Geography 549 - Water and Watersheds

Dr. Allan James, Spring, 2017

This course covers hydrology, water quality, and flood hazards and how they are associated with watersheds and watershed management. *Watersheds* are a fundamental natural division of the environment that determine pathways of water, sediment, and biochemical materials on the surface of the Earth. Historically, studies of aquatic systems have focused on local areas such as a hill slope, a stream reach, or an individual lake or pond. Over the past 25 years, however, there has been a concerted move by engineers, ecologists, planners, and policy makers to study aquatic systems at a broader " *watershed scale* " in order to appreciate the nature of inputs and the interactions between variables. Although watersheds are defined independently of scale, by definition they include the entire upstream area contributing surface water and other materials above a point on a stream. Therefore, they involve a large number of physical and human processes that contribute water, sediment, and pollutants. This course elucidates the integrative perspective of environmental processes at the watershed scale with an emphasis on hydrological processes in the broad sense of the term. The tripartite focus on hydrology, water quality, and flood hazards is integrated in the context of Rocky Branch watershed (RBW), in Columbia, SC. RBW is a small, urban stream that flows from the headwaters around Five Points, Shandon, and the USC campus across Assembly Street southwest to Olympia Village and to its mouth at the Congaree River.

Hydrology is a diverse field encompassing both the quantity and quality (volumetric and biochemical characteristics) of water, both on the surface and underground. Hydrology can be approached in many ways and involves many perspectives including engineering, agricultural, geological, geographic, environmental, public health, hazards, and planning viewpoints. Hydrologic studies can focus on any of several aspects of the water cycle including floods, droughts, water yields, drinking-water quality, point and non-point source pollution, geomorphic work by water, human impacts on hydrologic systems, aquatic ecology and restoration, and so forth. Obviously, no single course or textbook can cover all these hydrologic topics in depth, so prioritization and focus are required.

This course emphasizes a geographic perspective of watersheds by dividing topics into three components: physical hydrology, water and environmental quality, and water-related hazards. The *physical hydrology* component of the course covers the mechanical or volumetric aspects of runoff and soil water that drive surface-water systems. This emphasizes the generation of runoff and the quantity and timing of stream flow. Groundwater is also important to watersheds but is not covered in detail by this course in order to achieve a focus on surface processes. Evaluation of *water and environmental quality* includes the biological and physical constituents occurring in water, how they are generated and transported, their effects on the environment and society, and relationships between environmental quality and water quality. The relevance, measurement, and interpretation of common constituents in water are briefly covered, including dissolved and suspended solids, nutrients, dissolved oxygen, heavy metals, pathogens, etc. This water-quality section of the course is focused on two areas: the role of natural treatment of water and the volumetrically important aspects of non-point source pollution; that is, soil erosion and sediment behavior in watersheds. Natural treatment is a growing area of integrated water-resources management that holds the potential to reduce costs of water and sewage treatment and channel maintenance by restoring and protecting natural aquatic systems to enhance water quality and reduce sedimentation. *Water-related hazards* include floods, droughts, pathogen outbreaks, and releases of chemical substances. The emphasis of this course is on flood hazards and strategies for mitigating flood risk.

More information about the topics to be covered can be seen in the lecture schedule.