Environmental Science

Essential Standard 5.00: Understand the environmental science industry (water, soils, wildlife and forestry).

Objective 5.01

- Remember careers in the environmental science industry.

Major career areas of Environmental Science

- Water resources
  - an essential nutrient for all plant and animal life
- Soil resources
  - the top layer of the Earth's surface, which is suitable for the growth of plant life

Major career areas of Environmental Science

- Wildlife
  - animals that are adapted to live in a natural environment without the help of humans
- Forestry
  - industry that grows, manages, and harvests trees for lumber, posts, panels, paper and many other commodities

Examples of careers in Environmental Science

- Soil conservationist – assists landowners in implementing best land use practices
- Soil scientist– classify soil according to the most appropriate use. Requires bachelor's degree (4 yr)
- Silviculturist– one who scientifically manages forests (specializing in the care of trees)
- Forestry consultant– advises private forest land owners.
- Loggers– one who harvests trees

Examples of careers in Environmental Science

- Urban Forester–
  - the one responsible for the health and well-being of our cities trees
- Wildlife biologist–
  - does research on habitat and wildlife and advises government agencies in establishing fish/game laws and habitat improvement programs. Requires minimum of bachelor's degree (4 yr)
- Wildlife manager –
  - often work in government agencies , advising land owners and managing game populations on public lands
- Wildlife officer/Game warden–
  - works for the agency (North Carolina Wildlife Commission) responsible for controlling the harvest of wildlife

Examples of careers in Environmental Science

- Soil technician – uses soil auger/soil tube to take soil samples and do technical field work
- Wildlife technician – works in the field tagging animals, gathering data and assisting with research
- Ecologists – studies the effects of the environment on animal life

Examples of careers in Environmental Science

- Forester –
  - provides assistance in managing forests for the private landowner as well as the commercial grower
- Timber Cruiser –
  - are hired by private landowners and companies to estimate tree volume on a tract of land
- Logging foreman –
  - is responsible for overseeing and managing logging operations
- Skidder operators –
  - move felled trees form the cutting site to the loading area

Objective 5.02

- Understand biotechnology in the environmental science industry.

Environmental Biotechnology

- Biotechnology is playing a large part in detecting and monitoring pollution and determining how much is present

Environmental Biotechnology Examples

- Indicator species
  - Lichens are widely used as environmental indicators or bio-indicators
  - If air is very badly polluted with sulfur dioxide, there may be no lichens present, just green algae may be found

Environmental Biotechnology Examples

- Bioremediation
  - Bacteria is used to clean up oil and fuel spills
    - Oleophilic (attracted to oil) bacteria used to clean up oil spills
    - Hanahan, SC, a suburb of Charleston, had an 80,000 gallon jet fuel leak from a military fuel storage facility
      - fuel entered the ground and the groundwater
      - Bacteria were successfully used to remediate this problem

Environmental Biotechnology Examples

- Biostimulation
  - The Exxon Valdez clean-up
    - Used the addition of nutrients
      - Feed the oleophilic bacteria

Environmental Biotechnology Examples

- Biodiesel
  - made from oilseeds
    - Soybean
    - canola oil
  - proven to decrease harmful emissions

Environmental Biotechnology Examples

- Phytoremediation
  - Oregon Poplar Site (illegal industrial waste dumping site)
  - J-Field at Aberdeen Proving Ground(disposal site of chemical warfare agents, munitions and industrial chemicals)
    - used hybrid poplar trees
    - remove VOC's
      - volatile organic compounds from contaminated soil

Environmental Biotechnology Examples

- Genetic engineering
  - bacterial strains are under development to convert solid waste from humans and livestock into sugar and fuel

Limitations of using bio and phytoremediation

- Time
  - often considered slower than chemical techniques
- Applicability
  - they do not apply to all situations
- Fear
  - those who live near treatment sites often would rather have the contaminated soil removed than treated
    - Fear that the process will not uncontaminate the soil

Objective 5.03

- Understand basic environmental science principles and practices.

