

**EDU
ARCTIC**

Monitoring manual



Introduction – how to be a scientist

General rules

How does it work

Parameters to be observed and reported

Conclusions

Introduction – how to be a scientist?

Would you like your students to learn first-hand about the weather, climate, water, biology and effects of global climate change on the natural world?

Consider lending a hand to scientists by observing the world around you and reporting what you spot. Information that you and your students will collect as **observers** in **monitoring programme** can be used in numerous investigative studies and are a foundation of the comprehensive climatological study. This data are increasing in importance as the world faces more challenges posed by climate change. Those challenges include: higher temperatures, prolongation of warm seasons, more frequent storms, floods, droughts, and other forms of natural disasters. Even slight change in air temperature and precipitation can upset the delicate balance of ecosystems, and affect plants and animals that inhabit them. Rising temperatures and changing patterns of precipitation are influencing for example time and place of particular plant species occurrence.

Observations taken at fixed locations and fixed time, together with standardized recording format will give accurate data for comparison. Different regions of Europe have different phenological patterns depending on their latitudes, longitudes and heights. Even at the same location, the phenological pattern observed in the past may be quite different from the present.

Although, scientists nowadays have access to data from radars, satellite images, and surface weather stations, technology cannot detect every instance of hazardous weather and phenological change. Observers can help fill in the gaps by reporting hail, strong wind, flooding, heavy snow and storms. Scientists need observers to report when and how storms and other hydrometeorological and phenological phenomena are impacting their area.

As an observer you and your students can act as scientific eyes and ears in the field. Your reports can help meteorologists and climatologists by providing direct, timely, accurate, and detailed observations. Reports also provide critical verification, by confirming the information detected by other instruments or meteorological models. Archived meteorological data can help improving our knowledge and influence the future warning services and climatological modelling.

Remember that personal safety is the primary objective of every observer.



General rules

- ✓ Even though you – as registered **teachers** – are supposed to **report observations on portal**, your **students should play a crucial role, make observations and provide you with data required**.
- ✓ We invite you to report observations conducted by your students in schools' surroundings **each Monday**. If you are unable to report it on Monday, no worries: you may still do that on Tuesday, but **remember to provide information on values accurate for the previous day**.
- ✓ Actual values should be reported for **12:00 (Monday) local time**.
- ✓ Please note that the system accepts only **one report from one location (SCHOOL) per week**, therefore if more than one teacher is willing to register data from the same school, there should be e.g. an internal schedule of reporting (who reports when – e.g. every 2 weeks).
- ✓ For biotic elements: it may occur that particular species are not observed in your surroundings, in such case you may just **leave the box empty**, but still provide other information.
- ✓ Remember, you get extra points in EDU-GAME: **50 points for registration and 10 points weekly for regular, active participation**.



How does it work?

How to register data in the EDU-ARCTIC monitoring system

In order to register data in the EDU-ARCTIC monitoring system please visit the website: <http://edu-arctic.eu/program/#measurements> and press the “New Measurement” button.



Once you have pressed, the system will ask you to perform the following actions:

- sign in (if you are not logged in) or sign up (if you don't have account)
- confirm your school location - please mark the correct location on the map and press “submit” (please see example below).

Where is your school located?

Longitude

Latitude

Once done, you will see the form ready for your regular observations. Please fill in that regularly (every Monday) and compare the results provided by other schools.

Actual values - on Monday

<p>Air temperature</p> <input style="width: 90%;" type="text"/> °C	<p>Cloud cover</p> <input style="width: 90%;" type="text"/>
<p>Atmospheric precipitation</p> <input style="width: 90%;" type="text"/>	<p>Types of atmospheric precipitation</p> <input style="width: 90%;" type="text"/>
<p>Visibility reduction</p> <input style="width: 90%;" type="text"/>	<p>Wind force</p> <input style="width: 90%;" type="text"/>

Noticed since the last observation (previous week)

Data from abiotic environment field observations

<p>Lightning</p> <input style="width: 90%;" type="text"/>	<p>Snow cover</p> <input style="width: 90%;" type="text"/>
<p>Ice on lakes</p> <input style="width: 90%;" type="text"/>	<p>Ice on rivers</p> <input style="width: 90%;" type="text"/>
<p>Extreme atmospheric phenomena</p> <input style="width: 90%;" type="text"/>	<p>Other atmospheric phenomena</p> <input style="width: 90%;" type="text"/>

Data from biotic environment field observations

Monitoring plants

<p>Please, indicate species, which opened buds</p> <input style="width: 90%;" type="text"/>	<p>Please, indicate species, which started to flower</p> <input style="width: 90%;" type="text"/>
<p>Please, indicate species with ripen berries</p> <input style="width: 90%;" type="text"/>	<p>Please, indicate species, which seeds are ready</p> <input style="width: 90%;" type="text"/>
<p>Please, indicate species, which leaves started coloring</p> <input style="width: 90%;" type="text"/>	<p>Please, indicate species, which leaves started falling down</p> <input style="width: 90%;" type="text"/>
<p>Please, indicate species, with all leaves fallen down</p> <input style="width: 90%;" type="text"/>	

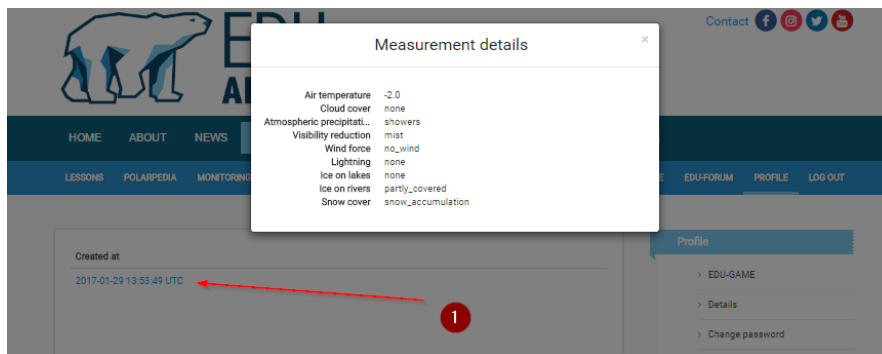
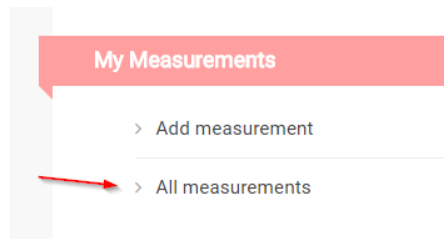
<h4>Monitoring insect</h4> <p>First observation in the year</p> <input style="width: 90%;" type="text"/>	<h4>Monitoring migrating birds</h4> <p>First observation in the year</p> <input style="width: 90%;" type="text"/>
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SUBMIT

