

Methodology of nature monitoring

Methodological guide for:

Plant species:

4068 Lady bells *Adenophora liliifolia* (L.) Besser
by Adam Rapa

Translated by

LIDEX Sp. z o.o.

ul. Magiera 16/17, 01-873 Warszawa

LIBRARY OF ENVIRONMENTAL MONITORING

Warszawa 2017

Contents:

4068	Lady bells <i>Adenophora liliifolia</i> (L.) Besser.....	3
	I. INFORMATION CONCERNING THE SPECIES	3
	1. Systematic position	3
	2. Status.....	3
	3. Description of the species	4
	4. Biology of the species.....	4
	5. Environmental requirements	4
	6. Distribution in Poland.....	5
	II METHODOLOGY	6
	1. Description of monitoring studies.....	6
	2. Evaluation of population and habitat condition indicators	8
	3. An example of a filled-in species observation sheet for a monitored location	9
	4. Protection of the species.....	13
	5. References.....	13

4068 Lady bells *Adenophora liliifolia* (L.) Besser



Photo 1 Lady bell *Adenophora liliifolia* in "Dąbrowa koło Zaklikowa" special area of conservation (© A. Rapa)

I. INFORMATION CONCERNING THE SPECIES

1. Systematic position

Family: bellflower *Campanulaceae*

2. Status

International law

Habitats Directive - Annex II and IV

Berne Convention – not included

National law

Protection of the species - strict protection since 2001

Threat category

IUCN Red List – not included

Polish Red Book of Plants (2014) – CR

Red List of vascular plants in Poland (2016) – CR

3. Description of the species

The lady bell is a perennial plant with a beetroot-shaped root. One specimen (cluster) consists of a variable number of shoots – from one to a dozen or so. The stem is between a dozen or so and 160 cm long, with an alternate arrangement of leaves. Basal leaves, roundish and heart-shaped, petiolated, dry out early. Stem leaves are the largest in the middle and bottom sections of the stem. They are egg-shaped and lanceolate, short-petioled or non-petioled, with serrated edges, slightly wrinkled. The underside of leaves is covered with short and stiff hairs, especially on the veins.

Initially, the inflorescence has the form of a raceme, which later turns into a loose panicle. The calyx consists of 5 lanceolate-triangular sepals; the sepals are about 2 times shorter than the corolla. The corolla consists of white or pale blue bell-shaped flowers. It is naked and is 1.5–2 cm long. The lobes of the corolla are shorter than the tube.

There are 5 stamens with elongated anthers. At the base, filaments are flattened and clearly ciliated. There is just one pistil. The neck of the pistil is 2 times longer than the corolla, thickened in the upper part, covered with papillose hairs, ending with three flat stigmas; the base of the neck is surrounded by the honey ring (Korzeniak, Nobis 2004). Fragrant flowers.

Fruits are pear-shaped capsules, which open with three holes at the base part (Piękoś Mirkowa, Mirek 2008). The seeds are flattened, egg-shaped, of brown colour, with narrow wings on one side. They reach a length of up to 1.7 mm. The number of chromosomes $2n = 34$ (Wcisło 1983).

During the flowering stage, they are easily confused with other species. In the barren stage, they can be mistaken for other bellflowers, especially young specimens.

4. Biology of the species

The lady bell is a perennial plant with overwintering buds located at the soil surface (hemicryptophyte).

Flowering lasts from the second decade of July to the second half of August. Individual shoots from one cluster may flower at slightly different times, thus prolonging the flowering period (Rapa, unpublished data). The lady bell is pollinated by numerous species of insects. The seeds ripen and are dispersed in late August and throughout September. The plant can also reproduce vegetatively from fragmented roots (Korzeniak, Nobis 2004).

From year to year, the number of shoots in a cluster changes only slightly. The number of clusters, on the other hand, remains constant over the years (Rapa A., unpublished data from a multi-year observation of a site with *Adenophora liliifolia* in the special area of conservation “Dąbrowa koło Zaklikowa”). The length of shoots depends not only on the development stage of an individual lady bell, but also on habitat conditions. The longest shoots and the largest number of flowers and fruits can be found in places with favourable light conditions. In too shady conditions, however, shoots are short and barren or long and sometimes generative. In the latter case, plants try to break through a layer of, for example, low bushes to places with better light conditions (Rapa A - unpublished data).