Water Resources

- Potable Water
  - Drinkable-free from harmful chemicals and organisms
  - Most of the Earth's water is not fresh water
- Universal solvent
  - it dissolves or otherwise changes most other materials

Water Resources

- Water Cycle
  - cycling of water between water sources, atmosphere, and surface areas
    - Precipitation – moisture from rain or snow
    - Evaporation – changing from a liquid to a gas
- Watershed
  - large area in which water is absorbed from rain or melting snow and from which water drains
    - acts as a storage system
      - absorbs excess water and releasing it slowly throughout the year
- Water Table
  - level below which soil is saturated with water

Water Resources

- Types of Groundwater
  - Capillary
    - water that plant roots can absorb
  - Free (gravitational)
    - water that drains out of a soil after it has been wetted
  - Hygroscopic
    - water that is held too tightly for plant roots to absorb

Water Resources

- Conserving Water and Improving Water Quality
  - Ask the right questions
    - How can we reduce water pollution?
    - How can soil erosion be reduced?

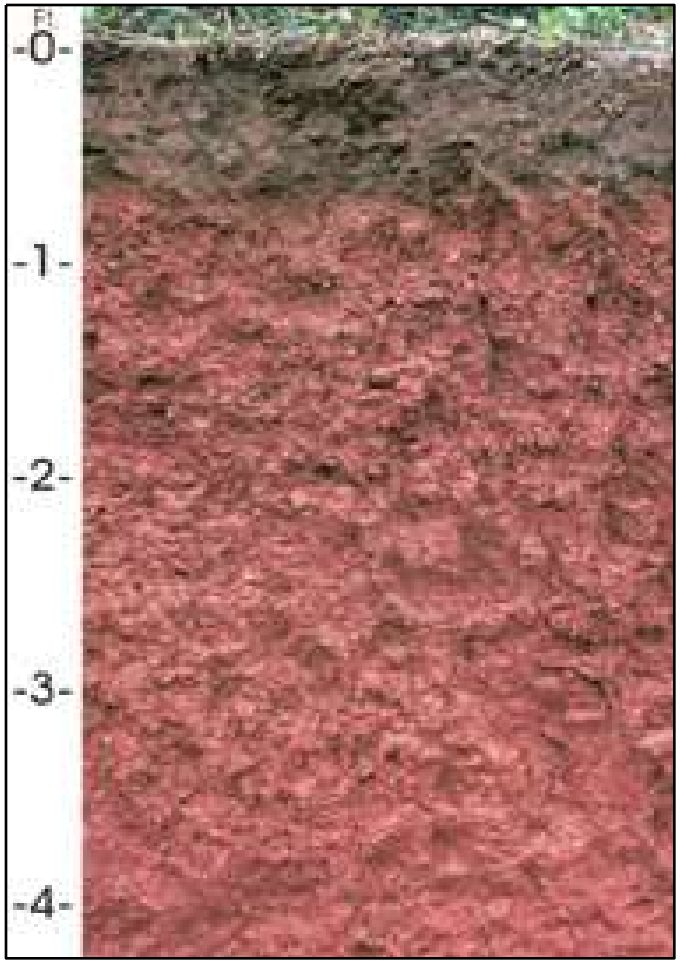
Water Resources

- What is the most productive use of water and soil without polluting or losing these essential resources?
  - Good practices:
    - Save clean water
      - turn off water faucet while brushing teeth
    - Dispose of household products carefully and appropriately.
      - never pour paint down the drain as it will eventually enter the water supply
    - Care for lawns, gardens and farmland carefully
      - only till soil that will not erode excessively and don't over fertilize

Soil

- Soil Profile
  - A Horizon- topsoil
    - Surface layer of soil approximately 6” deep.
    - Organic matter
      - typically darker color
    - Greatest influence on crops
  - B Horizon – subsoil
    - Subsurface layer
    - Increase in clay content
    - Greatest influence on urban uses (building sites, septic systems, etc.)
  - C Horizon – parent material (bedrock)
    - Releases water to the upper soil layers
    - Contains larger soil particles

Soil Profile



Soil Texture

- Refers to the size of soil particles
  - Sand
    - Largest soil particle
      - Problems holding enough water for good plant growth
      - Individual particles can be seen with the naked eye
    - Drain well
  - Silt
    - Intermediate size soil particle
    - Can't be seen with naked eye
  - Clay
    - smallest soil particle
    - holds lots of water
    - may be airtight, infertile for root growth, and associated with wet soils

