa. (13-15)	A wild beast, Cerberus, uncouth and cruel, is barking with three throats, as would a dog, over the people that are there submerged. (13-15)

The greedy are laid in the mud and Cerbero, a cruel and three-headed beast, barked above them with its three jaws. It had red eyes, dirty and black beard, a swollen abdomen and legs with claws. It scratched the souls to tatters and its barking echoed in their ears so that they wanted to be deaf. The damned shouted like dogs at the rain, often turning from side to side, in the vain attempt to protect themselves.

It is possible to compare Cerbero to the following three species. *Dinophysis acuta* and *Dinophysis acuminata* are armored, marine, planktonic dinoflagellates. These species are compressed laterally. Their cell size ranges between 40-94 µm in length. They are oceanic and neritic planktonic species of cold or temperate waters. *Prorocentrum lima* is an armored, marine, benthic dinoflagellate with world-wide distribution. *P. lima* is a bi-valvate species often observed in valve view. Its cell size ranges between 32-50 µm in length and 20-28 µm in width (Figure 3).

They are toxic species associated with **"Diarrhetic Shellfish Poisoning" (DSP)** events. As the name suggests, this syndrome manifests itself as intense diarrhea and severe abdominal pains. Nausea and vomiting may sometimes occur too.

DSP and its symptoms usually set in within about half an hour of ingesting infected shellfish, and last for about one day.

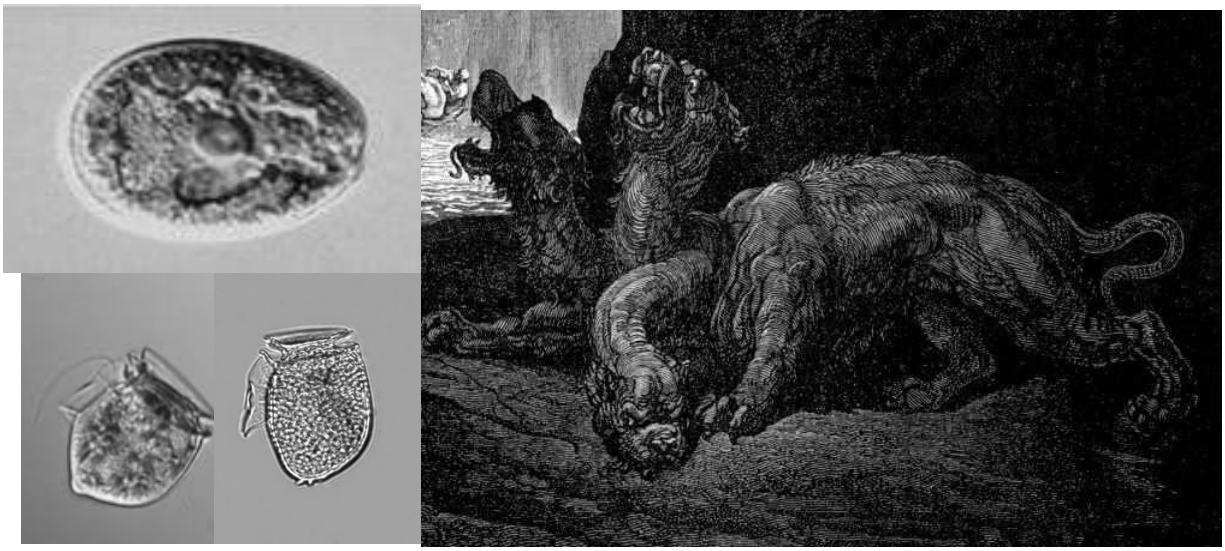

Figure 3 - *Dinophysis acuta, Dinophysis acuminata*, *Prorocentrum lima* and Cerbero

The association with Cerbero refers to the state of malaise generated by the alga, comparable to what the damned suffer because of the fire.

4. Medusa (VI circle – IX poem – "Eretics and Epicures") & *Alexandrium spp/Gymnodinium catenatum*

In the VI circle, where "Heretics and Epicures" were found, there was the figure of Medusa, one of the three Gorgons of Greek Mythology, the most dangerous because she is able to petrify whoever looks at her.

Dante put her among the demons which guarded the city of Dis. She didn't appear directly, but was evoked by the three Furies in order to petrify Dante. Virgilio, his companion, who obliged Dante to turn and to cover the eyes with his hands, took the threat very seriously.

