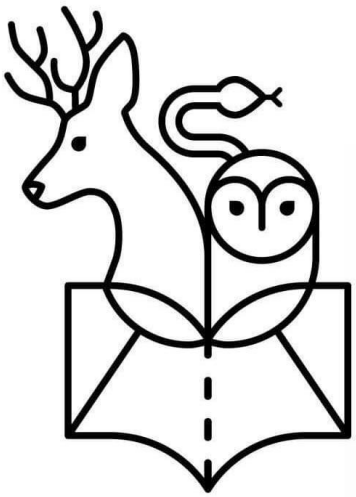
Educational Proposal: Wildlife Vehicle Collisions

8 ACTIVITIES

EnVeROS Project

Primary and Secondary education



Erasmus+

Activity leading organization

Participating organizations

This activity guide is part of IO3 within the ERASMUS+ Enveros project, targeting teachers working in primary and secondary education. The material can be used either as a complete education package comprising all proposed activities or separately as a number of self-standing activities for a diverse range of training events. This is the reason why some of the information is repeated in each activity. Although there are many examples from Cyprus, these can be easily adapted to other countries or areas.

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Contents

1. KEEP YOUR EYES OPEN

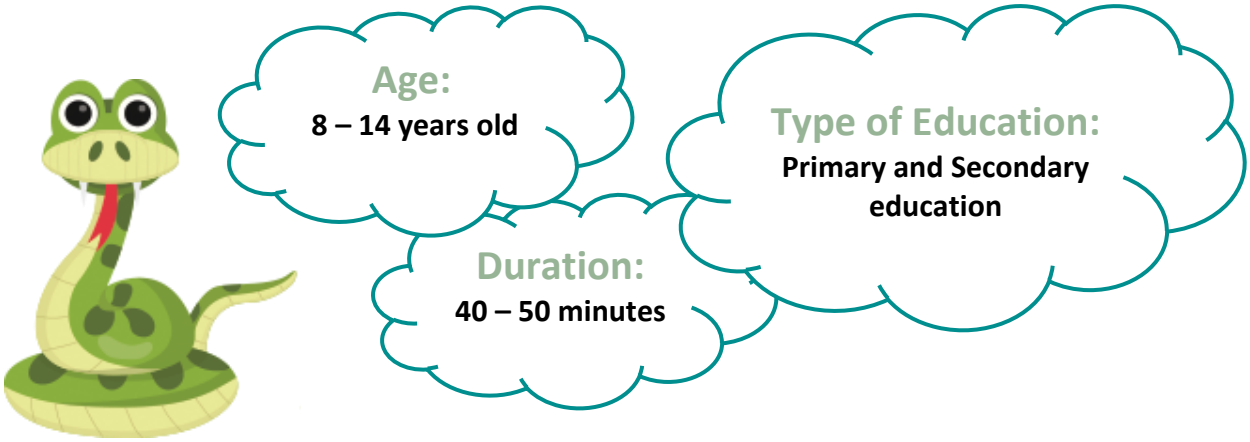
1.1. Aim

The aim is to educate the trainees about the basic rules of behaviour, both as passengers and as future drivers, while at the same time educate them on how this behaviour has an impact on the biodiversity of a country. In addition, it gives trainees the opportunity to learn about the species that often lose their lives on the road network and the need for their protection. This is achieved through game interaction, question – answering, species – specific enrichment and the evaluation of certain criteria in order to properly select mitigation measures, thereby broadening their horizons. In addition, through the team play characteristics of the game, a spirit of cooperation is cultivated.

1.2. Educational Objectives

By the end of this activity trainees should be able to:

- Recognize the main characteristics of the animals involved in accidents on the road network of each project partner's country.
- Develop the ability to identify different species and learn about their different characteristics.
- Be aware of the problem of wildlife vehicle collision on the road network.
- Recognize responsible behaviour as car passengers.
- Compare different types of animal passes (overpasses, underpasses) as a mitigation measure and choose the most suitable measure for each animal accordingly.



1.3. Introduction for educator

- Wildlife vehicle collisions (WVC): Collisions with all species of wild animals.
- Deer vehicle collisions (DVC): Collisions that involve only deer species. A separate term is used only for deer because it accounts for the majority of WVC.
- Animal vehicle collisions (AVC): Collisions with wild and domestic animals.
- Roadkill: refers to an animal or animals that have been struck and killed by motor vehicles on roads. It has increasingly become the topic of academic research in an attempt to understand the causes and how it can be mitigated.

WVCs have a broad range of consequences both for motorists and animals. These consequences are divided into major categories according to their characteristics:

- Vehicles (damage to vehicles, infrastructure).
- Health and safety (injuries, hygiene – dead bodies on the roads, emotional trauma, delay in work/schedule).
- Species (impact on biodiversity, mortality of animals, economic loss, e.g. game species and impact for the hunters).
- Financial cost for the public sector (i.e., insurances, health costs, road maintenance, mitigation and prevention measures).

Animals have different sizes, shapes and speed in their movement. Some animals are faster and can easily cross the road, but some others are slower. Turtles, snakes, frogs, hedgehogs need more time to cross with safety.

- The most common animals found dead on the roads in CY are lizards, snakes, hedgehogs and foxes.
- Dusk and dawn are times of highest collision risk.

Most animals are unable to recognize the street as a possible danger. Instead, they accept it as an element of their natural habitat and use it in some cases to their advantage: ex. thermoregulation, predation, mating, food + salt source or for migration along the barrier-free elements of infrastructures. The variety of attractants could cause Wildlife Vehicle Collisions.

- **Reptiles** → May bask on the warm surface of the road.
- **Herbivores** → May forage on the enhanced plant growth on roadsides.
- **Scavengers** → Can be attracted to feed on roadkill.

Three reasons that lead an animal to cross the road:

1. **Food** **2. Migration** **3. Mating**

Ecological effects of roads and highways:

- Local effects, such as noise, water pollution, habitat destruction/disturbance and local air quality.
- Wider effects such as habitat fragmentation, ecosystem degradation/ habitat loss and road mortality.

Roads affect the species' abundance and distribution having both direct and indirect (secondary) effects:

- Direct Alteration of Species Abundance and Distribution.

The most obvious impact of roads on wildlife is mortality or injury through collision.

- Secondary Impacts.

Birds, small and large mammals, and amphibians appear to be markedly affected by fragmentation of habitat caused by roads; the open spaces associated with roads can represent barriers to movement, but also allow predators or alien species to invade habitats.

Useful links:

- https://www.fhwa.dot.gov/publications/research/safety/08034/exec.cfm
- https://www.sciencedirect.com/science/article/pii/S0301479719302270

The solution:

Drivers and passengers, including children, can learn how to be more alert and careful when driving in wildlife areas by scanning their eyes from one side of the road to the other, watching for movement. Children as passengers could support Wildlife Vehicle Collisions mitigation by keeping litter off roadsides and encouraging other passengers to do so. Apart from the general negative results of litter in nature, this may be very attractive to wild animals: even biodegradable items such as apple cores or banana peels should not be thrown out of the car window because they attract animals to roadsides where they are more likely to be hit by a car and/or cause an accident.

Rules:

1. Never throw food or other litter out of the car window. Human food can attract wildlife to the roadside where they might get hit by cars.
2. Always help the driver by watching out for wildlife on the roadside.
3. Drivers need to keep their eyes and attention on the road. When you are in a car, do not distract the driver and watch out for wildlife.

Indicative mitigation measures:

Overpasses and underpasses: The first artificial animal bridge ws created in France in the 1950s to help hunters guide deer. Since then, wildlife crossings have spread around the world. Europe has become a leader in the installation of bridges. The Netherlands currently has 66 different crossings for many of its wildlife species, among which the largest animal bridge in the world. It is called the Natuurbrug Zanderij Crailoo and stretches across half a mile of railways, rivers and buildings.

Overpasses/underpasses provide safe passageways for a wide range of species, allowing them to continue to move beyond the landscape and restore the connectivity of habitats. Wildlife crossings allow animals to travel up or down roads in Europe, some locations in the US and partly in Western Canada.

Fences are often built in conjunction with other transit infrastructures because they are another tool that can separate animals from motorways waiting at the edge of forests. This combination of fences and under/over passes has reportedly reduced the rate of traffic accidents by 80%. As new highways cause more and more

fragmented habitats, these intersections can play an important role in protecting endangered species. Animals have different preferences in terms of feeling safe on a long-distance or underground crossing. Elk, deer and moose prefer big, open structures. Tunnels equipped with slotted tops to allow rain to enter, provide the damp conditions preferred by migrating amphibians. Herpetofauna use wide culverts with natural subtract. Vegetation at the entrance of the structures, the availability of suitable habitat and the low level of human activity are significantly related to the use of carnivores. These inclinations are based on how each animal has evolved. Thus, monitoring before constructing a passage is critical.

Useful links:

- https://www.artfido.com/bridges-for-animals-to-safely-cross-freeways-are-popping-up-around-the-world/
- http://www.enveros.eu/wp-content/uploads/2019/06/ENVEROS-IO1-report.pdf
- https://www.wur.nl/en/Dossiers/file/Wildlife-bridges.htm?f14374784=10

1.4. Implementation of activity

- Trainees sit in a circle with the educator in the middle.
- The educator shows the trainees cards with animal bridges and initiates a dialogue about the existence of these bridges and their usefulness. Indicative questions:

  - Why does an animal want to cross a road?
  - When do animals move more frequently, during which seasons and what time of the day?
  - What impact does a road have?
  - Which are the most common animals found dead on the roads of your country? Why these animals? What are their characteristics?
  - What attracts an animal to the road?
  - What can the government do to prevent collisions with animals?
  - What should a passenger do in the car in order to contribute to the prevention of an accident with an animal?

