

EWCE 131
Ecology and Environmental Pollution

Lecture 8

Instructor

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Lecture outline

Environmental parameters, measurement and impacts on ecology

- **Atmospheric/ meteorological parameters –**
- **wind,**
- **rainfall,**
- **Temperature,**
- **relative humidity,**

Environmental Parameters

- Environmental parameters influence the distribution, abundance and activity of animals and plants.

- Local meteorological conditions such as air temperature, rainfall or sunlight may affect the behavior of terrestrial organisms, and

- Water parameters, such as - water current, dissolved oxygen, suspended material and river bed topography may influence aquatic species.

Importance of Measuring Environmental Parameters

- Measurement of environmental parameters is an integral part of any study design targeted to observe change in species, populations, activities or function as an outcome of introduction of any chemicals, like fertilizer, pesticides etc.

- Example: **Use of Pesticides**

  ✓ Pesticides behave differently under varying environmental conditions

  ✓ Information about soil type, soil moisture, the pH of water and the type of sediment are also instructive in pesticide impact assessment.

Importance of Measuring Environmental Parameters

✓ The bioavailability of an insecticide is an expression of likely exposure of an organism to the toxin.

✓ Soil moisture and pH can greatly modify the degradation rate of pesticides and, therefore, their persistence and bioavailability in the environment.

Meteorological Parameters - **Wind**

Significance of Measuring

- Wind speed and direction provide useful information for –
  - ✓ predicting the heading of migratory pests,
  - ✓ the distance and direction of travel of insecticide droplets, and
  - ✓ the evaporation rates and residence times of pesticide residues on surfaces, etc.

- Wind speed and direction are best measured semi-continuously, and especially for large scale pesticide application monitoring.

Meteorological Parameters - **Wind**

Significance of Measuring

- Significant for detecting wind in industrial field.

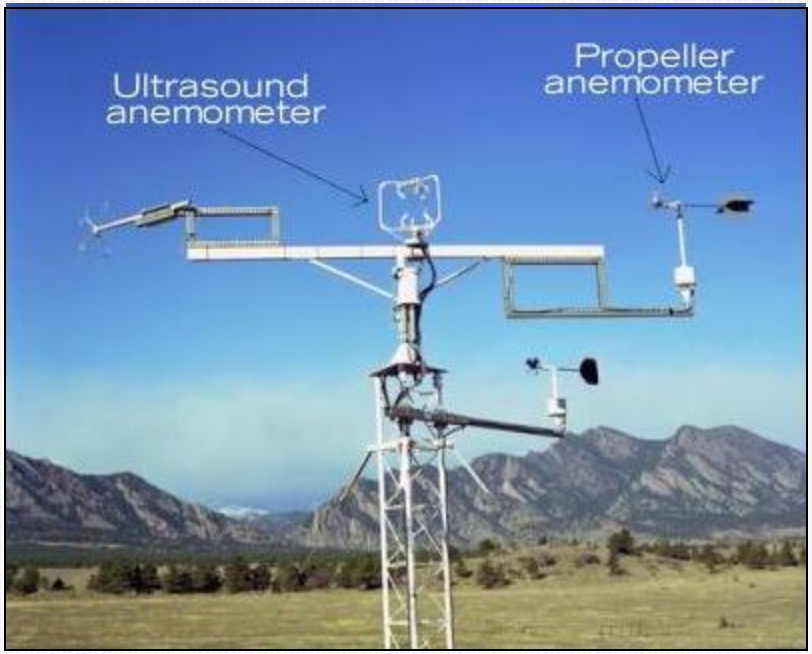
- Also for environment monitoring and controlling systems, air conditioning systems.

