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Comment

Comment on Gerbaudo et al. Are We Ready for a Sustainable Development? A Survey among Young Geoscientists in Italy. *Sustainability* 2022, *14*, 7621

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The opening question of the article from Gerbaudo and co-authors ("Are We Ready for a Sustainable Development?") is a compelling 'hook' for their important contribution [1]. The authors built their case following one of the United Nations 2030 goals: "introducing the concept of education for sustainability (EfS) to a wider population in order to promote knowledge about sustainability, encouraging prosperity respectful of the planet and its population." The assumption behind their manuscript is that earth science (ES) education is a key component of EfS, and improving societal knowledge around sustainability issues should be conducted by broadly sharing ES concepts with the community. To test the awareness level of such induction among ES practitioners, the authors distributed a survey at the BeGeo 2021 Conference to gauge the knowledge level of current students and recent graduates from geoscience programs in Italy, which turned out to be extremely informative at identifying gaps within currently available curricula. Even though the results are specific to Italy, we do applaud the initiative and action of the authors, as this could be an extremely effective vehicle to raise global awareness for the newest ES generations. We think that this initiative has all the potential to be exported and applied to other countries.

The 17 Sustainable Development Goals (SDGs) launched by the UN 2030 Agenda were adopted by all the 193 member states during the 21st Conference of Parties (COP21) held in Paris in December 2015 [2]. The Paris Agreement (as it is normally referred to) is well-known by policy makers and climate activists (sometimes with the most diverse viewpoints), as it sets out important parameters for anyone interested in the climatic future of our planet. What many people might not know is what Gerbaudo et al. 2022 recognized: all 17 SDGs have ties to ES. With this in mind, they motivate the geological scientific community to learn how to recognize their leading role in delivering the SDGs. The analyses presented by Gerbaudo et al., 2022 are destined to influence much of the future actions at universities in Italy and abroad and are worth a careful read by geoscientists around the world. While requesting to connect geosciences with sustainability issues, Gerbaudo et al., 2022 bring to the table an 'ethical dimension' and the societal implications that are rarely heard, and they unveiled a potential lack of strategy (at least at the country level), and they point a way forward and actions to be taken in the departments with which they are currently involved, sooner rather than later. Unfortunately, as we have stated in the past [3], sustainability education and research have been taking place in the absence (partial or total) of geological sciences and without familiarity with Earth's history and the inherent "dynamic disequilibrium" that drives Earth systems. We have predicted that any mitigation approach devised under the umbrella of sustainability risks falling short in protecting humankind's future [3].

Maybe a bit rhetorically, the authors specifically ask: "Is the geoscience community aware that proper education in ES can be a vector for change?" Unfortunately, we do not have a measurable answer about the awareness of the geoscience community as a whole, but according to the results published in their contribution and some of the recent shifts in

ES departments in the United States [3], we suspect that ES has not been given the needed relevance in programs that are focusing on sustainability. In other words, these issues do not reside solely in the ES community but are more systemic and profound. In our 2021 contribution [3], we made the point that any initiative in sustainability and its theoretical applications should not (and cannot) be enabled without the full consideration of the concept of "deep time"—a concept that only earth scientists can master after very specific training. We do know that Earth's patterns (of which climate is intrinsically related) operate over a wide range of timescales. Earth scientists with an understanding of deep time can bring to the table the ability to read natural patterns across time-dependent scenarios, an approach too often ignored by quick-response engineering solutions. As the world's richest people are now interested in saving the world and literally throwing their money behind climate engineering (maybe without fully grasping their long-term impacts) and/or supporting sustainability education with a start-up mentality (sometimes hastily mapped on table napkins), we think geologic principles should be implemented to help prevent "unforeseen" consequences. A healthy awareness of ES concepts should be a requirement for any policy maker or sustainability practitioner, enforced as strictly as mathematics are for any engineering degree!

We should not let our society move forward with fundamental concepts, such as energy transition and climate action, without understanding the behavior and limits (physical and temporal) of the environment we are trying to protect and sustain. The unique and hard-earned understanding of Earth's past [4] must educate global decisions about climate and energy.

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References

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