Trainees will then play the following game:

- Trainees are divided in groups of 3 to 4 people.
- Each team decides who will be the driver of the team; the rest will be passengers.
- The driver of each team starts the game as a pawn throwing the dice to get started. The largest number plays first.
- The game begins and trainees have a path to follow through the floor game by following the instructions or questions that will be found on each square. Some squares might provide only useful information about animal characteristics.
- Participants have to answer several questions if the colour of the box is blue, in order to find the right animal crossing or select the right species according to the question. Wrong answers receive traffic points (if they reach 50 traffic points, they have to start all over again).
- "STOP" boxes indicate that there should be a mandatory stop. If the playing team manages to get a number below the speed limit when rolling the dice, then it rolls the dice again; if not, the team waits for the next round (e.g. speed limit 50 – roll 3 = 30 *km/h* → continues).
- The various crossings (via ladders) enable each group to move boxes faster.
- The winning team is the one that will finish first having the lowest traffic points.

EDUCATIONAL MATERIALS:

1 large dice

Floor game printed or projected

35 Cards of game

Cards of points

Cards of animal crossings

Optionally Safety Vest

Cards of animals

1.4.1. Supporting material

1.4.2. Supporting material

Cards to print:

Congratulations! You identified the snake that was crossing the road, you were careful! Give back 5 traffic points.	**You hit 3 animals and your car was destroyed. You start all over again.**	**Well done! You have explained to your friends the correct behavior of a passenger. Give back 5 points.**
Sleepy! You have to change with your co-driver who is more relaxed.	**You are tired! You have to change with your co-driver who is more relaxed.**	**You were not wearing your seat belt. Get 10 points.**
The road enters a Natura Protected Area. Get 10 traffic points.	**You were careful and spotted the fox that was crossing the road. Give back 5 traffic points.**	**Unacceptable! You threw the packaging of your food out of the window. Get 10 points.**
You overtook someone and unfortunately you didn't see the hedgehog crossing the road. Get 10 traffic points.	**You hit a bird. Get 5 points.**	**You went over the speed limit. Get 10 points.**
You have just seen an animal that was hit on the road and you called for help. Give back 5 traffic points.	**You avoided an animal. Throw the dice again.**	

The mouflon is threatened by illegal hunting, attacks by stray dogs, as well as the lack of water and food mainly during the summer months.

The fox is pregnant for 50 – 55 days and gives birth to 3 – 6 young ones every time, but more than half die before reaching adulthood.

The fox is an omnivorous animal and is one of the main regulators of the mouse population.

The fox usually lives in caves, bushes or in holes in the ground.

Barn owls are nocturnal birds of prey and are very beneficial for agriculture as they feed on harmful mice.

Barn owls can be found in fields or other open agricultural areas, barns and ruins.

The mouflon gives birth to one and rarely two young ones and their gestation period lasts about 5 months.

Female mouflons stay with their mother their entire life, while males only for a few years.

Barn owls have an incredible way of flying, which is entirely silent, so their prey does not know they are being hunted.

Barn owls swallow their prey whole and then expel a small ball out of their mouths.

The mouflon is endangered due to illegal hunting, stray dog attacks and the lack of food and water in the summer months.

The mouflon is the largest terrestrial mammal of Cyprus, it is an herbivore and it is mainly found in the Paphos forest.

Snakes in Cyprus can usually be found at rocky areas with little water and shrubby vegetation.

Snakes are reptiles, which are carnivore, and mainly eat small mammals, birds, lizards and amphibians.

The hedgehog has a strong sense of smell and hearing, while its vision is weak.

The hedgehog is a nocturnal mammal and mainly eats invertebrates, nuts, fruits and sometimes bird eggs.

In Cyprus, we have 8 different species of snakes. Three of them are poisonous, but only one is considered dangerous.

Hedgehogs are endangered by vehicles, pesticides used in crops and poisoned baits.

The hedgehog, when scared, remains motionless and curls into a ball.	**The Starred Agamas can reach about 30 cm in length and can be found everywhere, especially in fields and ruins of houses.**	**The Starred Agama is a very fast reptile: when it does not run, it remains still with its head held upwards.**
Swamp frogs are found in rivers, tanks or dams.	**The hare of Cyprus is a very fast and intelligent animal, looking for food at night and hiding in the morning from its enemies.**	**The chameleon has the ability to change colour according to its environment for camouflage or according to its mood.**
The black rat can carry several human-transmitted diseases and causes damage to agriculture and livestock.	**The chameleon is the slowest lizard we have in Cyprus, it cannot run fast and therefore frequently falls victim to cars when crossing roads.**	**The chameleon lives on trees and shrubs.**

Many mouflons pass through here. Which of the animal crossings is more suitable? In case of a mistake, get 5 traffic points.

Many Barn owls pass through here. Which of the animal crossings is more suitable? In case of a mistake, get 5 traffic points.

Is the number of animals that are moving this time of the year large or small? In case of a mistake, get 5 traffic points.

Many hedgehogs pass through here. Which of the animal crossings is more suitable? In case of a mistake, get 5 traffic points.

Which 3 of the animals are active during the night? In case of a mistake, get 5 traffic points.

What does a good passenger do while in the car? (give 3 examples). In case of a mistake, get 5 traffic points.

Which 3 of the animals are the main regulators of the mouse population? In case of a mistake, get 5 traffic points.

Which are the 3 most commonly hit animals in Cyprus? In case of a mistake, get 5 traffic points.

Which are the 2 fastest animals that can be hit by cars in Cyprus? In case of a mistake, get 5 traffic points.

A friend is calling your mother while she is driving. What do you suggest her to do? In case of a mistake, get 5 traffic points.

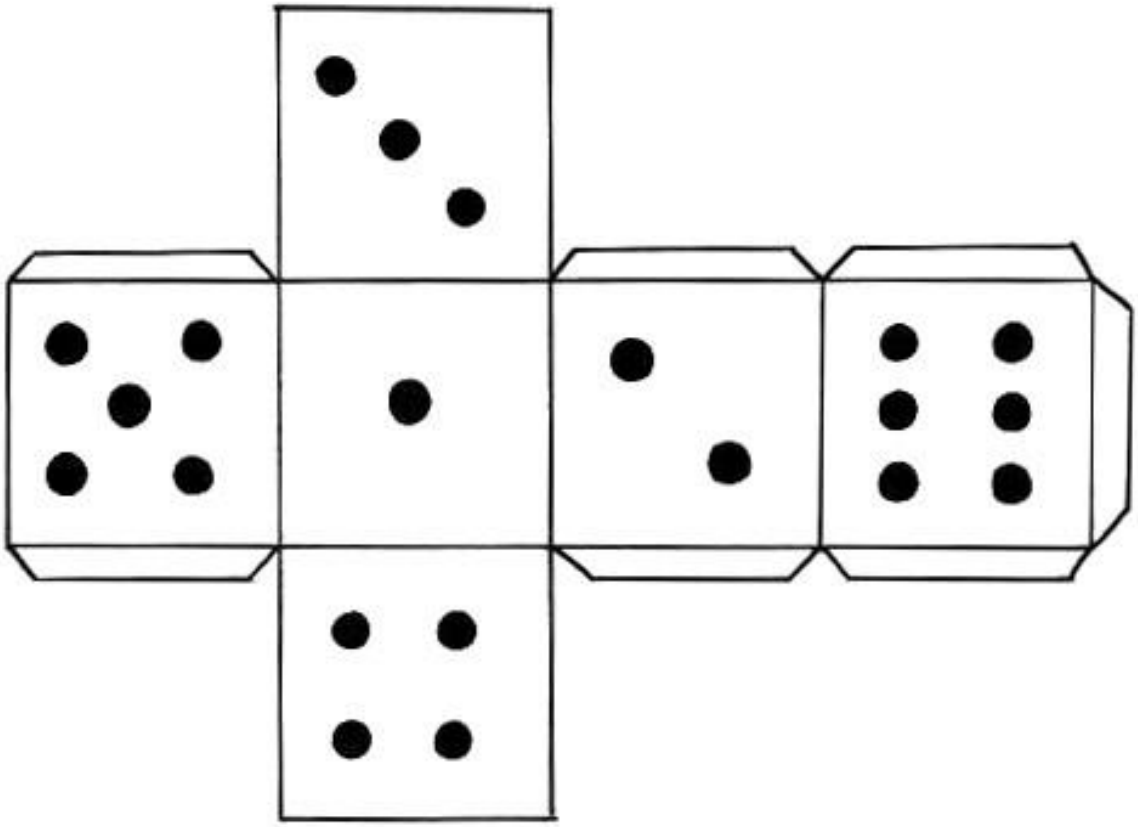
Which are the 2 slowest animals that can be hit by cars? In case of a mistake, get 5 traffic points.

What time of the day do we observe the highest records of WVC? In case of a mistake, get 5 traffic points.

You are eating a chocolate in the car. What should you do with the litter when you finish eating? (give 2 options) In case of a mistake, get 5 traffic points.

