Wildlife Monitoring with GLOBE Atmospheric Parameters

GLOBE		*Related SDGs:*	*Type of activity*
Sphere	**Protocols**		
Atmosphere	All	13 (Climate Action) 15 (Life on Land)	Research Application
Biosphere	Land Cover Classification (MUC) Migratory Birds Hummingbird		

Overview

To associate the atmospheric protocols to the sighting of wildlife species in order to study if these variables influence the presence of the species studied. To check if changes are recorded in the times of sightings, number of species, habitats visited, etc. according to what is defined in the reference guides on the species historically.

Prerequisites

Notions of Bird Migration and Ruby-Throated Hummingbird Protocols.

Total activity time:
4 months (one whole season for monitoring and one month for the other activities). Note: Monitoring can be repeated in another season or other seasons to compare data.

School Level
Fourth grade and above.

Purpose

To observe processes that occur in nature by applying environmental monitoring techniques (e.g., arrival of monarch butterflies in our region, sightings of migratory swallows, etc.). To determine when certain migratory species arrive or when others begin to be sighted. To determine what variables, influence their sightings or determine their presence.

Student outcomes

- To observe nature in order to understand its processes and dynamics.
- To apply Atmosphere and Land Cover Protocols to wildlife observation and monitoring.
- To determine an animal species of interest for study.

- To develop a plan to study the chosen species.
- To conduct observation of a species over an entire season to monitor its behavior.
- To record both sighting and environmental variable data (temperature, humidity, precipitation, wind, clouds, surface temperature).

Introduction

How many times have we said or heard someone say: "Now you don't see as many butterflies as before", "This year the swallows haven't arrived", "You don't see light bugs (fireflies) in the field at night any more". Is it really like that or is it that we no longer pay attention to what surrounds us? We are immersed in a globalized world and technology often takes up all our free time and we do not spend time or spend very little time enjoying and observing nature.

Just as it is vitally important to conserve the quality of water, air and soil, it is also essential to pay attention to the state of wildlife populations in a given ecosystem for the survival of the species that inhabit it and those that depend on them. Many species are threatened by various factors in their habitats such as deforestation, cattle raising, agriculture, mining, hunting, the introduction of exotic species and the growth of cities. These factors, along with forest fires and climate change, have caused these species to be displaced, having to migrate to other territories, or directly to be eliminated from a habitat. "Nowadays we speak more of a dynamic conception of the flow of nature in which a constant change in ecosystems and biological reserves is defined" (Maza and Bonacic, 2013).

Therefore, it is a priority to know more about the animal and plant species in the habitat we live in (distribution, abundance and population dynamics) and thus contribute to their conservation and protection.

One of the criteria we can take when choosing our target species is to identify a native or endemic species (one that lives naturally in a region, that is, one that is believed to have originated or arrived naturally in the country, without human intervention) over an exotic species (a species from another part of the world that has been introduced mainly by human incidence, either voluntarily or accidentally). Another criterion could be to study a common species versus one that is considered at risk for our country or region. If you prefer to study the latter, you can consult the IUCN Guides and Red Data Books of Threatened Species (*) and others specific to each country where species are classified in categories such as "Critically Endangered" (CR), "Endangered" (EN) or "Vulnerable" (VU).

Why monitor? It allows us to determine the status of the species in a specific ecosystem or site, identify over time whether the population is growing or declining and what may be the factors that cause it, protect the sites where they stop after a migration or where they go to reproduce, develop a guide about the species of the site, obtain data on species as indicators of the state of the ecosystem, make databases for future studies available, etc.

From GLOBE's perspective we can collaborate through citizen monitoring, making our young people aware of the importance of contributing to the knowledge of what happens in the ecosystem, paying special attention to the observation of species and, in this case, to the atmospheric factors that accompany the observation. Temperature, relative humidity, cloudiness, precipitation and wind are factors that affect the sighting or appearance of species such as butterflies, hummingbirds, birds (including migratory ones), fireflies, etc.

- Temperature: it affects the presence or absence of species and their daily behavior and also on flowering or fruiting. Minimum, maximum, current and daily and

seasonal average temperature can be studied. Daily and monthly averages of high and low temperatures can also be taken. To measure this parameter, a liquid or digital thermometer is used.

