

## Spatial monitoring wildlife, environment and health interactions – methodology

### *Purpose of the data*

Field data is collected using “**environmental indicator**” survey forms, which record the **biotic and abiotic characteristics** of each site, based on the biology of the species being monitored. During site visits, staff record more detailed information depending on the situation, such as the type of vegetation present or whether waste is observed. This data is then organised in **tables or databases** and **mapped using GIS software**.

These maps make it possible to:

- **visualise how species are distributed across the area**
- **identify sensitive locations**
- **analyse relationships between environmental indicators and the presence of species**

Ultimately, these maps and analyses are intended to **support decision-making in urban planning projects**.

### *How analysis criteria are defined*

The project is built around the **One Health** framework, taking into account the biology of each species, including its needs, feeding behaviour and preferred habitats, in order to understand:

- which environments favour the development of the species
- the impact of the species on its surroundings

These criteria are **defined in close collaboration with scientists** who provide specialist expertise on each monitored species. This partnership ensures that the indicators and monitoring methods reflect the biological and ecological characteristics of the species, improving the reliability and relevance of the collected data.

### *The One Health vision*

The **One Health** concept is based on the interconnection between the health of humans, animals, plants and the environment. The survey forms help identify factors that favour the presence of certain species and assess their impacts on ecosystems and human populations. Conversely, they also analyse how environmental conditions influence the presence of species.

For example, in the case of rats, the analysis aims to:

- determine whether human presence favours their proliferation
- identify possible interactions with people and potential public health impacts
- evaluate the role of vegetation on their development and their effects on soils or planted areas

The resulting maps allow the presence of species to be analysed through different One Health themes. For example, rat locations can be compared with children's playgrounds to help plan targeted actions.

### *Methodology and monitoring*

- The **indicator survey forms** follow standardised field protocols to describe habitats and environments (recognised typologies, floristic and faunal surveys), ensuring that the collected data is both **rigorous and comparable**.
- **GIS mapping** is used to represent data spatially, as well as identify ecological corridors, refuge areas and habitat connectivity. This guides decisions on **urban planning or interventions**.
- The approach takes **urban dynamics, biodiversity and health** into consideration order to anticipate and manage interactions between species, environments and human populations in an integrated way.

### *Example application: leptospirosis*

A practical example is the use of a **leptospirosis risk index table**, which summarises urban risk factors by combining **environmental and social factors**:

- presence of rats (0 = no, 2 = yes)
- presence of a humid environment (0 = no, 1 = yes)

Combining these variables produces a **priority index**, which is then complemented by a **human exposure index** to determine the **priority of intervention** required (awareness actions, site improvements or environmental testing).

This unified format facilitates import into GIS software and **optimises the processing and visualisation of the data**, contributing to the **spatial monitoring of wildlife, environment and health interactions**, carried out in **collaboration with scientists according to the species being studied**.

# Species data collection form

## Tiger mosquitos



**Purpose of the form: Identify the factors that contribute to the development of species and its impact on health**

Agent name: Other  
contact person:  
Morning/afternoon: Site  
address:

GIS coordinates:  
Date:  
Season:  
Time:

### 1) Context

*(Tick the option that describes the intervention location)*

- Urban centre (vertical architecture, presence of shops, etc.)
- Industrial area (no housing, presence of businesses and industrial activities)
- Residential neighbourhood (presence of housing, no shops)
- Public facility (specify the type, e.g. hospital, school, etc.): .....
- Public green spaces
- Private green spaces private
- Other: .....

### Where has the species been observed? *(several answers possible)*

- Near a pond or lake
- Park
- Square (small park with playground)
- In a cemetery
- In a residential complex (large complex, housing block, etc.)
- At a private residence
- In a community garden/educational garden
- Outside
- Inside

### 2) Specific characteristics of the site: particular features that may explain why the species is present.

*(Tick the relevant boxes, several answers possible)*

- Presence of artificial stagnant water points (pond, fountain, depressions, etc.)
- Presence of containers holding stagnant water (watering cans, saucers, tarpaulins, tanks, etc.)
- Presence of waste containing water (tyres, bottles, etc.)
- Presence of vegetated areas left fallow or not maintained
- Presence of flat roofs (water drains slowly and stagnates)
- Presence of vegetated balconies
- Presence of raised terraces (water may stagnate underneath the terrace)
- Presence of technical spaces, such as rainwater drains or underground fibre optic connections
- Old or poorly maintained blocked gutters
- Construction sites or works

### 3) Surrounding environment: features within a 150 m radius that may influence the species and the health of the environment

*(Tick the relevant boxes, several answers possible)*

- Presence of maintained green spaces
- Presence of waste or a dump site
- Presence of vegetated areas left fallow or not maintained
- Presence of artificial, potentially stagnant water points (pond, fountain, depressions, etc.)
- Presence of unsanitary / abandoned housing
- Presence of stagnant water source(s)
- Presence of community gardens/educational gardens
- Business park / Industrial zone
- Construction sites or works
- Other: .....