CANCEL

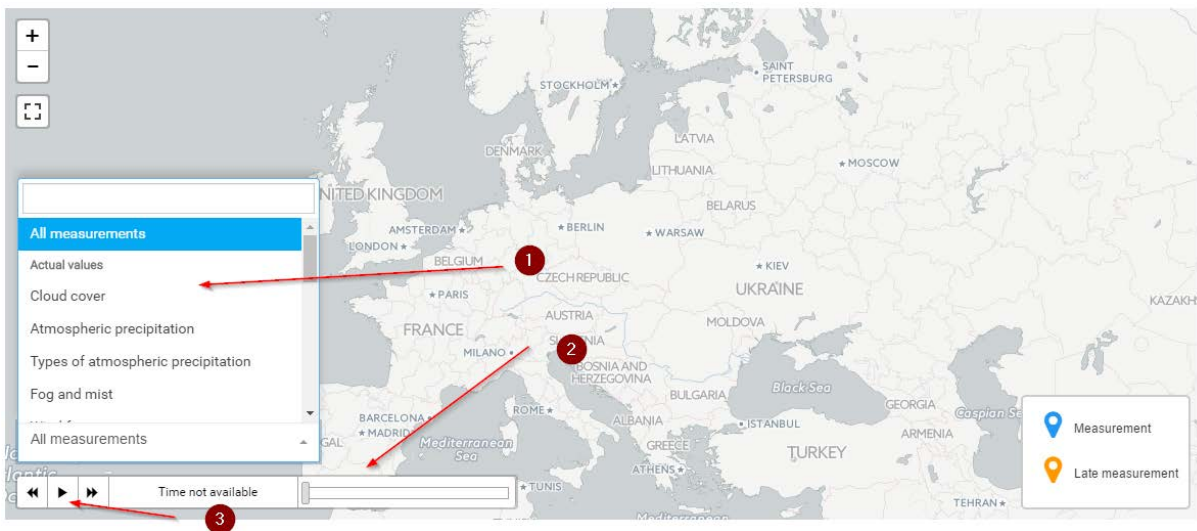
Once you have filled in, please press the “submit” button.

You may check your observation on the map by clicking on your school location. You will also find every of your registered observation in the PROFILE → My Measurements section.



Every registered observation is being displayed on the map. You may check various of provided data by selecting each school location (by clicking on the displayed icons on the map).

You may also choose any parameter of your interest, select the date range and press the “play” button on the menu.



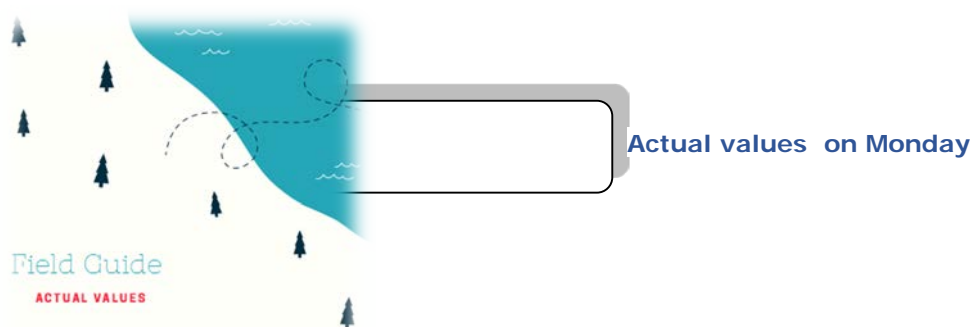
If you would like to compare data, observe variability etc., you can generate reports (.xls format):





Parameters to be observed and reported:

- ✓ Actual values
 - ✓ Abiotic environment
 - ✓ Biotic environment – plants, insects, birds
-



Actual values - on Monday

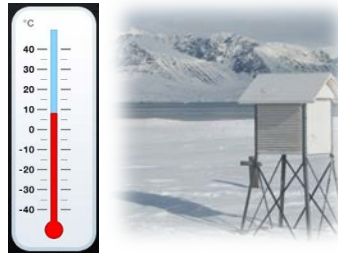
Air temperature	Cloud cover
<input type="text"/> °C	<input type="text"/>
Atmospheric precipitation	Types of atmospheric precipitation
<input type="text"/>	<input type="text"/>
Visibility reduction	Wind force
<input type="text"/>	<input type="text"/>

Air temperature (data presented in degrees Celsius).

The air temperature is measured by an ordinary thermometer in degrees Celsius °C. At the meteorological stations thermometers are placed 2 m above the ground in a special white shelter (a Stevenson screen) to shield them against precipitation and direct sunlight, allowing air to circulate freely around them, to provide a standardized environment in which to measure air temperature.

By measuring the temperature of the air we need to remember these tips:

- The correct measurement of the air has to be done outdoor, in the shade, ~2m above the ground,
- At school or in the house put a thermometer outside the window on the north side.









Phot. 1. Ordinary thermometer is placed inside a Stevenson screen.


Cloud cover (none, partly, completely)

 Cloud cover







Cloud is an aggregate of very small water droplets, ice particles or a mixture of both. Cloud cover (or cloudiness) refers to the fraction of the sky obscured by clouds when observed from a particular location. Total cloud amount is the fraction of the sky covered by cloud of any type or height above the ground. Okta is the usual unit of measurement of the cloud cover – from 0 to 8, although for monitoring purpose choose one of the following:

<p>None - represents the complete absence of clouds, when the sky is completely clear</p>	<p> None</p>		<p>Phot. 2. Stonehengesteinane during beautiful, clear weather (southern Spitsbergen)</p>
<p>Partly cloudy - represents a cloud amount higher than zero but not full cloud cover, so type it if you can see blue sky between clouds</p>	<p> Partly cloudy</p>		<p>Phot. 3. Sørkapp Land (southern Spitsbergen) and cumuliiform clouds above</p>
<p>Complete cloud cover – full cloud cover with no breaks or sky obscured by fog or other meteorological phenomena, no sky visible</p>	<p> Complete cloud cover</p>		<p>Phot. 4. Full cloud cover above Hohenlohefjellet (Svalbard)</p>


Atmospheric precipitation (none, showers, continuous)







 **Atmospheric precipitation**

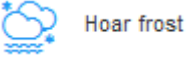



Precipitation is water in a solid or liquid form that falls from clouds to the Earth's surface under the influence of gravity. Depending on duration of this phenomena choose one of the following:

<p>None - no precipitation observed</p>	<p align="center"> None</p>		<p><i>Phot. 4. High clouds above meteorological site next to Polish Polar Station Hornsund on Spitsbergen</i></p>
<p>Showers – precipitation begins and ends suddenly. Relatively short-lived, but may last half an hour. Often, but not always, separated by blue sky. Showers come from puffy clouds or cumuliform clouds, like cumulus or cumulonimbus</p>	<p align="center"> Showers</p>		<p><i>Phot. 5. Showers above Billefjorden</i></p>
<p>Continuous – precipitation which does not cease after half an hour, or ceases only briefly. May last up to few hours</p>	<p align="center"> Continuous</p>		<p><i>Phot. 6. A view from Fugleberget during rain (southern Spitsbergen)</i></p>


Types of atmospheric precipitation (drizzle, rain, snow, hoar-frost, hail)

 **Types of atmospheric precipitation**





<p>Drizzle - fairly uniform precipitation composed exclusively of very small water droplets (less than 0.5 mm in diameter) very close to one another. Can be felt on the face but produces little runoff from roads or roofs.</p> <p>Drizzle is produced by low-level stratiform clouds.</p>	 <p align="center">Drizzle</p>		<p><i>Phot. 7. Drizzle falls from low clouds.</i></p>
<p>Rain - precipitation of liquid water drops greater than 0.5 mm in diameter. Mostly falls from stratiform (layer) or cumuliform clouds</p>	 <p align="center">Rain</p>		<p><i>Phot. 8. Drops of rain on the lake surface</i></p>
<p>Snow - is formed from solid water ice crystals that agglomerate together becoming flakes. Big ones form near freezing and small ones form at colder temperatures.</p>	 <p align="center">Snow</p>		<p><i>Phot. 9. Snowfall at the main entrance to the Polish Polar Station Hornsund</i></p>





<p>Hoar-frost - is the coating or deposit of ice that may form in humid air in cold conditions, usually overnight. It is deposited on the ground or loosely attached to exposed objects such as wires or tree branches</p>			<p><i>Phot. 10. Hoar-frost deposited on rock</i></p>
<p>Hail - is a form of solid precipitation that consists of balls or irregular lumps of ice, each of which is called a hailstone. Hail is possible within most thunderstorms as it is produced by cumulonimbus</p>			<p><i>Phot. 11. Hail (source: CC BY-SA 3.0 by 59Ballons)</i></p>

Visibility reduction


 **Visibility reduction**

Meteorological visibility is a measure of the distance at which an object or light can be clearly seen.






<p>None – good visibility, more than 10 km</p>	 None		<p><i>Phot. 12. Mountains and glaciers of western Spitsbergen seen from the distance</i></p>
<p>Mist - restricts visibility to between 1 to 10 km.</p>	 Mist		<p><i>Phot. 13. Mist above Hornsundfjord</i></p>

<p>Fog - restricts visibility to 1 km or less</p>	 <p>Fog</p>		<p><i>Phot. 14. Fog in Revdalen (southern Spitsbergen)</i></p>
<p>Smog – a fog in which smoke and other forms of atmospheric pollutants have an important part in causing the fog to thicken, and can have dangerous physiological effects.</p>	 <p>Smog</p>		<p><i>Phot. 15. Smog above Warsaw</i></p>

Wind force (none, light wind, gusty wind, hurricane)

 **Wind force**

Wind is the horizontal movement of the air mass caused by differences in the atmospheric pressure in the neighboring areas. When a difference in atmospheric pressure exists, air moves from the higher to the lower pressure area. The greater the pressure difference, the higher the wind speed. Wind speed usually is given in meters per second (m/s), in kilometers per hour (km/hr) or on the Beaufort scale (in °B). Choose one of the following:

 <p><i>Phot. 16. Flags on the masts of Hornsund station during windy weather</i></p>	<p>None – calm conditions, smoke from chimneys rises vertically</p>	 <p>No wind</p>
	<p>Light wind - weak wind that lightly moves leaves on trees</p>	 <p>Light wind</p>
	<p>Gusty wind – moves branches on the trees, makes small deciduous trees sway. Dust and loose paper raise</p>	 <p>Gusty wind</p>
	<p>Hurricane - strong wind that causes damage to nature and households.</p>	 <p>Hurricane</p>



Noticed since the last observation (previous week) - data from abiotic environment field observations. Collect information on meteorological and hydrological phenomena:

Data from abiotic environment field observations

Lightning

Snow cover

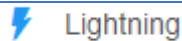
Ice on lakes

Ice on rivers

Extreme atmospheric phenomena

Other atmospheric phenomena

Lightning (none, lightning inside clouds, lightning strikes the ground)








Lightning is a sudden electrostatic discharge between electrically charged regions of a cloud, between two clouds, or between a cloud and the ground, that occurs during thunderstorm. The best shelter from lightning is inside a large enclosed structure, such as your home or school. Avoid contact with the windows. No place outside is safe during a thunderstorm.


Cumulonimbus clouds often form thunderstorms



Phot. 17. Towering vertical cloud. Cumulonimbus seen above Bieszczady Mountains in Poland.





<p>None – lightning did not appear</p>	 None	<p style="text-align: center;">-</p>	<p style="text-align: center;">-</p>
<p>Lightning inside clouds - happens completely inside the cloud, jumping between different charge regions in the cloud or between separate clouds</p>	 Lightning inside clouds		<p><i>Phot. 18. Lightning inside the clouds (source: CC BY-SA 3.0 by 350z33)</i></p>
<p>Lightning strikes the ground - lightning that occurs between the cloud and the ground</p>	 Lightning strikes the ground		<p><i>Phot. 19. Lightning strikes the ground (source: CC BY 3.0 by Unfortunately Named)</i></p>

Extreme atmospheric phenomena (none, flood, whirlwind, avalanche)


 **Extreme atmospheric phenomena**






Report any extreme events that happened in previous week in your area (city, town, district) and caused damage on property and nature.