1.4.3. Supporting material

To print:



1.4.4. Supporting material

Cards of traffic points:

5	5	5
5	5	5
5	5	5
5	5	5
5	5	5

1.4.5. Supporting material

Picture 1

Picture 2

1.4.6. Supporting material

Animal cards:

1.4.7. Supporting material

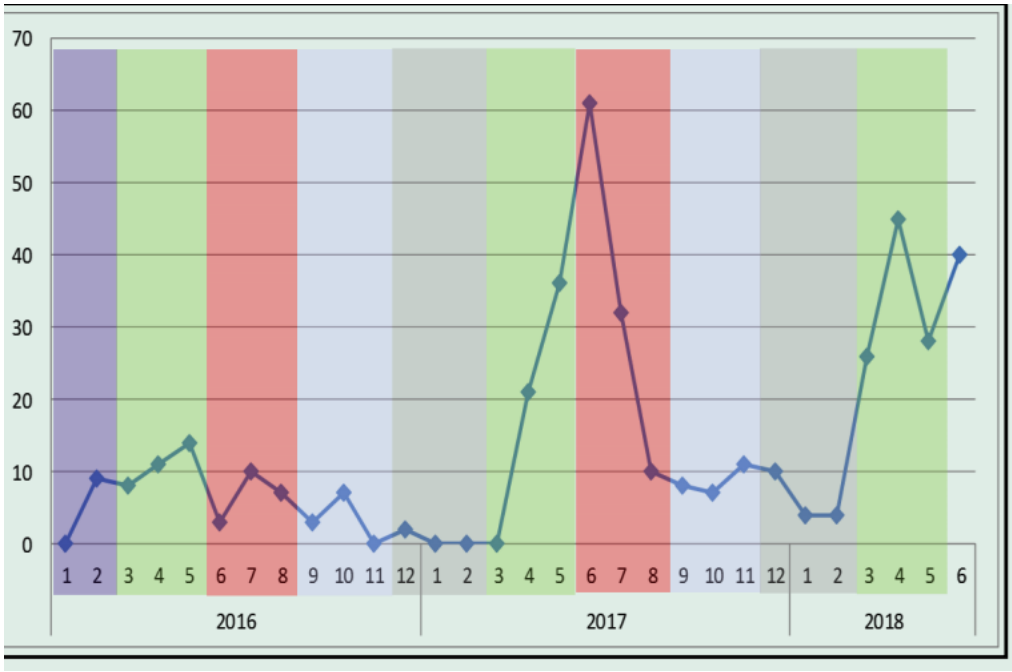
Cards of animal crossings:

→ *Mouflons*

→ *Barn owls*

→ *Hedgehogs*

1.4.8. Supporting material



Number of wildlife vehicle collisions per month for the period 2016-2018 in Cyprus.

1.4.9. Supporting material

Is the number of animals moving this time of the year large or small? In case of a mistake, get 5 traffic points.
(Consult supporting material 1.4.8.)

What does a good passenger do while in the car? (give 3 examples) In case of a mistake, get 5 traffic points.
1. Not distracting the driver 2. Never throw food or other litter out of the car 3. Watching out for wildlife

Which 3 of the animals are active during the night? In case of a mistake, get 5 traffic points.
1. Hedgehog 2. Barn owl
3. Hare

Which are the 3 most commonly hit animals in Cyprus? In case of a mistake, get 5 traffic points.
1. Snakes 2. Hedgehogs
3. Foxes

Which 3 of the animals are the main regulators of the mouse population? In case of a mistake, get 5 traffic points.
1. Barn owls 2. Foxes
3. Snakes

Which are the 2 fastest animals that can be hit by cars in Cyprus? In case of a mistake, get 5 traffic points.
1. Hares 2. Mouflons

You are eating a chocolate in the car. What should you do with the litter when you finish eating?
(give 2 options)
In case of a mistake, get 5 traffic points.
1. In my pocket 2. In my bag

What time of the day do we observe the highest records of WVC? In case of a mistake, get 5 traffic points.
Dusk and dawn

Which are the two slowest animals that can be hit by cars? In case of a mistake, get 5 traffic points.
1. Snakes 2. Hedgehogs

A friend is calling your mother while she is driving. What do you suggest her to do? In case of a mistake, get 5 traffic points.
Call him back later

2. MOVE LIKE AN ANIMAL

2.1. Aim

The aim is to educate ttrainees about the 2 – 3 Cypriot/Czech/South Tyrolian fauna species that are most frequently involved in WVCs, be able to recognize their features and trace their footprints. In addition, trainees will be able to recognize roads as an obstacle to animal movement.

2.2. Educational Objectives

By the end of the activity trainees should be able to:

- Identify the behaviour and movements of each animal.
- Recognize the main animals involved in vehicle collisions of each country, their characteristics and behaviours.
- Compare footprints of animals and recognise them.
- Understand the restrictions that roads impose on the animals' movements.

Age:
6 – 8 years old

Duration:
40 – 45 minutes

Type of Education:
Primary Education: Basic Environmental Concepts (wildlife, food chain, endangered species, biodiversity, diversity, endemic species, fauna, flora) (CY) / Habitats and their species

2.3. Introduction for educator

- Wildlife vehicle collisions (WVC): Collisions with all species of wild animals.
- Deer vehicle collisions (DVC): Collisions that involve only deer species. A separate term is used only for deer because deer accounts for the majority of WVC.
- Animal vehicle collisions (AVC): Collisions with wild and domestic animals.
- Roadkill: refers to an animal or animals that have been struck and killed by motor vehicles on roads. It has increasingly become the topic of academic research to understand the causes and how it can be mitigated.

Impact of roads on animals: The most obvious impact of roads on wildlife is mortality or injury through collision. Roads affect the species' abundance and distribution through both direct and indirect (secondary) effects. Birds, small and large mammals, and amphibians appear to be markedly affected by fragmentation of habitat caused by roads; the open spaces associated with roads can represent barriers to movement, but also allow predators or alien species to invade habitats.

Animals have different sizes, shapes and speed in their movement. Some animals are faster and can easily cross the road, but some others are slower. Turtles, snakes, frogs, hedgehogs need more time to cross with safety. The most common animals found dead on the roads in Cyprus are lizards, snakes, hedgehogs and foxes.

Most animals are unable to recognize the street as a possible danger. Instead, they accept it as an element of their natural habitat and use it in some cases to their advantage: ex. thermoregulation, predation, mating, food + salt source or for migration along the barrier-free elements of infrastructures. The variety of attractants could cause Wildlife Vehicle Collisions.

Three reasons that lead an animal to cross the road:

- Food
- Migration
- Mating

Most species involved in WVC

Cyprus
WVCs affect many different species and vary depending on the landscape, road types and habitats. Species of reptiles, amphibians, mammals and birds may be severely affected. In addition, data from the Game and Fauna Service (GFS) suggest that 13% of mortality of the protected Cyprus mouflon is due to WVCs. The Department of Public Works has 1,454 files since 2013, mainly concerning foxes, hedgehogs and snakes. They have also reported 1,245 WVCs with 46 pets such as cats and dogs.

Italy and the Autonomous Province of Bolzano/Bozen
The most affected animals related to collisions are large animals, especially Cervidae (red deer, roe deer, fallow deer), Bovidae (chamois, ibex, mouflon and wild goats), Suidae (wild boar), Ursidae (brown bear), Marsican (brown bear) and Canidae (wolf, fox, golden jackal, domestic dog). Collisions with smaller animals, often of high conservation value, are documented at regional or provincial level, but are rarely reported in national statistics.

Czech Republic
Most of the records in which mammal species were identified are related to roe deer (Capriolus capriolus), which reached 58%, followed by Wild Babi (Sus scrofa) (10%). The most endangered species are not among the most common files that apply specifically to amphibians. Most records concern Bufo bufo, followed by Rana 39 temporaria. and S. salamandra, which despite not being very common, it can be threatened locally as its populations are not as large as those of the two aforementioned species. Birds are also often killed by motor vehicles. Owls, due to their low flight and hunting behaviour, are particularly vulnerable to vehicle collisions. The barn owl and the little owl (Athene noctua) are considered as endangered due to roadkill. The most affected mammal species in the Czech Republic is probably the weasel. Also, many hedgehogs are killed in towns, as well as bats that are considered a particularly vulnerable species.

2.4. Implementation of activity

- Using a tape, the instructor sets the boundaries of the area where the trainees will be having their lesson. This can either be in the school yard or inside the classroom. The instructor will print the footprints of animals 2 – 3 times and create carton papers designed as roads.
- The instructor presents a video to the trainees, showing animal footprints and some of their characteristic moves. As soon as they finish discussing about the different kinds of animals encountered in Cyprus and their special characteristics, they are then divided into teams of 3 – 4 people.
- The instructor distributes the footprints in order for them to identify and cut them. This will enable them to identify the animal footprints, a skill needed at a later stage.
- The instructor puts the animal footprints in line, directing them towards their nests. S/he also creates nests using 1 – 2 chairs for each animal group at 4 – 5 points within the border lines.
- Depending on the animal they have been given, trainees go to the starting point and begin to move in space with the movements representing their animal group (slow – fast, crawling – making jumps).
- Trainees see the different types of footprints in space and are requested to identify their own footprints (those of the animal they represent) in order to find their way to their nest. This will take place 3 times. However, at each round, the educator will be adding roads on the floor so as to restrict the movement of the animals (Note: trainees are not allowed to cross over the road). At this phase, the educator (representing a car) also comes into space: the child (animal) s/he encounters first will be the one to be hit by the car, thus eliminating the individual from the game.
- The aim is to time how long it took them to find their nests (1) without roads (2) with a few roads present (3) with many roads present. By the end of the game, some animal groups will have been significantly reduced.
- At the end of the game, they will discuss the difference in time that was needed by each child (animal) to reach its nest. This will make them realize that roads are indeed an obstacle to the movements of animals and that many times they can be driven to a collision with a passing car.

EDUCATIONAL MATERIALS:

Road paper slips

Animal nests

Spread sheets for recording time

Carton paper for indicating game limits

Timer

Animal footprints

Video with animal footprints

2.4.1. Supporting material

Video of animal footprints: https://www.youtube.com/watch?v=za2rQw_oWSw

3. BE A REPORTER FOR A WEEK

3.1. Aim

The aim is to educate trainees about the simple form of citizen science and how it can contribute to the creation of data. In addition, they will realize that some animals and other living organisms that exist in our environment get little attention by us and that, very often, roads become an obstacle to their movement.