5. Environmental requirements

The lady bells are a photophilous species, requiring soils rich in calcium carbonate. In Poland, they occur mainly in oak forests *Potentillo albae-Quercetum petraeae*. In addition, they can be encountered in subcontinental oak-hornbeam forest *Tilio cordatae – Carpinetum* and mixed pine and oak forest *Quercus roboris-Pinetum*. In the past, they were also reported to be present in xerothermic

grasslands of the *Festucetalia valesiacae* order (*Festuco-Brometea* class), in xerothermic scrubs of the *Prunetalia* order (*Rhamno-Prunetea* class) and on dry meadows (Korzeniak, Nobis 2004).

The ecological indicator values are as follows:

Indicator	According to Zarzycki et al. (2002)	According to Ellenberg et al. (1992)
light L	3	7
thermal T	4-5	6
of continentalism C	4	6
soil moisture M (F)	3	6
of trophism Tr (N)	3	8
of soil acidity R	4	2



Photo 2 *Potentillo albae-Quercetum petraeae* oak forests in the special area of conservation "Wierchowiska" (© A. Rapa)

6. Distribution in Poland

In Poland, lady bells have been reported to occur on about 100 sites (according to the data collected since the end of the 19th century until 2010), mainly in central and north-eastern Poland, but also in upland areas. The north-western limit of the species' distribution ran through Pomerania, Greater Poland and Silesia. In most sites, the species has become extinct or its presence has not been confirmed recently, for example in Subcarpathia (Piękoś-Mirkowa, Mirek 2008), Eastern Pomerania, Western Pomerania, Greater Poland (Żukowski, Jackowiak 1995) and in Lower Silesia (Kącki 2003).

Today, *Adenophora liliifolia* occurs in upland areas (Roztocze, Lublin Upland, Volhynian Upland, Lesser Poland Upland and Silesian-Cracow Upland), in Central Polish Lowlands (Central Masovian Lowland, South Masovian Heights, South Podlachian Lowland), North Podlachian Lowland and in the Masurian Lake District.

Depending on the site, the number of specimens (clusters) in a population varies, ranging from several to over 1000 specimens. The largest population of lady bells in Poland can currently be found in the Special Area of Conservation "Dzwonecznik w Kisielanach" (Ciosek 1998, 2006).

