Geoethical Aspects in the Natural Hazards Management

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Giuseppe Di Capua and Silvia Peppoloni

Abstract

The defence against natural hazards involves many actors with different roles: geoscientists, decision makers, local authorities, mass media, citizens. A proper management of georisks requires that each role is well-defined and governed by shared operational protocols, especially during the emergency phase, so that overlapping and misunderstanding don't jeopardize population safety and economic activities. To achieve good results in this direction, it is necessary to undertake a careful evaluation of the limits and expectations of each component of society and the respect of legitimate aspirations and prerogatives. An effective defence system against natural hazards should be planned rationally and based on scientific data, in order to avoid alarmism among citizens, misleading sensationalism by media, careless decisions by politicians, as well as approximation in managing different phases of the risk cycle. Taking into consideration geoethical aspects related to natural hazards can be helpful to make geoscientists aware of their responsibilities towards society and to clarify the role they can play in the interaction with other actors, aiming at more efficacious actions for georisk mitigation.

Keywords

Geoethics • Natural hazards • Risks • Society • Responsibility

11.1 Introduction

With the increasing impact of human activities on the environment, it has become urgent to follow a respectful and pragmatic behaviour towards the geosphere. Humans are both an active part within Nature, as a factor which conditions Nature itself, and a passive element towards Nature, since they are exposed and forced to coexist with natural phenomena. This involves a risk for their life, productive activities and artistic and historical heritage.

Geological activity has evident repercussions on society (Wysession and Rowan 2013). So the adoption of ethical principles and standards is essential. Geoscientists are expected to put society's needs first in their activity, since they possess appropriate knowledge and skills and this implies moral obligations, especially considering practical consequences, that are issues dealt with by geoethics. In particular, geoethics consists of research and reflection on those values upon which to base appropriate behaviour and practices where human activities intersect the geosphere.

G. Di Capua (✉) · S. Peppoloni
Istituto Nazionale di Geofisica e Vulcanologia (INGV),
via di Vigna Murata 605, 00143 Rome, Italy
e-mail: giuseppe.dicapua@ingv.it

S. Peppoloni
e-mail: silvia.peppoloni@ingv.it

G. Di Capua · S. Peppoloni
International Association for Promoting Geoethics (IAPG),
via di Vigna Murata 605, 00143 Rome, Italy

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Geoethics deals with the ethical, social and cultural implications of using Earth sciences for societal benefits. But above all, geoethics represents an opportunity for geoscientists to consider their activities in an ethical sense and also as a tool for increasing the awareness of society regarding problems related to geo-resources, geo-environment and geo-hazards.

Among its issues, geoethics deals with problems related to the management and mitigation of georisks and to the information provided to the public; fosters the proper and correct dissemination of the results of scientific studies; aims to improve the relationships between the scientific community, mass media, policy-makers and citizens.

In this perspective, the socio-cultural role played by geoscientists is fundamental. Through their activities, they can persuade people that the geo-environment constitutes a common heritage, which should be considered for its scientific, cultural and educational value, as well as a social capital. Moreover, they can teach to society that a defence against many natural phenomena, based on a rational approach, is possible (Peppoloni and Di Capua 2012).

11.2 The Role of Geoscientists

Since the beginning, geosciences have shown that natural phenomena are not metaphysical events, but rather normal events that demonstrate the vitality of planet Earth. They can be analyzed from a scientific point of view and their effects can be partly foreseen (Zoback et al. 2013).

We all know that the risk is defined as the symbolic product of hazard, vulnerability and exposure. It is quantified such as the loss produced on an element or group of elements at risk as a consequence of the occurrence of a given phenomenon of a given intensity. The hazard is the probability that a phenomenon of a given intensity occurs in a certain area in a given time interval. The vulnerability is the capability of an element to resist to a given phenomenon. And finally the exposure is the value of the elements at risk (in terms of human lives, or economic value or historical-artistic value) in a certain area.

These concepts have been introduced to analyze the impact of natural phenomena on humans and their effects are quantified using mathematical tools, for example, the probability calculus and evaluation of errors and uncertainties (Marzocchi et al. 2010; Albarello 2013).

Disasters always scared populations, the fear cannot be eliminated, but the proper dissemination of scientific knowledge and an adequate preparedness can help to transform the fear into respect for the natural processes that govern the geosphere. The scientific approach, based on quantitative assessments of risks and probabilities of occurrence (Marzocchi et al. 2010; Jordan 2013), helps to find strategies for mitigating their effects (Albarello 2013). It is also an effective way to limit the scope of irrationality and uncertainty.

The damage due to geo-hazards is not entirely avoidable, but can be reduced through correct land use and respect for natural processes, through prevention and mitigation efforts, and through effective information to the population.

And geoscientists possess the appropriate knowledge for bringing science closer to society (Allington and Fernandez-Fuentes 2013). They have an ethical responsibility towards both citizens and the scientific community to which they belong (Peppoloni and Di Capua 2012). It includes:

- making data and results of their studies public, easily accessible and user friendly;
- transferring advanced knowledge to industry and authorities;
- participating in educational campaigns for the population, paying attention to simplify concepts, without making them banal;
- assuring their ongoing professional training;
- collaborating in the training of the skills of technicians and professionals;
- conducting their studies, verifying the sources of information, the adherence of results to observations and the related uncertainties and errors;
- accepting a fair debate with hypotheses and theories that disagree, without being overconfident in their own results.

Without an ethical approach, geosciences run the risk of becoming a body of conventional knowledge, not oriented towards the common good and the human progress (Peppoloni and Di Capua 2012).

