Infrastrutture Wireless Italiane

Biodiversity Protection for INWIT: impacts and opportunities

Position Paper

INWIT S.p.A.

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INWIT'S APPROACH: EXECUTIVE SUMMARY

The protection of biodiversity has been identified as one of the key issues for INWIT and its stakeholders. In its Sustainability Plan, INWIT pledged to carry out an assessment of the impacts and opportunities of its infrastructures in terms of biodiversity.

This paper aims to paint a picture of the impact on Italian biodiversity of the activity of INWIT, Italy's leading tower operator, with over 23,000 telecommunications towers. The different types of sites (raw-land and roof-top) will be examined, along with the various types of environments within which the company's infrastructures stand.

The research is an integral part of the initiatives undertaken by INWIT for the protection of biodiversity, inspired by SDG 15 of the UN 2030 Agenda, to "Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss." Further impetus has been given by the European Taxonomy [Regulation (EU) 852/2020], through the definition of the environmental objective "protection and restoration of biodiversity and ecosystems." The Italian legislator has also shown sensitivity to the issue, by approving, on 8 February 2022, amendments to Article 9 (and 41) of the Constitution[1], adding the protection of the environment, biodiversity, ecosystems and animals among the fundamental principles of the Italian Constitutional Charter.

With regard to its geographical context, Italy is a biodiversity hotspot. In other words, it is a place where many animal and plant species are concentrated, and which has a high level of environmental variability. The many endemic species and the threatened species listed in the IUCN[2] Red Lists are safeguarded by the Protected Areas and by the Natura 2000 Sites[3], a network of sites identified by the European Union as having priority status for the protection and conservation of habitats and plant and animal species. In its infrastructure positioning analysis, INWIT reported that approximately 5% of its towers are located within Natura 2000 Sites.

Based on the precautionary principle and with a conservative approach, INWIT has assessed the impacts of its activities, breaking them down by type and discussing them in detail. The theoretical estimate of the impacts showed that the areas impacted the most are natural areas or those close to water bodies, on which around 12% of INWIT towers stand, while the least impacted areas are built-up areas, where around 55% of INWIT towers are present. Agricultural areas, on which around 33% of the towers stand, have intermediate characteristics.

As a result of this assessment, **the theoretical values of the estimated magnitude of impacts relevant to the activities under consideration invariably fall within the ranges of absent/insignificant and mild/moderate, not showing the presence of possible significant impacts**. The impacts with higher magnitude values, but which still fall within the aforesaid

[1] https://www.cortecostituzionale.it/documenti/download/pdf/Costituzione_della_Repubblica_italiana.pdf
[2] International Union for Conservation of Nature
[3] https://www.mite.gov.it/pagina/rete-natura-2000

ranges, appear to be linked to the deterioration or disturbance of habitats of species.

Opportunities to benefit and protect biodiversity were also assessed, where such opportunities can be directly linked to INWIT's digital tower activities. Starting, for example, by installing IoT sensors and smart video cameras on the towers, for environmental and wildlife monitoring or fire prevention purposes.

Lastly, INWIT has developed specific biodiversity protection protocols, dedicated to creating new infrastructures, with a view to further reducing the impact on biodiversity. These protocols, starting with the identification of environmental quality elements, involve detection of the possible impacts, the consequent mitigation measures required, and the monitoring put in place to verify the effectiveness of such measures.

THE STATE OF BIODIVERSITY IN ITALY

Biodiversity (short for biological diversity) is defined as the variability present in living organisms at all levels, from ecosystem diversity and species diversity down to the levels of genetic diversity, i.e. the intrinsic variability of an individual organism's genetic makeup.

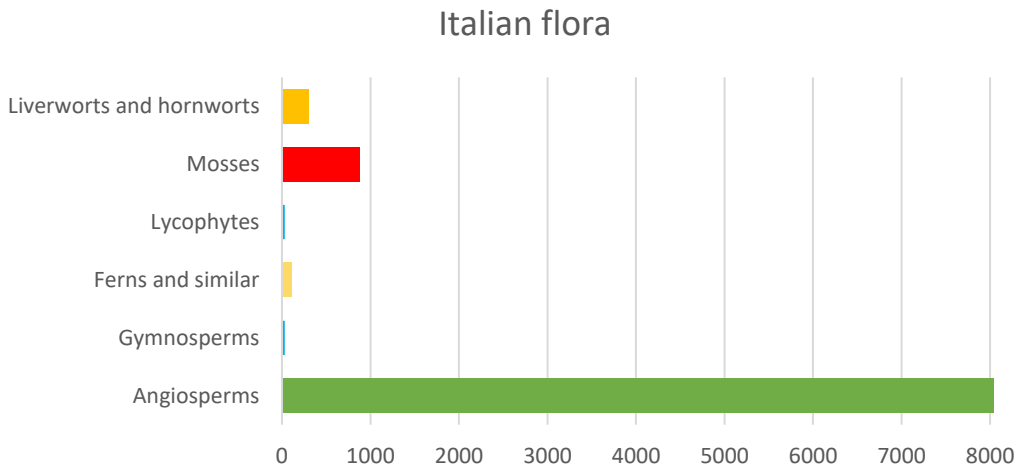
Italy is considered a **biodiversity hotspot**, in other words, a territory where a large number of plant and animal species are concentrated. Specifically, the Italian territory is particularly important for its high number of endemic plant species, i.e. species whose range of distribution is limited to the national area, and high environmental variability that enables the persistence of species typical of the Balkans, North Africa and Western Europe.

