\*Slide intro

\*clicG - Aerial monitoring is an ecological monitoring technique commonly used in protected areas, particularly in Africa where protected areas can be quite vast.

\*B - It essentially relies on the use of an aircraft but other instruments can also be used (ULMs, drones, kites...).

\*clicG - Some conditions determine this choice of method:

First, the protected area should be sizeable. This means that for a best cost-benefit ratio, monitoring a park of less than 1,000 km² should be ground-based.

\*B - The environment needs to be open. Aerial monitoring is not adapted to closed areas, forests or uneven terrain, where the ground cannot be seen.

\*clicG - Finally, the species we look for need to be visible from air. They would usually be the bigger mammals or species living in large herds like impalas. You can also choose to monitor the flora distribution.

\*B - So the main objective of aerial monitoring is to be able to estimate the numbers and monitor the evolution of one or more species, in time and in space, by conducting periodic surveys.

\*clicG - But aerial monitoring also gives a different perspective of the territory; a broader and more comprehensive view compared to the traditional ground-based monitoring.

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\* - It is a good tool to better understand how the ecosystem works.

\*clicB - It allows to confirm the existences of certain species when they are hard to detect by other means.

\*G - It provides an estimation of the numbers within the detected species, as well as an estimation of the size or the structure of the groups.

\*clicB - Obviously, it allows to understand the spatial distribution of these species in the park, and shows the evolution in number and distribution when the counting is repeated over time. \*clicG - When you have a map of the protected area’s vegetation, aerial monitoring allows to connect the distribution of species and of different habitats.

\*clicB - It also gives important additional information for management like signs of poaching, carcasses, the presence of cattle or human activities like gold-mining, encroachment of park boundaries, logging...

\*clicG - There are many advantages to overflying: it is a reliable method, that can be implemented rapidly, it mobilises few staff members and allows to cover large surfaces. Thanks to overflying you can access usually non-patrolled territories, and easily get a lot of geo-specific information.

\*clicB - This method is limited by the state of the area that shouldn't be too closed, and by some species that are being looked for. Some of them are difficult to detect because they live in the forest, or form uncountable herds like the baboons, or because they don’t run away as the aircraft gets closer and are difficult to spot like the eland.

\*clicG - Aerial surveying can also of course be costly, even though this fact needs to be put into perspective compared to other methods and quality of obtained results.

\*clicB - Aerial surveying is done by transects, usually parallel lines followed by the aircraft.

\*G - Most of the time, several transects are covered during a flight, and they are oriented in a way to avoid having to face the sun.

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\* - Generally speaking, the overflight takes place early in the morning or in the late afternoon to avoid the hot hours of the day.

\*B - Animals are counted in theoretical paths on the ground, that were calibrated on the plane during the preparation phase of the protocol.

\*clicG - Aerial counts are made thanks to a high-winged aircraft for better visibility on the ground. The surveying team usually gathers four people including the pilot who follows the flight plan, the navigator who records the information given by the observers and controls the flight parameters, and two observers at the back in charge of detecting the fauna.

\*clicB - The pilot and the navigator can also contribute to the survey by supporting the main observers, and the GPS will be programmed with all the transects before take-off.

\*clicG - Sampling is the best way to proceed to aerial survey, because if you do a total count, there is a high risk of recounting moving animals, especially when using several aircrafts launched at the same time.

\*B - The first step consists in defining a path on each side of the plane, generally between 100 and 250 metres large according to the visibility you’ll have. You then calibrate the plane thanks to banners attached to the spars to define the path on the ground.

\*clicG - The interval between transects then depends on the desired sampling rate you wish to obtain.

\*B - During the overflight, only the animals within the path are taken into account, which allows to calculate a theoretical density, along with a standard deviation that is of greater magnitude when there are fewer contact points, and when the counting effort is reduced.

\*clicG - The sampling method requires simple statistical processing of data, following the Jolly method most of the times. It is explained in the second module about statistics.

\*clicB - The count usually covers 10 to 20% of the territory, and the results can greatly vary from one season to another. In order not to disrupt the flight, big herds are usually photographed for subsequent counting.

\*clicG - Finally, using a geographical information system allows to determine the distribution of animals within the protected area if the GPS positions of the observations are properly recorded.

\*clicB - Sources of error are due to the sampling rate. The more transects there are and the wider the paths are, the more ground is covered and therefore the precision of the survey improves.

\*G - Some species will systematically be underestimated because they are hardly visible from the plane, like the lion for example. For bigger herds, you need to force yourself to count only the animals present inside the counting path.

\*B - The meteorological conditions and visibility can also greatly affect the counting performance.

\*clicG - The experience of the people is essential to avoid identification mistakes and to quickly being able to estimate the number of animals present. You also need to take into account that tiredness greatly affects attention after a while. Of course, you would need to test the ability of observers to fly without getting sick in often harsh conditions.

\*clicB - Finally, since it is a low-level flight in a quite hostile environment, you need to have prepared the team to the possibility of an engine failure that will lead to an emergency landing.