3.2. Educational Objectives

By the end of the activity trainees should be able to:

- Collect data about the presence and behaviour of the animals in the area.
- Process the data and understand the attributes of each area.
- Understand the restrictions that roads pose to the movements of animals.

Duration:
90 minutes

Type of Education:
Primary Education: Factors contributing to degradation of forest ecosystems (fragmentation → road kills) + Multi-dimensional (environmental, social, economic and cultural) impacts from the degradation of forests (CY) / Impacts of human activities on the natural surrounding (IT)

Age:
8 – 10 years old

3.3. Introduction for educator

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Most animals are unable to recognize the street as a possible danger. Instead, they accept it as an element of their natural habitat and use it in some cases to their advantage: ex. thermoregulation, predation, mating, food + salt source or for migration along the barrier-free elements of infrastructures. The variety of attractants could cause Wildlife Vehicle Collisions.

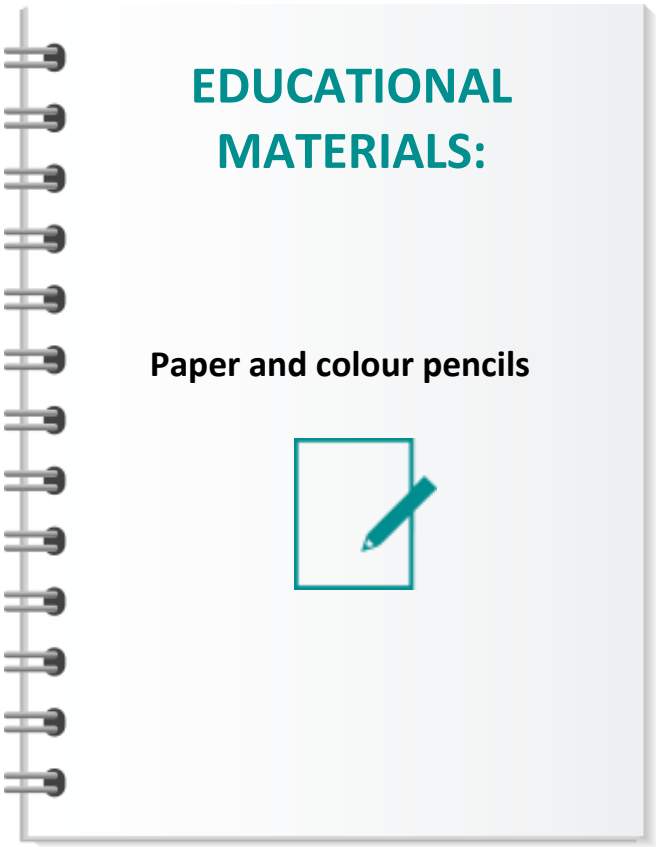
Three reasons that lead an animal to cross the road:

- **Food**
- **Migration**
- **Mating**

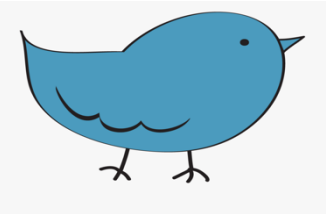
WVC application: System (https://www.roadkill.enveros.eu/?lang=en) used for recording citizens' and volunteers' observations of dead wild fauna throughout the road network of the country. Data from these observations include the group of animals and the species identified, as well as the exact (GPS) location, the date and time of recording, photos of the roadkill and any relevant additional information related to the species, the road or the traffic condition.

3.4. Implementation of activity

- The instructor discusses with the trainees the positive and negative aspects of roads on ecosystems, making a list of them on the board. Then, they analyse the reasons why a road can become an obstacle to the movement of animals.
- After the discussion, the instructor encourages trainees to become observers of animals in their neighbourhoods and to record some data for a week.
- Trainees create their own animal observation datasheet.
- Trainees, accompanied by an adult, record for a week the animals that they spot in the streets or near the streets, and then they combine all their results to draw some conclusions (e.g. which animals are present or moving in their area, what did they do when they encountered them, how many of those were crossing the street, was the road an obstacle for those animals?).



3.4.1. Supporting material

	1st Day	2nd Day	3rd Day	4th Day	5th Day	6th Day	7th Day
What animal can you see?							
What does the animal do now?							
What time is it now?							
Is the animal near the road?							

4. THE POSTER

4.1. Aim

The aim is to educate trainees about appropriate car passenger behaviour and the problems that can be caused when not applied. The aim is also to encourage them to disseminate their knowledge on WVCs to their fellow students.

4.2. Educational Objectives

By the end of the session trainees should be able to:

- Identify the proper behaviour of a passenger in order to avoid accidents with animals.
- Distinguish proper and bad behaviour of a passenger.
- Learn about road accidents with wild animals and develop their own code of conduct.
- Prepare a poster and share their knowledge about WVC with other students.

Duration:
90 minutes

Age:
8 – 10 years old

Type of Education:
Primary Education: Consequences of the traffic issue on our quality of life and the environment (CY) / Impact of human activities on the natural surrounding (IT)

4.3. Introduction for educator

- Wildlife vehicle collisions (WVC): Collisions with all species of wild animals.
- Deer vehicle collisions (DVC): Collisions that involve only deer species. A separate term is used only for deer because deer accounts for the majority of WVCs.
- Animal vehicle collisions (AVC): Collisions with wild and domestic animals.
- Roadkill: refers to an animal or to animals that have been struck and killed by motor vehicles on roads. It has increasingly become the topic of academic research in an attempt to understand the causes and how it can be mitigated.
- The animals move to forage, reproduce or migrate.
- Main taxa that face restrictions to the WVC are mammals, reptiles and amphibians.
- The collisions with those species can cause an increasing decline in their numbers.
- Important factors that contribute to wildlife vehicle collisions are the increase of the number of vehicles, road networks and speed limits.
- The increase of road networks causes habitat fragmentation with multiple consequences for the animal populations that need to cross to breed, forage, reproduce or migrate.

Drivers and passengers, including children, can learn how to be more alert and careful when driving in wildlife areas by scanning their eyes from one side of the road to the other, watching for movement. Children as passengers could help with the issue of Wildlife Vehicle Collisions by keeping litter off roadsides and encouraging other passengers to do so. Apart from the general negative results of litter in nature, this may be very attractive to wild animals: even biodegradable items such as apple cores or banana peels should not be thrown out of the car window because they attract animals to roadsides where they are more likely to be hit by a car and/or cause an accident.

Rules:

1. Never throw food or other litter out of the car window. Human food can attract wildlife to the roadside where they might get hit by cars.
2. Always help the driver by watching out for wildlife on the roadside.
3. Drivers need to keep their eyes and attention on the road. When you are in a car, do not distract the driver and watch out for wildlife.

Animals have different sizes, shapes and speed in their movement. Some animals are faster and can easily cross the road, but some others are slower. Turtles, snakes, frogs, hedgehogs need more time to cross with safety.

Most animals are unable to recognize the street as a possible danger. Instead, they accept it as an element of their natural habitat and use it in some cases to their advantage: ex. thermoregulation, predation, mating, food + salt source or for migration along the barrier-free elements of infrastructures. The variety of attractants could cause Wildlife Vehicle Collisions.

Three reasons that lead an animal to cross the road:

1. **Food**
2. **Migration**
3. **Mating**

4.4. Implementation of activity

- The instructor presents to the trainees footage of animal bridges across the world. Then, s/he initiates a discussion about why these bridges exist and what their purpose is.

Some indicative questions:

- What did you observe?
- Why do these bridges exist?
- Were all bridges the same? What was different?
- Do these kinds of accidents with animals also occur in your country? If so, with which animals?
- What can we do to prevent an accident with a wild animal?
- Which behaviour should be avoided when in the car and what steps can we, as good passengers, follow in order to prevent such accidents? (Note down rules).

- In groups of 3 – 4 people, trainees start making their poster so they can inform their fellow students about the problem of wild animal roadkill and the correct car passenger behaviour. In this way, they help solve the issue indirectly. The most beautiful posters will decorate the poster wall of the school.

***Here, trainees can create their posters by drawing and sticking pictures of bridges from abroad and animals of their countries. They can also make their own moto and rules for car passengers to follow in order to avoid such accidents.**

EDUCATIONAL MATERIALS:

Video

https://www.youtube.com/watch?v=p3CQz4-K5AQ

Paper, colour pencils, glue and scissors

5. FOOD CHAIN

5.1. Aim

The aim is to educate trainees about the importance of the planet's food chain and identify the problem of WVC as a threat to biodiversity and as a factor for its decline.

5.2. Educational Objectives

By the end of the activity trainees should be able to:

- Understand how the organisms are linked through the food chain.
- Understand the importance of the food chain.
- Recognize WVC as a factor that could affect the ecosystem.
- Understand the impact of wildlife vehicle collisions on biodiversity.

Duration:
40 – 45 minutes

Type of Education:
Primary Education: Basic Environmental Concepts (wildlife, food chain, endangered species, biodiversity, diversity, endemic species, fauna, flora) (CY) / Life cycle of single species (IT)

Age:
6 – 8 years old

5.3. Introduction for educator

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- Animal vehicle collisions (AVC): Collisions with wild and domestic animals.
- Roadkill: refers to an animal or animals that have been struck and killed by motor vehicles on roads. It has increasingly become the topic of academic research in an attempt to understand the causes and how it can be mitigated.

Impact of roads on animals: The most obvious impact of roads on wildlife is mortality or injury through collision. Roads affect the species' abundance and distribution through both direct and indirect (secondary) effects. Birds, small and large mammals, and amphibians appear to be markedly affected by fragmentation of habitat caused by roads; the open spaces associated with roads can represent barriers to movement, but also allow predators or alien species to invade habitats.