11.3 Georisks: Actors Involved

Who are the main actors involved in a society exposed to geo-risks and what are the weaknesses of their roles?

The actors are the same all over the world, but problems in their relationship could be different considering countries, or due to cultural and economic differences.

Decision-makers are responsible for the prevention and mitigation of natural hazards, but often have completely different skills than those required by their role. So, they often ignore the limits of a scientific study regarding the prediction of the hazard and the level of seriousness with which a warning could be issued to the public. In many cases, this results in a discharge of responsibility on the scientific community, which is asked to provide “truth” scenarios,

while only probabilistic ones are possible, each of them with its own probability of occurrence (Albarello 2013).

Media has a crucial role in our culture, but the language of media is quite different from the language of scientists. In particular, on the one hand journalists generally have a poor qualification in Earth sciences. In addition, the media often use sentences given by scientists out of the context in which they were originally stated, and thus can transform the meaning of their words in a sensationalist manner.

Citizens have the legitimate right to demand actions in defence of their safety and to be appropriately informed about risks. In fact, in general they are poorly prepared in science (especially regarding aspects and concepts of "probability"; Albarello 2013) and thus have a low resilience towards a natural disaster.

Often geoscientists do not pay sufficient attention to the communication of risks and they don't succeed in making the population able to understand the scientific and technical language. Moreover, in some cases they haven't an open-minded attitude towards the discussion and comparison with new hypotheses of study. In order to gain social credibility, they should base their new theories on well-grounded observational data and propose them to the scientific community. Referring to natural hazards, new models should have a predictive level higher than those already in use or at least comparable to those in use.

11.4 Consequences of a Society Unprepared

The 2009 earthquake in central Italy and the convictions of scientists for negligence in seismic risk assessment (known as "The L'Aquila earthquake-case"; Hall 2011; Amato et al. 2013), certainly have produced a negative effect on people: the feeling that it is possible to do something in the short term to reduce the seismic risk. This is false from a scientific point of view, but in the medium and long term many initiatives can be adopted for the defence of our society against geo-hazards.

Moreover, there are also other possible consequences for future crises and problems in risks management, due to the severe epilogue of the L'Aquila earthquake-case:

(a) prolonged alarmism could have as an extreme consequence that a threat is not perceived as such all the time;
(b) if the precautionary threshold becomes too high, the costs of prevention become excessive and therefore there arises an attitude of resistance to risk mitigation policies.

The extreme effect will be the development of a culture of emergency rather than a culture of prevention to face geo-hazards, with an increase of victims and economic repercussions of disasters on future generations.

If society is not sufficiently involved in the scientific knowledge, we could have two negative consequences:

- the cultural and social marginalization of scientists, with a loss of sense of the role they can play in protecting society from natural hazards (and the "L'Aquila earthquake-case" is emblematic: society did not feel helped and protected by the scientific community and thus the judge condemned scientists for negligence);
- the tendency of people to lose confidence in science, to embrace preconceived ideas in a non critical way, ideas sometimes provided by the media, often incorrect.

As a consequence, without a society scientifically prepared, it is not possible to develop risk reduction strategies that are really effective and widespread.

It must be remembered that the assessment of the level of acceptable risk and the consequent action to be taken is up to decision-makers and not up to the scientists (Albarello 2013; Jordan 2013). Geoscientists have only the expertise necessary to provide accurate data and risk assessments based on deterministic (Wyss 2013) or probabilistic models (Marzocchi et al. 2010), but they can never be expected to predict an event with an accuracy of few hours or a few days. The technical and operational decisions should regard the civil protection authorities and not the scientists (Jordan 2013).

11.5 Conclusions: What Could be Done by Geoscientists

Geoscientists have a great responsibility towards society in the natural hazards management and their role is crucial to reduce the impact of natural phenomena and to improve the resilience of communities to future disasters (Peppoloni and Di Capua 2012; Jordan 2013; Wyss 2013).

The scientific and professional communities are still not fully aware of their social role, in a world where natural disasters are increasing and there is an urgent demand for an ethics of prevention and communication. Moreover, there aren't clear institutional procedures that facilitate a good interaction between geoscientists and society. Nevertheless geoscientists' action is fundamental in the balance among citizens, politicians, media, since they have the proper ability and skills to transfer knowledge to society for a more effective defence against geo-hazards (Allington and Fernandez-Fuentes 2013).

Moreover, the general public tend to have little confidence in science and therefore to assume a fatalistic attitude towards risks.

What could be done by the scientific community?

- Organizing a communication strategy before, during and after the emergency phase, strengthening the communication by the scientific community, without copying the style of traditional media and opening out to new communication tools (like social networks).
- Making research outcomes public, with explanatory information targeted to the population, distinguishing clearly scientific observations from working hypothesis.
- Learning to communicate science without trivializing it, showing also different hypotheses and theories.
- Making citizens involved in the process of construction of knowledge with educational campaigns that aim to develop an analytical and critical attitude, rather than transfer absolute certainties on scientific theories. The population should be informed also about the limits of the scientific methods used, so that it can better understand and share the decisions taken to deal with a natural hazard. Informing the population on natural risks should be prioritized for geoscientists, which is their ethical commitment.
- Increasing the synergy with government agencies and local administrations, through the development of operational protocols and the definition of an encoded stream of information from the scientific community to the authorities (Jordan 2013).

The improvement of own professional skills (Allington and Fernandez-Fuentes 2013) and the respect of research integrity values (Mayer and Steneck 2011) could help in this direction. Geoethics may be the foundation on which to establish a new and profitable relationship between science and society.

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