Transcript of the Video
Magda Bou Dagher Kharrat

To study biodiversity, we must consider its different levels:

Species-level = species diversity

Ecosystem level = landscape diversity

Intraspecific level = genetic diversity

When asked to characterize biodiversity, we generally limit ourselves to species diversity. However, it is recommended to consider the other two levels.

In this MOOC, we will address only the species level.

For species diversity, it is necessary to consider animal, plant, and fungal species and microorganisms and other forms of life called "protists."

These inventories are not just a list of species but rather contribute to an understanding of the functioning of the ecosystem. Thus, these studies will clarify the potentialities of the site to be studied, its weaknesses, the issues, and the constraints to be tackled.

Ideally, the entire ecosystem should be systematically inventoried. As part of the "One cubic foot" project, a photographer systematically photographed every living organism he found in this volume; he carried out this exercise on land and in the sea. The results would not be precisely the same if he had examined the integrality of the site. This approach is not feasible on a large scale since it is time and resources consuming.

For this reason, we carry out a sampling in a representative area of our site, and we will then extrapolate the results to a larger area.

This representative area can be a "Quadrat," which is a rectangular surface whose size depends on the nature of the ecosystem:

- 1x1 in a bog
- 5 x5 in a meadow
- 100 x 100 m in a forest.

Several quadrats are defined when the site is heterogeneous. The location of the quadrats must be studied scrupulously to represent all types of habitats.

One could also draw transects and assess the biodiversity along these transects. The choice of the transect location must also cover the maximum number of habitats in the site to be studied.

The quadrat technique is used in terrestrial, aquatic, or underwater environments. It is adopted for fixed or low-mobility species.

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To inventory species and draw up an inventory of biodiversity, it is necessary to tackle all groups of organisms and find the optimal means of effort and resources to be spent to list the site's biodiversity.

Naturalists competed in imagination and creativity to adapt sampling techniques appropriate to their group of interest.

Mammals inventory: they should be observed with the naked eye or binoculars. There are other means of observation for fearful or stealthy animals. It will be necessary to install camera traps.

Alongside these traps, researchers tend to set traps or decoys. For example, to attract big cats, perfumes like Chanel Number 5 or Obsession by CK have proven their effectiveness in attracting big cats.

Other means also exist, such as non-invasive traps, which allow animals to be trapped temporarily to study them before releasing them.

I cite other techniques such as ultrasonic detection for bats.

Traces left by animals can also constitute indirect evidence of their passage: droppings, hair, paw prints, etc.

Animal droppings, for example, have proven to be a great source of information; sometimes, scat shape could be sufficient to identify the animal that dropped it: rabbit droppings are ball-shaped, while wombats ones are cubic ….

Apart from the shape that can tell us about the animal's identity, droppings contain much more information. Animals' diets can be revealed through the analysis of their scats. The technique of DNA metabarcoding, which simultaneously sequences several DNA fragments and compares them to a database, allows us to know what the animal has consumed, such as leaves or roots or other parts of plants that are not detectable like seeds visual analysis.

For birds, ornithologists have their tools. There is, of course, observation using binoculars, but the most popular technique today relies on the bird-song recording. And in this regard, today's technologies have revolutionized this field since they allow uninitiated amateurs to identify the birds encountered from their song. Indeed, it is possible to record the sound of a bird and use specific applications available on smartphones, for example, compare the soundtrack to the database and identify the bird.

Techniques for tracking traces such as feathers or nests or eggs… Examination of droppings is also possible.

This is especially interesting in owls, where whole rodent skeletons can be found in the scats.

Japanese mist net for catching birds is used when seeing the bird is necessary for studies and for ringing them. Ringing makes it possible to monitor a large number of birds individually and to collect a lot of information (sex, age, biometrics, etc.). This collected data improves the bird's life, behavior, and survival rates.

GPS tags are used for migrating birds. This allows you to know the dates and routes of migration and the location of rest areas.

To study reptiles, herpetologists have techniques and tools specific to them: long cuffs, thick gloves... because the bites of some reptiles can be dangerous.