On a national level, the greater **pressures** on biodiversity stem from human activity and are mostly due to the ever-increasing land take for civil, industrial or agricultural use. The abandonment of environmentally friendly practices, such as pastoralism and traditional agriculture, has also contributed to the loss of areas particularly rich in biodiversity, such as grassland environments and wetlands.

State of the art of Italian animal and plant species

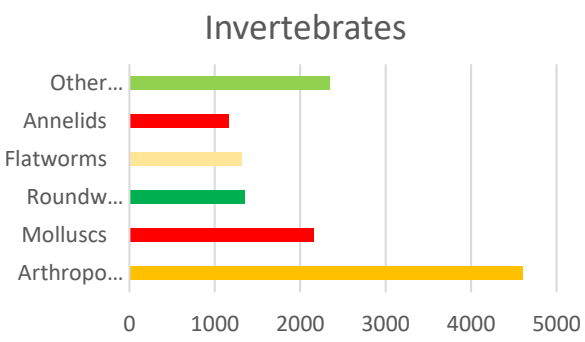
Italy is a region with an enormous wealth of **plants**, thanks to its significant altitudinal gradient, the variability of its climate (both in terms of temperature and rainfall) and its high level of geological variability: its unique orography and the presence of mountain ranges (primarily of the Alpine region) has also enabled many species that would otherwise now be extinct to survive in small enclaves during glacial periods (so-called "glacial relicts") and then spread once again, thereby increasing the total number of species.

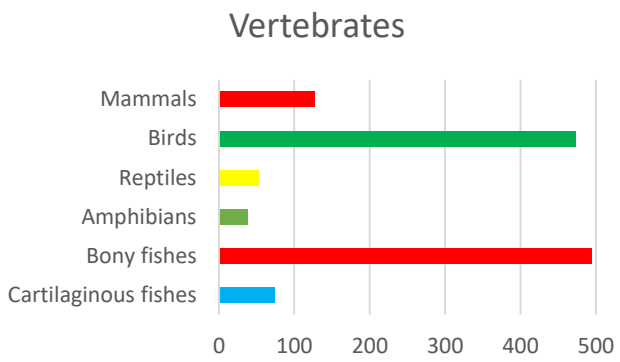
The flora of Italy currently consists of **1,169 bryophytes** (of which 297 liverworts and hornworts and 872 mosses) **and 8,195 vascular plants** (23 lycophytes, 108 ferns and similar, 30 gymnosperms, and 8,034 angiosperms). The data is updated continually thanks to recent taxonomic studies and the discovery of new species as a result.



The **fauna** of Italy, on the other hand, excluding protozoa, consists of **58,022 species**. Just as for the plant component, the reasons for such a high number lie in the considerable variability of Italy's climate, altitude and geology, which determine a high level of environmental variability. The geographical location of the Italian territory also favours the arrival of species from central Europe, the Balkans, the Iberian Peninsula and North Africa, particularly those of high mobility, such as birds.

Most of the animal species are made up of **invertebrates**, which include **54,942 species** (46,603 arthropods, 2,158 molluscs, 1,357 roundworms, 1,317 flatworms, 1,163 annelids and 2,344 species belonging to smaller *phyla*, such as cnidarians, sponges and echinoderms). As for **vertebrates**, there are a total of **1,258 species** (74 cartilaginous fishes, 494 bony fishes, 38 amphibians, 52 reptiles, 473 birds and 127 mammals).





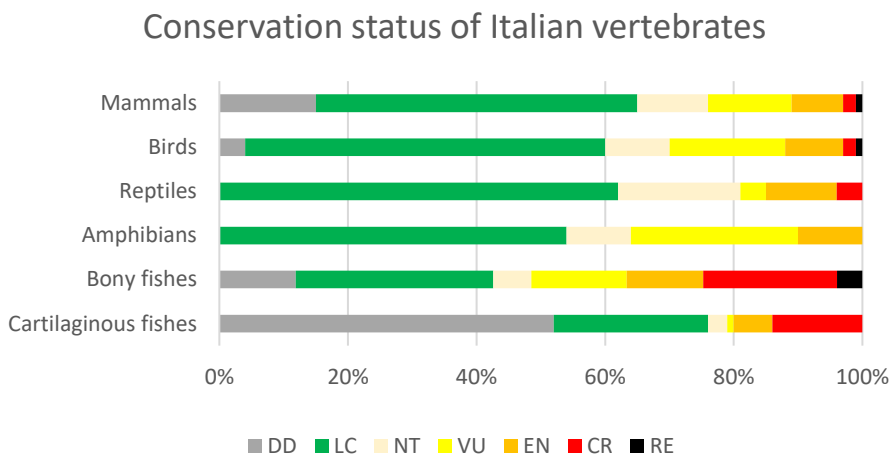
Endemic and endangered species in Italy

The Italian territory is home to a wealth of **endemic** plant and animal species or subspecies, occurring within this territory only. This evolutionary process takes place as a result of the isolation of certain populations following geographical changes and changes in ecological conditions. The many Italian islands are conducive to this phenomenon, thanks to the unique ecosystem conditions created there. Another contributing factor is the presence of the Alps, which constitute a true physical barrier to the rest of Europe, and Apennines, whose range in fact separates Tyrrhenian Italy from Adriatic Italy.