- Precipitation: like temperature, it influences the presence and behavior of animals and the phenology of plants. Sightings can be studied depending on whether it rained that day or not, on what amount, and also on monthly and seasonal averages. It is also important to study it in the case of flooding of habitats of land species, since they can be displaced to other territories. The rain gauge is used to make precipitation measurements.
- Clouds: they are linked to precipitation and air temperature. A nimbostratus cover, for example, indicates probable precipitation, which will surely affect the presence of insects and birds. To estimate this variable, the GLOBE Cloud Chart and optionally the GLOBE Observer app are used.
- Wind: wind speed has an impact on some species in particular, e.g., butterflies and hummingbirds, and it will depend on the wind speed on a given day whether these species are sighted or not. It is measured with the anemometer and both wind speed and direction can be recorded on a daily basis.
- Relative humidity: days with low relative humidity and no precipitation, added to high temperatures, cause vegetation to dry out (causing animals to be unable to feed and migrate to other areas or die) and also increase the risk of fire. Humidity is measured with the hygrometer and can also be recorded daily and throughout the day.
- Surface temperature: linked to air and soil temperature, it influences the presence and behavior of insects and birds. It can be monitored throughout the day, but especially after local solar noon, when maximum temperatures usually occur. This measurement is done with the infrared thermometer.

Guiding Research Questions

- When do the monarch butterflies arrive in my region? Do they arrive on the same dates every year? And when do they stop being seen?
- What were the temperatures recorded this spring when the swallows began to arrive? Was it in the rainy or dry season?
- This spring was unusually rainy, did this result in that almost no hummingbird was sighted?

Scientific concepts

- Environmental monitoring
- Scientific names/Common names
- Risk of extinction
- Vulnerable
- Wealth
- Distribution
- Population
- Resident vs. migratory and native vs. exotic species

Materials and Tools:

- GPS App or GPS device

- Alcohol or digital thermometer
- Hygrometer or hygro thermometer
- GLOBE Cloud Chart / GLOBE Observer app
- Anemometer and wind vane or app for device (it can be Wind Compass)
- Rain gauge (optional)
- Infrared or surface temperature thermometer (optional)
- Field Guide with the step-by-step tour (student-designed)
- Science notebook or Excel spreadsheet (student-designed to record data)
- Pencil or pen
- Camera or electronic device
- Compass
- Wildlife Field Identification Guides
- Binoculars (optional) / Magnifying glass
- Ribbons, banners or other items to mark the observation trail

What to Do and How to Do It

Beginning -

In one visit or a series of visits by the teacher (probably more than one will be needed at different times or seasons), a monitoring site is determined, if possible, within the school grounds, or close to them and easily accessible, since the visits will be frequent (orchard, garden, field, forest or nearby park, botanical garden, protected area, etc.). The teacher can visit the site a second time with the students to see what species are present or can be seen in the habitat. Bibliography or identification guides that list the geographical distribution of species can also be consulted.
In a first class it is determined which species is of interest for observation according to the existing ones in the chosen site.
To do so, certain characteristics and conditions of the species should be taken into consideration in order to facilitate its observation at the chosen site:

- to be a frequent species at the site
- that is easy to observe and to record photographically
- that can be identified either by its colors, shape, flight, trill, etc.
- to consider that daytime habits species should be chosen, as the observation of students is likely to be done during school hours.
- if it is also attractive to the group of students it would be ideal, as it is a good stimulus for their study.

Examples:

- the monarch butterfly (*Danaus plexippus*) or any day butterfly;
- the white-browed swallow (*Tachycineta leucorrhoa*) which is migratory and moves over a large area of South America, or some other bird;
- the ruby-throated hummingbird (*Archilochus colubris*) or the one observed in our region
- ladybirds, St. Anthony´s ladybugs or ladybugs (*Coccinellidae*)

It is recommended to always prefer native species over exotic ones and the special protection species in particular.