# Vegetation characteristics at the site that may explain the presence of the species (breeding areas, shelter zones, etc.)

*(Tick the relevant boxes, several answers possible)*

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li><input type="checkbox"/> Presence of hedges</li> <li><input type="checkbox"/> Presence of flowers</li> <li><input type="checkbox"/> Presence of dense vegetation cover (inaccessible ground, abundant vegetation)</li> <li><input type="checkbox"/> Presence of sparse vegetation cover (simple lawn, a few shrubs)</li> <li><input type="checkbox"/> Absence of vegetation cover</li> </ul> | <ul style="list-style-type: none"> <li><input type="checkbox"/> Presence of deciduous trees</li> <li><input type="checkbox"/> Presence of conifer trees</li> <li><input type="checkbox"/> Presence of plane trees</li> <li><input type="checkbox"/> Presence of bamboo</li> <li><input type="checkbox"/> Presence of plants that may act as "water containers"</li> </ul> |
|---|---|

## 5) Presence of the species at the site

**Information source:** \_\_\_\_\_

- City of Lyon technician or officer
- Site user or resident

**Signs of presence:** \_\_\_\_\_ *(Tick the relevant boxes, several answers possible)*

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li><input type="checkbox"/> None</li> <li><input type="checkbox"/> Visual observation of adults</li> </ul> | <ul style="list-style-type: none"> <li><input type="checkbox"/> Mosquito bites</li> <li><input type="checkbox"/> Presence of larvae</li> <li><input type="checkbox"/> Carcass</li> </ul> |
|--|--|

**Conclusion of presence:** \_\_\_\_\_ *(Tick the relevant boxes, several answers possible)*

- |   |   |  |
|---|---|--|
| <ul style="list-style-type: none"> <li><input type="checkbox"/> Low presence</li> <li><input type="checkbox"/> High presence</li> </ul> | <ul style="list-style-type: none"> <li><input type="checkbox"/> A few individuals observed</li> <li><input type="checkbox"/> Larvae</li> <li><input type="checkbox"/> Adults</li> </ul> | <ul style="list-style-type: none"> <li><input type="checkbox"/> No individuals observed</li> <li><input type="checkbox"/> Many individuals observed</li> <li><input type="checkbox"/> Larvae</li> <li><input type="checkbox"/> Adults</li> </ul> |
|---|---|--|

## 6) Assessment of the nuisance

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li><input type="checkbox"/> No nuisance (no bites, no visual observation)</li> <li><input type="checkbox"/> Occasional nuisance (occasional bites and observations)</li> </ul> | <ul style="list-style-type: none"> <li><input type="checkbox"/> Moderate nuisance (frequent bites, individuals regularly visible)</li> <li><input type="checkbox"/> High nuisance (bites almost immediate, permanent presence)</li> </ul> |
|--|---|

## 7) Assessment of the impact on human health

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li><input type="checkbox"/> Minor behavioural changes: use of repellents, low level of concern</li> </ul> | <ul style="list-style-type: none"> <li><input type="checkbox"/> Major behavioural changes: use of repellents and traps, constant concern</li> </ul> |
|---|---|

## 8) Assessment of potential presence risk

Scoring method: if the listed factors are observed, the maximum score assigned to them is applied (e.g. 2 in the case of a rainwater collector, 1 for the presence of bamboo). If the factor is not observed, the score is 0.

	Rainwater collector (0/2)	Misc. items (buckets, watering cans, etc.) (0/1/2)	Blocked gutters (0/1)	Old/blocked drainage systems (0/1)	Raised terraces (0/2)	Flat roofs (0/1)	Bamboo (0/1)	Dense vegetation (0/1)	Waste (0/1)	Construction site/works
Presence										
Note										

**Results:**

**Remark(s)**

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# Species data collection form

## Rats



This form is used to identify the factors that lead to development of the species of concern.

Agent name:

Other contact person:

Morning/afternoon:

District and site address:

Date:

Season:

Time:

GIS coordinates:

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### 1) The site

*(Tick the option that describes the intervention location)*

- Urban centre (vertical architecture, presence of shops, etc.)
- Industrial area (no housing, presence of businesses and industrial activities)

- Residential neighbourhood (presence of housing, no shops)
- Public facility (specify the type, e.g. hospital, school, etc.): .....

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### Where were signs of rat presence observed? *(several answers possible)*

- In a waste management area (bin storage, compost area, etc.)
- In communal areas
- Inside one or more homes
- In a park
- In a square
- In planted beds / vegetated strips

- In community gardens / an urban farm
- In a vegetated square
- In the street
- In shops
- In a cellar
- In playground areas

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### 2) Specific characteristics of the site: particular features that may explain why the species is present.