<p>None – lack of extreme events</p>	 None	<p style="text-align: center;">-</p>	<p style="text-align: center;">-</p>
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<p>Flood - overflow of water that submerges land which is usually dry</p>	 <p>Flood</p>		<p>Phot. 20. Flood in Alaska (source: Diocese of Alaska)</p>
<p>Whirlwind - a weather phenomenon in which a vertically oriented rotating column of air forms</p>	 <p>Whirlwind</p>		<p>Phot. 21. Whirlwind (source: CC BY-SA 3.0 by NJR ZA)</p>
<p>Avalanche - a rapid flow of snow down a sloping surface</p>	 <p>Avalanche</p>		<p>Phot. 22. Avalanche on the slope (source: CC BY-SA 3.0 by Scientif38)</p>


Other atmospheric phenomena (none, aurora, rainbow, glazed frost)





 Other atmospheric phenomena

<p>None – lack of other noticeable events</p>	 <p>None</p>		
<p>Aurora - is a natural light display in the sky, produced when the magnetosphere is sufficiently disturbed by the solar wind</p>	 <p>Aurora</p>		<p>Phot. 23. Northern lights during polar night (Hornsund)</p>

<p>Rainbow - a meteorological phenomenon in the form of a multicoloured arc, caused by reflection, refraction and dispersion of light in water droplets resulting in a spectrum of light appearing in the sky</p>	 <p>Rainbow</p>		<p><i>Phot. 24. Rainbow above Polish Polar Station Hornsund</i></p>
<p>Glazed frost - ice coating occurring when freezing rain or drizzle hits a surface</p>	 <p>Glazed frost</p>		<p><i>Phot. 25. Glazed frost covering frozen tundra</i></p>


Ice on lakes (none, lake surface is freezing, lake surface is melting, complete ice cover)





 Ice on lakes

<p>None – lack of ice on the lake surface</p>	 <p>None</p>		<p><i>Phot. 26. Tundra lake in summer</i></p>
<p>Lake surface is freezing – air temperature is below 0°C, ice forms on the top of a lake</p>	 <p>Lake surface is freezing</p>		<p><i>Phot. 27. Tundra lake in autumn</i></p>

<p>Lake surface is melting - air temperature is above 0°C, ice on the top of a lake melts</p>	 Lake surface is melting		<p><i>Phot. 28. Tundra lake in spring</i></p>
<p>Complete ice cover – surface of lake completely covered by ice</p>	 Complete ice cover		<p><i>Phot. 29. Tundra lake in winter</i></p>

Ice on rivers (none, partly covered, complete ice cover)









 Ice on rivers

<p>None – lack of river ice</p>	 None		<p><i>Phot. 30. River in summer (Girdwood, Alaska)</i></p>
<p>Partly covered – part of river surface is frozen</p>	 Partly covered		<p><i>Phot. 31. Ebba river partly covered by ice (central Spitsbergen)</i></p>

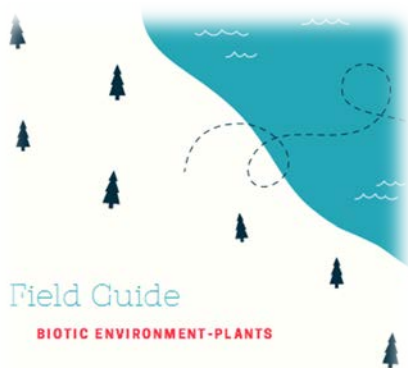
<p>Complete ice cover – river surface is covered with ice</p>	 Complete ice cover		<p><i>Phot. 32. Complete ice cover over Revelva in Revdalen (Spitsbergen)</i></p>
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Snow cover (none, first snow, snow accumulation, stable snow cover, snow melting)

 Snow cover

<p>None – no trace of snow on the ground</p>	 None		<p><i>Phot. 33. Reindeer on tundra during summer</i></p>
<p>First snow – first observation of snow in autumn (beginning of winter)</p>	 First snow		<p><i>Phot. 34. First snow in Denali National Park (Alaska)</i></p>
<p>Snow accumulation – snowfall observed in previous 7 days, increase of snow cover thickness compared to that of previous week</p>	 Snow accumulation		<p><i>Phot. 35. Snow accumulation</i></p>
<p>Stable snow cover – remained almost unchanged to that from previous observation with no (settled and consolidated but did not melt)</p>	 Stable snow cover		<p><i>Phot. 36. Tracks of female polar bear with the cub and arctic fox</i></p>

<p>Snow melting – decline of snow, surface runoff produced from melting snow</p>	 <p>Snow melting</p>		<p>Phot. 37. Measurements of runoff from melting snow</p>
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Noticed since the last observation (previous week) - data from biotic environment field observations. Collect information on selected common species of plants (birch, lilac, rowan, bilberry, rosebay willowherb). Observe and note the most important phenological phases – lifecycle events, influenced by seasonal and interannual variations in climate, as well as habitat factors (such as elevation). This will give approximate dates of first occurrence of biological events in their annual cycle.

Monitoring plants

Please, indicate species, which opened buds

Please, indicate species, which started to flower

Please, indicate species with ripen berries

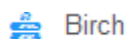
Please, indicate species, which seeds are ready

Please, indicate species, which leaves started coloring

Please, indicate species, which leaves started falling down

Please, indicate species, with all leaves fallen down

Birch (*Betula pendula*)









Medium sized tree with white peeling bark (like tissue paper) on the trunk. It's a pioneer tree with low demands. Native to and common in Northern Europe. Its range extends into Siberia, China and southwest Asia in the mountains of northern Turkey, the Caucasus and northern Iran. In southern Europe it appears at higher altitudes. The twigs are slender, reddish brown and noticeably drooping and the leaves are roughly triangular with doubly serrate margins and turn yellow in autumn before

they fall. Its drooping branches give it a "weeping willow" appearance. Buds are slender, pointed, green and brown.

In early Celtic mythology, the birch symbolised renewal and purification. Bundles of birch twigs were used to drive out the spirits of the old year.




Phot.39: Birch alley; <http://pixabay.com>

<p>Started to flower – male flowers (catkins) are long and yellow-brown in colour, and hang in groups of two to four at the tips of shoots, like lambs' tails, producing yellow pollen. Female catkins are smaller, short, bright green and erect.</p>	 <p>Started to flower</p>		<p>Phot. 39 male catkins Wikipedia</p>
<p>Opened buds – buds are small, pointed, sticky resin that covers and permeates the entire bud, open into bright green, sticky, nice-smelling leaves</p>	 <p>Opened buds</p>		<p>Phot. 40: Paula Gordon, 2013, https://dbaplanbpix.wordpress.com/tag/spring-buds/</p>
<p>Leaves started coloring - The foliage is a pale to medium green and turns yellow early in the autumn before the leaves fall (approx. 5 - 10% of foliage)</p>	 <p>Leaves started coloring</p>		<p>Phot. 41: By Famartin - Own work, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=36954291</p>