White-browed Swallow
Image: Jorge Barcala

Monarca
(Danaus plexippus)
Creative Commons

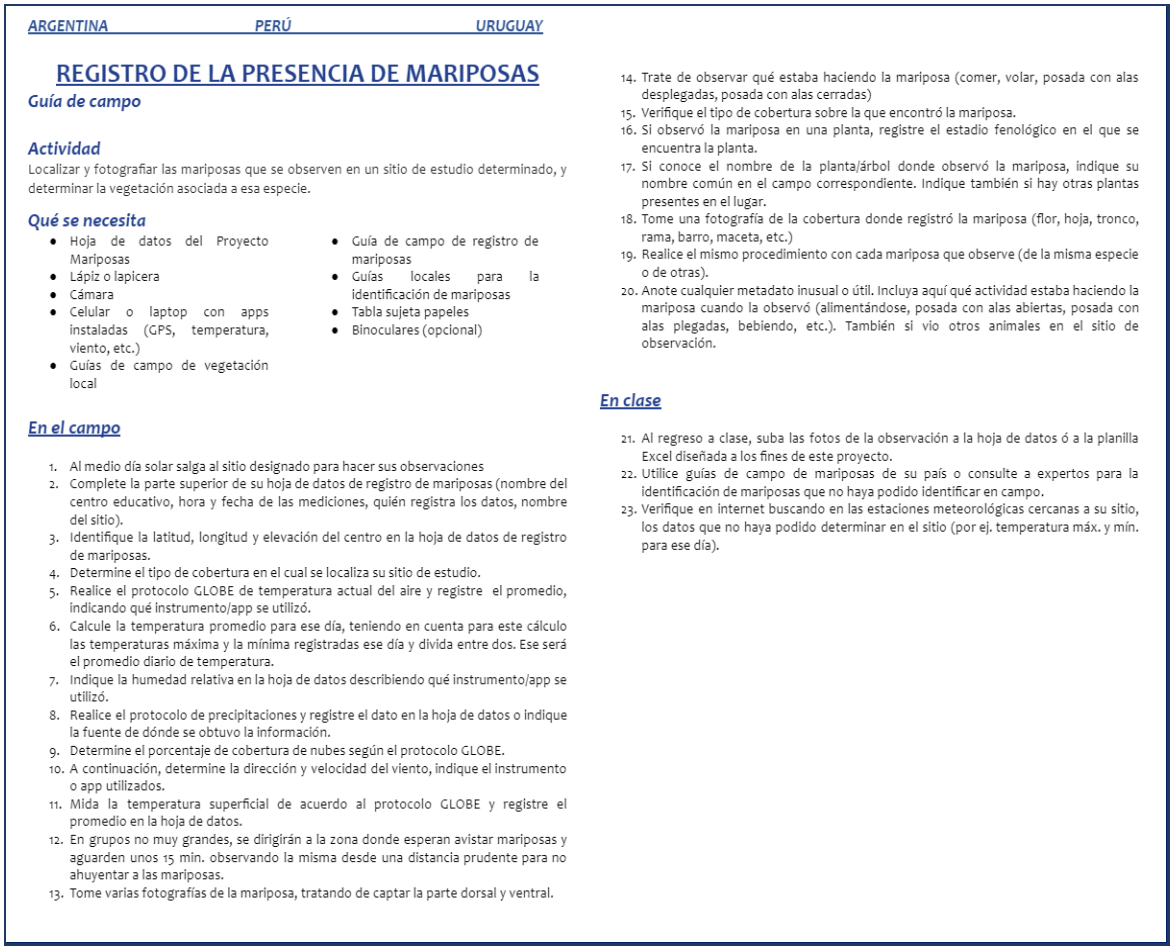
Ladybird
Creative Commons

Development -

1. In the second class, the students look for information about the characteristics of the chosen species, its behavior, ecology, geographical distribution, what type of habitat it lives in, when it is sighted, what it feeds on, etc. To do this, they use field guides to identify species in the country/region or ask a scientist, park ranger (or forest ranger) or local species expert to give them a talk in class.
2. The students determine what features to observe in the species under study that differentiate it from others of its genus, e.g. number of legs, wings, antennae, color patterns, etc.
3. According to the chosen species, the students discuss as a group and define which atmospheric parameters will be applied in the monitoring. For example, they can measure temperature, wind and precipitation. These will be the variables that will be determined as factors that influence the appearance or sighting of that species for this particular study. It should be noted that the variables to be studied will also depend on the instruments available at the school. The necessary instruments to study the atmospheric variables can also be obtained from a science museum, a university or the GLOBE Coordination in your country.
4. In the third class, the teacher teaches the protocols that were defined to study the species in question and such protocols are practiced in class beforehand.
5. On a new visit to the chosen site, the students and teacher plan an observation trail and mark it with flags, for example, or with ribbons on trees or whatever is most visible to them. The GPS protocol will be used to geolocate the site, either with the GPS device or with the app on the mobile device and is recorded in the science notebook along with a sketch of the trail and the site.
6. In the fifth class, a monitoring or observation plan is drawn up detailing what is going to be monitored, when, how, how often, for how long, who is going to do it (in groups or pairs, taking turns, etc.) and a schedule of activities with specific dates is made. All this will be recorded in a document and shared with all the students.
