Stream Ecology (MB162P31)

Instructor: Tyler Kohler

The aim of this course is to provide students with the theoretical base needed to pursue independent ecological investigations of stream environments. Students will be encouraged to read a selection of both "classic" and recent literature, and discuss these during relevant classes. Lectures will loosely follow material from *Stream Ecology*, by David Allan and Maria Castillo, as well as incorporate research experience from the lecturer. While no prerequisites are required for enrollment, a basic knowledge of chemistry, biology, and ecology will be useful. The course will run for 12 weeks, and lectures will be in English. Students will be evaluated by their participation in class, a final exam, and several activities distributed throughout the semester. Lecture topics will be as follows:

1: INTRO TO STREAM ECOSYSTEMS - why study streams? - fluvial geomorphology - spatial scales of investigation - the River Continuum Concept and other models

2: HYDROLOGY - the hydrologic cycle - streamflow generation - interpreting hydrographs - measuring discharge - suspended material transport

3: THE ABIOTIC ENVIRONMENT - special properties of water - temperature - light - pH - dissolved gasses and solids - the carbonate buffering system

4: NUTRIENTS – redox - minor nutrients - sources and cycles of Si, P, N - introduction to carbon - nutrient spiraling

5: AUTOCHTHONOUS PRODUCTION - photosynthesis - algal diversity– macrophytes - growth forms and succession - environmental controls

6: ALLOCHTHONOUS INPUTS - respiration - mechanical litter breakdown - heterotrophic biofilms and bacterioplankton - stream metabolism

7: HYPORHEIC AND RIPARIAN ZONES – physical and chemical characteristics – methods for observation – ecological relevance – flora and fauna

8: MACROINVERTEBRATES - diversity - life history and physiology - functional roles - longitudinal patterns - the special case of drift - terrestrial subsidies

9: FISHES - zoogeography - local environmental filters - ecomorphology - migration and life history – ecological roles

10: SPECIES INTERACTIONS – classic studies of competition, herbivory, predation - trophic cascades - foodwebs

11: STREAMS OF THE ANTHROPOCENE - physical alterations - invasive and non-native species - contaminants - overexploitation - climate change

12: MONITORING, MANAGEMENT, AND RESTORATION - ecosystem health, integrity, and services - scientific methods for investigation - management, remediation, and restoration

Textbooks:

Stream Ecology, by David Allan and Maria Castillo (recommended)
Methods in Stream Ecology, edited by Richard Hauer and Gary Lamberti (optional)

Suggested readings:

Ward, J.V., 1989. The four-dimensional nature of lotic ecosystems. *Journal of the North American Benthological Society*, *8*(1), pp.2-8.

Poff, N.L., Allan, J.D., Bain, M.B., Karr, J.R., Prestegaard, K.L., Richter, B.D., Sparks, R.E. and Stromberg, J.C., 1997. The natural flow regime. *BioScience*, *47*(11), pp.769-784.

Vannote, R.L. and Sweeney, B.W., 1980. Geographic analysis of thermal equilibria: a conceptual model for evaluating the effect of natural and modified thermal regimes on aquatic insect communities. *American naturalist*, pp.667-695.

Newbold, J.D., O'Neill, R.V., Elwood, J.W. and Van Winkle, W., 1982. Nutrient spiralling in streams: implications for nutrient limitation and invertebrate activity. *American Naturalist*, pp.628-652.

Fisher, S.G. and Likens, G.E., 1973. Energy flow in Bear Brook, New Hampshire: an integrative approach to stream ecosystem metabolism. *Ecological monographs*, *43*(4), pp.421-439.

Junk, W.J., Bayley, P.B. and Sparks, R.E., 1989. The flood pulse concept in river-floodplain systems. *Canadian special publication of fisheries and aquatic sciences*, *106*(1), pp.110-127.

Stanford, J.A. and Ward, J.V., 1993. An ecosystem perspective of alluvial rivers: connectivity and the hyporheic corridor. *Journal of the North American Benthological Society*, *12*(1), pp.48-60.

Townsend, C.R., Scarsbrook, M.R. and Dolédec, S., 1997. The intermediate disturbance hypothesis, refugia, and biodiversity in streams. *Limnology and oceanography*, *42*(5), pp.938-949.

Townsend, C.R., 1989. The patch dynamics concept of stream community ecology. *Journal of the North American Benthological Society*, pp.36-50.

Resh, V.H., Brown, A.V., Covich, A.P., Gurtz, M.E., Li, H.W., Minshall, G.W., Reice, S.R., Sheldon, A.L., Wallace, J.B. and Wissmar, R.C., 1988. The role of disturbance in stream ecology. *Journal of the North American Benthological Society*, pp.433-455.

Ward, J.V. and Stanford, J.A., 1983. The serial discontinuity concept of lotic ecosystems. *Dynamics of lotic ecosystems*, *10*, pp.29-42.

Vannote, R.L., Minshall, G.W., Cummins, K.W., Sedell, J.R. and Cushing, C.E., 1980. The river continuum concept. *Canadian journal of fisheries and aquatic sciences*, *37*(1), pp.130-137.