<p>Leaves started falling down - it starts shedding leaves to survive harsh weather conditions (Report on this phase, when up to 10% of leaves has fallen down.)</p>	 <p>Leaves started falling down</p>		<p>Phot. 42: Stephen Rowlings, http://lossofthenight.blogspot.de/2014/12/artificial-light-and-trees.html</p>
<p>All leaves fallen down - goes dormant for the winter months</p>	 <p>All leaves fallen down</p>		<p>Phot. 43: http://unsplash.com</p>

Black Alder (*Alnus glutinosa*)







 Black alder







Alnus glutinosa is a tree in the birch family that can grow up to 15-20m tall with the crown spreading 6-12 m wide. It can be single or multi-stemmed, with a smooth greyish-green bark that turns a speckled grayish-brown. It is native across Europe, temperate Asia, and north Africa. It has been planted extensively in North America as an ornamental tree and for erosion control. Rapidly growing tree that is useful for planting on drastically disturbed and acid sites such as coal strip-mines. It is capable of nitrogen fixation – **thanks to its symbiotic relationship with a nitrogen-fixing bacterium called *Frankia alni*. This bacterium is found in the root nodules. The bacterium absorbs nitrogen from the air and makes it available to the tree.**

Wet and swampy, alder woods, or carrs, were thought to have a mysterious atmosphere. The green dye from the flowers was used to colour and camouflage the clothes of outlaws like Robin Hood, and was thought to also colour the clothes of fairies. Wet and swampy, alder woods, or carrs, were thought to have a mysterious atmosphere. The green dye from the flowers was used to colour and camouflage the clothes of outlaws like Robin Hood, and was thought to also colour the clothes of fairies.



Phot.44 Black alder – Wikimedia commons (Eaglestein), CC-BY-SA 4.0

<p>Started to flower Flowers: are on catkins which appear between February and April. Alder is monoecious, which means that both male and female flowers are found on the same tree. Male catkins are yellow and pendulous, measuring 2–6cm. Female catkins are green and oval-shaped, and are grouped in numbers of three to eight on each stalk.</p>	 <p>Started to flower</p>		<p>Phot. 45. pixabay.com</p>
<p>Opened buds – the buds are purplish-brown and have short stalks.</p>	 <p>Opened buds</p>		<p>Phot. 46. Pixabay.com</p>
<p>Leaves started coloring - leaves round in shape. In addition, some leaves have a distinct notch at the apex, which is not obvious until the leaves are fully</p>	 <p>Leaves started coloring</p>		<p>Phot. 47: pixabay.com</p>





<p>expanded. They turn yellow/brown/orange early in the autumn before they fall (approx. 5 - 10% of foliage).</p>			
<p>Seeds ready</p> <p>The fertilized female flowers become cone-like, green fruits by late spring, and as they grow throughout the summer, they often weight down the branches that support them. In autumn, the seeds are released as the cones open, and by winter the remaining structures (called strobiles) persist on the twigs.</p>	 <p>Seeds ready</p>		<p>Phot. 48: pixabay.com</p>
<p>Leaves started falling down - it starts shedding leaves to survive harsh weather conditions. Report on this phase, when up to 10% of leaves has fallen down.</p>	 <p>Leaves started falling down</p>		<p>Phot. 49: pixabay.com</p>
<p>All leaves fallen down - goes dormant for the winter months</p>	 <p>All leaves fallen down</p>		<p>Phot. 50: pixabay.com</p>

Lilac (*Syringa vulgaris*)



Lilac is a shrub or a small tree, with greyish bark on multiple stems and simple oval leaves. Purple or white flowers grow in large panicles, and are extremely fragrant. Lilac is native to woodland in southeastern Europe to eastern Asia, and widely and commonly cultivated in temperate areas elsewhere.

The wood of lilac is close-grained, diffuse-porous, extremely hard and one of the densest in Europe. The sapwood is typically cream-coloured and the heartwood has various shades of brown and purple. **Lilac wood has traditionally been used for engraving, musical instruments, knife handles.**

<p>Opened buds when the first leaves push out of the bud and unfold completely</p>	 <p>Opened buds</p>		<p>Phot. 51 http://pixabay.com</p>
<p>Started to flower - the flower buds for the following year are set in the fall before the lilac shrub goes dormant. The flowers grow in clusters 10 cm – 20 cm (4 – 8 in.) long.</p>	 <p>Started to flower</p>		<p>Phot.52 http://pixabay.com</p>



<p>All leaves fallen down lilac needs a cold-dormant time of year to rejuvenate for spring flowers and greenery</p>	<p> All leaves fallen down</p>		<p>Phot. 53 Lilac in winter</p>
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Rowan (*Sorbus aucuparia*)

 **Rowan**

Rowan is a typically small and slender tree with a greyish-brown bark. As the leaves emerge they are a mid green colour. In early to mid autumn the leaves turn yellow to orange and fall off. The flowers appear in mid-May as sprays of cream to white. They have a slightly sweet scent. The fruits appear in late summer, and are initially green, they quickly ripen to a bright red in very early September. Birds love them and often trees are stripped of their ripening fruit within a few days, especially if the weather turns cold. Rowan is native to most of Europe and parts of Asia, as well as northern Africa. The range extends from Madeira and Iceland to Russia and northern China, but mostly inhabits cool to cold areas.

Rowan trees can live up to an impressive 100 years or more.

<p>Opened buds –</p> <p>Buds are small (up to 1,7cm), egg-shaped, grey, covered by bright short hairs.</p>	<p> Opened buds</p>		<p>Phot. 54 https://commons.wikimedia.org/wiki/Sorbus_aucuparia#/media/File:Sorbus_aucuparia_lateral_bud.jpg</p>
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<p>Started to flower –</p> <p>Small white flowers, borne in dense corymbs, each flower contains 5 petals</p>	 <p>Started to flower</p>		<p>Phot. 55 https://commons.wikimedia.org/wiki/Sorbus_aucuparia#/media/File:Sorbus_aucuparia_no.JPG</p>
<p>Ripen berries</p> <p>Its fruits are small, orange, bright red or red</p>	 <p>Ripen berries</p>		<p>Phot. 56 https://commons.wikimedia.org/wiki/Sorbus_aucuparia#/media/File:Jodlowka_Tuchowska_Brzanka_Jarczobina_1.jpg</p>
<p>Leaves started coloring –</p> <p>The foliage is medium green and turns gold-yellow and gold-red in the autumn before the leaves fall</p>	 <p>Leaves started coloring</p>		<p>Phot.57 https://commons.wikimedia.org/wiki/Sorbus_aucuparia#/media/File:Arbre_avc_fruits.JPG</p>
<p>Leaves started falling down-it starts shedding leaves to survive harsh weather conditions (Report on this phase, when up to 10% of leaves has fallen down.)</p>	 <p>Leaves started falling</p>		<p>Phot. 58 https://commons.wikimedia.org/wiki/Sorbus_aucuparia#/media/File:Arbre_avc_fruits.JPG</p>
<p>All leaves fallen down - goes dormant for the winter months</p>	 <p>All leaves fallen down</p>		<p>Phot. 59 https://upload.wikimedia.org/wikipedia/commons/8/8a/Ancient_rowan_tree_at_site_of_old_croft_on_ridge_above_Divach_-_geograph.org.uk_-_1220522.jpg</p>