The **flora** of Italy consists **of 1,330 endemic species**, amounting to 18.4% of Italy's native flora. Of the total endemic species, 65% are regional endemics, of which two thirds are found exclusively in Sicily and Sardinia, followed by Calabria and Abruzzo.

The **fauna** of Italy, on the other hand, consists of 4**,777 endemic species** (8.6% of the species richness of Italy). Southern Italy is home to the highest percentage of endemic species (7.60%), followed by Sardinia (6.68%), Sicily (5.83%) and Northern Italy (5.12%).

The main assessment of the **level of risk** for the conservation of flora and fauna species is conducted by the International Union for Conservation of Nature (**IUCN**) through the creation of the so-called "Red Lists", in which the conservation status of species is quantified using scientific criteria, dividing the species into different categories according to the level of threat to each one. Based on these criteria, each species is classified as regionally extinct (RE), critically endangered (CR), endangered (EN), vulnerable (VU), near threatened (NT), least concern (LC), data deficient, and therefore not assessable (DD), or assessment not applicable (NA).



The analysis by the IUCN highlights how marine species are those at greatest risk, followed by freshwater species, forestry species and grassland habitat species. It also shows that endemic species are, on average, more endangered: these species are found solely within limited distributional areas, the impairment of which, even minimal, can have enormous implications for their conservation.

Environmental biodiversity in Italy

Figure 1: distribution of the bioclimatic regions in Italy

Despite having a relatively small surface area, the Italian territory has a high level of environmental diversity when compared to the continental average. In fact, Italy is home to 137 (58.8%) of the 233 habitats worthy of protection identified by the European "**Habitats**" Directive. Italy also has a very high percentage of priority habitats, with the presence of 35 of the 71 identified in Europe (around 50%).

These habitats are distributed over three **biogeographic regions**:

- the Alpine region, characterised by high altitude and low temperatures;
- the continental region, characterised by freezing winters and hot, relatively dry summers;
- the Mediterranean region, characterised by hot, dry summers and rainy, mild winters. The marine environments are typically Mediterranean, on the other hand, with relatively high temperatures and salinity.

Italian Protected areas

Italian legislation provides for two types of protected natural area: one under national law, with Framework Law 394/91 on Protected Areas as its regulatory cornerstone, and one of Community inspiration, based on the "Birds" Directive (79/409/EEC, later replaced by Directive 2009/147/EC) and the "Habitats" Directive (92/43/EEC).

The protected areas under Italian law are broken down into **National Parks (24), Marine Protected Areas (27), Regional Nature Parks (134), National Nature Reserves (147), Regional Nature Reserves (365**) and other specific types of protected area on a national or local scale (174). They extend over more than 3 million hectares, covering around **10.5% of the national territory**.

The protected areas of Community inspiration are broken down into **SPAs** (Special Protection Areas), identified in accordance with the "Birds" Directive, and **SCIs** (Sites of Community Importance) / **SACs** (Special Areas of Conservation), under the "Habitats" Directive. Collectively,

they are known as Natura 2000 Sites, and together with the other European sites they form the "Natura 2000 Network". The purpose of the European legislation is not, in fact, to protect the most important biotopes in isolation, but to preserve the network of relationships between the continent's various ecosystems. There are **2,625 Natura 2000 Sites** in Italy, for a total of almost **6 million hectares** on land (19.35% of the national territory) and **more than 1.5 million hectares** at sea.

POSSIBLE IMPACTS RELATED TO THE ACTIVITY OF INWIT

The first step of the biodiversity protection programme launched by INWIT consists in identifying factors of **potential impact** (in other words, factors that could lead to a negative impact on biodiversity) in relation to its key activities as a tower operator.

The analysis has taken into consideration the two types of towers currently in existence:

- roof-top, referring to those infrastructures built on a property and made up of one or more structural poles, standing on pre-existing buildings and primarily linked to urban and industrial areas.
- raw-land, referring to all those infrastructures built on land, either pylons or masts, of different sizes and heights, predominantly located in agricultural or wooded areas.

For raw-land towers, a distinction must be drawn between the impacts stemming from fast-site installations, made up of prefabricated elements, and those from towers built from scratch with specially designed installations.

The habitat impact assessment set out below is based on disturbance primarily to the plant population that defines and characterises the habitats, as provided for in the relevant Community legislation (e.g. the "Habitats" Directive).

Land use

The impact contemplated here is the one related to effects that change the level of naturalness of the disturbed habitat, in terms of rarity, fragility and consistency (e.g. by altering the state of trees or shrubs, their level of development or the stability of the stand), or compromise its ability to self-regenerate (e.g. by lowering its chances of recovering its original vegetation structure). The first parameter highlights the degree of impoverishment of vegetation structures in relation to the level of naturalness present and the diversity of the biotic systems involved, while the second measures the ability of the plant community to self-regenerate (recovery: the possibility of returning to its initial state following disturbance). It should be noted that a disturbance to a particular plant community, even one with strong natural characteristics, may not have any significant impact. This assessment must however be carefully weighed up and considered in relation to the self-regenerative ability of the system itself (homeostasis and the capacity to absorb disturbances).