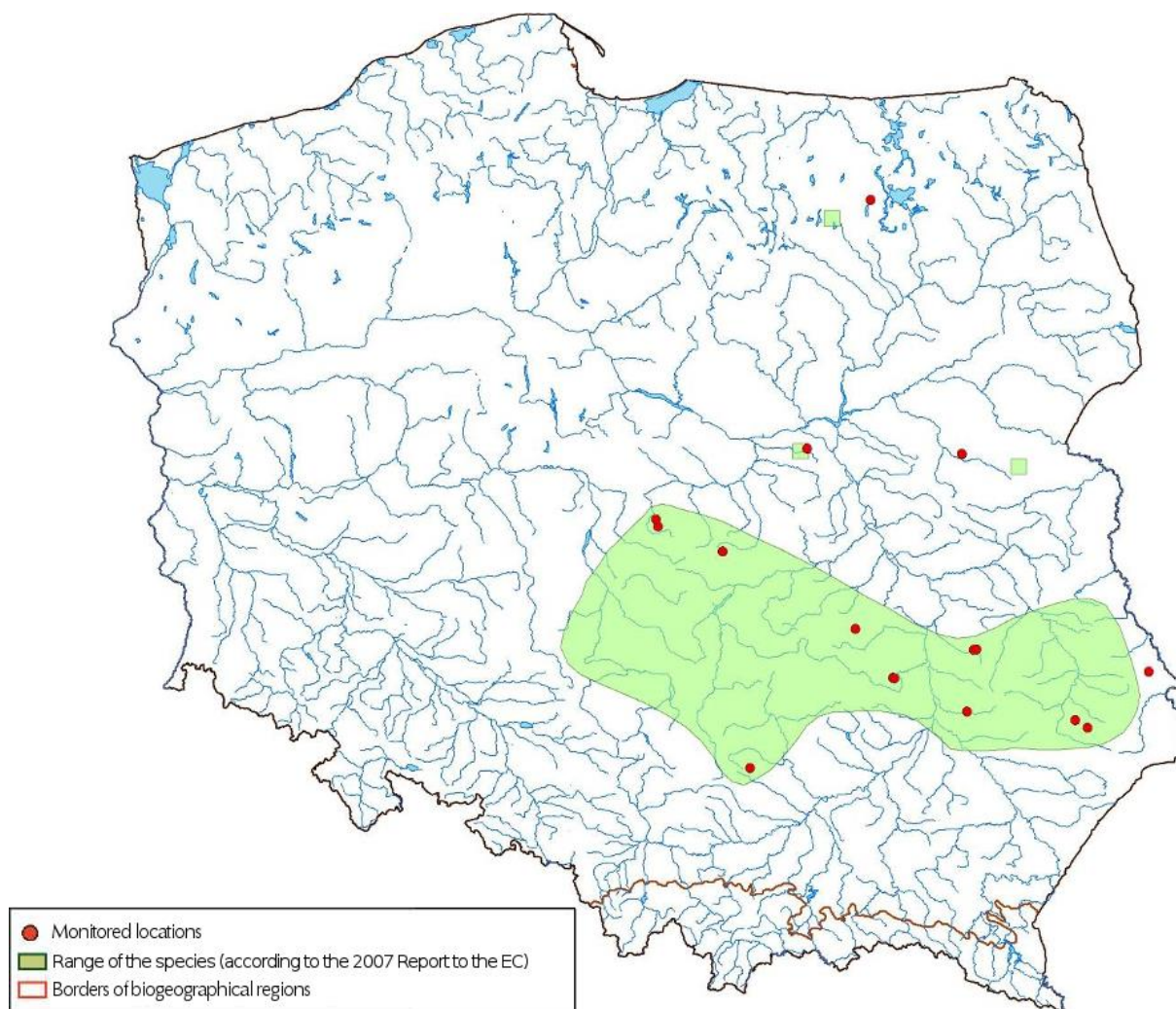


Fig. 1 The distribution of the monitoring locations compared with the geographical range of the species

II METHODOLOGY

1. Description of monitoring studies

Selection of monitoring areas and their suggested size

The sites should be selected in such a way so as to take into account populations of different sizes (small populations consisting of several specimens, medium-sized populations – a dozen or so clusters, as well as large ones, consisting of several dozen or over 100 specimens).

In the case of small and medium-sized populations, the monitoring area should cover the whole acreage of this population, whereas in the case of large populations a representative research area of about 0.5 ha should be selected.

Lady bells should be monitored at about 10 sites situated in the main areas of its occurrence, within the limits of their range.

In addition, the analysis of the conservation status of the species in Poland should take into account the results of monitoring activities conducted in national parks (all analyses should be performed using the same methodology).

Study method

The cluster is used as a calculation unit. Single shoots growing on their own should be treated as clusters.

Table 1 The method of measuring the indicators used for assessing the condition of the population and the habitat