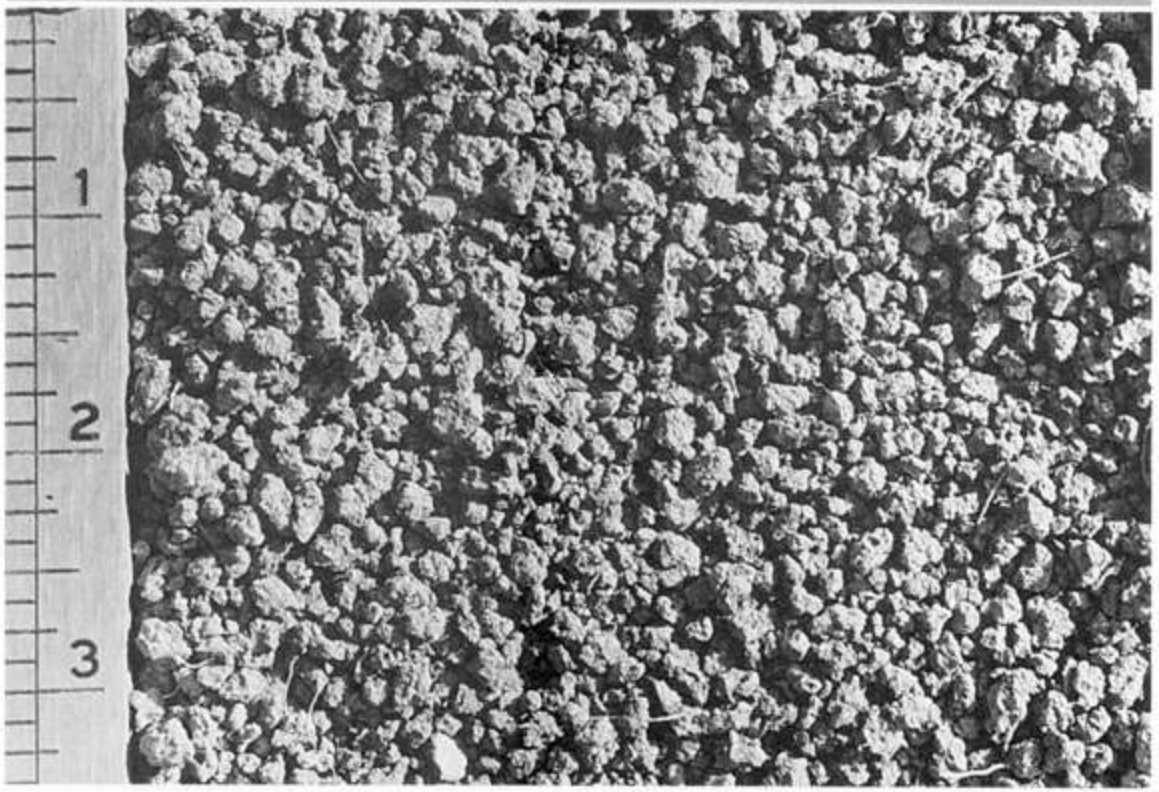
Soil Structure

- Refers to the tendency of soil particles to cluster together
  - Single grain
    - sandy soils
  - Granular
    - particles cling together to form rounded aggregates
    - very desirable for all soil uses
  - Blocky
    - particles cling together in angular aggregates
    - typical of soils with high clay content