Bilberry (*Vaccinium myrtillus*)




Bilberry (also known as Blueberry, Whortleberry, Huckleberry, Hurtleberry) is a small shrub (up to 40 cm) growing mainly at the northern parts of the Northern Hemisphere (known as the taiga zone and the subarctic zone) *Vaccinium myrtillus* is found natively in Europe, northern Asia, Greenland,

Western Canada, and the Western United States. It occurs in the wild on heathlands and acidic soils. Small, elliptic, green leaves are finely toothed and prominently veined on the lower surface. Flowers are pink and urn-shaped. Fruits are dark blue, with dark red, strongly fragrant flesh and red juice that turns blue in basic environments.

Bilberries are very healthy and are recommended to lower blood glucose, reportedly they have anti-inflammatory and lipid-lowering effects, and promote antioxidant defense and lower oxidative stress. Bilberry juice was used as a dye for food and clothes.

<p>Started to flower</p> <p>Blueberries produce small, pink-green or pink-white flowers, single or paired on the brush</p>	 <p>Started to flower</p>		<p>Phot. 60 CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=160910</p>
<p>Ripen berries</p> <p>Bilberries grow small fruits, ripen ones are dark purple or even near black</p>	 <p>Ripen berries</p>		<p>Phot. 61 By Marek Silarski - from de.wikipedia [1], CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=638397</p>

Rosebay willowherb (*Chamerion angustifolium*)





 **Rosebay willowherb**

Rosebay willowherb is also known as willow herb. It has reddish stems, which are simple, erect, smooth and tall (up to 2 m). The leaves of this plant are unique in that the leaf veins are circular and do not terminate on the edges of the leaf, but form circular loops and join together inside the outer leaf margins. This feature makes the plants very easy to identify in all stages of growth. The flowers are 2 to 3 cm in diameter, with four pink petals and four narrower pink sepals behind. It inhabits light-filled forest heaths, broad-leaved forests, rich mixed swamps, burned areas, disused fields, railway embankments, banks, wasteland, often used to reestablish vegetation. It is native throughout the temperate Northern Hemisphere, including large parts of the boreal forests, in a variety of arctic ecosystems.

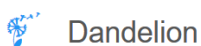
Rosebay willowherb has been believed in Finland to increase the milk production in cattle, and was thus often added to feed. In Russia flowers/leaves were traditionally used to make tea. The plant is also called "fireweed" or "bomb weed", as it was said that it only bloomed in London after the Great Fire of 1666 and after the bombings during WW2.



Phot. 62: Lateral leaf veins have a unique quality – they do not extend to the outer edge of the leaf, but loop together near the margin. This makes it easy to identify before it flowers. Source: <http://wildfoodsandmedicines.com>

<p>Started to flower</p>	 <p>Started to flower</p>		<p>Phot.63 http://pixabay.com</p>
<p>Seeds ready Seeds have a plume of hairs and are wind dispersed</p>	 <p>Seeds ready</p>		<p>Photo. 64 Dcrjsr (Own work) [CC BY 3.0 (http://creativecommons.org/licenses/by/3.0/)], via Wikimedia Commons</p>





Dandelion (*Taraxacum officinalis*)

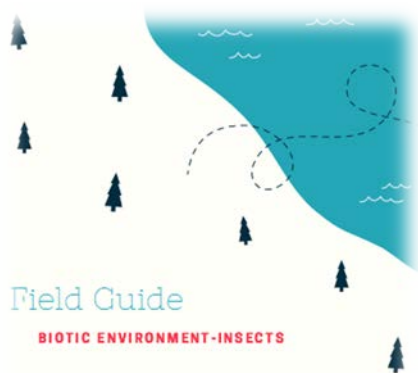


Dandelion

Familiar weed of lawns and roadsides. Dandelions are native to Eurasia and North America, but was introduced from Europe and now are wildflowers (present in all areas except for Svalbard). Dandelion has edible, deeply toothed or notched leaves, golden-yellow flowers, and rounded clusters of white, hairy seeds. The roots are fleshy and brittle roots are filled with a white milky substance that is bitter and slightly odorous. The dark brown roots may reach deep into the soil.

It is widely used in medicine (for liver diseases, high blood pressure etc.)

<p>Started to flower</p> <p>First flowers is fully open - 21 days after average day temperature passes 6/7°C</p>	 <p>Started to flower</p>		<p>Phot.65 http://pixabay.com</p>
<p>Seeds ready</p> <p>Seeds have a plume of hairs and are wind dispersed</p>	 <p>Seeds ready</p>		<p>Phot.66 http://pixabay.com</p>



Noticed since the last observation (previous week) - data from biotic environment field observations. Collect information on selected insects (Bumble bee, Mosquito, Ant, Common brimstone, European peacock). Observe and note the very first appearance in your neighborhood.

Monitoring insect _____

First observation in the year

Why is it so important and what does it actually say? See the dates of insect appearance and activity in Britain shown in relation to temperature variables:

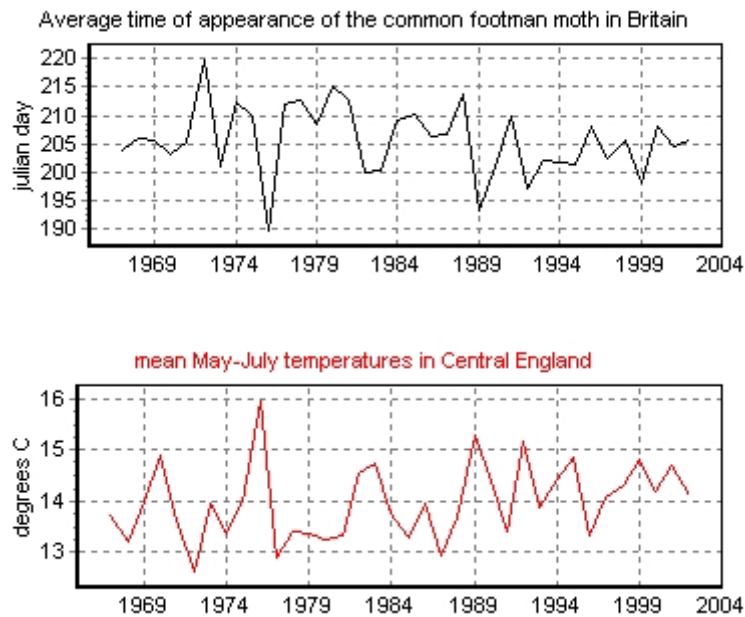


Fig.1 source: <http://www.ecn.ac.uk/iccuk/indicators/27.html>

The activity of insects is related to many important environmental factors. In winter, they hibernate, and wake up in early spring/late winter to lay eggs. The interannual variability of their appearance, number etc. is subject to scientific observations and research.

Bumble bee (*Bombus*)



Bumble bee is a large insect with round body covered in soft hair often consisting of contrasting bands of colour (many are **black and yellow**) making it appear and feel fuzzy. They feed on nectar, using their long hairy tongues to lap up the liquid. Bumblebees are typically found in temperate climates, and are often found at higher latitudes and altitudes than other bees, some range into very cold climates, e.g. *B. polaris* occurs in the high Arctic. This is the most northernmost occurrence of any **eusocial insect**. One reason for their presence in cold places is that bumblebees can regulate their body temperature, via solar radiation, internal mechanisms of "shivering" and radiative cooling from the abdomen.

Many bumble bees are social insects that form colonies with a single queen. Bumble bees are important pollinators of wild flowering plants and agricultural crops like tomatoes, peppers, and cranberries.

<p>First observation in the year</p>	<p> First observation in the year</p>		<p>Phot. 67 http://unsplash.com</p>
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Mosquito (*Culex*)



Mosquitoes have two pairs of wings, but their second pair of wings is reduced to short, peg-like structures. Mosquitoes have thin, long bodies and three pairs of extremely long legs. They have scales along the veins of their wings and long beak-like, sharp sucking mouth parts. Mosquitoes feed on sweet nectar, fruit, and other sugary substances. Mosquito eggs require water in order to develop. Females of some mosquito species also feed on blood, which they need in order for their ovaries to mature and for their eggs to develop. Female mosquitoes detect their blood hosts (not only humans, but also other mammals, birds, lizards etc.) partly through the sense of smell and partly by sight from up to 30 meters. They live on almost every continent and habitat and serve important functions in numerous ecosystems (as pollinators or parts of a food chain), although some researchers claim that if extinct, they could be easily replaced by other species.

The oldest known mosquito with an anatomy similar to modern species was found in 79-million-year-old Canadian amber.

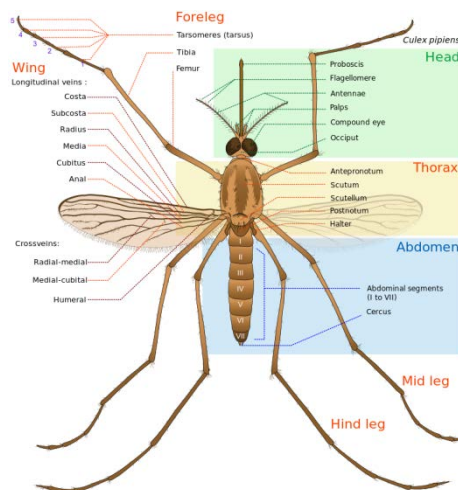


Fig. 2 Source: Wikipedia

<p>First observation in the year</p>	 <p>First observation in the year</p>		<p>Phot. 68 https://commons.wi kimedia.org/wiki/Fil e:Diptera-komar- moscow.jpg</p>
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Ant (*Formica*)

 **Ant**

Ants are very capable, busy insects 2 to 25 mm long (larger ants occur in tropical regions). Ants have a narrow "waist" between the abdomen and thorax, large head, elbowed antennae, and powerful jaws. Ants can lift and carry more than three times their own weight. Enthusiastically social insects, ants typically live in structured nest communities (typically with one queen-with wings, female workers care for the queen's offspring, work on the nest, protect the community, and perform many other duties and males destined only to mate with the queen), that may be located underground, in ground-level mounds, or in trees. Ants communicate and cooperate by using chemicals that can alert others to danger or lead them to a promising food source. They typically eat nectar, seeds, fungus, or insects. Ants can be found everywhere on the planet except for permanently icebound northern and southern areas of the globe.

Ants play a key role in global ecosystem and have a big impact on their local environment as a result of their activity as 'ecosystem engineers' and predators.

<p>First observation in the year</p>	 <p>First observation in the year</p>		<p>Phot. 69 http://unsplash.com</p>
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Common brimstone (*Gonepteryx rhamni*)

 **Common brimstone**


Common brimstone is a butterfly living in Europe, North Africa and Asia. Despite its opened-wing brilliant colour they are masters of disguise when closed as their under-wing colour and shape provide camouflage for resting and hibernating adults. Brimstones are common bright yellow butterflies and are often cited as the first butterflies of the year because adults hibernate over winter in woodlands and emerge on warm spring days. Males have sulphur-yellow fore and hindwings with an orange central spot, the females' wings are a more delicate yellow or pale green. The eggs are laid singly on the leaves of either common buckthorn (*Rhamnus cathartica*) or alder buckthorn (*Rhamnus frangula*) – the only two food plants – and females will wander far and wide in search for these particular

shrubs. Brimstone butterflies spend the summer feeding on nectar to build up energy reserves for the winter and by the end of August they are already beginning their long sleep.

The name "butterfly" is believed to have originated from the brimstone — which was called the butter-coloured fly by early British naturalists.

<p>First observation in the year</p>	 <p>First observation in the year</p>		<p>Phot. 70 http://pixabay.com</p>
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European peacock (*Inachis io*)

 **European peacock**

This remarkably beautiful butterfly is rather common in temperate Eurasia, inhabiting woodlands and gardens. The base colour of the wings is a rusty red and there is a distinctive blue eye on each wingtip. The underside of the wings is a dark greyish brown, giving the butterfly perfect camouflage against a branch or tree trunk. The male and female have identical markings. Host plants for the caterpillars are first of all the stinging nettle, *Urtica dioica*, and sometimes Common hop, *Humulus lupulus*.

