A PREY-PREDATOR DYNAMIC MODEL TO ESTIMATE THE FUTURE PRIMARY PRODUCTION OF METALS

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The Paris Agreements (COP21) call for global carbon neutrality to be achieved by 2050. At this end, new infrastructures of energy production, storage, transport and use have to be built, which will consume vast amounts of raw materials. This move towards low-carbon energy must take place in a context of rapidly growing demand due to the economic emergence of populated countries, urbanization, and the development of new technologies. If current trends continue, we will need to produce until 2050 more metals than we have produced since antiquity, which raises the question of their availability. Some anticipate shortages in the course of the century, while others claim that technological evolution and recycling will make it possible to maintain the increase in production observed over the last century (3-5%/year). To go further on the question, we have built a dynamic model of metal primary production and recycling using a prey-predator dynamics. The model links the evolution of reserves, the quality of ore deposits, the energy of extraction, the industrial capital and the price of metals. It is able to reproduce the historical global data of copper production - a metal of crucial importance for the energy transition - since hundred years, and it provides insights on the future production until the end of the century for different assumptions of GDP/capita evolution that will control the future demand.

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