In the case of brand new constructions, this type of impact is temporary with regard to the storage or construction site areas, but permanent in relation to the area physically occupied by the installation. The magnitude of the impact is therefore directly proportional to the size of the installation (in any case in the range of tens of square metres), and is zero for roof-top structures, which stand on already built-up land. With regard to raw-land structures, the most sensitive environments are woodland environments or those with natural or semi-natural vegetation, while construction in agricultural areas has a lower impact on biodiversity

Table 1: state of the art of INWIT sites with respect to the type of environment

Type of environment	% INWIT sites
Built-up areas	55,3%
Agricultural areas	33,1%
Wooded areas and semi-natural environments	11,1%
Wetland areas	0,02%
Water bodies	0,5%

Table 2: data on INWIT Sites and Natura 2000 Sites

% INWIT sites within Natura 2000 Sites	4,9%
% Natura 2000 Sites with the presence of INWIT Sites	23,7%

Climate Change

The impact contemplated here is related to the release into the atmosphere of greenhouse gases, i.e. gases that prevent infrared radiation from leaving the atmosphere, causing the so-called "greenhouse effect". The main gases responsible for this phenomenon are water vapour, carbon dioxide, methane and nitrous oxide. The effect is negligible on a small scale; on a global scale, however, it leads to the occurrence of climate events that are negative for both mankind and biodiversity (increased temperatures, fiercer storms, increased drought, warming and rising oceans, loss of species, famines and adverse socioeconomic phenomena). Carbon dioxide (CO_2) is the main greenhouse gas produced by human activities and is therefore particularly relevant when it comes to quantifying this impact. The use of electricity is another parameter for this assessment, as its generation involves a certain degree of greenhouse gas emissions (particularly when related to the use of fossil fuels). Emissions are minimal during the construction phase, mainly due to the low amounts required for the construction of the installations; energy consumption during operation can also be reduced, thanks to the use of *ad hoc* technologies (e.g. high efficiency current rectifiers or free cooling technology, which uses

external air to cool the electronic equipment housed in the tower), and the impact in terms of CO2 can be lowered by using electricity from renewable energy sources. Of all the impacts considered, the release of greenhouse gases is the one least connected to the various types of environment, as the impact is large-scale.

With regard to the activity under examination here, the direct impact is linked to the release of CO_2 as an exhaust gas by the vehicles and equipment used on the construction site; one of the indirect impacts, on the other hand, is related to the use of electricity by the installation during operation. Regarding the direct impact mentioned above, it should be noted that construction site activities have a relatively short duration, ranging from two days for fast-site systems to two to four weeks for those constructed *ad hoc*. Regarding the indirect impact mentioned, systems equipped with high efficiency current rectifiers or free cooling technologies use less electricity than structures using more energy-intensive systems.

Deterioration of water quality

The impact contemplated here is that related to the deterioration of the chemical and physical characteristics of water bodies located near the infrastructure, including due to indirect causes (e.g. contamination of water by construction site wastewater, accidental spillage of pollutants during processing, leaching of residues into the first 5 mm of water, etc.). This impact affects the flora and fauna of wetland areas, particularly the most sensitive components. Considering how the animal and plant species use the water, it is clear how even the slightest deterioration of its chemical and physical characteristics can have serious repercussions for all species.

In this case, a possible impact can stem from the poor management of contaminated run-off rainwater *(AMDC - Acque Meteoriche Dilavanti Contaminate).* This rainwater, usually identified as the first 5 mm of water from each rainfall event, may contain substances that are dangerous for the environment, such as hydrocarbons produced by the vehicles and equipment used in construction activities. It must therefore be treated with appropriate treatment systems, as required by article 113 of Italian Legislative Decree no. 152/2006.

Water bodies located in wooded or natural/semi-natural settings are more sensitive to this impact than those in agricultural areas or urban and peri-urban settings.

Deterioration or disturbance of the habitats of species: physical impacts

This type of impact includes a wide range of physical disturbances to wildlife species and their habitats.
Three main types of disturbance can be identified:

- Disturbances to the plant component of the habitats of species: this manifests primarily through the emission of dust into the atmosphere (volatile particulate matter), raised by

vehicles during transportation, and from exhaust gases (volatile chemicals) produced by the vehicles themselves. On a small or medium scale, in principle, the effect may become manifest in the deterioration of the natural plant community and in the temporary or permanent displacement of animal populations. In detail, the release into the atmosphere of substances, especially airborne particulate matter, which can be deposited on leaf blades, leads to a state of severe stress for the plant component, especially in its most sensitive components. The disappearance of these species causes deterioration of the plant community, ultimately leading to the possible recession of the edge of natural association from the source of the impact, with obvious repercussions for fauna. In the case under examination, the relatively short time period of the works (in particular where a fast-site system is being constructed) significantly reduces this type of impact, which is in any case greater for wooded or largely vegetated areas.