Indicator	Measure	Measurement method
Population		
Quantity	Number of specimens (pcs)	Counting of pieces – clusters and shoots growing on their own
The number of generative specimens	The number of clusters (pcs)	Counting of blooming clusters (containing at least 1 generative shoot) as a proportion of all clusters
The number of shoots in a cluster	The number of shoots (pcs)	Counting of shoots in particular clusters as well as the minimum, maximum and average number
The height of plants	In cm	Measurement of the height of shoots (all shoots in small populations and in large ones – of 30 specimens), together with the maximum, minimum and the average height.
Health condition	Identified diseases, parasites, mechanical damage, etc.	Observation of shoots and flowers for the presence of parasites and traces of their feeding, bite marks left by herbivores and other mechanical damage
Habitat		
Potential habitat area	Area (in: ha, a)	Estimation of the area of the whole habitat of the species at a given site
The area of the covered habitat	Area (in: a, m ²)	Specify the acreage covered by the population, i.e. a convex polygon encompassing all places where particular specimens occur; in the case when the acreage is small, its evaluation can be based on measurements
Density of trees	% of coverage	Evaluate the average coverage (%) by particular species of trees (separately for each species) in the area of the habitat occupied by lady bells
Density of bushes	% of coverage	Evaluate the average coverage (%) by particular species of bushes (separately for each species) in the area of the habitat occupied by lady bells
Density of undergrowth	% of coverage	Evaluate the average coverage (in % or in percentage ranges) within the limits of the habitat concerned
Expansive, competitive species	Species and % of coverage	In the patch where the species occurs: Identify species present in the patch which are already forcing lady bells out or which have a strong competitive potential, e.g. bushgrass <i>Calamagrostis epigejos</i> , blackberries etc. and assess the area covered by them.
The height of undergrowth	In cm;	The average from 20 measurements of the main vegetation mass
Dead organic matter (non-decomposed plant debris, litterfall)	Thickness in cm	The average from 20 measurements performed in the patch (measurement sites should be selected in such a way so as to take into account the maximum, the minimum and the average thickness, e.g. 0-5 cm, with the mean value of 3 cm)
Germination sites	Specify in %;	The area and frequency of gaps (exposed soil)
Alien, invasive species	% of coverage by particular species	In the patch where the species occurs: Identify alien and invasive species that are present in the patch and measure the area covered by them.

Time and frequency of studies

The best period for studying lady bells is the first half of August, because at that time most specimens have flowers and it is easier to find them within the site. It is also easier to establish the number of generative specimens. The condition of plant communities where *Adenophora liliifolia* grows, especially of *Potentillo albae-Quercetum petraeae* oak forest communities, provides a basis for evaluating essential parameters of the habitat and making a phytosociological relevé. The

monitoring activities should be repeated every 6 years, whereas on smaller sites, situated at the edges of the range and strongly endangered - every 3 years.

In addition, it is suggested that several representative sites are selected all over Poland for multi-year population studies. Lady bells are a perennial plant, therefore correct conclusions as to their population dynamics can only be drawn after a series of long-term observations.

Equipment used in studies

The studies do not require any specialized equipment. Useful equipment includes a measuring tape – for measuring the size of the patch, a ruler – for measuring the thickness of non-decomposed plant debris and the height of forest floor vegetation, a notebook, a satellite GPS receiver for establishing the exact location of the site and a digital camera.

2. Evaluation of population and habitat condition indicators

Suggested indicators to be evaluated: The height of forest floor vegetation, non-decomposed plant debris (dead organic matter), germination sites, the number of shoots in a cluster and the height of plants can only be evaluated after a series of long-term observations and, possibly, after the species ecology having been researched.

Table 2 Evaluation of population and habitat condition indicators

Indicator	FV favourable	U1 unsatisfactory	U2 bad
Population			
Number of specimens (clusters)	At least the same as in the previous monitoring period; however, there may be no fewer than 50 specimens	Up to 10% smaller than in the previous monitoring period; however, there may be no fewer than 20 specimens	More than 10% smaller compared with the previous monitoring period, or fewer than 20 specimens
The number of generative specimens (% of the population)	>60%	30%-60%	< 30%
The number of shoots in a cluster (minimum, average, maximum) ¹	XX	XX	XX
The height of plants ¹	XX	XX	XX
Health condition	None	Single attacked specimens or shoots	More than 20% of specimens with signs of necrosis

¹ It is suggested that this indicator should be used at the end of studies. There are no field data for its evaluation.

