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Humans need to Recover Functional Interactions with Biodiversity: A Challenge for Education and Innovation in Food and Health Systems

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Humans are part of biodiversity. The first functional interactions with the rest of biodiversity emerged from the coevolutionary process in primitive ecosystems. Some interactions have been positive (food, health, habitat, etc.); others negative (pathogens, predators, etc.). However, it is clear that positive (beneficial) interactions have declined, while negative (harmful) interactions have increased; in both cases, as a consequence of the cumulative effects of socioeconomic development.

With social development, human populations have gradually clustered in rural, urban, and peri-urban areas. This has contributed to today's society being composed of population clusters in anthropized habitats, where the quality of food and health, which are still valued separately, have become major social issues.

Specifically, during the transition from the Holocene to the Anthropocene, various risks have accumulated for human populations, some of which exceed the limits of tolerance. Among these risks has been the loss of biodiversity and its functional interactions.

However, biodiversity loss is not limited to natural ecosystems and agroecosystems, but also occurs in socio-ecosystems, where clusters of human populations, especially those living in extreme conditions, whether very precarious or excessively artificial, are exposed to various factors that limit the positive interactions of biodiversity that determine nutrition and health.

Human nutrition, in particular, has shifted toward a predominance of products obtained from specialized systems that exploit large areas of monocultures, with high mechanization and the use of agrochemicals, or those replaced by bioproducts. These products are subsequently transported and marketed through long supply chains.

The latter have become a few staple foods, the negative effects of which are well known, due to prolonged exposure over many generations to a low diversity of nutrients and their associated microbiota. Consequently, the natural nutritional and immune functions of food have been reduced in the human abdominal ecosystem. No less important is the complexity in the manifestation and dissemination of the causative agents of health problems, which can develop into epidemics and pandemics.

As part of social development, under the pressure of the negative externalities of modernity, several strategies have advanced: prevention and curative treatment to reduce health problems; increasing

conventional industrial production to meet food demands; improving the environmental quality of cities to reduce pollution; and promoting education on environmental conservation, nutritious food, and health.

However, these strategies have not considered the restoration of biodiversity functions to regulate positive and negative interactions. This means that human life, as elements of biodiversity, is also approaching the limits of tolerance. This situation justifies the need to move toward education and self-governance of food and biosecurity at the household level. The challenge is to understand that socioecosystems are complex systems in which humans need to interact with the rest of the biota, even under the pressure of anthropogenic factors.

Biodiversity conservation and the generation of ecosystem services are strategies promoted and implemented by institutions that manage ecological systems, and are also being embraced by the governance of agri-food systems. However, it is clear that a more integrated vision is required at the rural and urban landscape scale, due to the pressure that development exerts on human-induced self-extinction.

It's not about halting socioeconomic development, but rather making it more harmonious and less degrading to natural resources, fostering a focus on sustainability in its various dimensions, for which there is very good practical experience and scientific evidence.

Within the family, according to cultural perception, well-being needs to be harmonized with the facilitation of functional interactions between human-associated biota, primarily in two directions: housing as a habitat that should integrate some natural attributes, and nutrition, which requires the integration of nutrition with immunity. Including fresh foods obtained from semi-natural environments in the diet facilitates the positive functions of biodiversity in the abdominal ecosystem.

Sustainable quality of life, although a highly complex socio-environmental challenge for food and health systems, can be considered one of the priorities for the survival of human populations. It is a holistic approach to the conservation of life on Earth, which is particularly diverse in urban, peri-urban, and rural socio-ecosystems, where factors determining habitat quality, healthy nutrition, and appropriate medication converge.