A food chain: at the beginning of all food chains is the sun. Sunlight is energy and plants use this energy to turn water and carbon dioxide into plant food. Plants also need minerals and nutrients, which they get from the soil when their roots take up water. A food chain is a linear sequence of links in a food web starting from a species called producers in the web and ends at a species called decomposers. In a food chain, organisms are related with each other by the food they eat. Four main elements of food chain:

1. Producers

2. Consumers

3. Prey

4. Predator

Since all animals hold a specific place on the food chain, it can be disastrous if one animal disappears from it. Food chains are important because they show the intricate relationships in ecosystems. They can reveal how each organism depends on someone else for survival. Food chains also display what happens when a problem occurs, and when a producer or consumer is lost. Entire communities can collapse.

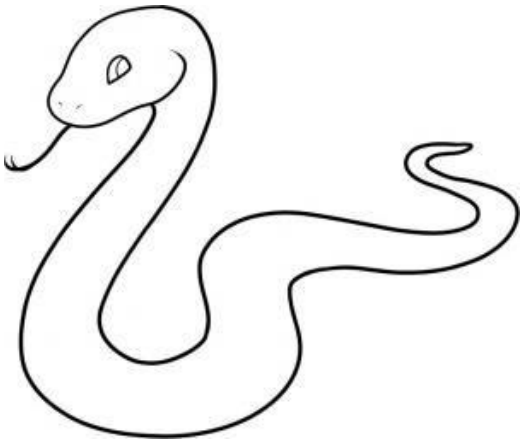
5.4. Implementation of activity

- The instructor prepares his / her ribbon (made of a carton paper strip) and sticks a car card on it. This indicates the instructor's role in the game.
- The instructor hands out a carton paper and asks trainees to cut a large strip so as to fit onto their heads as a ribbon (see picture). Then, s/he gives pictures of animals/organisms to the trainees and asks them to paint them and stick them onto their ribbon. Thus, every child 'becomes' an animal/organism (some trainees will possibly have the same animal/organism). The aim is to create 4 – 5 food chains.
- Once everyone prepares their ribbons, they gather together in the middle of the class forming a large circle with the instructor in the middle of the circle. They are then asked to be divided in various small food chains, depending on what each animal eats.

- For the chains to be created, the instructor puts a vegetation card at the beginning of every chain. Trainees are then asked to complete the chains. Once these chains are formed, the instructor asks them what will happen if an animal suddenly disappears from the chain and how important the role of an animal is.
- Then, s/he asks trainees how an animal population can be diminished? After the discussion, the instructor (as a car) starts taking animals away from the chain causing it to break.
- A discussion follows about accidents with animals, their impact on biodiversity and ways of decreasing them.