Indicator	FV favourable	U1 unsatisfactory	U2 bad
Habitat			
Potential habitat area	A multiple of the area occupied by lady bells	No more than several times larger than the one occupied by lady bells	Not much larger than the one occupied by lady bells
The area of the covered habitat	The same or larger, but not smaller than 0.5 ha	Smaller but by no more than 10%, not smaller than 0.25 ha	Smaller by more than 10%, or smaller than 0.25 ha
Density of trees	≤70%	71%-80%	>80%
Density of bushes	≤70%	71%-90%	>90%
Density of undergrowth ²	<85%	85-95%	>95%
Expansive species	<10% of the area of the patch	10%-40%	>40% of the area of the patch
Height of undergrowth ³	XX	XX	XX
Non-decomposed plant debris (dead organic matter) ²	0-2 cm	2-5 cm	>5 cm
Germination sites ²	>5%	3-5%	<3%
Alien, invasive species	None	Single specimens of 1 species	More than 1 species or more than 10% of the area covered

Cardinal indicators

- Number of individuals
- Expansive species

3. An example of a filled-in species observation sheet for a monitored location

Template of a filled-in species observation sheet for a monitored location with instructions for filling in particular fields

² The values given are purely indicative and may be modified following further studies.

³ The species thrives in monitored locations within the height range of the undergrowth of between 25 and 170 cm. Current knowledge does not suggest that this indicator can be linked with the evaluation of the habitat.

A species observation sheet for the site "Dąbrowa koło Zaklikowa"	
Code and name of the species	4068 Lady bell <i>Adenophora liliifolia</i>
Code and name of the area	Name of the monitored Natura 2000 site PLH180019 Dąbrowa koło Zaklikowa
Other forms of protection of the area within which the site is situated	Nature reserves, national and landscape parks, sites of ecological interest, documentation sites, etc. None
Site name	Name of the monitored location Dąbrowa koło Zaklikowa
Type of site	Reference/research Research
Site description	A description which makes it possible to identify the site in the area The site covers a limestone hill in the village of Dąbrowa (municipality of Zaklików, district of Stalowa Wola)
Site area	Area (in ha, a) 2a
Geographical coordinates	Geographical coordinates of the site N 50°45'..., E 22°08'...
Elevation a.s.l.	Site elevation (or elevation range) a.s.l. 191 - 200 m a.s.l.
The characteristics of the species' habitat at the site	General character of the area: e.g. meadow, warm grassland, a fragment of a forest, brushwood natural habitat type (natural habitat code/plant community/plant association) composition and age of tree stands (in the case of forest habitats) habitats in the vicinity of the site The site covers a limestone hill in the village of Dąbrowa (municipality of Zaklików, district of Stalowa Wola). The forms present include: <i>Potentillo albae</i> - <i>Quercetum petraeae</i> oak forest, subcontinental oak-hornbeam forest and some forms in-between. Apart from the acreage covered by lady bells <i>Adenophora liliifolia</i> , the hill is also occupied by substitutional communities with pine and birch trees. In the vicinity, there are also arable fields, underwoods and buildings belonging to the residents of the village of Dąbrowa. The site is a private property of the residents of Dąbrowa. Natural habitats: 91I0 – Warmth-loving oak forests (<i>Quercetalia pubescenti-petraeae</i>) 9170 – Central European and subcontinental oak-hornbeam forest (<i>Galio-Carpinetum</i> , <i>Tilio-Carpinetum</i>) 8210 – Limestone rock walls with <i>Potentilletalia caulescentis</i> communities
Information about the species at the site	Synthetic information about the occurrence of the species at the site, research to date and other essential facts. Results of monitoring activities from previous years. The presence of lady bells <i>Adenophora liliifolia</i> was first reported in 2005 (Rapa A. - unpublished materials). Most lady bells (more than 60 specimens) grow in the westernmost part of the hill in the best preserved patch of <i>Potentillo albae</i> - <i>Quercetum</i> .
Observer	First name and surname of the local expert responsible for the site (as specified in the agreement) Adam Rapa
Dates of observations	Dates of all observations (as specified in partial forms) 11 – 20 August 2009

The description should be based on studies/field observations. A proposal of an expert summary of studies/observations carried out at the site as part of the project in the current year is presented below; the summary can be supplemented with one's own data collected previously at the site under analysis.