Blocky Structure

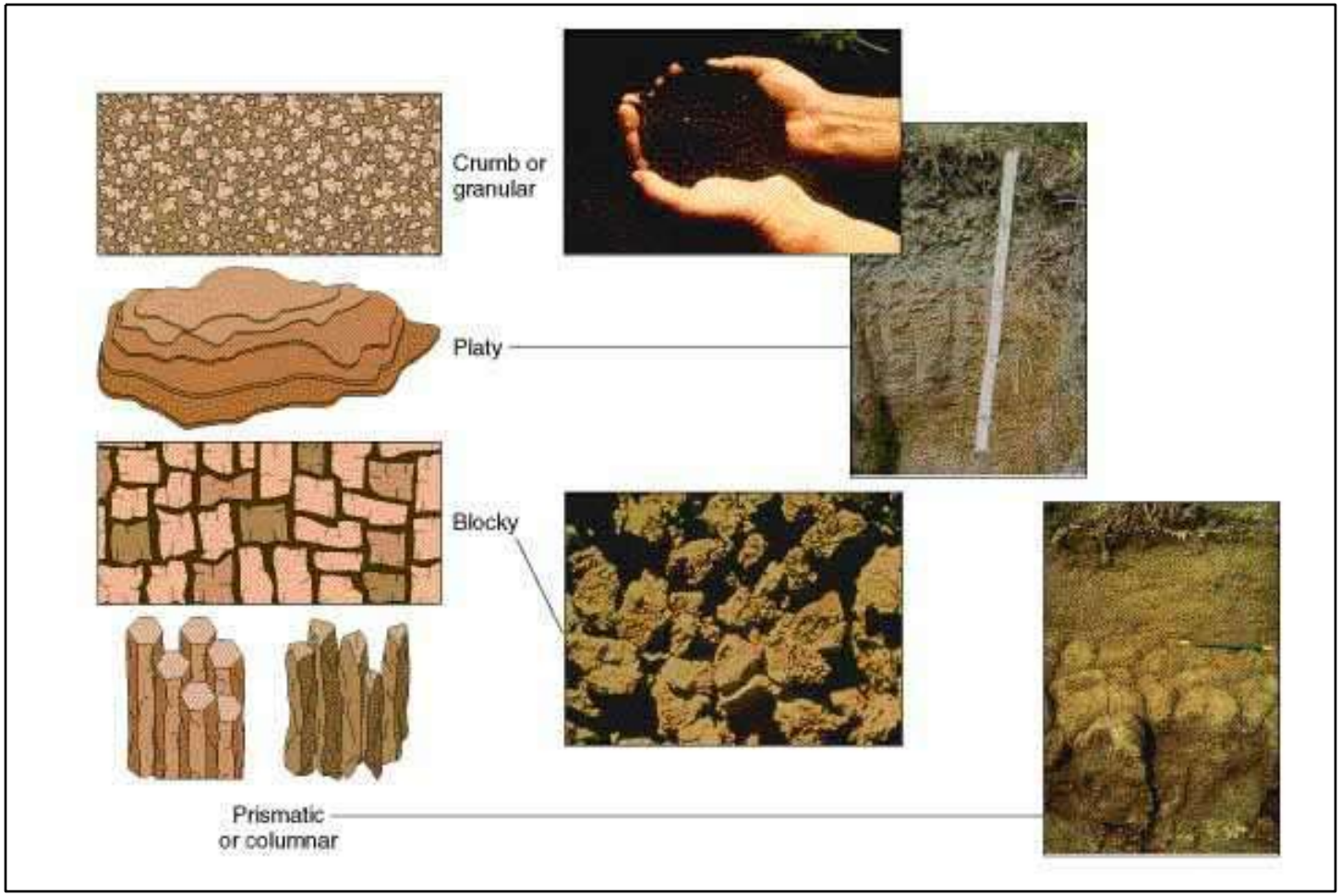
Granular

FIGURE 3-30



Strong fine and medium granular peds.

Structure



Soil Classification

- Land capability maps are based on the physical, chemical, and topographical aspects of the land
- Land Capability classes are designated by Roman Numerals I – VIII.
  - Class I and II land
    - best land for the most intensive cultivation of field crops
    - fewest limitations and can be planted year after year
- Class VII
  - very steeply sloping
  - best used for planting trees
- 3) Class VIII
  - land is best suited for wildlife and recreation

Soil Conservation

- Two types of erosion
  - Sheet – removal of layers of soil from the land.
  - Gully – removal of soil that leaves trenches.
- "No till"
  - Crops are planted directly into the residue of a previous crop
  - An effective means of erosion control
- Conventional Tillage
  - disturbs the soil surface by plowing
- Conservation Tillage
  - intermediate tillage system conventional and no-till

Sheet Erosion

Soil accumulated along fencelines could be an indicator

Gully Erosion

Severe gully erosion.

