Exergy and ecological services in reservoirs

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Received July 5, 2012 – Accepted September 12, 2012 – Distributed November 30, 2012

(With 1 figure)

1. Introduction

The search for ecological indicators is at present a relevant task of environmental managers. Since the ecosystem is a complex system it is not easy to find good ecological indicators that can give information on ecosystem integrity. According to von Bertalanfly (1952) the evolution of ecosystems as complex systems is characterised by four major attributes:

- Progressive integration (between the different species of biota, climate hydrology);
- Progressive differentiation and specialisation as the biotic diversity evolves;
- Progressive mechanisation – including numbers of feedback and regulation mechanisms; and
- Progressive cooperation and growing adaptation of other components of the ecosystems.

Constanza (1992) summarises the concept definition of ecosystem integrity as the following:

- Homeostasis;
- Absence of disease;
- Diversity or complexity;
- Stability or resilience;
- Vigour to growth; and
- Balance between system components.

Exergy expresses the biomass of the system and the amount of genetic information incorporated in it. Accordingly to Jorgensen and Svirezhev (2004) ecosystems attempt to develop towards a high level of exergy. Since exergy expresses biomass and information (the level and quality of information), it is useful to consider that the range and diversity of ecological services (Periotto and Tundisi, 2012) of the reservoirs and their watersheds is dependent on the exergy such as shown in Figure 1.

If this is true, the more stable and diverse the ecosystem with more efficient ecohydrological mechanisms (Zalewsky, 2002), the higher will be the exergy and the diversity and value of services of the ecosystem offered for human well-being. Reservoirs offer a wide range of ecological services for human well-being, from hydroelectricity, water supply, navigation, recreation, tourism and recreation for fisheries and aquaculture (Tundisi and Matsumura Tundisi, 2008). When they stabilise after construction, the buffer capacity of reservoirs and their resistance to perturbation depends upon its ecohydrologicalmechanisms based on diversity and integrity of the watershed reservoir relationship. (Tundisi et al., 2008a,b).

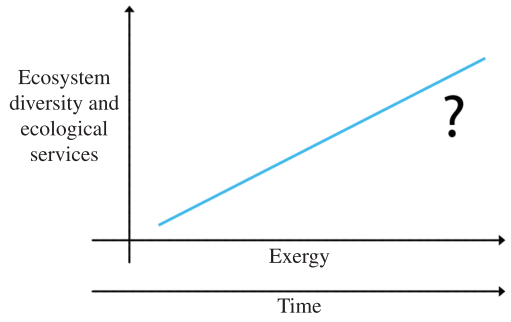

Figure 1. Possible relationship between exergy and diversity in ecosystems.

For its maintenance, the ecosystem must produce entropy and disorder. However the energy flowing through the system may be able to cover this disorder resulting in increased information and order in the system. The higher the accumulated information the higher the diversity and value of ecosystem services offered. In the next steps,research work will be developed in this line of investigation.

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