Volgiti 'n dietro e tien lo viso chiuso; ché, se 'l Gorgón si mostra e tu 'l vedessi, nulla sarebbe di tornar mai suso». (55-57)	Turn back, and close thine eyes, for should the Gorgon reveal itself, and thou behold the face, there 'd be no more returning up above. (55-57)
Così disse 'l maestro; ed elli stessi mi volse, e non si tenne a le mie mani, che con le sue ancor non mi chiudessi. (58-60)	The Teacher thus: and turning me himself, on my hands he did not so far rely, as not to close mine eyes with his as well. (58-60)

The ability of Medusa to petrify people can be represented by the species *Alexandrium spp*.e *Gymnodinium catenatum*. *Alexandrium spp* are armored, marine planktonic dinoflagellates. They have a rounded shape with a central sulcus. Their cells size ranges between 20-60 and 15-40 µm in width. *Alexandrium spp* are widely distributed in cold temperate coastal waters. The *Gymnodinium* is an unarmored, marine planktonic dinoflagellate species. This species is typically seen in chain formation with up to 64 cells. Their cells are small with a morphology varying between single cell and chain formation. Single cells are generally elongate-ovoid with slight dorso-ventral compression. Their cell size ranges between 34-65 and 27-43 µm in width. *G. catenatum* populations are found in warm, temperate coastal waters.

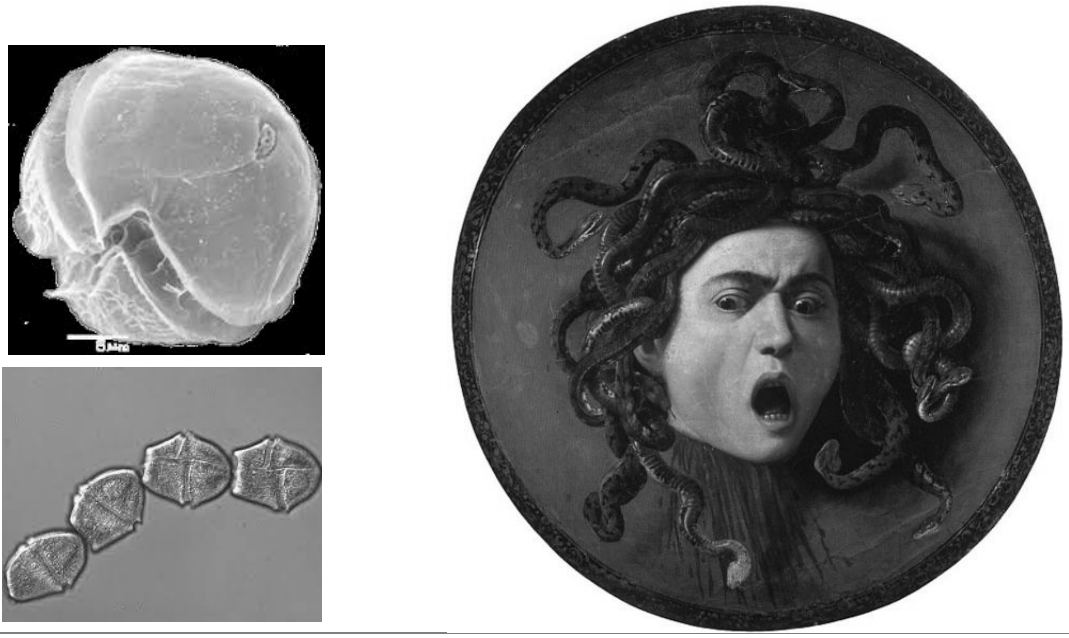

Figure 4 - *Alexandrium spp*, *Gymnodinium catenatum* and Medusa

These microalgae are planktonic red tide, toxin-producing species linked to Paralytic Shellfish Poisoning (PSP), events which occur throughout the world. PSP affects people who come into contact with the toxins by ingestion of affected shellfish. Symptoms can appear from 10 to 30 minutes after ingestion, and include nausea, vomiting, diarrhea, abdominal pain, tingling or burning lips, gums, tongue, face, neck, arms, legs, and toes. Shortness of breath, dry mouth, a choking feeling, confused or slurred speech, and loss of coordination are also possible. Because of these symptoms, the microalgae were associated with Medusa (Figure 4).

5. Odysseus (VIII circle–XXVI poem – "Fraudulent advisers") & *Karenia*

The "fraudulent advisers" in life acted with deception and fraud. Among these damned, in a little flame with two points, stood Odysseus, the Greek hero famous for his cunning and tricks.

Odysseus served his sentence sharing his little flame with Diomede, another Greek hero and his closest friend.