7. The students, guided by the teacher, will agree on a field guide, or step-by-step guide that they will follow in the field so that everyone follows the same procedure or protocol

for making observations and recording data. Please find an example of a Field Guide developed by the Butterflies and Environmental Variables Project Team for the Observation of Butterflies and Environmental Variables (see Figure 1).

8. All materials, instruments, data sheets and recording forms to be used are defined and recorded in a spreadsheet that will be consulted each time a site visit is made.
9. To keep records of data, it is convenient to develop a form (it can be on paper or Excel) that includes all the fields according to the protocols to be applied and the observations of the species to be taken into account (e.g. specimens are observed- yes or no, how many specimens are observed, what genus they are, what species they are, common name, activity being carried out, etc.). This form should clearly state the date, time and person responsible for the observation in order to keep a more rigorous record. Recording in spreadsheets makes it easier to systematize the information obtained and save time in the field. A simple form is presented as an example. The fields can be obligatory or optional (see example in Figure 2).
10. Accompanying the observation and monitoring with a photographic record is fundamental to help the students identify the species, and also the host or feeding species they visit. Having a camera for this purpose or several mobile devices for recording images helps, as well as instructing students to behave prudently in order to capture the species without disturbing them or scaring them away from their usual activity and habitat.



ARGENTINA PERÚ URUGUAY

REGISTRO DE LA PRESENCIA DE MARIPOSAS

Guía de campo

Actividad

Localizar y fotografiar las mariposas que se observen en un sitio de estudio determinado, y determinar la vegetación asociada a esa especie.

Qué se necesita

- Hoja de datos del Proyecto Mariposas
- Lápiz o lapicera
- Cámara
- Celular o laptop con apps instaladas (GPS, temperatura, viento, etc.)
- Guías de campo de vegetación local
- Guía de campo de registro de mariposas
- Guías locales para la identificación de mariposas
- Tabla sujeta papeles
- Binoculares (opcional)

