In the computer lab preceding this field trip, we studied the Google Earth Pro interface for viewing geographic data. Among these data was a layer called “Land Cover - Land Use”.

The purpose of this field trip is to look at a real watershed and see first-hand the challenges involved in mapping the properties of a landscape over a wide area. Land use planners use these kinds of data layers. We will also see later in the lab how mathematical modelers use them in attempting to simulate a large, complex environment with sets of equations. We will visit Piper’s creek in Carkeek Park (northwest Seattle) as a substitute for Big Beef Creek, which we will study later in the course.

We are visiting Piper’s Creek to observe the methodology for collecting data used as input to GIS mapping layers, and to assess the limitations of that methodology. We will focus on the type of vegetation, as visualized in the land cover & land use data layers we have examined on Google Earth Pro.

**Part I Seattle Public Utilities—“Natural Drainage Systems” (3.5 pts)**

We will first meet with Bill Malatinsky from SPU (or possibly Brian Gay). He will discuss the SPU’s effort to reduce runoff by implementing Natural Drainage Systems (NDS). To find out more about this project, visit the SPU links on the Lab 2 Materials webpage.

1. (1 pt) Explain the problems that prompted the development of natural drainage systems.

*Problems included the high volume of water being diverted into streams and rivers, the velocity and volume of water scouring these streams, and the toxic runoff carried into the streams by the conventional drainage systems.*

1. (1 pt) How do Natural Drainage Systems mitigate the problems described above?
2. *NDS mitigates these problems by slowing the runoff water and removing toxins via biofiltration.*
3. (1 pt) What characteristics of Piper’s Creek make it a good test bed for Natural Drainage Systems (i.e. why did SPU choose Piper’s Creek for the pilot project)?

*The relatively small size of the creek as well as the salmon presence*

4) (0.5 pt) What is the proposed total project cost of the Pinehurst Natural Drainage system? What is the projected cost of a traditional drainage design? (Can be found by reading the “Pinehurst NDS summary” on the FT 1: Piper’s Creek website.)

*The proposed total project cost of the Pinehurst NDS was $4.6 million compared to the cost of a traditional system which was proposed at $8.8 million.*

**Part II Land-based Vegetation Mapping (9 points)**

Next we will meet with Nelson Salisbury from Earthcorps [formerly Seattle Urban Nature (SUN)], a non-profit consulting company, to discuss forest vegetation assessment in an area of the park. They are gathering details about different forest assemblages that were mapped during 1999–2000.The background of the previous mapping project is described at <http://www.seattleurbannature.org/Survey/survey.html> and). The existing online habitat maps can be seen at <http://www.seattleurbannature.org/Survey/ihm.html>.

The present effort by Earthcorps is a Citywide Habitat Assessment (CHA) together more information about each of the forest types defined by the previous mapping. This effort is described at <http://www.seattleurbannature.org/Projects/citywide.html>.

# (2.0 pts.) First we will talk about techniques for mapping forest types and assessing their characteristics.

## (0.5 pts.) What is the definition of a “mapping unit” for SUN’s purposes of mapping forest types?

**A defined size & shape of land area within which the forest is treated as a single “type”**

## (0.5 pts.) Does a forest types contain all one species of tree? If not, how can you more realistically define a forest type?

**Usually is not homogenous but contains characteristic definable proportions and associations among species & their characteristics**

## (0.5 pts.) What minimum size of “mapping unit” does SUN use for mapping forest types?

**0.5 acre, a square about 150 feet by 150 feet or 30 meters by 30 meters (1 acre = about 210 by 210 feet or 70 meters by 70 meters)**

## (0.5 pt.) What is the trade-off in choosing whether to establish smaller- or larger-sized mapping units when collecting and data for a vegetation map?

**Smaller-sized mapping units give a more accurate representation of the composition and distribution of vegetation but are very effort-intensive and may yield more information than is manageable. Larger-sized mapping units can be more efficient to survey but sacrifice detail and may give characterizations too broad to answer meaningful questions.**

# (2 pts.) Next we will look at a boundary between two forest types as defined by the 1999-2000 survey.

## (0.5 pts.) What two forest types are on either side of this boundary?

**Mixed conifer & deciduous**

## (0.5 pts.) What predominant tree species (common names) do you observe that distinguish these two forest types from each other?