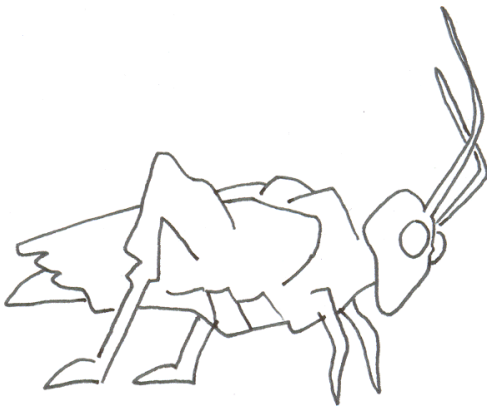
5.4.1. Supporting material

Picture 1

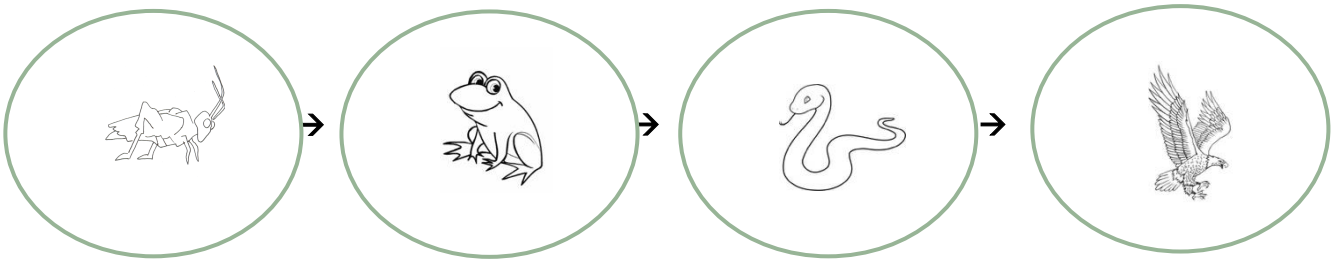


Picture 2

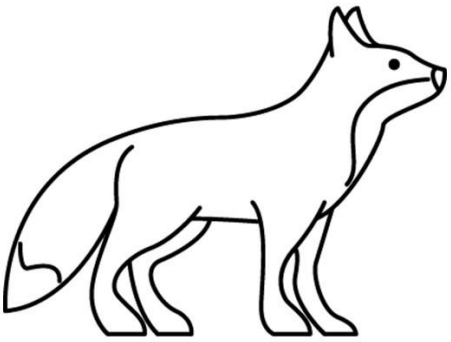
Picture 3



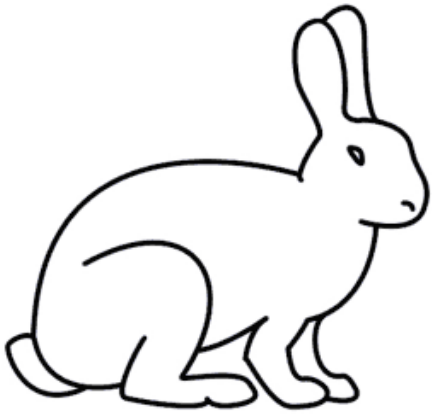
Picture 4



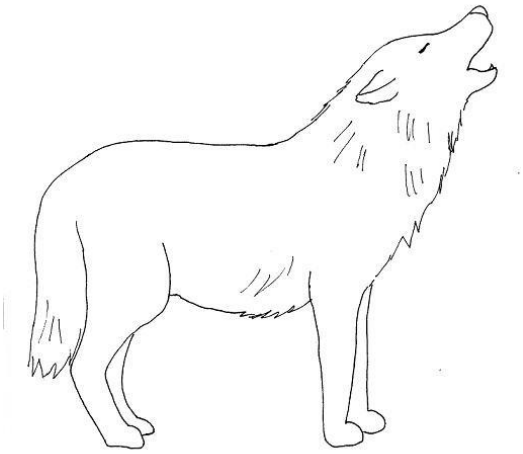
Picture 5

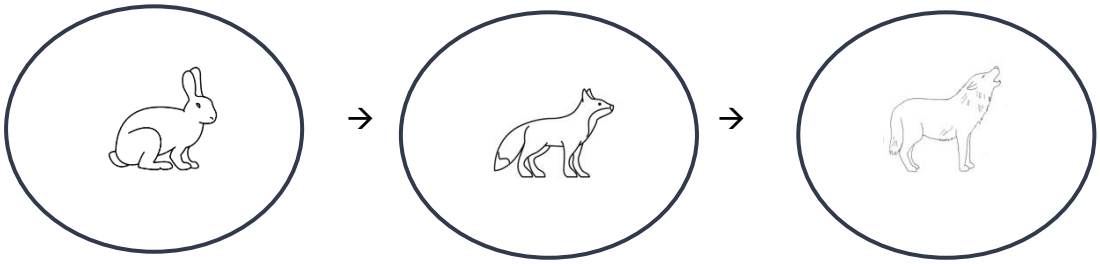


Picture 6

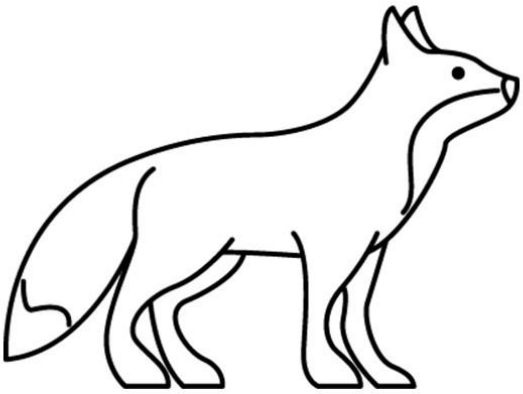


Picture 7

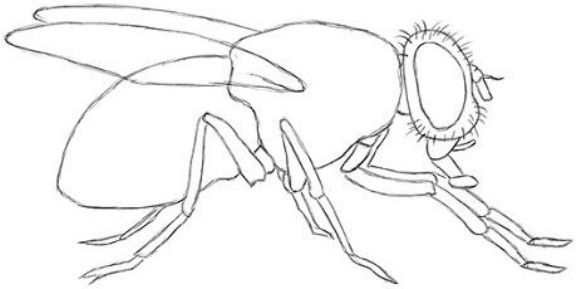




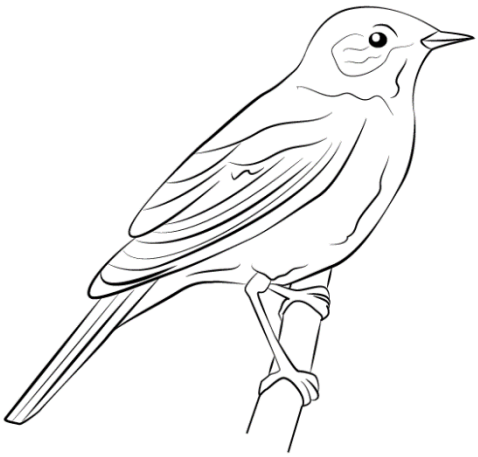
Picture 8



Picture 9



Picture 10



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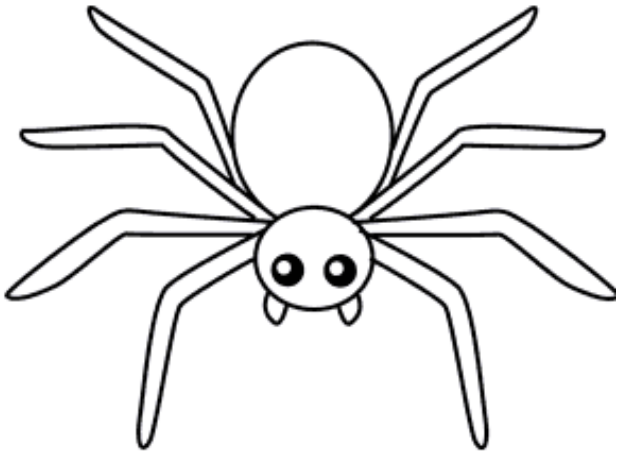
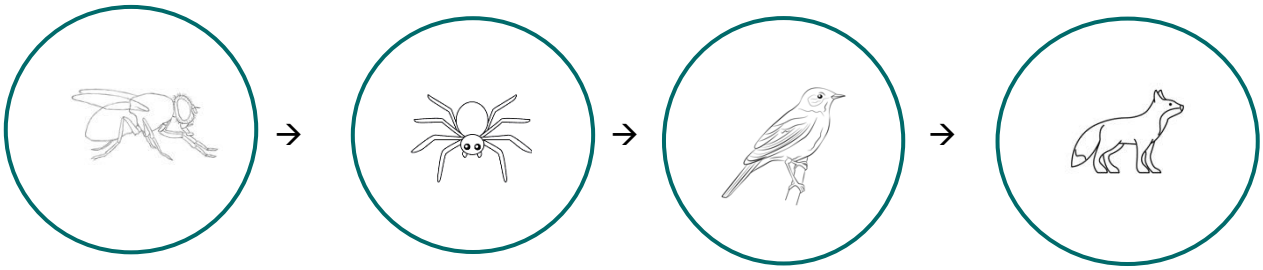
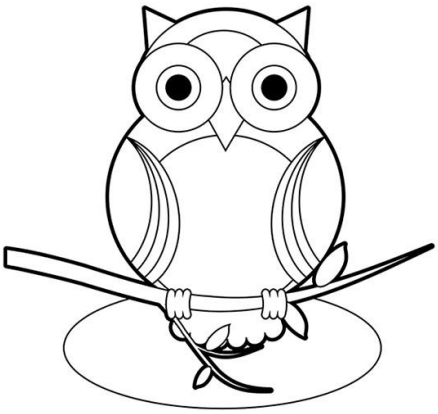
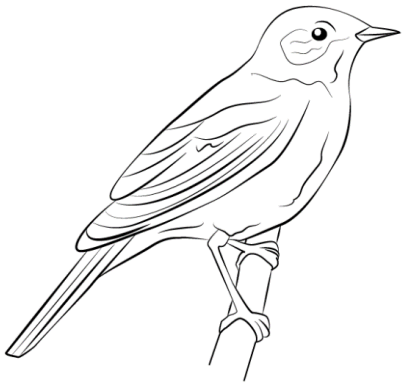




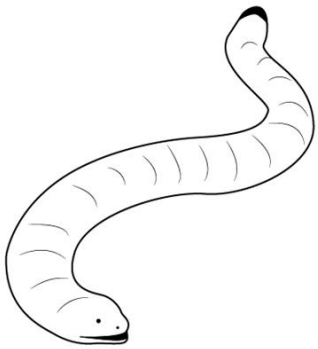
Picture 12



Picture 13



Picture 14



5.4.2. Supporting material

1. Snakes: They feed on small animals such as frogs, birds, eggs or insects.

2. Frogs: They eat fish eggs and fry, worms and insects like locusts.

3. Locusts: They are herbivorous insects and their diet is not limited to a single plant.

4. Eagles: They are predatory birds and usually eat other smaller birds, fish, snakes or larger animals.

5. Foxes: They are omnivorous animals, mainly eat hares, rabbits, birds, reptiles and fruits.

6. Wolves: They mainly eat large mammals, such as deer, but may also hunt red foxes.

7. Hares: They eat greens, clover, leaves, tender shoots, fruits, vegetables and cereals but especially love carrots.

8. Herbivore insects: They mainly feed on plants.

9. Birds: They feed on seeds, worms and insects such as spiders or even fish.

10. Spiders: They mainly eat insects.

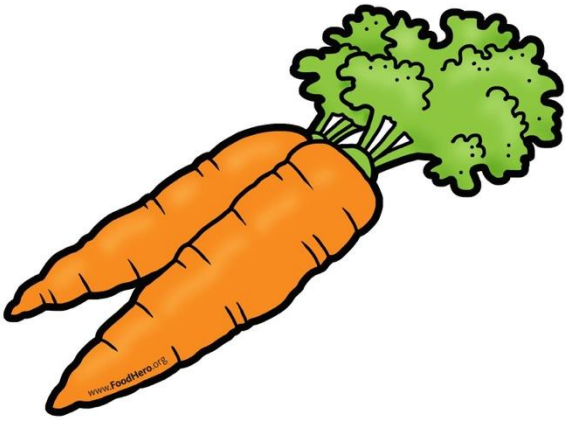
11. Owls: They mainly eat birds, fish, mice.

12. Earthworms: They feed on dried leaves and rotten plants.

5.4.3. Supporting material

Label 1

Label 2



Label 3

6. THE REPORTER

6.1. Aim

The aim is to raise awareness about the problem of Wildlife Vehicle Collisions (WVC) and inform trainees about the various WVC applications, teach them how to process the information and data of the system and develop a map according to the data provided.

6.2. Educational Objectives

By the end of the activity trainees should be able to:

- Understand the WVC as a biodiversity threat.
- Understand the main factors that lead to WVC, the main animals usually involved in each country's WVC, and how different stakeholders (e.g. police, insurance companies, NGOs, policymakers, etc.) can influence and be affected by WVC.
- Learn how to use WVC application/citizen science.
- Learn how to process data and information deriving from the WVC application.

Age:
11 – 14 years old

Duration:
90 minutes

Type of Education:
Secondary Education: Threats to biodiversity and mitigation measures (CY) / Ecosystem, interactions between species, biodiversity and species conservation (IT)

6.3. Introduction for educator

- Wildlife vehicle collisions (WVC): Collisions with all species of wild animals.
- Deer vehicle collisions (DVC): Collisions that involve only deer species. A separate term is used only for deer because deer accounts for the majority of WVC.
- Animal vehicle collisions (AVC): Collisions with wild and domestic animals.
- Roadkill refers to an animal or to animals that have been struck and killed by motor vehicles on roads. It has increasingly become the topic of academic research in an attempt to understand the causes and how it can be mitigated (Van der Ree et al. 2015; Introduction to road ecology; Wiley Blackwell).

WVCs can have a broad range of **consequences** for both motorists and animals. **These consequences can be divided into major categories according to their characteristics:**

- Vehicles (damage to vehicles, infrastructure).
- Health and safety (injuries, hygiene – dead bodies on the roads, emotional trauma, delay in work/schedule).
- Species (impact on biodiversity, mortality of animals, economic loss, e.g. game species and impact for the hunters).
- Financial cost for the public sector (i.e., insurances, health costs, road maintenance, mitigation and prevention measures).

Most animals are unable to recognize the street as a possible danger. Instead, they accept it as an element of their natural habitat and use it in some cases to their advantage: ex. thermoregulation, predation, mating, food + salt source or for migration along the barrier-free elements of infrastructures. The variety of attractants could cause Wildlife Vehicle Collisions.

Three reasons that lead an animal to cross the road:

1. **Food**
2. **Migration**
3. **Mating**

Main factors that lead to WVC:

- For many rare species worldwide, especially amphibians and reptiles, **traffic** is considered a threat to their survival.
- **Traffic** also poses a problem to many large and medium-sized mammals, and even common game species, since road mortality significantly affects the management of local populations.
- Increased **traffic** is indicative of the number of WVCs, even though high volumes of traffic can also discourage species from crossing at all.
- Roads that are close to wetlands, which typically host a variety of species populations, are at high risk of having many animals lingering by the roadside.

Sustainable development of the road network does not put limitations on mobility of people and goods and, at the same time, it reduces pollution, saves the environment and road users. One of the objectives of sustainable development of the road network is to reduce the negative impact on the biological diversity by adopting mitigation measures, thus minimizing the negative effect of roads on biological diversity.

For WVCs mitigation, there are:

- Measures aiming to change the driver's behaviour (e.g. speed reduction, warning signs) including sophisticated devices as a part of automobiles.
- Measures focusing on changing the behaviour of the species in the proximity of roads (e.g. fencing, vegetation clearance, dry ledges, overpasses and underpasses, olfactory repellents).

WVC application: A system used for recording the citizens' and volunteers' observations of dead wild fauna throughout the road network of the country. Data from these observations include the group of animals and the species identified, as well as the exact (GPS) location, the date and time of recording, photos of the roadkill and any relevant additional information related to the species, the road or the traffic condition.

