NUS National University of Singapore | Department of Biological Sciences Faculty of Science

SEMINAR

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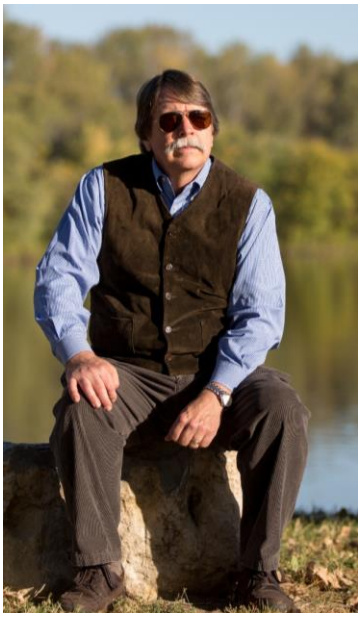
Hosted by A/P Darren Yeo

Macrosystem Analysis of Temperate Steppe Rivers in the USA and Mongolia



By **James H Thorp**

Professor, Kansas Biological Survey of the University of Kansas

James H. Thorp is a Professor of Ecology and Evolutionary Biology, and a Senior Scientist at the Kansas Biological Survey of the University of Kansas. He is internationally regarded as one of the foremost freshwater ecologists, having authored over 100 publications in highly-regarded journals, including, Nature, Frontiers in Ecology and the Environment, Ecology, and Freshwater Biology, among others. He is senior editor of three editions of the seminal work, Ecology and Classification of North American Freshwater Invertebrates (1991, 2001, 2010), and series editor for the 4th edition, now called Thorp and Covich's Freshwater Invertebrates. He has also been Editor-in-Chief of Aquatic Ecology, Associate Editor of Freshwater Science, and on the editorial boards of River Research and Applications and River Systems. Prof Thorp is currently working on an international research project funded by the US National Science Foundation aimed at characterizing the macrosystem ecology of rivers, in which he leads a research group including scientists from 10 universities in four countries. A major goal of the project is to evaluate the impacts of climatic change and anthropogenic disturbance on river macrosystems. His other research interests include food web ecology, ecological traits of fish and invertebrates, and the role of methane in river food webs.

The need to understand and manage ecosystems at larger "macrosystem" levels is becoming increasingly crucial with global climate changes and impacts of exotic species in our freshwater rivers and lakes. Macrosystem management requires an understanding of how different levels of spatial complexity (reach to valley scale) and biotic organization (populations to ecosystems) affect the functioning of ecological systems.

To better understand rivers, I am leading a group of scientists from 10 universities in four countries in a U.S. National Science Foundation funded project to study ~ 18 rivers in the two largest temperate steppe biomes of the world: the North American Great Plains and the Euro-Asian Steppes (as in Mongolia). These rivers flow through 3 major types of ecoregions within these temperate steppe biomes: mountain steppe shrublands, short-to-tall grasslands, and semi-arid shrublands. Scientists and students from the USA and Mongolia are sampling the structure and functioning of these rivers in a variety of hydrogeomorphic areas (called functional process zones, or FPZs). Despite their similarity in biome and ecoregional types, the rivers of the North American Great Plains and the Mongolian steppes vary substantially in fauna, flora, and community through ecosystem functioning. This results in part because of differences in climatic patterns, the degree of riverine landscape modification (e.g., by dams, levees, and riparian modification), and the naturalness of the resident fauna. For example, most rivers in the USA contain some dams and many exotic fauna have been introduced, while the vast majority of Mongolian rivers contain no dams and their aquatic fauna is almost exclusively natural and different from those in the USA. Moreover, the Central Asian subcontinental area of Mongolia has one of the strongest warming signals on earth, with air temperatures rising three times faster than the overall northern hemisphere average. Consequently, riverine macrosystems in the USA can help predict changes to Mongolian rivers as a result of pending dam construction and possible species introductions to some rivers, while knowledge of responses of Mongolian macrosystems to more rapid climatic changes can help predict future effects in U.S. rivers. Therefore, this project's goals are to: (a) compare and contrast hierarchical scaling relationships and effects of system drivers and cross-scale interactions on rivers in similar biomes and ecoregions of the two continents; (b) evaluate effects of climatic changes and anthropogenic disturbance to these river macrosystems; and (c) generally advance the science of macrosystem ecology.

In my seminar at your university, I will discuss the project as a whole, review some of our current ecological findings to date, and focus on the results of our food web studies in my lab.

Artwork by Ann Nee, DBS, NUS