Meteorological Parameters - **Wind**

Equipment:

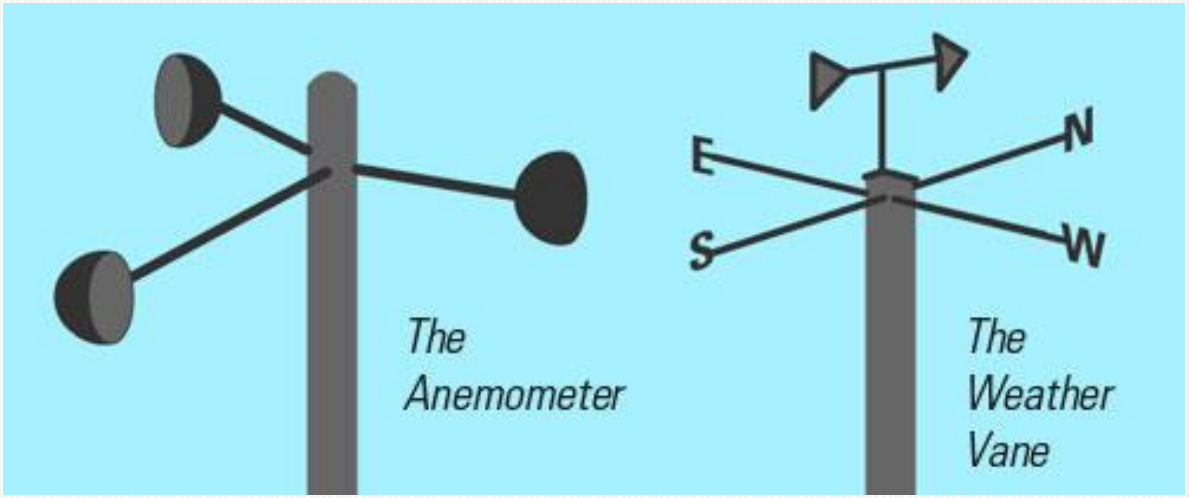
- Anemometer or wind gauge
- Data logger
- Compass and wind vane





Meteorological Parameters - **Wind**

- Equipment:





Meteorological Parameters - **Wind**

- Resulting data:

✓ Speed in m s^{-1}.

✓ Data can be represented in tabular or graphic form.

- Sampling period:

✓ Collect data over the entire monitoring period.

✓ Electronic data loggers can be set to record every 20 min.

✓ Manual intervals (wind gauge) should be used twice a day at the same time of day.

Meteorological Parameters

Rainfall

- Rain gauges of various designs provide data that are fundamental for the interpretation and comparison of biological and chemical information.

- Rain determines –
  - ✓ the growth of vegetation,
  - ✓ soil microbial activity,
  - ✓ the presence and behavior of non-target organisms,
  - ✓ pesticide dissipation, movement and degradation.

Meteorological Parameters - **Rainfall**

Significance of Measuring

- Agriculture – what to plant in certain areas, where and when to plant, when to harvest
- Horticulture/viticulture - how and when to irrigate
- Engineers - to design structures for runoff control i.e. storm-water drains, bridges etc.
- Scientists - hydrological modelling of catchments

Meteorological Parameters - **Rainfall**

- Equipment:

✓ Instrument used to collect and measure the precipitation is called rain gauge

✓ The location at which rain gauge is located is called gauging station.

Meteorological Parameters - **Rainfall**

- Equipment:

(a) Non-recording (Manual) types





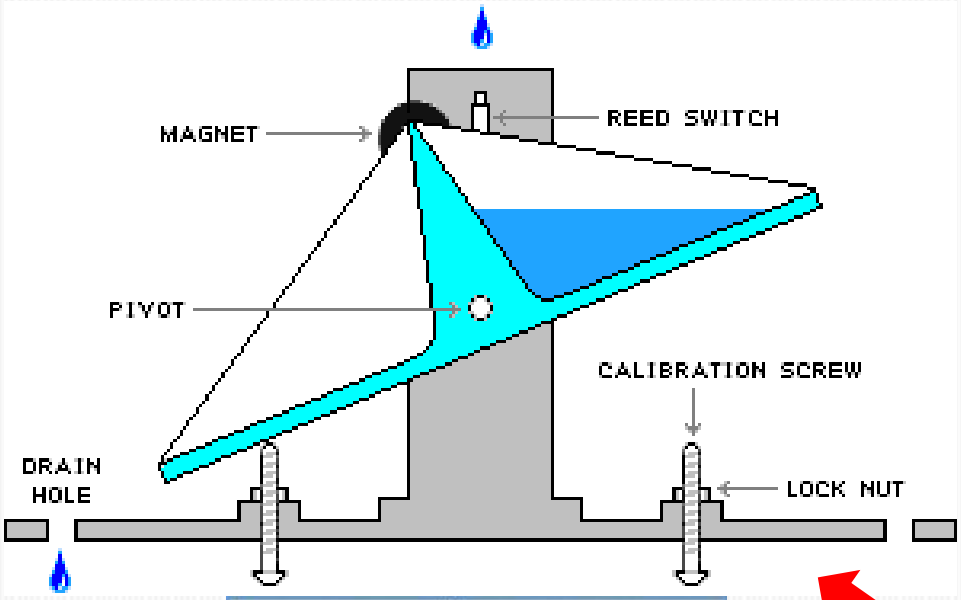


- Graduated Cylinder Gauge

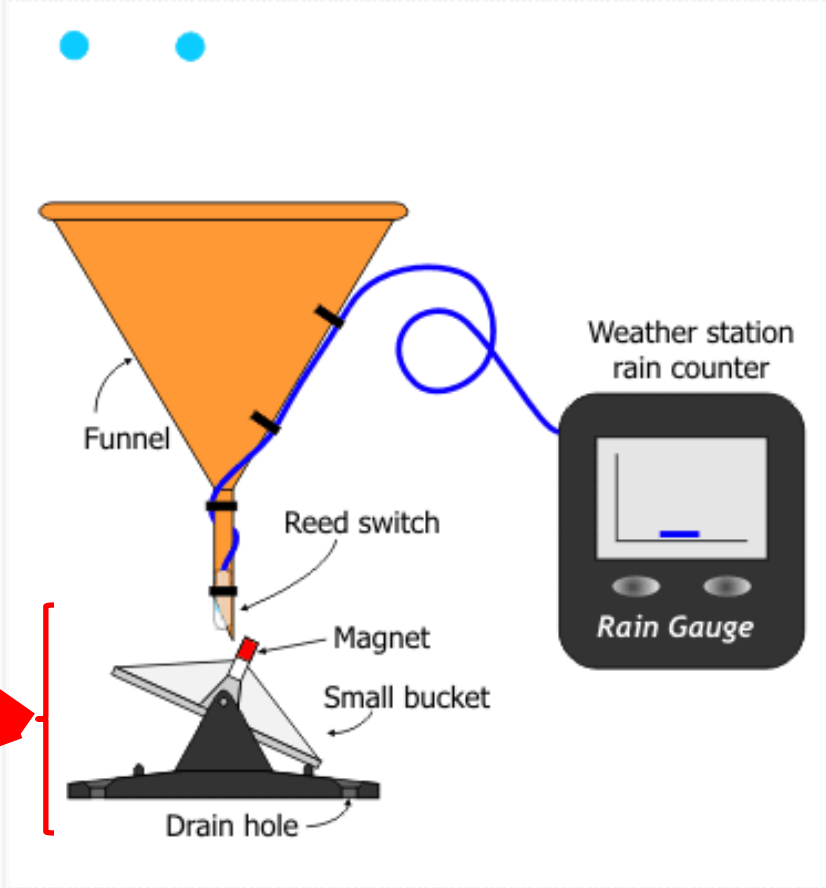
Meteorological Parameters - **Rainfall**

- Equipment:

(b) Recording (Automatic) types







Tipping Bucket Rain Gauge

Meteorological Parameters - **Rainfall**

- Measurement Units:

(a) Amount of precipitation/rain (mm or inch)

✓It is measure as total depth of rainfall over an area in one day.