*(Tick the relevant boxes, several answers possible)*

- Presence of waste on the ground (within a 50 m radius)
- Presence of compost
- Presence of waste storage areas
- Presence of open or accessible bins
- Presence of damaged bins
- Presence of bins with visible plastic bags
- Presence of unsanitary housing/squats
- Presence of homeless people

- Presence of gaps or passageways that facilitate the entry or movement of animals
- Presence of an accessible underground network
- Regular human food activity
- In planted beds / vegetated strips
- Presence of soil ground cover
- Presence of wood chip ground cover
- Presence of water points

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### 3) Surrounding environment (features located around the site that may influence the species and the health of the area)

*(Tick the relevant boxes, several answers possible)*

- Presence of green spaces (park, public garden, etc.)
- Presence planted beds / vegetated strips
- Presence of water points
- Presence of food shops
- Presence of construction sites or works
- Regular human food activity
- Other: .....

- Presence of waste storage
- Presence of unsanitary housing (squats)
- Presence of homeless people
- Presence of feeding areas for other animals (pets, pigeons, etc.)
- Regular presence of a market

#### 4) Flora: Vegetation characteristics that may explain the presence of the species

(Tick the relevant boxes, several answers possible)

- Presence of deciduous trees
- Presence of conifer trees
- Presence of hedges
- Presence of ivy
- Presence of dense vegetation cover (abundant vegetation, ground not visible)
- Presence of sparse vegetation cover (lawn, a few shrubs, etc.)
- Absence of vegetation cover
- Presence of food-producing trees (fruit, seeds, acorns, etc.)

#### 5) Observation of the species – number of times the species has been observed and/or number of individuals.

##### Information source

- City of Lyon technician or officer
- Site user or resident

##### Signs of presence (Tick the relevant boxes, several answers possible)

- None
- Visual observation
- A few burrows
- Many burrows
- Closed burrows (appearing inactive)
- Damage caused
- Droppings
- Sounds or noises
- Carcass

##### Assessment of presence (Tick the relevant boxes, several answers possible)

Note: the site context should always be considered: two rats in a communal or confined area = many individuals / two rats in a park = a few individuals.

- Minor signs of presence
- Major signs of presence
- No individuals observed
- A few individuals observed: .....
- Many individuals observed: .....

#### 6) Assessment of site use

- Quick transit, no contact with the ground = **0**
- Organised activities, with moderate ground contact (picnics, team sports) = **2**
- Short stationary presence or waiting, with minimal ground contact (bench, picnic table) = **1**
- Free presence with prolonged ground contact (children's play area, bathing, squats, picnics on the ground) = **3**

#### 7) Assessment of presence risk

Scoring method: if the listed factors are observed, the maximum score assigned to them is applied (e.g. 2 for waste on the ground, 1 for the presence of homeless people). If the factor is not observed, the score is 0.

Presence	Waste on ground (0/2)	Bins with plastic bags 0/2	Accessible bins (0/1)	Regular human food activity (0/2)	Food shops (0/1)	Homeless or informal housing (0/1)	Dense vegetation (0/2)
Score							

**Results:**

#### 8) Assessment of leptospirosis risk

Scoring method: if the listed factors are observed, the maximum score assigned to them is applied. If not observed, the score is 0. For human presence, 1 = low, 2 = moderate, 3 = high. For site use, see the scoring defined in section 6 above.

Presence	Wetlands (0/1/2)	Rats (0/1/2)	Frequency of humans (1/2/3)	Site use (1/2/3)
Score				

**Results:**

# Species data collection form

## Coypus



**Purpose of the form: Identify the causes that contribute to the development of species of concern.**

Agent name: Other  
contact person:  
Morning/afternoon: Site  
address:

GIS coordinates:  
Date: Season:  
Time:

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### 1) The site

*(Tick the option that describes the intervention location)*

- Urban centre (vertical architecture, presence of shops, etc.)
- Industrial area (no housing, presence of businesses and industrial activities)
- Residential neighbourhood (presence of housing, no shops)
- Public facility (specify the type, e.g. hospital, school, etc.): .....

- Urban farm, community gardens (green spaces for producing for and/or for educational purposes)
- Private gardens
- Parks
- Squares (small city-centre parks)

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### Where is the nuisance observed? *(several answers possible)*

- Near a river
- Near a pond or lake
- Near a canal or ditch
- In green spaces

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### 2) Specific characteristics of the site: particular features that may explain why the species is present.