- Disturbances from noise or vibration pollution: this is the impact relating to increased noise levels caused by the vehicles and equipment used in the construction activities. This impact affects the fauna component, particularly mobile terrestrial fauna and birds residing in or visiting the disturbed area, which may move away during the construction period. The impact of increased noise levels is particularly high during the rearing season of avian species and breeding seasons of the most sensitive species. The impact is even greater during periods of hibernation or other forms of dormancy, especially in bats. Moreover, the vibration aspect of the works disturbs the fauna residing on the land within the construction area. This type of impact is also drastically reduced given the short duration of construction site activities. In general, woodland species are more disturbed by noise than species that colonise open environments: however, the significance of this type of impact must be appropriately assessed, taking into account the sensitive species residing in each area.
- Mortality caused by running over: this is the impact related to the occasional killing of animals, which are run over by the vehicles used in construction site activities; this category also includes the potential loss of fauna temporarily colonising the construction site area, for instance as a foraging, refuge or nesting site (as in the case of certain species of amphibian). Animal populations in the area are reduced as a result of these killings. What is more, the ecological corridors in the area itself become disrupted in the long run. The impact is more significant where highly vulnerable populations are present, such as those comprising few individuals, subjected to other pressures, or which periodically migrate in mass, passing through or over the infrastructures. This impact affects vagile terrestrial fauna and, in particular, small low-mobility fauna, such as amphibians and reptiles. This type of impact is greater in environments close to natural or artificial lakes and ponds (waterholes), including in peri-urban areas or areas concerned by human activity.

Deterioration or disturbance of the habitats of species: visual impacts

The impact contemplated here is linked to increased levels of visual or perceptual disturbance caused by the presence of the installation. This type of impact is permanent for the most sensitive species, i.e. those affected by the presence of human activity. More tolerant species are, on the other hand, subject to gradual acclimatisation to the presence of the installation: in this case, the disturbance may result in temporary displacement from the area. This disturbance is significantly greater if the installation features lighting: in this case, nocturnal fauna are hit the hardest. Special attention should be paid to the study of the positive phototaxis phenomenon, which is characteristic of many nocturnal insects, causing an increase in the levels of predation of such insects. The most vulnerable species of insectivorous bats may also be adversely affected by this phenomenon, which can cause their prey to move outside of the normal foraging areas. Certain diurnal animals may also be hit by the disturbance, including songbirds or amphibians, which may be induced to continue their singing or calling even at night.

In the case in question, a visual disturbance could be caused by the presence of a structure whose height is unusual for a pristine environment. As pointed out earlier, full acclimatisation may be assumed even as early as in the medium-term, especially in the most tolerant species. Wooded areas are likely to be impacted the most, owing to their relatively uniform landscape. The impact is practically zero, on the other hand, for heavily urbanised areas or areas where similar structures already stand (e.g. lattice towers for electric railways or other transmission towers). Regarding light pollution, this is only expected in the presence of aviation obstruction lighting. The areas most affected are those frequented by bats or nocturnal predators, such as areas adjacent to abandoned buildings or caves.

Electromagnetic interference

The impact analysed here concerns electromagnetic emissions in the form of radio waves. Telecommunications operators, which use INWIT infrastructures for services that emit electromagnetic waves, are responsible for ensuring that their systems are designed and operate in full compliance with the legislation. If these waves exceed the limits in place — which the Italian legislation has set with a wide safety margin[4] 100 times lower than those provided for by the international standards (European Council Recommendation[5], 1999/519/EC) — they may be a potential source of disturbance to birds, as they could alter the sensory systems linked to orientation; and they may cause animals to overheat. To date, the only research studies showing impacts of this kind have been conducted by simulating, under laboratory conditions, levels of

[4] Italian National Institute of Health (ISS), *5G e Salute* [5G and Health]

[5] 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) - Publications Office of the EU (europa.eu)

prolonged electromagnetic pollution way above the limits currently permitted by the legislation in force. These studies are therefore not deemed to be relevant here.

Significant disturbance — due to overheating, in the immediate vicinity of the antennas or transmission systems — would only occur under the extreme conditions mentioned above, affecting large birds in particular. In practice, wild fauna can easily avoid this disturbance (simply by moving just a few metres away from the source of the emission).

Considering INWIT's activity as a tower operator, the analysis does not enlarge upon this matter, which, by its very nature, does not apply to the simple installation and management of transmission towers.

Summary estimate of the impacts

The following is a summary of the impacts described in their entirety in the previous sections, with details on the two phases analyzed, construction site and infrastructure operation, and mediated between the two phases. As shown in table 1, INWIT's activity as a tower operator mainly impacts on urban or industrial areas (55%), followed by agricultural areas (33%), natural areas (11%) and areas close to water bodies or wetlands (<1%). In order to assess INWIT's activity comprehensively, the impacts on the different types of environment must therefore be considered, both in terms of likelihood and magnitude.

Methodological note: the process of identifying the magnitude of a given interference was based on the a priori assumption of certain assumptions relating to the actual occurrence of the interference and the quantification of its value, therefore of the explicit effect on the target natural component. Both of these assumptions respect the **principle of maximum precaution**, as it is assumed that 1) the interference necessarily occurs, and 2) the estimated valence interval varies in a range that includes its maximum value (i.e. the one at which the maximum negative effect on the target). It is clear that this position is absolutely conservative with respect to the estimation of potential impacts, since, on the practical case, the interference may not occur at all (point 1) and, in the event of an actual occurrence, its magnitude may also be negligible. within a wide range that includes sensitive values (point 2).

