**3.4 SCRIPT Monitoring an environment’s abiotic factors**

Abiotic factors ("a" meaning without and “bios” meaning life) are the lifeless elements of an environment. They include physicochemical factors, and in this case, they are climatic (rainfall, temperature, humidity, wind, light), edaphic (the soil’s texture, structure, pH) and hydrological (water physicochemical properties, flow, siltation, levels…) elements impacting the environment’s living beings. Abiotic factors are therefore potentially key ecological attributes assessing the health condition of certain habitats.

For instance, general climatic factors, especially those related to rainfall, to the wind, to temperatures and to the relative humidity, highly influence plant phenology (periods of flowering, fruiting and of plant species leaf renewal). They also influence fruiting and seedling germination.

Monitoring these factors consists in implementing an observation system on the field, that involves a synchronic observation approach - in other words, comparing the state of the environment to a defined moment in time within and between territories-, as well as a diachronic approach, meaning the long-term comparison over time.

In practice, the heterogeneity of the ecosystem usually requires a representative sampling approach. Thus, start by considering some of the following questions:

* What are the variables and indicators for change to monitor?
* What is the minimum amount of data needed to detect such changes?
* How to account for the data collection process (proper data sheet)? Etc.

Then, depending on the factors, three lines of approach in monitoring abiotic factors can be identified:

* Focus 1: weather monitoring that accounts for climatic factors
* Focus 2: hydrological monitoring that accounts for hydrological factors
* Focus 3: pedological monitoring that accounts for edaphic factors
* ***Weather monitoring***

Weather monitoring focuses on the measurements of rainfall, daily temperatures (maximal and minimal), air humidity (hygrometric content), wind strength and light.In fact, indices of rainfall, temperature, wind strength and light intensity are monitoring indicators that ought to be tested and validated. Climatic data measurement should be carried out daily, and always take place at the same time of the day or night (meteorologists have chosen: midnight, 6am, noon and 6pm GMT).

* ***Hydrological monitoring***

Within a PA, this type of monitoring essentially targets surface waters. This focus of ecological monitoring is particularly useful when it comes to managing PAs in arid and semi-arid regions where water is a limiting factor. The most important variables in hydrological monitoring are the quantity of water in stock (flood, baseflow, evaporation, infiltration etc. of water bodies), water quality (physicochemical), water flow, and waterbody siltation.

Water levels, temperatures, pH, oxygen, conductivity, turbidity, height of solid deposits, and flow velocity (rate of flows entering and leaving the ponds), are PA waterbody indicators that have been tested and approved.

The periodicity of hydrological measures is usually seasonal, but monthly controls of water levels should be considered in dry and semi-humid zones (savannahs), especially in dry periods. The data collected helps to elaborate weekly hydrological reports in periods of flooding, and monthly ones in low-water periods.

* ***Monitoring edaphic factors (pedological monitoring)***

Under natural conditions, the soil (edaphic) does not vary significantly in one place from a year to another.

* Soil monitoring especially targets typological variables (type of soil) and the degradation of soils (by desertification, erosion, pollution etc.). In practice, pedological monitoring also considers the use of lands. Above all, indicators consider the ratio of lands affected by a phenomenon (desertification, pollution, soil salinity etc).

The data are collected through pedological studies (observation of the field, physicochemical analyses, description of soil profiles), socio-economic studies, remote detection, cartography etc. The periodicity of data collection for pedological monitoring purposes depends on the problematic. Synchronic and diachronic data series should help validating indicators of change. The idea is to proceed to comparative analyses between indicators to understand the shifting trends observed, especially related to living beings in the ecosystem.