**Conifer: Douglas fir, western hemlock, western red cedar**

**Deciduous: Red Alder, black cottonwood, bigleaf maple**

## (0.5 pts.) Using a measuring tape at this location, is it possible to define a standard-sized SUN “mapping unit” that contains only one forest type?

**Yes, there is a distinct conifer stand and a distinct deciduous stand, each if which is at least 30 by 30 meters**

## (0.5 pts.) Suppose you were using a square-shaped mapping unit in which each side of the square was five times longer than the side of a standard-sized SUN mapping unit. Visualizing such a larger mapping unit at this location, is it possible to define a unit that contains only one forest type?

**No, a 150 by 150 meter mapping unit at this location would contain both conifer and deciduous.**

# (2.5 pts.) For the Citywide Habitat Assessment, Earthcorps is gathering more detailed data about the forest types defined by the 1999-2000 mapping program.

## (0.5 pt.) Why did the SUN workers abandon the methodology that was used to generate the maps in 1999-2000?

**It was not scientific and repeatable; they estimated % cover, which is more subjective and has greater potential for disagreement and error than actually counting trees**

## (1.5 pts.) What are three types of data (besides tree species) that SUN is collecting within in each forest type to characterize that forest type more fully?

**% composition of overstory trees (number per unit area by species; % composition of regenerating layer; % cover of understory layer including shrubs, herbs & grasses, and invasive plants; “gaps”**

## (0.5 pts.) Why are the SUN workers using a 50m x 8m “linear belt” shape of transect rather than a square or circle transect?

**A linear belt should capture a wider range of the variability in species, density, and gaps than a circle or square of the same area**

# (2.5 pts.) One reason for categorizing and mapping the types of trees & other vegetation cover is for building a hydrology model (such as DHSVM, which we will look at later in the course). Different types of trees and vegetation assemblages have different effects on the passage of rainfall from the atmosphere into the ground and beyond.

## (1.5 pts.) What are three major processes by which vegetation cover affects water movement in the watershed (0.5 pts. each)?

**Interception & retention by the canopy; Interception & retention by the roots; evapotranspiration (DHSVM PRISM page lists 21 factors)**

## (1 pt.) What are two significant differences between the two major categories of trees that cause them to have different effects on water movement in the watershed (0.5 pts. each)?

**Deciduous trees lose leaves in winter; conifers tend to grow taller & larger diameter, so hold more water in their tissues; needles on conifers are transpiring all year; needles transpire less than leaves at their seasonal peak**

**Part III Piper’s Creek Salmon Run (5.5 Points)**

# (4.5 pts.) This is the beginning of the return of spawning salmon to Pipers Creek. But the Creek did not always look like this. (Refer to the WDFW Piper’s Creek page <http://wdfw.wa.gov/fish/chum/viewingchum_pipers.htm> linked on the Ocean 260 Piper’s Creek page.)

## (1.5 pts.) List three alterations that were made to the natural habitat in the Piper’s Creek watershed during the early 20th-Century.

**1893 railroad built across the creek; 1906 creek culverted under railroad; Logged off by 1921; (1929 became a park)**

## (0.5 pts.) How did these alterations affect the salmon of Pipers Creek?

**1927 last native salmon observed; 1929 last fish trap removed; they were eliminated**

## (0.5 pts.) When and how did today’s salmon population become resident in Pipers Creek?

**Beginning 1979, planting of chum eggs & fry from the Suquamish tribal hatchery**

## (0.5 pt.) Identify one way that the habitat and fish are being managed to sustain today’s resident salmon population in Pipers Creek?

**Public education about fish and water quality; halting fishing at mouth of creek during spawning season; holding fingerlings 3-4 days in the imprinting pond before release to enhance return of spawners**

## (1 pt.) List two enhancements that have been made to the creek and riparian zone to enhance the value of habitat for salmon in Pipers Creek?