Since reptiles are cold-blooded animals, they often seek warmth. Traps such as tunnels or artificial shelters that trap heat catch reptiles and identify them.

Identifying reptile exuviae can also reveal the identity of the reptile. Examination of the DNA extracted from it allows precise identification of the species.

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Observation of amphibians can be done with or without capture. This observation can be done during the day or night, a privileged time for certain species to move. Singing detection: Singing (croaking) can reveal the identity of frogs.

We choose listening points to cover potential areas of species presence. The songs are diurnal and nocturnal. Visual detection in water or on the ground: The use of a high-power lamp makes it possible to detect amphibians present in the breeding sites at night. We gently walk around the perimeter of the aquatic sites, observing the borders and water areas. Searching for eggs and clutches (some species have very typical egg-laying techniques) can also reveal the species present.

To capture amphibians, the use of artificial caches is employed. This propensity to use shelters can be taken advantage of by placing plates (wood, sheets, squares of carpet) near the egg-laying sites.

These techniques make it possible to assess the biodiversity of aquatic environments, but what has revolutionized the field of study of aquatic biodiversity is the discovery of eDNA or environmental DNA. The DNA can be recovered after water filtration extracted from an aquatic environment. The analysis of this DNA reveals the identity of the lake inhabitants who, by their mere presence, leave cells, excretions, etc.

Arthropods: This group forms more than 52% of our planet's biodiversity. There is enormous variability in the life forms of this group. The techniques for studying insects are just as diverse.

Active methods require dislodging insects from their environment using threshing, mowing, or debarking techniques. Then a visual identification specimen by specimen is carried out.

In the aquatic environment, cloudy-water nets are used, such as the Suber net, to recover animals dislodged from their habitats.

Some of these animals are indicators of water quality.

As for the passive techniques, they are also very numerous:

Light traps consist of placing a light source rich in UV or a lighted white sheet in the middle of the biotope whose insects you are trying to study. This phenomenon of attracting insects to lights is well known to entomologists worldwide. We can even observe it with our insects in town around public lighting or a lamp on our terraces in summer evenings.

The Barber Trap, invented in 1931 by the American entomologist Herbert Spencer Barber, makes it possible to capture organisms moving on the surface of the ground. It consists of the insertion in the ground of a container filled with a liquid (vinegar or alcohol) in which the insects drown by falling into it.

René Malaise a Swedish entomologist invented the device that bears his name. It is a tent with a white roof which makes it possible to converge the insects which enter it, in particular Diptera and Hymenoptera, towards a bottle filled with alcohol which will keep them for later studies.

To study the arthropods of the soil, it is the Berlèse device that will have to be used. A fraction of the soil (litter plus the height of a shovel) is taken and then placed in a device lit brightly from above (wide-mesh sieve above a funnel), causing the arthropods to escape from below into the pot collector containing a preservative liquid (alcohol).

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"Splatometer" is an unusual technique that relies on the evaluation of the diversity and abundance of insects killed on the windshields and license plates of cars during their movement at high speed.

To study the diversity of plants, the procedure is relatively simple since the plants are generally fixed to the ground. On the other hand, to assess all the plant diversity of a place, it will be necessary to pass several times and in different seasons to observe the different parts of the perennial plants and to be able to observe the seasonal plants.

Plant pollen can also be a plant identification tool. Placing a device such as the Cyclone sampler in an environment that sucks up airborne particles reveals the presence of plant or fungal species that have released these spore or pollen particles. It is by analyzing the DNA of these particles that we will identify the species.

Mushrooms are present all year round but visible above ground only at certain times of the year when humidity and heat conditions are adequate.

The study of the carpophore (visible part of the mushroom) allows their identification. Note that the genetic study from soil extracts is possible all year round.

The LIFEPLAN project aims to establish the current state of biodiversity across the globe, and to use our insights for generating accurate predictions of its future state under future scenarios. Biological diversity will be explored through a worldwide sampling program, and develop the bioinformatic and statistical approaches needed to make the most out of these data. LIFEPLAN is led by the University of Helsinki, it brings together more than 100 study points around the world

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