It is no coincidence that the European Peacock's markings resemble staring eyes. When the butterfly opens its wings, it is these staring eyes that scare off predators.

<p>First observation in the year</p>	 <p>First observation in the year</p>		<p>Phot. 71 http://pixabay.com</p>
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Noticed since the last observation (previous week) - data from biotic environment field observations. Collect information on selected species of birds (arctic tern, common cuckoo, white wagtail, crane). All of them are migratory birds, and fly hundreds and thousands of kilometers to find the best ecological conditions and habitats for feeding and breeding. Observe and note the very first appearance in your neighborhood. This will give approximate schedule and routes of their return.

Monitoring migrating birds

First observation in the year

Arctic tern (*Sterna paradisaea*)



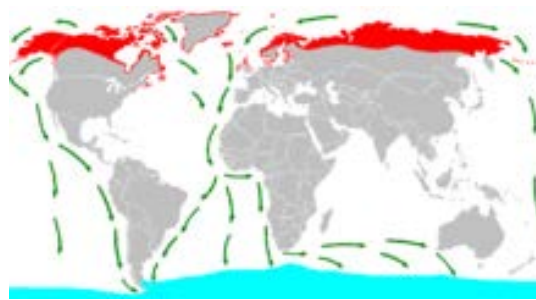
Arctic tern

Arctic tern is a medium-sized, slender white bird with black cap, deeply forked, long tail and white wings with some dark at tips, well known for its long yearly migration. Its travel from its Arctic breeding grounds to its wintering grounds of Antarctica may cover perhaps 40,000 km (25,000 mi), and is the farthest yearly journey of any Bird. The birds survive the vast journey by dipping down to the sea surface to catch fish and other food (invertebrates) as they travel. It nests once every one to three years (depending on its mating cycle); once it has finished nesting it takes to the sky for another long southern migration. The Arctic tern has a continuous worldwide circumpolar breeding distribution.

Arctic terns can live for 15 to 30 years, meaning the record-breaking tern could fly as far as 3 000 000 kilometres over its lifetime, the rough equivalent of four round trips to the moon.

Distribution of Arctic tern.

Fig. 3. Source: Wikipedia



Red –breeding area

Blue – feeding area



<p>First observation in the year</p>	 First observation in the year		<p>Phot. 72 http://pixabay.com</p>
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Common cuckoo (*Cuculus canorus*)

 **Common cuckoo**

Common cuckoo can be actually difficult to spot, as it's more often heard than seen. The familiar and unforgettable 'cuck-oo cuck-oo' call heralds the beginning of spring when they return to European forests from wintering in sub-Saharan Africa and south east Asia. As one of the most infamous brood parasites, cuckoos lay their eggs in the nests of other birds with precision timing. Once hatched, the chick ejects the legitimate occupants and then gets fed by its new and unsuspecting foster parents. Although its eggs are larger than those of its hosts, the eggs in each type of host nest resemble the host's eggs! The adult too is a mimic, in its case of the sparrowhawk; since that species is a predator, the mimicry gives the female time to lay her eggs without being seen to do so. Cuckoos are quite large (up to 34 cm long, 60 cm of wingspan), the plumage is greyish with a slender body and long tail and can be mistaken for a falcon in flight, where the wingbeats are regular. During the breeding season, common cuckoos often settle on an open perch with drooped wings and raised tail.

Cuckoos are insectivorous, and in particular are specialised in eating larger insects and caterpillars, including noxious hairy types avoided by other birds, they are able to shake the toxins out of hairy caterpillars before eating them.

<p>First observation in the year</p>	 First observation in the year		<p>Phot. 73 Chris Romeiks Vogelart.info http://commons.wikimedia.org/wiki/File:Cuculus_canorus_vogelartinfo.jpg</p>
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White wagtail (*Motacilla alba*)



White wagtail is a rather tiny bird (length up to 19 cm, wingspan up to 25 cm). White wagtail is instantly recognisable thanks to its distinctive black and white plumage, loud *tsli-vitt* call, and characteristic habit of constantly bobbing the tail, hence the common name 'wagtail'. It is mostly an aquatic bird, but this species can be common in various types of habitats, as well near water to hunt as in urban parks and cities for roosting in trees, so they are often seen running across lawns, car parks and other flat areas in pursuit of insects. These birds flock together to roost at warm sites such as reed beds and sewage farms.

This species breeds in much of Europe and Asia and parts of north Africa. It is resident in the mildest parts of its range, but otherwise migrates to Africa.

<p>First observation in the year</p>	 First observation in the year		<p>Phot. 74 http://pixabay.com</p>
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Crane (*Grus grus*)



Crane is large and impressive waterbird with a long neck, beak and legs. The plumage is mainly slate grey, with black flight feathers, the innermost of which are greatly elongated, forming a drooping, bushy 'cloak' over the tail. In contrast, the neck, chin and throat are dark grey to black, with a black forehead and a distinctive white stripe that runs from behind the eye, down the neck and to the upper back. The top of the head bears a red patch of bare skin, and the eye is also bright red or reddish-brown. Cranes eat mostly plants (roots, seeds, berries-like cranberry), insects, snails, amphibians etc. Common crane is breeding from Western Europe to Siberia. Monogamous pairs reinforce their bond with a series of calls and elaborate head jerks. Together

the pair builds a ground nest within their wetland habitat from a mound of swampy vegetation. The job of incubating their two eggs is also shared. They breed near water (marshy wetlands, swampy openings etc.). Cranes are quite social - flocks of up to 400 birds may be seen flying together during migration to/from southern Europe, Africa or northern India. Before spotting it, you can hear its piercing call from considerable distance.

During incubating eggs, adults sometimes embark on the fascinating behaviour of 'painting' their upper bodies and wings with reddish mud, which is thought to provide camouflage.

<p>First observation in the year</p>	 <p>First observation in the year</p>	 	<p><i>Phot. 75 Flock of cranes during flight</i> http://pixabay.com</p> <p><i>Phot. 76: Common crane</i> http://pixabay.com</p>
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Conclusions

We hope you and your students will enjoy conducting measurements, making observations and reporting. We encourage you to observe our maps, to compare your results with schools from all over Europe and to draw conclusions.

We strongly advise to discuss your results and experience regarding MONITORING on our EDU-FORUM (dedicated 'Monitoring' section).

Please don't hesitate to contact us in case of any problems or questions. For technical issues, please contact our support. For scientific issues, please contact Institute of Geophysics Polish Academy of Sciences (IGF PAS).

And remember: "To acquire knowledge, one must study, but to acquire wisdom – one must observe".
So keep calm and ...

