# Environmental management for a changing world

## Summary

 The purpose of this essay is to show the proposed updated approaches for global sustainability through the definition of the planetary boundary within which it is argued that humanity can operate safely. The planetary boundary (PB) framework defines a secure operational space for humankind based on the biological processes that determine the balance of the earth system (Richardson et-al, 2015). This article revises and updates the boundary regulation with a focus on bio-physical science targeting input from the research community and the overall scientific improvements over the last five decades. Human activities threaten the resilience of the earth system affecting in a way the functions of the earth system (ES). Climatic change and biosphere integrity are the fundamental and core to the ES. This article doesn’t, however, show how the society should develop since it involves political decisions that consider human dimensions but planetary boundary makes important contributions for decision making through identification of a safer operating space for human for societal development (Van der Leeuw, 2008)

## Analysis

 The threshold is a nonlinear change in the functions of environmental systems (Steffen, et-al, 2002). Humanity is faced with environmental problems at the global and local level where some have effective ways of dealing with the constraints than others and this leads to a threat to the environmental quality and stability hence the need for local or regional boundaries that regulate what should be released or extracted from the earth. I believe that there is an urgent need to integrate the human society that continues to develop and the maintenance of earth system.

## The PB: Thresholds, feedbacks, resilience, uncertainties

 The difference between the green zone and the threshold allow the human time to respond to early science warning actions. For such science that gives us warning signs to be beneficial in the policy formulation, it should give ample time within which the society can respond in order to evade the impending threshold before it happens. Thresholds impact the ability of the earth ecosystem to survive in a Holocene situation through the regulation of the biogeochemical flow or by providing conditions for the environment to persist and therefore the boundaries should be developed.

## Linking global and regional scales

 At this section, the sub-global aspects of the planetary boundaries will be addressed and the sub-global boundaries that will be compatible with the global boundaries will be indicated. The PB which has five elements should have an operating scale. They include; biogeochemical flow, biosphere integrity, change of the land system, atmospheric aerosol loading and freshwater use but they vary depending on the role they play in ES; variation in bio-sphere integrity happens at land-based biomes level, freshwater, major marine environment and it is the largest sub-global environment, land changes are related to forest biomes and the use and flow of the freshwater occur at large sub-global levels. I, therefore, agree with the authors that in order to understand the functions of the ES as a whole, we should focus on the sub-global levels and PB is meant to complement the efforts trying to address local and regional ecosystem issues rather than to replace them.

## The proposed planetary boundaries

 Climatic change boundary proposed aims at reducing the risks of irreversible earth responses related to the threshold and could lead to interferences with the regional climate (Lenton et al. 2008). Climatic change is caused by some gases and human-driven changes and emissions such as carbon dioxide, aerosols, greenhouse gases, and other factors that cause the imbalance in energy. To define PB for climatic change two approaches are used; CO2 concentration and radioactive forcing. The contemporary climate is changing from Holocene variability increasing the danger of climatic change. Moreover, ocean acidification is another PB which is linked to CO2 occurs when the gas combines with water release the hydrogen ions into the aquatic environment reducing saturation of oxygen thus harming marine organisms (Guinotte et al. 2003). The other proposed boundary is ozone depletion although humanity is taking necessary actions to correct the situation; stratospheric ozone prevents the ultraviolet rays from reaching the earth (World Meteorological Organization and the United States. Office of Mission to Planet Earth, 1995). This case of stratospheric ozone shows the put human efforts and decisions made to help us stay within the planetary boundary. The boundaries that regulated biogeochemical flow only targeted nitrogen and phosphorous but I believe human influence on the biogeochemical flow should be included. The regulations should be considerate that most of phosphorous come from the use of fertilizer to boost soil for crop production instead it should limit the amount to be used since it is currently in excess.

 Additionally, the updated freshwater boundary has included the use of blue water that is from lakes, rivers and the withdrawal of water causes a change in the climate (Gerten et-al, 2013). The water cycle is now in anthropogenic (Meybeck 2003) because human being influences its scale and flow. There is a threat to human survival and livelihood as a result of deteriorating water resources. The flow of green water influences the fall of rain and thereby influencing the availability of blue water. Earth system change is influenced by agricultural activities and intensification affecting sustainability and human activities (Foley et al. 2005, MEA 2005a).The updated biosphere integration focuses on constraining the size and outline of land modification but the land modification boundary is focused on the bio-geo-physical processes in the land that influence climatic change; energy, water and the balance between ground surface and the atmosphere. For humanity to survive within the boundaries, the lands which is to be cultivated should be given in the more productive area and the activities that may lead to loss of such land should be monitored. Aerosol activities have increased since the pre-industrial times increasing their global concentrations (Tsigaridis et al. 2006). Aerosol emission leads to a high number of deaths and affects the way the earth system functions and these emissions are of carbon either from cooking or heating bio-fuels and diesel transportation, sulfates and nitrates from fossil fuel burning. Aerosol substances lead to deteriorating effects such as crop damage, degradation, and loss of fresh water.

## Interactions among the Boundaries

 An interaction between boundaries changes the level of safety and some boundaries. The proposed and presented boundary interactions reduce instead of expanding the levels crushing the safe operating place for humanity. A stable and safe environment is important for the survival of a society and there should be an implementation of a sustainable environment through providing clean water, accessible and cheap energy and adequate food to meet human needs. Uneven distribution of wealth geographically and socially causes the uneven boundary processes and when applying boundary framework boundary interaction and scale should be observed.

 From this analysis, it is evident that human has already transgressed through three boundaries although there is uncertainty into how long the transgression will last before it starts causing unacceptable climatic change and also triggers threshold that would make it hard to return to safe level. There is no doubt that the intertwined processes; slow or fast causes and feedback are complex and challenging to the humanity. The concept of PB framework provides an operational base for humanity.

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