E 'l duca che mi vide tanto atteso, *disse: «Dentro dai fuochi son li spirti;* *catun si fascia di quel ch'elli è inceso». (46-48)*	And the Leader, who beheld me so attent, exclaimed: "Within the fires the spirits are; Each swathes himself with that wherewith he burns *(46-48)*
Rispuose a me: «Là dentro si martira *Ulisse e Diomede, e così insieme* *a la vendetta vanno come a l'ira; (55-57)*	He answered me: "Within there are tormented Ulysses and Diomed, and thus together They unto vengeance run as unto wrath. *(55-57)*

Odysseus was the inventor of the idea to construct a huge wooden horse as a treacherous gift to leave to the Trojans. The strongest Greek soldiers, hidden in the horse, opened the city door of Troy and conquered it. Odysseus is associated with the highest

points because of his overreaching, deceitful nature, described in the following lines:

Considerate la vostra semenza: *fatti non foste a viver come bruti,* *ma per seguir virtute e conoscenza* (118-120)	Consider ye the seed from which ye sprang; Ye were not made to live like unto brutes, But for pursuit of virtue and of knowledge (118-120)

It is possible to compare Odysseus and Diomede to the following two species: *Karenia brevis* and *Karenia papilionacea* (Figure 5).

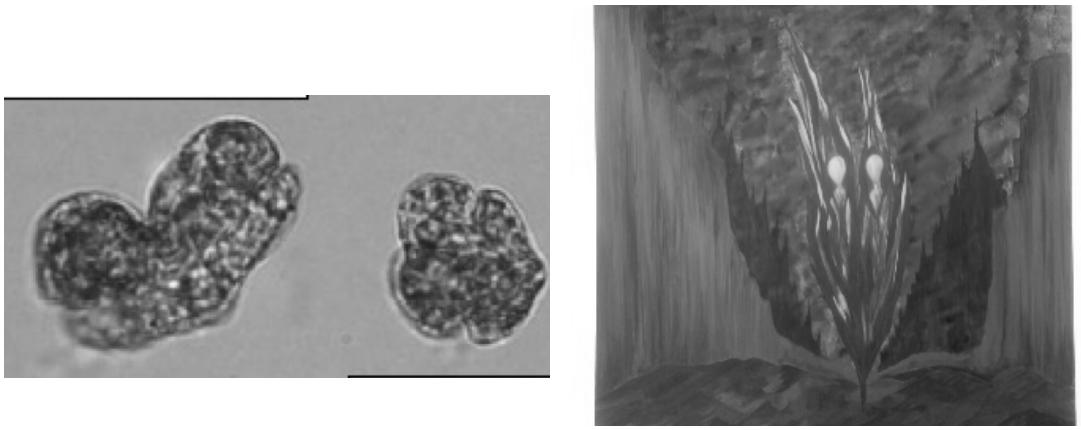

Figure 5 - *Karenia papilionacea and Karenia brevis* vs Odysseus and Diomede

Karenia brevis and *Karenia papilionacea* are unarmored, marine, planktonic dinoflagellate species. Their cells are small and dorso-ventrally flattened. *Karenia brevis* is smaller than *Karenia papilionacea*. In the first, their cells range in size from 20-40 µm in width and 10-15 µm in length. They are planktonic oceanic species, though populations have been documented in estuarine systems under bloom conditions. Either species produce brevetoxins responsible of Neurotoxic Shellfish Poisoning (NSP). NSP is a disease caused by the consumption of molluscan shellfish contaminated with toxin.

NSP causes a range of signs and symptoms, both neurological and gastrointestinal. Most individuals report multiple symptoms. Victims of NSP most frequently describe numbness and tingling in the lips, mouth and face, as well as numbness and tingling in the extremities. These paresthesias may be from minor to severe, and have been described as feeling like one's "nerves are on fire or ants are crawling and biting all over" one's body. The reversal of hot and cold sensations has been reported as well, a symptom shared with ciguatera poisoning. Slurred speech, headache, pupil dilation, and overall fatigue are also commonly reported. Victims have been described as appearing disoriented.

The association with Ulysses and Diomedes is related to the fact that they carried out their actions through deception and therefore were deceivers of reality.

6. Lucifer (IX circle–XXXIV poem – "The benefactors' traitors") & *Gambierdiscus toxicus*

This last example links the HABs to the IX circle of the Hell, where the benefactors' traitors stood, such as Lucifer, the most wicked character of all the poem. He deceived people to whom he gave the happiness of mankind and lived in absolute silence.

He was an horrid creature, endowed with three faces on one head and three pairs of bat wings. He was submerged in ice from the waist down and he broke the sinner with one

of his three jaws.
Dante and Virgilio saw Lucifer as the beginning of every evil and the most dangerous creature in Hell.

