

CARBON CREDITS AND BIOTECHNOLOGY: WOULD THIS BE THE SOLUTION FOR POOR AND DEVELOPING COUNTRIES?

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Industrialization represents the basis of economic expansion and global urbanization, which stimulates various sectors in parallel with the growth of the world population. By 2050, humanity is expected to reach 9.9 billion, increasing the demand for energy and food by 80% and 70% respectively (Wang *et al.*, 2021). Over the last two centuries, the world economy has developed through the overexploitation of natural resources and the detour and/or imbalance of the biogeochemical cycles on which the biosphere depends. In this context, rampant deforestation to use land for food production, as well as the use of resources such as burning fossil fuels, has led to intensified emissions of anthropogenic sources of greenhouse gases (GHGs), impacting the global climate (Malhi *et al.*, 2021). For example, in 2016, energy and food systems accounted for more than 90% of all global GHG emissions (mainly in the form of CO₂). Finally, it is estimated that GHG emissions will increase by 50% by 2050, mainly due to the 70% increase in energy-related CO₂ emissions, with direct impacts on the balance of the world's ecosystems and the survival of the biosphere.

More recent data makes clear the urgent need to accelerate efforts to reduce GHG emissions and thus reverse global climate impacts, since only 4.5% of countries have achieved carbon neutrality, and most countries still plan to do so by 2050-2070 (Chen *et al.*, 2022).

Notoriously, most poor or developing countries have warmer climates than developed countries (Vliert *et al.*, 2000). This is due to a series of factors, mainly historical and cultural, in which colonization processes have had a direct impact on the course of development in each country. On the other hand, the culture exported by the colonizing countries ended up affecting the development of technologies based on the physical realities of the colonized lands.

A clear example of this is the greater biodiversity of countries with warmer climates (Brown, 2014). Initially, it was believed that biodiversity was only important in terms of the particularities of tropical species. On the other hand, it is necessary to understand that the richness of great biodiversity is not just in the physiology of one organism or another, but in the way they relate to each other. Great biodiversity generates greater competition, making the environment more resistant and resilient to external interference.

Biotechnology, and microbiology in particular, fits into this context. It is common knowledge that the use of microorganisms can have a few functions, such as biofertilization or

bioremediation. Biofertilization is the promotion of nutrient mining from the soil, through the action of biofilms in extracting nutrients that are not bioavailable. Bioremediation, on the other hand, promotes the degradation of recalcitrant industrialized compounds or domestic sewage by enriching the microbiota (Rizvi *et al.*, 2022).

Thus, since most microorganisms develop more at higher temperatures (Qiu *et al.*, 2019) and the greater biodiversity of tropical environments, the economic evolution of less developed countries should be based on the use of biotechnology, which, according to the information mentioned above, can be considered their main vocation. Finally, warmer climates stimulate primary productivity and the consequent sequestration of carbon from the atmosphere. Wouldn't this be the ideal scenario for encouraging the carbon credit market and sustainable development?

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Received: December 4, 2023

Approved: December 4, 2023

DOI: 10.20985/1980-5160.2023.v18n3.1913

How to cite: Lattanzi, I.E., Daflon, S.D.A., Pierri, B.S., Fonseca, E.M. (2023). Carbon credits and biotechnology: would this be the solution for poor and developing countries? *Revista S&G* 18, 3. <https://revistasg.emnuvens.com.br/sg/article/view/1913>