Table 3: Estimate of the likelihood of occurrence of the identified impacts by type of environment, for roof-top and raw-land in the **construction phase**

	Rooftop				Rawland			
	Urban or Industrial Areas	**Agricultural Areas**	**Natural Areas**	**Water bodies**	**Urban or Industrial Areas**	**Agricultural Areas**	**Natural Areas**	**Water bodies**
LU land use	absent	absent	absent	absent	to be assessed	to be assessed	sensibile	absent
CC climate change	substantial	substantial	substantial	substantial	substantial	substantial	substantial	substantial
DWQ deterioration of water quality	insignificant	to be assessed	insignificant	substantial	insignificant	to be assessed	insignificant	substantial
DSP deterioration of the habitats of species: physical impacts	to be assessed	to be assessed	substantial	substantial	to be assessed	to be assessed	substantial	substantial
DSV deterioration of the habitats of species: visual impacts	insignificant	insignificant	insignificant	insignificant	insignificant	insignificant	insignificant	insignificant

Table 4: Estimate of the likelihood of occurrence of the identified impacts by type of environment, for roof-top and raw-land in the **operation phase**

	Rooftop				Rawland			
	Urban or Industrial Areas	**Agricultural Areas**	**Natural Areas**	**Water bodies**	**Urban or Industrial Areas**	**Agricultural Areas**	**Natural Areas**	**Water bodies**
LU land use	absent	absent	absent	absent	to be assessed	to be assessed	substantial	absent
CC climate change	substantial	substantial	substantial	substantial	substantial	substantial	substantial	substantial
DWQ deterioration of water quality	insignificant	insignificant	insignificant	insignificant	insignificant	insignificant	insignificant	insignificant
DSP deterioration of the habitats of species: physical impacts	to be assessed	to be assessed	substantial	substantial	insignificant	insignificant	insignificant	insignificant
DSV deterioration of the habitats of species: visual impacts	insignificant	insignificant	insignificant	insignificant	to be assessed	substantial	substantial	substantial

Tabella 5: Estimate of the likelihood of occurrence of the identified impacts by type of environment, for roof-top and raw-land mediated between **construction** and **operation phase**

	Rooftop				Rawland			
	Urban or Industrial Areas	**Agricultural Areas**	**Natural Areas**	**Water bodies**	**Urban or Industrial Areas**	**Agricultural Areas**	**Natural Areas**	**Water bodies**
LU land use	absent	absent	absent	absent	to be assessed	to be assessed	substantial	absent
CC climate change	substantial	substantial	substantial	substantial	substantial	substantial	substantial	substantial
DWQ deterioration of water quality	insignificant	to be assessed	insignificant	substantial	insignificant	to be assessed	insignificant	substantial
DSP deterioration of the habitats of species: physical impacts	to be assessed	to be assessed	substantial	substantial	to be assessed	to be assessed	substantial	substantial
DSV deterioration of the habitats of species: visual impacts	insignificant	insignificant	insignificant	insignificant	to be assessed	substantial	substantial	substantial

The likelihood scale ranges from absent (no likelihood of impact) to insignificant (no likelihood of significant impact), to be assessed (likelihood of impact depending on the presence of environmental quality elements) and substantial (presence of a considerable impact).

With regard to the estimate of the impacts, in the observed phases, in terms of magnitude (i.e. the size of any impacts affecting the relative flora and fauna), a rough theoretical assessment can be given here, taking into account the type of impact and the level of naturalness of the disturbed environments. The parameter is estimated as zero if the impact is deemed to be absent or in any case insignificant; where possible occurrence of the same is considered substantial, or in any case to be assessed in relation to the presence or absence of affected environmental elements, the magnitude of the estimated effect on the aforesaid elements (shown on a scale from insignificant to very serious) is reported in table 4 below. The theoretical estimate must be fine-tuned during the subsequent planning stages, once the flora and fauna effectively hit by the impact and their importance from an ecological and conservation perspective have been identified and described in detail. This applies in particular to interventions carried out in protected natural areas.

The magnitude scale, applied by practice in this type of work, varies from absent / insignificant (blue), mild (green), moderate (yellow), severe (orange), very severe (red). The range of magnitude corresponds to the valence intervals identified for each incidence of the different

environmental types and is estimated on the basis of the ecological value of the interfered environments as well as on the type of impact expected (therefore, very serious interferences that impact natural elements of little value can generate a moderate or even slight valence estimate, as well as negligible interference on ecosystems of high conservation value). Where the incidence is deemed absent or insignificant, the value of the parameter is zero.

