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TERRAFORMING MARS - A POSSIBILITY OR DAYDREAM IN THE 21ST CENTURY

Abstract

In the future, population growth and demand for resources may create pressure for humans to colonize new habitats such as Mars, the Moon and nearby planets, as well as harvest the Solar System's energy and material resources. Of all these, Mars happens to be the most realistic, being earth's twin. Terraforming is a process of planetary engineering, specifically directed at enhancing the capacity of an extraterrestrial planetary environment to support life. The ultimate aim in terraforming is to create an uncontained planetary biosphere emulating all the functions of the biosphere of the Earth–one that would be fully habitable for human beings. The creation of a self-sustaining ecosystem, or biosphere, on a lifeless planet is called ecopoiesis, a word which means 'the making of an abode for life'. In order to allow ecopoiesis of Mars, four principal modifications must be applied to the martian environment which include: mean global surface temperature must be increased by 60 K and above; the mass of the atmosphere must be increased; liquid water must be made available; and the surface UV and cosmic ray flux must be substantially reduced. These changes would suffice to render Mars biocompatible for certain anaerobic ecosystems, but not, as is often stated, for plant life. An additional requirement for plants is the presence of sufficient atmospheric oxygen to support root respiration, and although this would be much less than that needed for animals to breathe, such a quantity of oxygen is not expected to be released during initial planetary engineering. Thus, a fifth principal environmental modification will be needed for further terraforming: the atmospheric composition must be altered to increase its O2 and N2 fractions. Ecopoiesis is conventionally regarded as being possible on Mars once its CO2 atmosphere has been thickened and its greenhouse effect increased such as to raise the surface temperature above freezing. Mars would thus be tepid rather than frozen, but still relatively dry and anaerobic. Some microorganisms proposed to prosper under such conditions include Chroococcidiopsis sp., Matteia sp. And Deinococcus radiodurans. The obstacles posed by present conditions on Mars, quite apart from the costs entailed, seem almost insurmountable. In addition, the prospect of ecopoiesis, as a long-range objective for civilian space agencies, raises many unresolved philosophical, political and even legal questions. For example, do humans have any right to 'play God' on another planet?