The damned souls were covered by ice and shone through the ice like straws under glass. The petrified and mute damned are described in the following lines:

Lo 'mperador del doloroso regno da mezzo 'l petto uscìa fuor de la ghiaccia; e più con un gigante io mi convegno, (28-30)	The Emperor of the Realm of Woe stood forth, out of the ice from midway up his breast; and I compare more closely with a Giant, (28-30)
Oh quanto parve a me gran maraviglia quand'io vidi tre facce a la sua testa! L'una dinanzi, e quella era vermiglia; (37-39)	Oh, what a marvel it appeared to me, when I beheld three faces to his head! One was in front of us, and that was red; (37-39)

This terrible image can be well represented by the species *Gambierdiscus toxicus*.
As Lucifer represents the principle of every evil, *Gambierdiscus toxicus* is the most toxic microalgae know in the world (Figure 6).

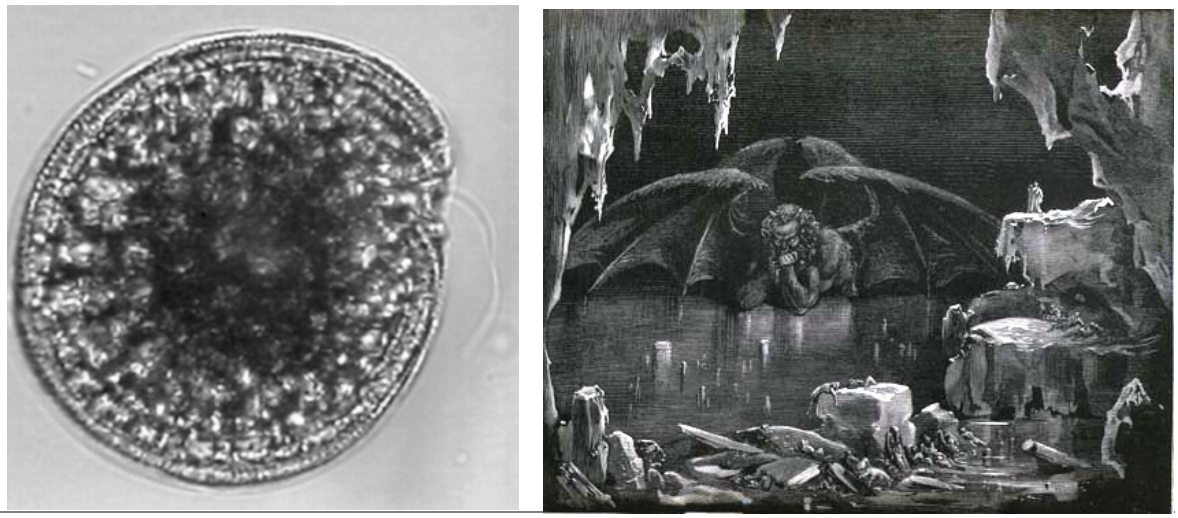

Fig. 6 - *Gambierdiscus toxicus* and Lucifero

Gambierdiscus toxicus is an armored, marine, benthic dinoflagellate species. Its cells are large, round to ellipsoid. The cell surface is smooth with numerous deep and dense pores. The cells range in size from 24-60 µm in length, 42-140 µm in diameter, and 45-150 µm in dorso-ventral depth. This species was identified from tropical reefs in the Pacific Ocean, the Indian Ocean, and the U.S. Virgin Islands. Populations have been found in tidal pools and lagoons, as well as in colored sand, in the Caribbean. *Gambierdiscus toxicus* produce *ciguatoxins*, a type of toxin that causes the foodborne illness known as ciguatera. Ciguatera is the most common form of seafood poisoning caused by harmful algal blooms in the world and its incidences and range appear to be spreading. Best estimates indicate that more than 50,000 people are globally affected every year. Hallmark symptoms of ciguatera in humans include gastrointestinal, cardiovascular, and neurological effects. Gastrointestinal symptom are usually followed by neurological symptoms such as headaches, muscle aches, paresthesia, numbness of extremities, mouth and lips, reversal of hot and cold sensations, ataxia, vertigo and hallucinations.

Severe cases of ciguatera can also result in cold allodynia, which is a burning sensation on contact with cold. Neurological symptoms can persist and ciguatera poisoning is occasionally misdiagnosed as multiple sclerosis. Cardiovascular symptoms include bradycardia, tachycardia, hypotension, hypertension, orthostatic tachycardia, exercise intolerance, and rhythm disorders. Death can occur, but is extremely rare. The symptoms can last from weeks to years, and in extreme cases as long as 20 years, often leading to long-term disability.