**Added “weirs” to make the upstream grade more gradual; planted riparian vegetation; protected existing wetland; erosion & sedimentation control projects; restricted human access to & disturbance of the creek & spawners**

## (0.5 pts.) How many adult chum salmon typically now return to spawn naturally each year in Pipers Creek?

**About 100-600 spawners, depending on year**

# (1 pt.) If necessary, on your own after the field trip, refer to the “Piper's Creek 2008 annual report” (PDF), available on the FT 1: Piper’s Creek course website.

## (1 pt.) Two water quality properties are considered in very good condition in Piper’s creek because of the good habitat condition. What are they and what quality of each is considered “good?”

**Cool temperature (below 55–60˚F) and high dissolved oxygen**

**Part IV Computer Study of Piper’s Creek (2 Points)**

Ground-based surveys are feasible for mapping vegetation in small areas such as Piper’s Creek watershed. But they are much too laborious for producing the large-scale vegetation maps such as we used in our GIS (Google Earth Pro) labs. For these maps, remote sensing with airplanes and satellites is used.

In this methodology, sensors aboard airplanes or satellites detect multiple wavelengths (colors) of light emitted from the ground. Ground surveys identify areas that are representative of particular types of vegetation cover, and pinpoint the locations using GPS equipment. The wavelengths of light detected from those stands by the airborne instruments (the “optical signatures”) are used to standardize the large-scale aerial surveys. Computers then work through the task of categorizing the vegetation of all the area surveyed using these guidelines, and the resulting data can be displayed as “geo-referenced” maps using GIS software.

Land cover surveys depend on having a rational and useful way of classifying different types of vegetation (as well as urban & other non-vegetated categories). In the following questions, we simulate the work of a ground crew surveying for representative vegetation stands to be used for calibrating airborne surveys. For background info, see the Ocean 452 page (linked on Ocean 260 Field Trip page).

On your own, view the vegetation and habitat maps of Piper’s Creek and Carkeek Park on the SUN web site: <http://www.seattleurbannature.org/Survey/ihm.html>. Also on your own, study aerial views of Piper’s Creek using Google Earth and/or Google maps (click the satellite button in google maps).

# 1) (1 pt.) Find the location where we worked with Earthcorps while at Carkeek Park on both the SUN online maps and the aerial photos (i.e. Google Earth).

## (0.5 pts.) Comparing the forest type maps with the aerial photos, what visual differences can you see between the forest types that might be detectable by airborne optical instruments?

**The conifer stands are darker colored and more angular than the deciduous trees; deciduous trees are generally softer-shaped and lighter colored**

## (0.5 pts.) What is one potentially serious source of error in aerial or satellite surveys of the deciduous forest types in Carkeek Park? Hint: How would canopy appearance change seasonally?

**Their appearance will be very different in summer when the trees still have leaves than in winter when the leafless areas would have a very different color signature, that of the soil. Maybe the aerial surveys should be done in both seasons?**

# (1 pts.) Download and read the pdf “Note on Landsat Data” from the field trip website. This document gives the details on how the land use data layers that we viewed in Google Earth Pro were generated

# (0.5 pts.) What were the dimensions (resolution) of the grid cells that were used by the LANDSAT satellite **in photographing** the landscape for the “WA Land use / Land Cover 2002” data layer?

# **30 meters by 30 meters “,,,the land cover data were derived from 30-meter resolution LANDSAT Thematic Mapper (TM) and Landsat ETM+..”**

# (0.5 pts.) What are the dimensions of the grid cells that are used to **display the data** in the “WA Land use / Land Cover 2002” data layer? Hint: the resolution of the displayed data is different than the resolution of the data from which it is derived (above).

# **90 meters by 90 meters “…However the accuracy assessment of the land cover classification and change analysis was performed at the 90-m resolution. The accuracy should therefore be interpreted at the 90-m scale.” Actually, I think I still see a 30-meter grid size.**