Table 6: Theoretical assessment of the magnitude of identified impacts by type of environment, for roof-top and raw-land in the **construction phase**

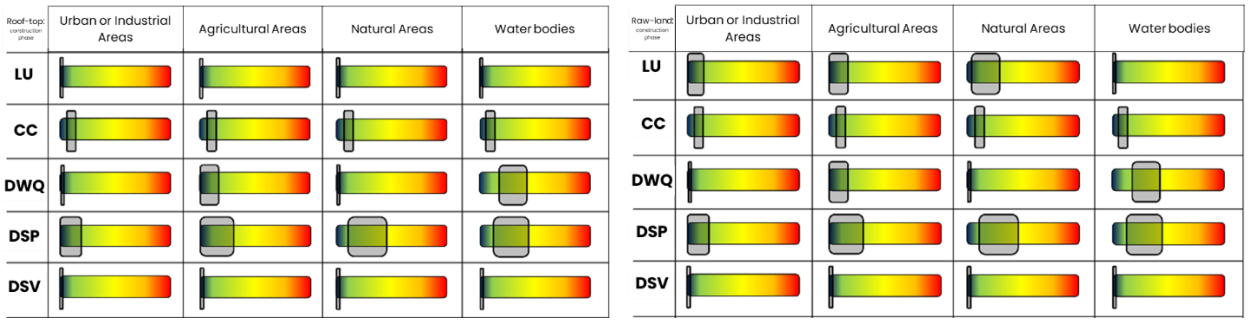


Table 7: Theoretical assessment of the magnitude of identified impacts by type of environment, for roof-top and raw-land in the **operation phase**

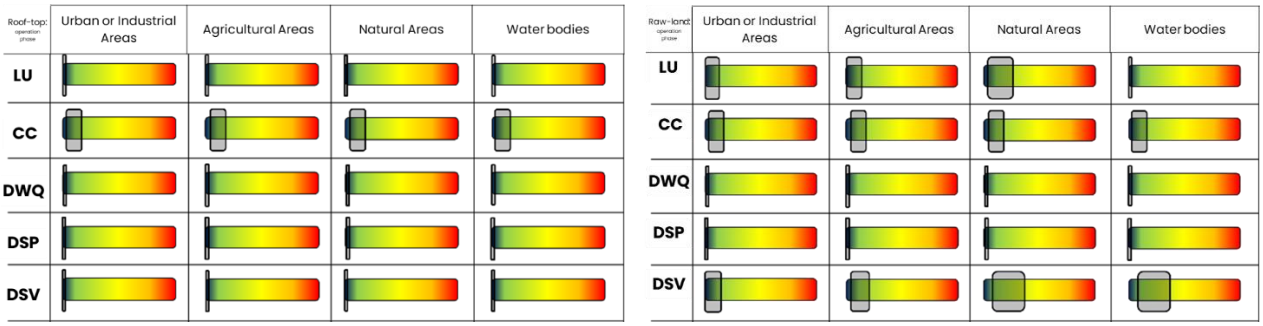
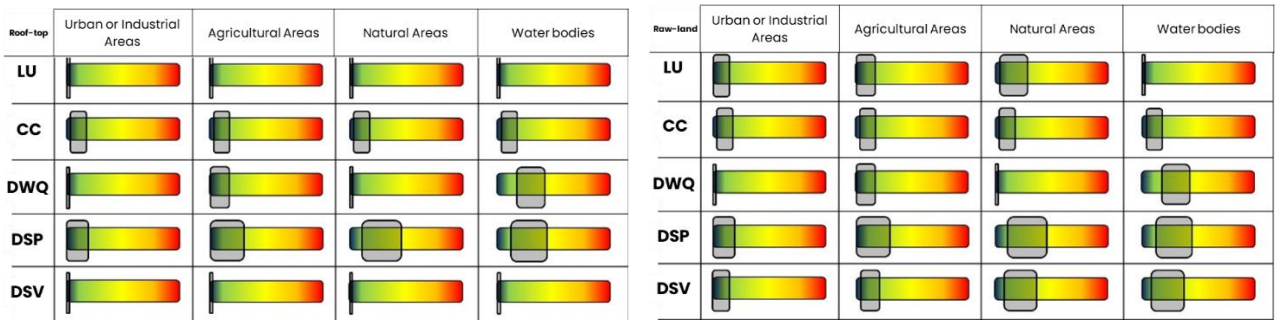


Table 8: Theoretical assessment of the magnitude of identified impacts by type of environment, for roof-top and raw-land mediated between **construction** and **operation phase**.



In conclusion, summarising the information derived from the analyses reported in the previous tables:

- **The theoretical values of the estimated magnitude of impacts relating to the activities under consideration invariably fall within the ranges of absent/insignificant** (blue) **and mild/moderate** (green/yellow). On the other hand, **only higher magnitude values**, highlighted by orange and / or red colors, **would have highlighted the presence of possible significant impacts on the different environmental types**.

- Impacts with higher magnitude values, but which nevertheless still fall within the limits referred to above, appear to be linked to the deterioration or disturbance of the habitats of species. Mitigation measures able to effectively reduce this magnitude can be put in place for these impacts.
- The "natural areas" and "water bodies" environment types are those for which the occurrence of impacts of significant magnitude may be expected. However, these types of environment are affected by a relatively small percentage of activities (around 12%), which are instead concentrated on urban or industrial areas (55%), for which the estimated occurrence and potential magnitude of impacts are very low.
- Roof-top types have a substantially lower impact than raw-land types, given the absence of major impacts relating to land use and deterioration or disturbance of the habitats of species.