Conclusions

Although harmful algal blooms can be natural phenomena, the nature of the global problem has expanded in both extent and its public perception over the last decades. The presence of HABs in aquatic ecosystems are ecological indicators of an environmental degradation and consequent problems for sustainability. HABs have one unique feature in common—they cause harm, either due to toxins production or to the manner in which the cells' physical structure or accumulated biomass affect co-occurring organisms and alter food web dynamics (Anderson et al., 2002).

Many factors may contribute to HABs. Studies indicate that many algal species flourish when wind and water currents are favorable. In other cases, HABs may be linked to eutrophication phenomena. This occurs when nutrients (mainly phosphorus and nitrogen) deriving from anthropogenic sources, such as lawns and farmlands, flow downriver to the sea and build up at a rate that 'overfeeds' the algae that exist normally in the environment. People often get sick by eating shellfish containing toxins produced by these algae. Airborne HAB toxins may also cause breathing problems and, in some cases, trigger asthma attacks in susceptible individuals. HABs can also be costly in economic terms as well. At present, HABs cause about $82 million in global economic losses to the seafood, restaurant, and tourism industries each year. HABs reduce tourism, close beaches and shellfish beds, and decrease the catch from both recreational and commercial fisheries. While much is being done on the technical side to reduce nutrient pollution, as yet there is a recognition that the general public may not fully understand the basic association between nutrient pollution and algal bloom and how this impacts on sustainability. In this project our intention was to share technical information about research and monitoring efforts underway, and to explore approaches for enhancing communication and education efforts directed towards the general public and, in particular, groups of students (Bravo, 2015).

HABs have been studied for many years, but they are little known at the level of learning curricula. To promote understanding and awareness, our idea was to explain the phenomenon through building an imaginary pathway based on parallels between scientific investigation and texts and a literary work such as *The Divine Comedy*, through a detailed comparison between scientific and literary contents language. It can be argued that Dante constantly pointed out the unsustainability of human behaviors both in terms of their physical and ethical consequences. Such correspondences can help grasp the dimension and the extension of the issues and the problems faced.

The experience was positive for all those involved. For the tutors, it was very satisfying to be able to deal with complex topics while teaching students who had

not previously built knowledge and skills in this specific technical-scientific field, by using a multi- and inter-disciplinary learner-centered approach. From their point of view, the students expressed their sense of the ease with which they managed to understand such scientific topics thanks to the correlation with the literature already known to them. Not only did this facilitate learning of new content, but also enable a vision that goes beyond the perspective of science and humanities as separate disciplines.

Overall we believe that such integration of literary and scientific contexts in terms of ecological indictors and their various related impacts helps students understand the relationship between the sustainability of human and environmental trajectories.

References

Alighieri, D. *La Divina Commedia - Nuova versione Integrale*. A cura di Jacomuzzi, S., Dughera, A., Ioli, G., Jacomuzzi, V. (2014). SEI Eds.

Alighieri, D. *The Divine Comedy*. The Italian Text with a Translation in English Blank Verse and a Commentary by Courtney Langdon, 3 volumes (Cambridge: Harvard University Press, (1918, 1920, 1921). http://oll.libertyfund.org/titles/167.

Anderson, D. M., Glibert, P. M., and Burkholder, J.M. (2002) Harmful Algal Blooms and Eutrophication: Nutrient Sources, Composition, and Consequences. *Estuaries* 25: 4b, 704–726.

Bravo, A. (2015) Building Public Awareness About HABs and Nutrient Pollution NALMS • LAKELINE 15.

Hallegraeff, G. M., Anderson, D. M., & Cembella, A. (2003) *Manual on Harmful Marine Microalgae, Monographs on Oceanographic Methodology.* UNESCO, Paris.

Marshall, H. H. (1990) Metaphor as an instructional tool in encouraging student teacher reflection. *Theory Into Practice*, 29:2, 128-132.

MIUR (2015) Legge 13 luglio 2015, n. 107. Riforma del sistema nazionale di istruzione e formazione e delega per il riordino delle disposizioni legislative vigenti. (15G00122) (GU Serie Generale n.162 del 15-07-2015).

The pictures of Posters 1, 2, 3, 5 and 6 are taken from Paul Gustave Doré, Dante, *Divina Commedia* - Inferno (1861)

The picture of Poster 4 (Medusa) is taken from Caravaggio, Uffizi Gallery (1597)

The pictures of microalgae are taken from https://oceanservice.noaa.gov, www.inlandbays.org, www.researchgate.net.