Study Guide for Module 6: Fluvial Systems

Overview:
This module focuses on fluvial systems as complex adaptive systems. Rivers are precious resources, as they provide the fresh water that humans and animals need to survive, food to eat, and a range of important ecosystem services. For these reasons, humans have settled in the floodplains of rivers for thousands of years. Fluvial systems are however, highly complex and dynamic systems, and therefore humans have tried to modify streams and rivers, in ways that have had important effects on ecosystem health. In this module you will learn the dynamics of fluvial systems, how they have been traditionally managed, and how they can be managed to better promote system resilience. In order to understand this, you will first learn the basic components of fluvial systems, including watersheds, drainage networks, rivers, streams, lakes, and wetlands. Understand how water and sediments are transported from the upstream parts of the watershed to the mouth. This will include understanding basic fluvial processes, including lateral meander migrations, recurrent flooding, and the formation of floodplains. Learn the ways in which fluvial systems contribute to ecosystem health and biodiversity in the rivers, riparian zones and beyond (e.g. the introduction of wolves in Yellowstone National Park). The following section will explore the different kinds of human interventions, and how they affect fluvial systems. These will be explored by looking at the impacts of such interventions as the straightening of the Mississippi and Mekong Rivers. Finally, you will gain an understanding of how climate change will affect fluvial systems, and the importance of increasing resilience by integrating more natural processes in river management.

Learning Outcomes:
In this module you will learn:

- What fluvial systems are and why they are important
- Why a systems approach is necessary to understand fluvial systems and their effect ecosystem health and services
- What types of human interventions have historically been employed in fluvial systems, and their consequences on the system
- How climate change will affect fluvial systems, and how they can be managed more sustainably to increase system resilience
Topic Outline

6.1 What is a Fluvial System?
   6.1.1 What are Fluvial Systems?
   6.1.2 The Fluvial System
   6.1.3 Other Components
   6.1.4 Knowledge Check

6.2 Why are Fluvial Systems Important?
   6.2.1 Fluvial Systems: Ecosystem Services
   6.2.2 Provisioning Services
   6.2.3 Supporting Services
   6.2.4 Cultural Services
   6.2.5 Regulating Services
   6.2.6 Knowledge Check

6.3 Why are Fluvial Systems Complex?
   6.3.1 Fluvial System Dynamics
   6.3.2 Dynamic Equilibrium
   6.3.3 Fluvial Systems and Surrounding Ecosystems
   6.3.4 Knowledge Check

6.4 Management and Governance of Fluvial Systems
   6.4.1 Engineering Interventions
   6.4.2 River Engineering
   6.4.3 Alternative Management Strategies: Fluvial Corridors
   6.4.4 Alternative Management Strategies
   6.4.5 Knowledge Check

Important Concepts
- The hydrologic cycle
- Ecosystem health
- Ecosystem services
- Ecological resilience
- Dynamic equilibrium

Study Materials:
- Readings:
  - Article from the NASA website about some of the effects of the Three Gorges Dam: [http://earthobservatory.nasa.gov/IOTD/view.php?id=7769](http://earthobservatory.nasa.gov/IOTD/view.php?id=7769)
o Balancing hydro-electric power needs and maintaining healthy ecosystems: http://science.sciencemag.org/content/351/6269/128.full.pdf+html

o Article discussing some of the ways in which human interventions are affecting the Mekong River floodplains:

o Article by the world bank on how Bangladesh is using the Room for the river concept with partners from the Netherlands:

o GoKunming. The Tonle Sap floodplain, Cambodia:

o When The Water Ends: Africa’s Climate Conflicts:
  http://e360.yale.edu/feature/when_the_water_ends_africas_climate_conflicts/2331/

• Videos:
  o A Tour of the Water Cycle: https://pmm.nasa.gov/education/videos/tour-water-cycle
  o George Monbiot: For More Wonder, Rewild the World TED Talk: https://www.ted.com/talks/george_monbiot_for_more_wonder_rewild_the_world?language=en
  o Archival footage of Mississippi flooding:
  o Meanders of the Amazon river: https://earthengine.google.com/timelapse/ (click the meander icon to view)

Activities:
Is there a river near your home which corresponds to one of these channel types? If so, take a picture of it and upload it to the interactive map.
References