Gully Erosion

Wildlife Management

- Benefits of Wildlife
  - Hunting/Fishing
  - Viewing
  - Photography
  - Environmental Indicator

Wildlife Environments

- Farm
  - By-product of the farming operation
    - Leaving crop residue standing can increase food supply
    - Creating brush piles when harvesting trees provides shelter and cover
- Forest
  - Difficult to manage
  - Plans should be developed so that timber and wildlife can exist in populations large enough to be sustained and harvested
- Wetland
  - Wetlands are the most productive wildlife management area

Wildlife Environments

- Stream
  - difficult to manage due to continuous flow of water
- Ponds/Lakes
  - easier to manage than streams due to water standing and not flowing
- Backyards (urban wildlife)
  - birds, butterflies and small mammals can be attracted through use of feeders, houses and proper landscaping

Carrying Capacity

- Number of wildlife that can be supported
- Exceeding the carrying capacity:
  - Wildlife is affected by malnutrition, disease, and a reduction in the reproduction cycle
  - Habitat quality decreases
    - A pond with a carrying capacity of 20 fish will decrease if 50 fish are competing for the same food, habitat and oxygen

Deer Overpopulation

Browse Line in Texas

Hunting and Fishing

- Helps to maintain the proper carrying capacity
- Prevents:
  - overpopulation
  - malnutrition
  - disease
  - reduction in reproduction
  - decreased wildlife population

Examples of Wildlife in North Carolina

- Hunted Species
  - deer, ducks, bear, quail, doves, rabbits
- Songbirds
  - Cardinal, robin, chickadee, Eastern bluebird
- Birds of prey
  - Red- tailed hawk, Turkey and black vulture
- Fish (freshwater)
  - largemouth and smallmouth bass, bream, catfish, crappie

Forest Management

- Northern coniferous forest
  - largest region and produces large amounts of pulpwood
- Pacific Coast Forest
  - most productive of the forest regions
  - some of the largest trees in the world
  - Douglas Fir
    - one of the most important commercially grown trees

Forest Management

- Southern forests
  - Most potential for meeting the future lumber and pulpwood needs of the US
    - Conifers
      - Virginia, loblolly, shortleaf, longleaf and slash pines
    - Hardwoods
      - Oak, poplar, maple and walnut

Importance of Forests

- Recreation
  - hunting, hiking
- Wood products
  - lumber, pulpwood, etc.
- Wildlife habitat
- Filter
  - water and air

Silviculture

- Scientific forest management techniques
- Managing growing timber
  - Prescribed thinning
    - remove some trees when competition slows the growth of all trees
  - Prescribed burning
    - reduce the risk of wildfires
    - eliminates forest litter (fuel)

Silviculture

- Harvesting Timber
  - Clear cutting
    - system of harvesting trees where all of the trees in an area are removed
  - Selection cutting
    - recommended for a forest of trees consisting of different ages and species
- Replacing trees
  - Replanting seedlings is a surer method of replacing trees
  - Natural seeding
    - least expensive

Identification and Uses of Important Tree Species in NC

- Conifers (softwoods) – needle-type evergreens
  - Frazier fir
    - Most important commercially grown Christmas Tree in NC (mountains)
    - dark green ½-1" long singular needle
  - Loblolly pine
    - pulpwood and plywood
    - 3 needles/bundle, needles 6-9" long needles.
  - Longleaf pine
    - lumber, pulpwood and plywood
  - 3 needles/bundle, 8-18" long needles

Coniferous

Identification and Uses of Important Tree Species in NC

- Hardwoods – deciduous trees
  - Ash
    - baseball bats, handles
    - opposite pinnately compound leaves
  - White oak
    - flooring, furniture
    - alternate, pinnately lobed leaves,
  - Red Maple
    - lumber, veneer, cabinets
    - opposite, palmately lobed,3-5 lobed

Deciduous

Measurement of Trees and Lumber

- Pulpwood
  - DBH, merchantable height in feet, cords
- Sawtimber
  - DBH, 16 foot logs, board feet
- Lumber
  - 1 board foot = 144 cubic inches

Objective 5.04

- Remember tools and their safety practices related to the environmental science industry.