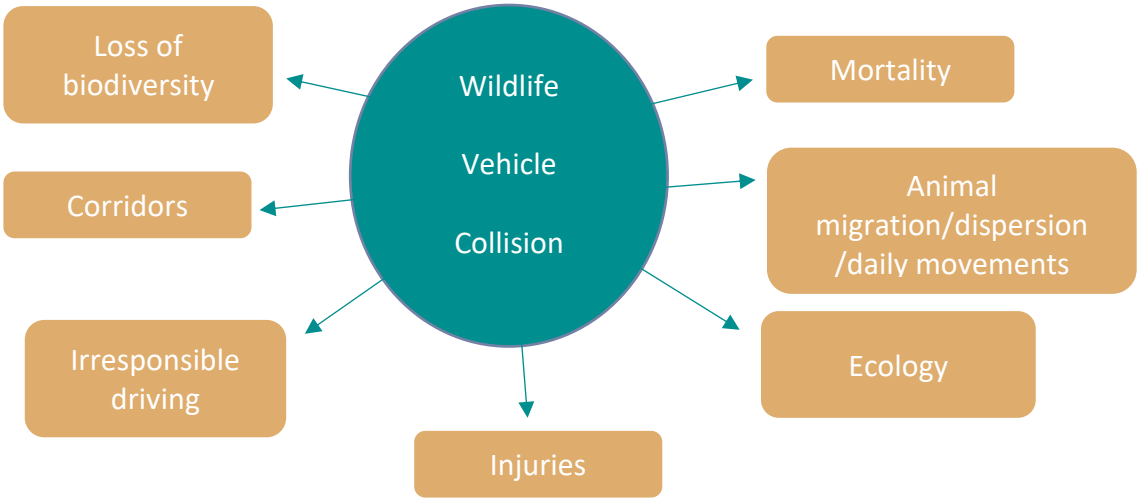
Accurate information on WVC in a **standardized form** is required to develop management measures able to protect both fauna and habitats, as well as to secure human health and safety.

A proper allocation of resources on **strategically selected areas/road** segments is essential to maximize the impact on travellers and wild fauna.

Collecting an extensive volume of data from large areas (e.g. at country level) requires the development of an efficient and accurate recording and analysing system.

6.4. Implementation of activity

- The educator presents to the trainees the issue of wildlife vehicle collision through a brainstorming exercise as shown in the example:



- A discussion is followed triggering specific questions:
  - What are the reasons that cause an accident – collision with a wild animal?
  - What are the ecological consequences of wildlife vehicle collisions?
  - What are the socioeconomic consequences of wildlife vehicle collisions?
  - How can we mitigate this problem?
  - What information is required to develop management solutions?
  - How can we collect information and data about such an issue?

***Information and material from the website www.enveros.eu – 06 WVC Monitoring.**

- In a room with computers (PCs), trainees are divided in groups of 3 to 4 individuals and are asked to process the information available at https://www.cyroadkills.org/home/ and http://srazenazver.cz/en/ and report the following:

1. **Which areas can be considered as WVC hotspots?**
2. **Which taxa are most affected by the road network?**
3. **Which specific species appear to interact more with WVC from the road network?**

- Trainees are invited to apply their knowledge outdoors, based on what they have learnt about the subject.
- The educator prints pictures of 10 – 15 wild animals (supporting material 6.3.1.) and places them at various locations outside the study room.
- In groups of 3 – 4 people, trainees split in different areas to find the pictures, identify the species and record background information in their datasheet.
- Trainees return to the classroom after they have collected the information. Altogether, they report their findings.

- The educator will provide a big map of the study area on which trainees will place their findings.
- Conclusively, the educator presents this method as a citizen science and emphasizes the importance of this method as a tool to understand and mitigate WVC.

***The educator can print more additional information (e.g. road type), which can be placed next to the animal picture so that the trainee can collect more information on their datasheet.**

6.4.1. Supporting material

To print:

6.4.2. Supporting material

Data sheet – Citizen Science

Species group: .....

Species name: .....

How certain are you?

Absolutely certain (100%)	Almost sure	Not sure

Date: .....

Time: .....

Location: .....

***Additional information:**

.....

Photograph:

7. DEBATE

7.1. Aim

The aim is to help trainees understand the issue of WVC and the complexity of making the decision to undertake a project that directly and indirectly affects the natural environment.

7.2. Educational Objectives

By the end of the activity trainees should be able to:

- Recognize that a natural area is important for many species (including humans).
- Understand that humans can negatively and positively affect a natural area.
- Realize that the protection of nature and biodiversity is not necessarily contrary to human needs.
- Formulate hypotheses and express their opinions with arguments.
- Understand the main factors that lead to WVCs, the animals usually involved in each country's WVCs, and how different stakeholders (e.g. Department of Road Transport, NGOs, policymakers etc.) influence and become affected by WVC.
- Understand the role of each stakeholder in mitigating WVC.
- Take initiatives, discuss and find a solution in a collaborative way.

Duration:
90 minutes

Type of Education:
Primary and Secondary education

Age:
14 +

7.3. Introduction for educator

Natural capital: the world's stock of natural resources, which includes geology, soils, air, water and all living organisms. Some natural capital assets provide people with free goods and services, often called ecosystem services. Two of these (clean water and fertile soil) underpin our economy and society, thus making human life possible.

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WVCs have a broad range of **consequences** for both motorists and animals. These consequences can be divided into major categories according to their characteristics:

- Vehicles (damage to vehicles, infrastructure).
- Health and safety (injuries, hygiene – dead bodies on the roads, emotional trauma, delay in work/schedule).
- Species (impact on biodiversity, mortality of animals, economic loss, e.g. game species and impact for the hunters).
- Financial cost for the public sector (i.e., insurances, health costs, road maintenance, mitigation and prevention measures).

Most animals are unable to recognize the street as a possible danger. Instead, they accept it as an element of their natural habitat and use it in some cases to their advantage: ex. thermoregulation, predation, mating, food + salt source or for migration along the barrier-free elements of infrastructures. The variety of attractants could cause Wildlife Vehicle Collisions.

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Main factors that lead to WVC:

- For many rare species worldwide, especially amphibians and reptiles, **traffic** is considered a threat to their survival.
- **Traffic** also poses a problem to many large and medium-sized mammals, and even common game species, since road mortality significantly affects the management of local populations.
- Increased **traffic** is indicative of the number of WVCs, even though high volumes of traffic can also discourage species from crossing at all.
- Roads that are close to wetlands, which typically host a variety of species populations, are at high risk of having many animals lingering by the roadside (Litvaitis and Tash, 2008; Environmental Management).

Sustainable development of the road network does not put limitations on mobility of people and goods and, at the same time, it reduces pollution, saves the environment and road users. One of the objectives of

sustainable development of the road network is to reduce the negative impact on the biological diversity by adopting mitigation measures, thus minimizing the negative effect of roads on biological diversity

For WVCs mitigation, there are:

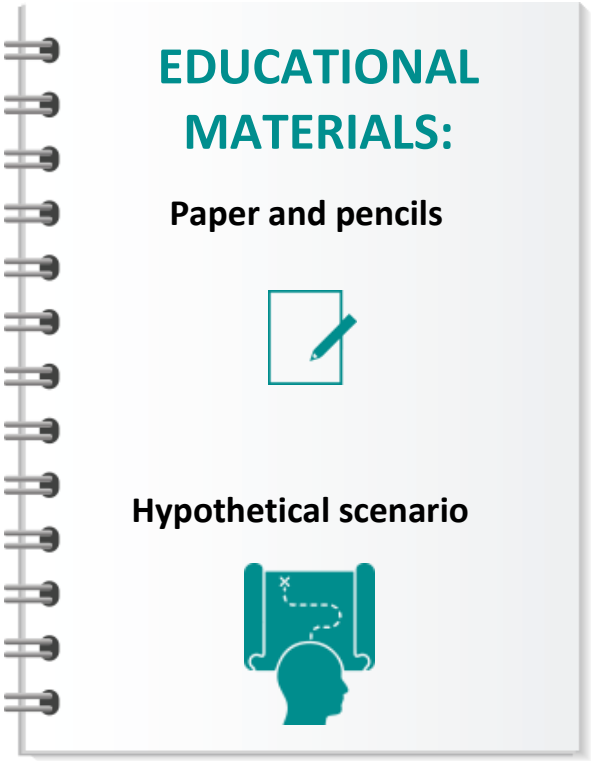
- Measures aiming to change the driver's behavior (e.g. speed reduction, warning signs) including sophisticated devices as a part of automobiles.
- Measures focusing on changing the behavior of the species in the proximity of roads (e.g. fencing, vegetation clearance, dry ledges, overpasses and underpasses, olfactory repellents).

7.4. Implementation of activity

- Trainees are divided in groups of 3 to 4 individuals and are asked to read the hypothetical scenario of a project development.
- Trainees have 10 minutes to read and understand the scenario.
- The educator assigns to each group one of the roles of the stakeholders and asks them to write and record their own views and positions on the issue and how the project may affect them.
- Trainees are asked to share their arguments with the rest of the groups/stakeholders.
- After the discussion between the stakeholders, each group has a meeting in order to consider its own solutions that may be accepted by all stakeholders.
- A common decision is held by all groups, considering potential mitigation/prevention measures.

Stakeholders:

1. Residents of the area 2. Traffic Police
3. Hotel owner 4. Environmental Organization
5. Mayor – Community Council



7.4.1. Supporting material

Hypothetical scenario

Located in an isolated village, a hotel offers high incomes to the community since it attracts thousands of tourists each year who are drawn by the natural landscapes and animals that inhabit the area. The surrounding natural area is a (protected) national park, which has been awarded for its geological and ecological environment. It has been characterized as a unique area of natural beauty offering precious ecosystem services to communities; with an ancient woodland ideal for outdoor walking and a natural lake that attracts a variety of species, from birds and amphibians to reptiles and mammals.

As announced on the news, the hotel is now planning to create a road across the forest so that tourists can travel faster and easier from the airport (reaching the hotel in half the time than previously required). This announcement has shocked many stakeholders since such a development could cause irreversible consequences to the ecosystems, such as habitat loss, habitat fragmentation and WVCs. Apart from the impact on the ecosystem, stakeholders argued that the road could also be a threat to travellers since large animals such as roe deer and wild boars could cross the road and cause accidents, as well as damages to the vehicles.

