Poll Res. 40 (4) : 1489-1491 (2021)

ISSN 0257–8050

POSSIBLE ENVIRONMENTAL AND HEALTH PERILS ASSOCIATED WITH ENHANCED ROCK WEATHERING

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(Received 25 May, 2021; accepted 22 June, 2021)

ABSTRACT

Research for developing negative emission technology for carbon capture in order to arrest global warming is a globe wide craze. Enhanced crop weathering in crop fields is a promising technique but comes with a package of negativities specially for developing countries in the form of crop quality and human health degradation, possibility of biodiversity loss in both land and marine ecosystem and pollution caused by usage of non green energy for crushing, transporting and spreading the rock dust. Much introspection is needed to take care of these pitfalls before implementing the process on a large scale.

KEY WORDS : ERW, Over mining, Crop quality decline, Biodiversity loss, Health hazard, SDG.

INTRODUCTION

Climate change triggered by human activities is a matter of global concern. Excessive green house gases emission has been identified as a major cause for global temperature rise. Innovations to create Negative Emission Technologies (NETs) for CO_2 removal (CRD) from atmosphere are most sought topics of research after the 2015 Paris agreement on climate change recognized the need of arresting future temperature increase. All large scale NETs proposed have poor acceptability as they donot consider the pitfalls of its application (Smith *et al*., 2016 and Williamson *et al*., 2016).

Lately potential for CO_2 removal in large scale by enhanced rock weathering (ERW) with croplands has raised hope among the scientific community (Beerling *et al*., 2018 and Beerling *et al*., 2020).

This involves physical addition of crushed rocks (fast reacting silicates) to croplands which generates base cations making the soil alkaline which is instrumental in turning atmospheric CO_2 to dissolved inorganic carbon (HCO_3^-) which is removed from the soil through drainage waters. Inspite of claims of this process also having potential benefits for soil fertility improvement and runoff water reducing ocean acidification (Hartmann *et al.*, 2013, Cripps *et al.*, 2013 and Albright *et al.*, 2016), in our opinion this proposed NET will have a huge negative impact on ecosystem and biodiversity.

Possible negative impacts of large scale implementation of ERW as a carbon capture technique:

- Yield of crops which is claimed to gain momentum with ERWmay be a reality,but at the cost of crop quality decline. Carbon capture is more effectively done by olivine rocks, which have high nickel and chromium content. Bio accumulation of these toxic metals by crops and hence food chain has to be considered as screening of these rocks before application is a remote possibility in developing countries taking in account the cost involved.
- We also have to consider the CO_2 emission that is associated with mining, grinding, transporting and spreading of rock dust. This decreases the efficiency of CO_2 removal (Moosdorf *et al.*, 2014), unless the entire process uses green energy source, which is also a remote possibility in developing countries.

- The next point of concern is of course over mining. Though this NET recommends use of silicates that are generally waste products from mining and iron and steel production (Renforth *et al.*, 2011), yet considering the vast area of agricultural fields in tropics, new mining will be required to supply enough silicates. This will not only be an environmental massacre (Edwards *et al.*, 2014) but will also require road expansion to those areas, which have high biodiversity and invite human interferences. Blasting rocks and mining in new areas will cause habitat loss to the local flora and fauna creating even more negative impacts on nature which the NET intents to reduce in actuality. The wildlife of the area migrating to areas inhabited by humans will not only cause human-animal conflict (which is already an untacklable problem) but also expose humans to zoonotic diseases. The magnitude of threat of zoonotic diseases is something that the world is bearing in this time of pandemic. Introduction of invasive alien species will prove harmful for biodiversity of that area in the long run.
- When we are speaking of increasing soil fertility by ERW we are forgetting about the species that inhabit the soil of these tropical cropland. Even the smallest ants and rodents inhabiting these soils provide ecological services like pollination and seed dispersal which are indispensable to humans. Those species which thrive in low pH areas risk the fear of being wiped out. The high nutrient and pH load may even be carried to forest land (Laurance *et al.*, 2002) if they are close by (which is so in many cases in the tropics). So biodiversity loss may occur not only in the cropland where crushed rock is applied but in forests in close vicinity.
- This carbon capture technique boasts of increasing ocean alkalinity via runoff from fields to surface waters and then to oceans (thus using oceans to store atmospheric CO_2) which in turn addresses the issue of protection of marine biocalcifiers. However the possibility of unweathered silicates being washed into rivers during storms, heavy rainfall and flooding which is common in the tropics also requires attention. These unweathered silicates will increase inorganic turbidity and sedimentation which will affect the reproduction of fish in rivers (Kemp *et al.*, 2011). If sedimentation becomes even higherthen it may even cause corals and marine fauna inhabiting the reefs to die off (Fabricius, 2005).
- Another matter of concern which is not at all being considered is the health hazard it possess to people who are involved in crushing and spreading the rock dusts. Inhaling silicate powder will cause silicosis and other diseases causing respiratory distress (Taylor *et al.*, 2016). In developing countries it is impossible to consider that the process of crushing and spreading rocks will be totally mechanized and contactless.

It may so appear that by pointing out by so many negativities of ERW we wish to totally dump the idea. But that is absolutely not the case. ERW definitely offers a pragmatic and rapid carbon sequestering solution, which addresses SDG 13(climate actions) advocated by United Nations Development Programme adopted by 193 countries in 2015 (United Nations, 2015). We want to draw attention to the fact that to address SDG 13, we should be careful not to hamper the other SDGs. ERW may look to be a promising NET option but it may pose a problem to SDG 3 (which advocates good health and wellbeing of human race). ERW may also jeopardize 'Life on land' (SDG 15) and ' Life below water' (SDG 14). We cannot risk to forget that even before the human race invented wheels and tools they were responsible for extinction of nearly fifty percent of the earth's big beasts (Harari, 2014). The first wave of extinction came with the spread of foragers (that's what we were) and the second wave was associated with the spread of farmers/agriculture. We are initiating the third wave by the industrial revolution. That humans have lived in harmony with nature since their inception is probably a misconception. The responsibility of curbing the third wave of extinction thus lies on our shoulders. Our knowledge of how many species we have vanished from the globe should be motivating enough to watch every step we take in the name of sustainable development. After all being the master of the planet we are her sole caretaker too.

ACKNOWLEDGEMENT

Both MD and PD acknowledge their respective institutions for providing intellectual and infrastructural support.

Conflict of interest

Both the authors have no conflict of interest.

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