En el campo

1. Al medio día solar salga al sitio designado para hacer sus observaciones
2. Complete la parte superior de su hoja de datos de registro de mariposas (nombre del centro educativo, hora y fecha de las mediciones, quién registra los datos, nombre del sitio).
3. Identifique la latitud, longitud y elevación del centro en la hoja de datos de registro de mariposas.
4. Determine el tipo de cobertura en el cual se localiza su sitio de estudio.
5. Realice el protocolo GLOBE de temperatura actual del aire y registre el promedio, indicando qué instrumento/app se utilizó.
6. Calcule la temperatura promedio para ese día, teniendo en cuenta para este cálculo las temperaturas máxima y la mínima registradas ese día y divida entre dos. Ese será el promedio diario de temperatura.
7. Indique la humedad relativa en la hoja de datos describiendo qué instrumento/app se utilizó.
8. Realice el protocolo de precipitaciones y registre el dato en la hoja de datos o indique la fuente de dónde se obtuvo la información.
9. Determine el porcentaje de cobertura de nubes según el protocolo GLOBE.
10. A continuación, determine la dirección y velocidad del viento, indique el instrumento o app utilizados.
11. Mida la temperatura superficial de acuerdo al protocolo GLOBE y registre el promedio en la hoja de datos.
12. En grupos no muy grandes, se dirigirán a la zona donde esperan avistar mariposas y aguarden unos 15 min. observando la misma desde una distancia prudente para no ahuyentar a las mariposas.
13. Tome varias fotografías de la mariposa, tratando de captar la parte dorsal y ventral.
14. Trate de observar qué estaba haciendo la mariposa (comer, volar, posada con alas desplegadas, posada con alas cerradas)
15. Verifique el tipo de cobertura sobre la que encontró la mariposa.
16. Si observó la mariposa en una planta, registre el estadio fenológico en el que se encuentra la planta.
17. Si conoce el nombre de la planta/árbol donde observó la mariposa, indique su nombre común en el campo correspondiente. Indique también si hay otras plantas presentes en el lugar.
18. Tome una fotografía de la cobertura donde registró la mariposa (flor, hoja, tronco, rama, barro, maceta, etc.)
19. Realice el mismo procedimiento con cada mariposa que observe (de la misma especie o de otras).
20. Anote cualquier metadato inusual o útil. Incluya aquí qué actividad estaba haciendo la mariposa cuando la observó (alimentándose, posada con alas abiertas, posada con alas plegadas, bebiendo, etc.). También si vio otros animales en el sitio de observación.

En clase

21. Al regreso a clase, suba las fotos de la observación a la hoja de datos ó a la planilla Excel diseñada a los fines de este proyecto.
22. Utilice guías de campo de mariposas de su país o consulte a expertos para la identificación de mariposas que no haya podido identificar en campo.
23. Verifique en internet buscando en las estaciones meteorológicas cercanas a su sitio, los datos que no haya podido determinar en el sitio (por ej. temperatura máx. y mín. para ese día).

Fig. 1: Field Guide for Butterfly Observation. Courtesy of the Butterfly and Environmental Variables Project.

Date	Time	No. of specimens observed / NO specimen (0)	Specimen photo	Common name	Genus	Specie	Place (plant, fruit, trunk, soil, pot, grass)	Action: feeding, flying, resting, etc.)	Land cover	Current temp. (°C)	Rainfall Yes/No (in mm)	Wind speed (km/h)	Student's name	Geographic coordinates (longitude, latitude, elevation)

Fig. 2: Recording Sheet (abbreviated example of the one used for the Butterfly Project). Courtesy of the Butterfly and Environmental Variables Project.

Ending -

At the end of the period determined for monitoring, the information obtained will be analyzed through tables and graphs, cross referencing variables of the observed species with atmospheric variables to determine how they influence their sighting / appearance / migration. The conclusions will be discussed as a group and a group report will be prepared for presentation at the GLOBE Virtual Science Symposium.
Optionally, historical information on that species and its behavior (if available) can be sought from various sources to compare students' findings and see if trends change or remain stable in terms of distribution, richness, habitats, sighting times, behavior, etc.

Frequently Asked Questions

What happens if the educational center where I work is in an urbanized area that has a closed courtyard among buildings where there are no wildlife species to be seen? Can I still carry out the activity?

Generally urban schools have fewer possibilities in terms of adequate space for green areas, but we can look for other options: create a space on the roof if it is accessible and safe; go out to the nearest square or park where we can see more wildlife; get and bring butterfly caterpillars to study the life cycle, etc.

Do I need to be an expert to study a certain species?

No, it is enough to read information about the chosen species and look for identification guides, applications that help us to identify them (e.g., iNaturalist for wildlife, Merlin Bird ID for birds, NatureID) or seek the advice of a specialist to help us throughout the study. What is important is to seek the support of a colleague or expert to accompany us throughout the activity or at least at the beginning and end (to analyze the results).

Suggested Resources for Further Information:

iNaturalist application: https://www.inaturalist.org/

Merlin Bird ID application: https://merlin.allaboutbirds.org/download/

NatureID Application: https://play.google.com/store/apps/details?id=plant.identification.flower.tree.leaf.identifier.identify.cat.dog.breed.nature&hl=en_UY&gl=US

PictureThis application: https://www.picturethisai.com/es/

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