*(Tick the relevant boxes, several answers possible)*

- Presence of waste on the ground (within a 50 m radius)
- Presence of compost
- Presence of waste storage areas

- Presence of open or damaged bins
- Presence of bins with visible plastic bags
- Presence of agriculture

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### 3) Surrounding environment (features located around the site that may influence the species and the health of the area)

*(Tick the relevant boxes, several answers possible)*

- Presence of green spaces
- Presence of wetland environments
- Presence of compost and/or waste storage
- Presence of food shops

- Presence of regular human activity
- Presence of animals (farm animals or pets)
- Presence of feeding areas for other animals (pets, pigeons, etc.)
- Other: .....

#### 4) Flora: Vegetation characteristics that may explain the presence of the species.

*(Tick the relevant boxes, several answers possible)*

- Presence of water lilies
- Presence of other rhizomes (specify if possible .....)
- Presence of reeds
- Presence of other grasses (specify if possible.....)
- Presence of tubers
- Presence of naturally shaded areas
- Presence of dense vegetation cover (abundant vegetation, ground not visible)
- Presence of sparse vegetation cover (lawn, a few shrubs, etc.)
- Absence of vegetation cover
- Presence of food-producing trees (fruit, seeds, acorns, etc.)
- Other plants (specify if possible): .....

#### 5) Observation of the species – number of times the species has been observed and/or number of individuals.

**Information source:** \_\_\_\_\_

- City of Lyon technician or officer
- Site user or resident

**Signs of presence:** \_\_\_\_\_ *(Tick the relevant boxes, several answers possible)*

- None
- Visual observation of the species
- Burrows (estimate, as far as possible, the number of entrances per m<sup>2</sup>: .....)
- Damage caused
- Droppings
- Sounds or noises
- Carcass: .....

**Conclusion of presence:** \_\_\_\_\_ *(Tick the relevant boxes, several answers possible)*

- Signs of low presence
- Signs of high presence
- No individuals observed
- A few individuals observed: .....
- Many individuals observed: .....

### Risk for 3 types of health

The objective is to formulate initial hypotheses about the potential impact of the species on human, animal and environmental health, based on the interactions observed with different components of the site.

#### 6) Risks to human health

*(Tick the relevant boxes, several answers possible)*

- Economic/material damage
- Risk to human health (zoonotic diseases)
- Hygiene issues
- Mental health
- Other: .....

#### 7) Risks to animal health

*(Tick the relevant boxes, several answers possible)*

- Risk to pets (illness, injury, etc.)
- Risk to endemic species (competition, illnesses, etc.)
- Other: .....

#### 8) Risks to the environment

*(Tick the relevant boxes, several answers possible)*

- Risk to soils (loss of biodiversity, erosion, etc.)
- Risk to flora (reduction or disappearance of species, or conversely proliferation)
- Risk to fauna (reduction or disappearance of species, or conversely proliferation)
- Other: .....

#### Remark(s)

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## QGIS guidance document

This directory contains several sub-folders:

- The **“Rat data collection”** folder. This contains the main Excel spreadsheet. All data collected from field survey forms should be entered here. \n The layer folder only contains the shp file listing all sites where signs of rat presence were observed. This is the base layer used to create the other indicator maps.
- The **“Rat health indicator”** folder. This contains the maps referenced in the “Health Indicators” document, concerning waste on the ground, human food sources and dense vegetation. Each of these factors has its own corresponding shp layer in the relevant folder.

Important: when these layers are added in QGIS, they will only show sites where the factor was actually recorded. To reproduce the same visual output as the PDF maps, you must add both the “rat data collection” shp and the shp for the factor or factors you want to display. Once added in QGIS, make sure the relevant layers are selected.

To show a factor clearly, apply categorised symbology and assign different colours to “yes” and “no”.

Note: the “waste on the ground” layer appears as points by default. To match the circular symbols used in the example maps, you must adjust the symbology manually (see the complete project for the exact settings).

- The **“Leptospirosis risk index”** contains maps linked to the Excel document of the same name, which is also included in this folder.

The base map layer is found under “leptospirosis index”. Its shp file shows all sites visited, similar to the rat data collection layer. However, the attribute table contains different variables: instead of health indicators, it includes risk factors such as site use, visitor frequency and humidity.

To display a specific factor, follow the same method described earlier but also use the “classify” option. If categories are missing, add them using the + button.

This approach has already been applied in the “intervention priority” folder. In this case, the shp layer corresponds to the map for this index. However, when it is first added the symbology is not applied automatically, so all points appear in the same colour. To fix this, open the symbology settings, go to “style” (below “classify”) and choose “load style”. Then select the layer in the folder called “symbology\_intervention\_priority” and the correct symbology should then be applied.



Lastly, the “**Complete project**” folder contains all the layers described above already loaded with the correct symbology. If you plan to work with it, make a copy first so that the original file is not accidentally modified or lost.