Examples of tools used in Environmental Science

- Bush axe
  - Cutting bushes and under growth

Examples of tools used in Environmental Science

- Chain saw file
  - Sharpening chain saw chain

Examples of tools used in Environmental Science

- Half hatchet
  - Cutting and fitting firewood

Examples of tools used in Environmental Science

- Increment borer
  - Checking growth rate of trees

Examples of tools used in Environmental Science

- Planting bar
  - Setting out tree seedlings

Examples of tools used in Environmental Science

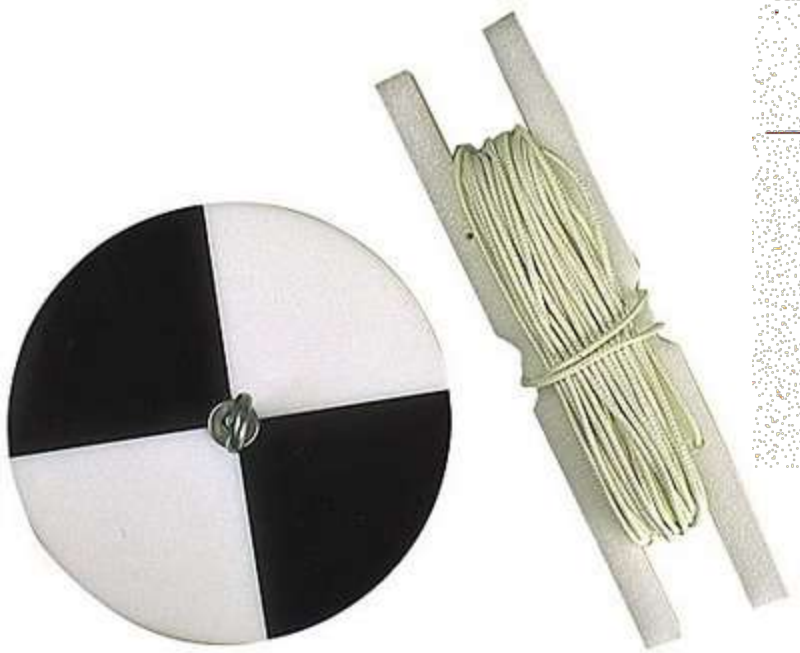
- Soil auger
  - Boring into soil to get samples

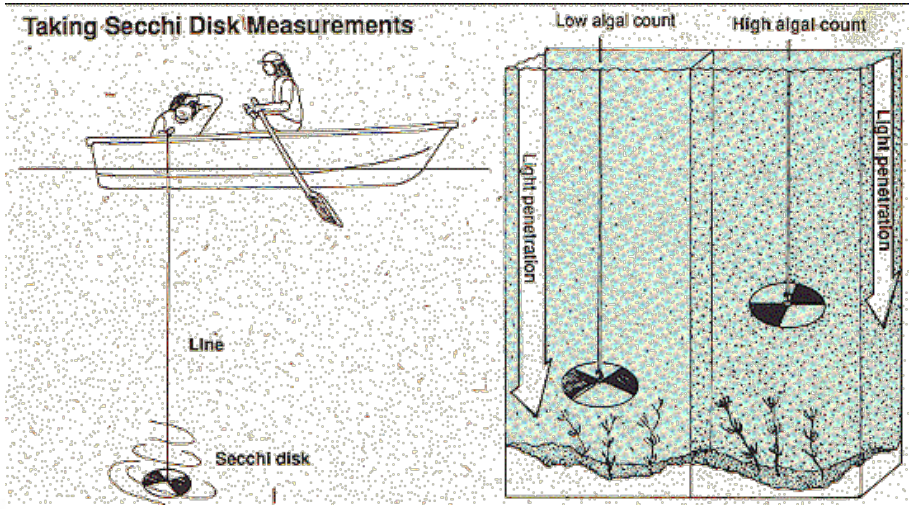
Examples of tools used in Environmental Science

- Tree diameter tape
  - Measure circumference of trees

Examples of tools used in Environmental Science

- Secchi disc
  - measures turbidity of water





Examples of tools used in Environmental Science

- Clinometer
  - used to measure the height of a tree

Examples of tools used in Environmental Science

- Tree scale stick
  used to measure tree diameter and height