(b) Intensity of precipitation/rain (mm/hr or inch/hr)

✓ It is the amount of precipitation at a place per unit time (rain rate).

✓ It is expressed as mm/hr or inch/hr

Meteorological Parameters - **Rainfall**

- Resulting data:

✓ Millimetres of rain per day/month, etc., that is best represented as a histogram with time on the x axis.

- Sampling period:

✓ Collect data over the entire monitoring period. Check and empty gauges daily (as necessary).

Meteorological Parameters

Temperature

- The temperature of air, water and soil is highly significant in terms of the distribution, behavior and activity of biota and pesticides.

- Higher temperatures generally increase animal activity and this has implications for activity based trapping techniques (e.g. pitfall traps) and the risk of contact with airborne droplets and surface deposits of

Meteorological Parameters - **Temperature**

- Temperature inversions (temperature increase with altitude) at dusk and dawn affect the behavior (dispersion) of emission dispersion from brick fields.

- Ambient temperatures affect significantly the toxicity of pesticides to most organisms – higher temperatures more commonly increasing toxicity, but lower temperatures increasing the toxicity of many pyrethroids.

- Pesticide degradation rates and persistence are markedly affected by temperature.

Meteorological Parameters - **Temperature**

Measuring Equipment:

- Thermometers, maximum–minimum thermometers or electronic devices employing thermistors.





Meteorological Parameters - **Temperature**

Measuring Equipment:

- Mercury in glass thermometers provide an accurate way of measuring air, water and soil temperatures.

- Maximum-minimum thermometers are particularly useful for ecological impact assessment as they are cheap, robust tools that are easily reset for daily recording.

- Hand-held, electronic temperature sensors are also good but expensive and require long-life batteries.

Meteorological Parameters - **Temperature**

- Resulting data:

✓ ^{o}C.

✓ Line graphs (x axis for time) or tables as appropriate.

- Sampling period:

✓ Collect data over the entire monitoring period – setting data loggers to record every 20 min.

✓ Manual readings should be taken at dawn, midday and dusk.

Meteorological Parameters

Relative Humidity – Significance of Measurement

- The speed with which many biota dehydrate is related to the humidity or moisture content of the surrounding air.

- They lose water very quickly by evaporation through the skin and cuticle when the humidity is low.

- Evapotranspiration process is aggravated by high ambient temperature and wind speeds.

Meteorological Parameters – **Relative Humidity**

Relative Humidity – Significance of Measurement

- Many species are inactive in dry conditions.
- Small amounts of shade or cover can significantly affect the degree of animal activity, especially above ground.
- Local conditions influence soil moisture and microbial activity.

Meteorological Parameters – **Relative Humidity**

Measuring Equipment:

- The best instrument with which to measure humidity is the whirling hygrometer as it is fast, accurate and cheaper than electronic humidity probes.





Electronic Temperature-Humidity probes



Digital Thermo-Hygrometer

Meteorological Parameters – **Relative Humidity**

Measuring Principle by Hygrometer:

- The measurement is based on the differential between two thermometers, one of which has a mercury bulb that is kept wet by a wick in a water reservoir, the other not.

- When the hygrometer is spun around in air (like a football rattle), the water in the wick evaporates as a function of humidity and cools the bulb.

- The lower the humidity the greater the cooling and the difference in bulb temperature of the two thermometers is used to calculate the relative humidity.

Meteorological Parameters – **Relative Humidity**

Measuring Principle by Hygrometer:

- Hygrometers measure the amount of water vapor in the air.

Humidity = P/ S

Where,

P = the amount of water in the air (gm)

S = the amount of water that would saturate the air (gm)

- High Humidity Indicates warmer temperatures
- Low Humidity Indicates cooler temperatures.

Meteorological Parameters – **Relative Humidity**

- Resulting data:

✓ Percentage relative humidity plotted against time or as a radial plot for a spatial representation.

- Sampling period:

✓ Take a reading at the same time of day throughout the monitoring period.

✓ Set a data logger to record relative humidity every hour.