ANALYSIS OF THE OPPORTUNITIES ARISING FROM INWIT'S ACTIVITIES

Through the role of "neutral host", INWIT's business model is increasingly evolving towards the concept of "tower as a service", in line with one of the major circular economy business models. INWIT is able to provide the entire market with access to its infrastructures, offering its customers increasingly integrated services, based on the idea of the tower as a technology hub.

INWIT's infrastructures can in fact offer a number of services, by transforming an infrastructure designed to house radio transmission systems into a technology hub with a "digital tower" approach, integrating IoT components, drones and communications systems to support telecommunications operators and benefit the community and the environment, as in the case of biodiversity protection.

By pursuing and creating a sustainable business model, not only is INWIT able to minimise the potential impacts through mitigatory measures, but it can also implement measures or equipment aimed at monitoring and protecting biodiversity, regardless of the expected impact. These actions constitute genuine opportunities for monitoring and mitigating the impacts on biodiversity. They are joined by a number of good practices for the creation of installations and infrastructures, which must only take place after proper verification of the possible impacts. The

actions that can be taken fall into two main categories:

- Implementation of **environmental monitoring** equipment: the infrastructures created by INWIT are particularly suitable for monitoring various kinds of environmental parameter, thanks to their **widespread presence throughout Italy** and their **height**, which enables monitoring of atmospheric parameters while avoiding the background noises that can occur close to the ground. What is more, thanks to their relatively isolated positioning, raw-land towers can receive data from areas that would otherwise receive little attention.
  Installation on the towers of **IoT sensors, smart video cameras and gateways** for the collection and subsequent communication and processing of the data enables practical environmental monitoring. This brings multiple advantages for biodiversity, for example in terms of monitoring fauna and natural habitats and fire risk, as well, of course, as enabling the collection of several different environmental parameters. The presence of a power supply means that electronic equipment can be implemented that is able to collect and communicate data in real time.
  In particular, the most useful tools that can be installed are: **weather monitoring equipment** (thermometers, anemometers, hygrometers, rain gauges, atmospheric pressure and solar radiation sensors), equipment for measuring **atmospheric pollution** (dust, CO2, ozone, volatile organic compounds, carbon monoxide, nitrogen and sulphur compounds) and **dendrometers** (for measuring the growth of tree trunks in forest environments). The infrastructures can also be used as a take-off and landing point for **drones**, which can recharge on the tower and download the data and images collected during their overflights. All this information is then shared with the end customer in an aggregated manner through the dashboard. The use of drones can be particularly suitable for monitoring animal species. Moreover, the setting up of dedicated partnerships and projects may enable us to achieve a greater benefit for biodiversity through the use of these scientific data.

- The use of **environmental engineering works** able to increase environmental quality: in the case of the installation of towers in areas of low biodiversity, such as urban, industrial or agricultural areas, works can be carried out that will increase environmental quality in the immediate vicinity of the installations, thus benefiting the overall biodiversity of the area. The main activities that can be carried out to achieve this are the **creation of green areas**, such as the growing of hedges through replanting and grassing. The choice of tree or shrub species is fundamental when creating green spaces, to achieve good growth of individual plants, with low mortality and greater propagation. For this reason, the species must be selected from those present in the neighbouring area. In addition, these species must come from certified regional nurseries, in order to maintain the genetic characteristics of native species. Also, exotic species should not be used, as these could compromise the ecological status of the neighbouring areas. The use of berry-producing species is also vital, as berries are an important source of nutrition and hydration for resident or migratory birds. Also in this case, preference should be given to hardy species over cultivated ones.

INWIT has taken additional action to protect biodiversity by developing protocols to be used when creating new sites. To do this, it was necessary, first of all, to divide the territory up into macro areas according to the types of environment present, as these differ in terms of environmental quality and, as a result, the measures to be applied and elements on which to focus. This macro-division breaks the areas down into urban or industrial areas, agricultural areas and wooded areas. Specific protocols were then developed, applicable across the board to all the aforesaid categories. The protocols focus on protected areas pursuant to the "Habitats" Directive and areas adjacent to water bodies and wetlands, as these require specific measures regardless of the type of environment concerned. The protocols, consisting of technical data sheets at the disposal of designers and installers, involve gathering information on the following topics:

- **Environmental quality elements**: the specific elements defining environmental quality shall be described for each of the environment types contemplated (of which a brief description is to be given), to be looked for within the installation construction area and in the areas situated nearby.
- **Main impacts** from INWIT's activities: for each type of environment, the main impacts shall be highlighted — from those described earlier in the previous section — that could potentially compromise the environmental quality of that particular type.
- **Mitigation measures**, where applicable: the possible mitigation measures relating to any impacts identified in the previous point shall be described for each type of environment.
- **Monitoring activities**: based on the type of environment, specific monitoring activities shall be proposed, aimed at demonstrating the effectiveness of the mitigation measures adopted.
- **Block diagram of the relationships** between the various parts of the protocol.

The technical data sheets drawn up apply to the tower type with the most potential impacts, i.e. the raw-land tower. For roof-top towers, on the other hand, impacts related to land use and deterioration of the habitats of species in terms of visual impacts need not be considered, as per table 2.

The operator's task is to identify the environmental quality elements that can be found at the project site: these very elements trigger a series of biodiversity protection activities (starting with identification of the impacts, implementation of mitigation measures and activation of monitoring protocols), enabling optimal management of the entire process.