Due to the potential damages of such a development, the conflicts and tension have substantially increased between the stakeholders. However, it was acknowledged that the hotel offers to the community at least €500.000 annually. In addition, the hotel has received numerous negative messages from customers who were disappointed with the existing road, which is very far from the nearest town and has many curves.

In an effort to restore order and find a solution, the mayor and the community council decided to convene a meeting with all the stakeholders and the hotel.

8. TIME TRAVELLING

8.1. Aim

The aim is to educate trainees to recognize the changes that have occurred through time in the road network, regarding the number and type of vehicles, in a specific area. This experience will help trainees understand the conflicts that arise from the development of road networks and vehicles towards biodiversity and the environment in general.

8.2. Educational Objectives

By the end of this activity trainees should be able to:

- Identify the spatiotemporal changes that occur in an area in terms of road development and number and activity of vehicles.
- Realise the impact of roads on biodiversity and ecosystems.
- Understand how WVCs could decrease the number of animals in an area.
- Realize that the development of the road network and increase of vehicles in an area can increase the chances of WVCs.

Duration:
45 minutes

Age:
7 – 12 years old

Type of Education:
Primary Education – Non formal

8.3. Introduction for educator

- Wildlife vehicle collisions (WVC): Collisions with all species of wild animals.
- Deer vehicle collisions (DVC): Collisions that involve only deer species. A separate term is used only for deer because deer accounts for the majority of WVC.
- Animal vehicle collisions (AVC): Collisions with wild and domestic animals.
- Roadkill: refers to an animal or animals that have been struck and killed by motor vehicles on roads. It has increasingly become the topic of academic research in an attempt to understand the causes and how it can be mitigated (Van der Ree et al. 2015; Introduction to road ecology; Wiley Blackwell).

WVC can have consequences for species:

- Mortality of animals → Mortality resulting from roadkill can be significant in species with small populations.
- For many rare species worldwide, especially **amphibians and reptiles**, traffic is considered a threat to their survival.
- Traffic also poses a problem to **many large and medium-sized mammals**, and even common game species, since road mortality significantly affects the management of local populations.

The development of the road network and growing number of vehicles in an area can increase the chances of WVC. Increased traffic is indicative of the number of WVCs, even though high volumes of traffic can also discourage species from crossing at all.

During the last 15 years, the sharp increase in WVCs observed globally has been attributed to causes such as:

- Demographic expansion of some species (e.g. ungulates in Europe).
- Increase of car speed.
- Further increase of the road network length.

Most animals are unable to recognize the street as a possible danger. Instead, they accept it as an element of their natural habitat and use it in some cases to their advantage: ex. thermoregulation, predation, mating, food + salt source or for migration along the barrier-free elements of infrastructures. The variety of attractants could cause Wildlife Vehicle Collisions.

Increase of road networks cause habitat fragmentation with multiple consequences for the animal populations that need to cross.

Three reasons that lead an animal to cross the road:

1. **Food**
2. **Migration**
3. **Mating**

8.4. Implementation of activity:

- The instructor will present images of the past and present (supporting material 8.4.1) and ask questions. Trainees will discuss and report their observations.

Potential questions:

- How have vehicles changed over time?
- Has the number of roads increased or decreased compared to the past? If so, why?

- The instructor will split trainees in pairs and will give them cards with images from different time periods (supporting material 8.4.2). Trainees will study them and report their first observations with the entire group.
- Then, the instructor will ask the pairs to place the cards in a temporal order and report their observations again.
- The instructor will hear the observations and ask the trainees: "What is the impact of the roads and the increase of vehicle number on biodiversity and the environment?" This question is expected to spark a discussion. The instructor will record all the thoughts and answers of the trainees. This raises the issues of WVC and/or restriction of species migration, if not reported.
- The instructor presents the issue of WVC on the movement of animals, with information such as:

  - The animals move to forage, reproduce or migrate.
  - Main taxa that face restrictions due to WVCs are mammals, reptiles and amphibians.
  - The collisions with those species can cause an increasing decline in their numbers.
  - Important factors that contribute to wildlife vehicle collisions are the increase of the vehicles' number, road networks and speed limit.
  - Increase of road networks cause habitat fragmentation with multiple consequences for the animal populations that need to cross to breed, forage, reproduce or migrate.

- The instructor asks the trainees to report measures that can improve and mitigate the issue of WVC in the future. The educator records all the ideas on the blackboard.
- In the end, the instructor asks the trainees to imagine and draw a future image (for the year 2060) of the area that they studied, by considering mitigation measures that can be implemented.

EDUCATIONAL MATERIALS:

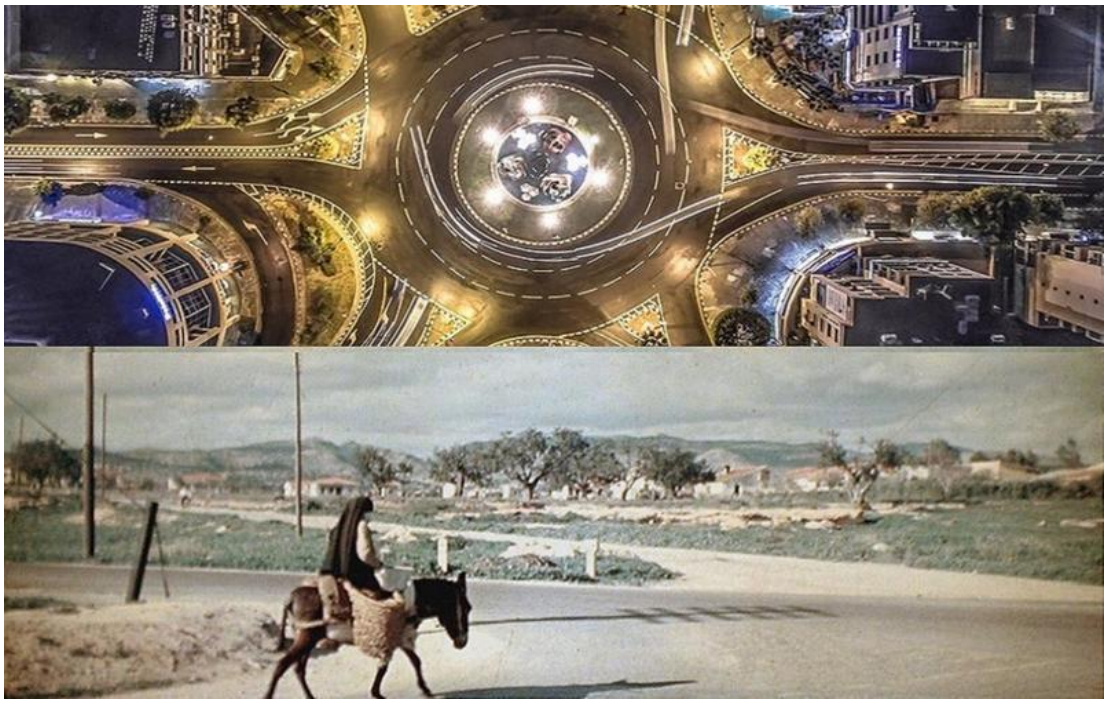
Paper and coloured pencils

Area Cards

Pictures from the past and present

8.4.1. Supporting material

An old picture of the building (1917) and the most recent one (2019).
Source: *"Limassol: A flashback memory", Tasos Andreou, Historical Archive of Limassol, Limassol Memories*



How the roundabout of Saint Nicholas has evolved through the decades.
Source: *"Memories of Limassol", Sky Art, Daniel Donovan*

Anexartisias Street, Pentadromos, "Today".
Source: *"All about Limassol"*

Anexartisias Street, Pentadromos, "Yesterday".
Source: *"All about Limassol"*

8.4.2. Supporting material

Source 1: "Limassol: A flashback memory", Tasos Andreou, 1878.

Source 2 Carriages (Tasos Anderou) 1930 – 1940.

Source 3 "Limassol: A flashback memory", Tasos Andreou, Historical of Limassol, Memories of Limassol, 1917.

Source 5 "All about Limassol", Seafront road of Limassol in the '70s.

Source 4 "All about Limassol", Ifigenias, Limassol, 1950.

Source 6 "All about Limassol", Makarios Avenue, Limassol, 2019.

Drawing

1878 | 1917 | 1930 – 1940 | 1950 | 1970 | 2019 | 2060

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- Watch out for wildlife activity fun book, Defenders of wildlife
- Zotos, S., Vogiatzakis, I., (2018). CyROS: Towards a common methodological framework for roadkills recording in Cyprus. Ecologia Mediterranea, 44: 109-114.

Webpage

- https://wwf.panda.org/knowledge_hub/teacher_resources/webfieldtrips/food_chains/
- http://www.enveros.eu/wp-content/uploads/2019/06/ENVEROS-IO1-report.pdf

Pictures

- CHANJ Guidance Document
- Dave Young (www.flickr.com)
- George Konstantinou (https://politis.com.cy/web-tv/i-agria-fysi-tis-kyproy)
- Jean-Jacques Boujot (https://en.wikipedia.org/wiki/European_hare)
- Jörg Hempel (https://el.wikipedia.org/wiki/Αγρινό)
- Kirsty Faulkner/Mercury
- Stevie B - [1] (https://el.wikipedia.org/wiki/Τυτώ#)
- Tasos Andreou – Limassol: A flashback memory

Webpages

- https://www.youtube.com/watch?v=UDiUSUhEAzw
- https://www.ecopedia.be/encyclopedie/ecoduct
- http://reptilescyprus.blogspot.com/2016/08/cyprus-whip-snake-hierophis-cypriensis.html
- https://politis.com.cy/web-tv/i-agria-fysi-tis-kyproy
- www.allaboutlimassol.com
- www.shutterstock.com