Evaluation of particular parameters: satisfactory (FV) / unsatisfactory (U1) / bad (U2) / unknown (XX)

Species protection status at the site				
Parameter/indicators		Indicator value and comment		Assessment
Population	Quantity	the number or density of specimens 77 clusters.	FV	FV
		type of distribution (dispersed, with assemblages) Dispersed		
	Number of generative specimens (% of population)	the number of generative specimens 56 clusters (72%)	FV	
	Number of shoots in a cluster	the number of shoots in a cluster (minimum, average, maximum) min: 0 (1 live leaf), average 2.0, max: 17	XX	
	Presence of seedlings	number of seedlings No seedlings were found	U2	
	Height of plants	The height of plants (average, max, min) average: 92.5 cm, max: 160 cm, min: 25 cm	XX	
	Health condition	Identified diseases, parasites, etc. Some specimens were found to have deformed leaves, probably due to a viral disease. It is unlikely to pose a direct threat to the species.	FV	
Habitat	Potential habitat area	Area (in ha, a, m²) At present, about 2 ha in habitat 9110 If long-term and intensive active protection measures are taken, the potential range of the habitat will be extended to include most of the planned special area of conservation – over 4 ha.	FV	U1
	The area of the covered habitat	Area (in ha, a, m²) About 1.5 ha	FV	
	Density of trees	Coverage (%) of trees at the site, species name 70% mainly oak <i>Quercus petraea</i> , <i>Quercus robur</i> in admixture: silver birch <i>Betula pendula</i> , scots pine <i>Pinus silvestris</i>	U1	
	Density of bushes	Coverage (%) of bushes at the site, species name 50-60% mainly common hazel <i>Corylus avellana</i> , spindle tree <i>Euonymus verrucosus</i> in admixture: hornbeam <i>Carpinus betulus</i>	U1	
	Density of undergrowth	Coverage (%) at the site, dominant species name 70-80% blueberry <i>Vaccinium myrtillus</i> , lily of the valley <i>Convallaria majalis</i> , <i>Brachypodium pinnatum</i>	FV	
	Expansive species	Species, coverage (%) Common hazel <i>Corylus avellana</i> 40%, spindle tree <i>Euonymus verrucosus</i> 10%	U1	
	The height of undergrowth	30 cm (the average). Max 50 cm, minim. 10 cm,	FV?	
	Non-decomposed plant debris and litterfall (dead organic matter)	0-2 cm	FV	
		Density: specify the % of the area of the patch covered by non-decomposed plant debris and litterfall > 90%		
	Germination sites	Specify in %; the area and frequency of gaps (exposed soil) in the patch or possibly in its direct vicinity 1 – 2%	FV?	
	Alien/invasive species	None found at the site occupied by lady bells.	FV	
Conservation prospects		The species sustainability prospects are good only if active protection measures are taken at the site – the cutting of underbrush. The population is quite numerous; however, it may be reduced and eventually become extinct due to progressive succession processes.		U1
Active protection measures and their effectiveness		Specify visible signs of protective measures, possibly relying on the knowledge obtained in the past (protection plans, etc.) There are no planned protective measures. The periodic cutting of bushes by owners makes it easier for the population of lady bells to survive. However, activities of this type should be planned and conducted on a larger scale. In the past, the area could have been used as a		
Overall assessment				U1

The list of the most significant impacts affecting the species and its habitat at the monitored location (including its use). Impacts should be coded in accordance with Appendix E to the Standard Data Form for Natura 2000 sites

Current impacts				
Code	Operation	Intensity	Impact	Synthetic description
950	Biocenotic evolution	A	-	Progressive succession processes - the undergrowth is increasingly overshadowed by bushes – mainly by hazel. The habitat is becoming more and more fertile. At the site with the main part of the population of <i>Adenophora liliifolia</i> – succession processes take place at an alarmingly fast rate.
165	The cutting of underbrush	C	+	The cutting of bushes is not performed on a sufficient scale.
250	Harvesting of plants	C	0	The picking of forest fruit and mushrooms does not have a major impact on <i>Adenophora liliifolia</i> .
164	Forest (tree) cutting	C	-	In oak forests <i>Potentillo albae-Quercetum petraeae</i> , oak trees are occasionally cut outside the sites occupied by lady bells. It results in an expansion of the underbrush, leading to degeneration of <i>Potentillo albae-Quercetum petraeae</i> oak forests because of excessive overshadowing of the stratum. Over the years the area of <i>Potentillo albae-Quercetum petraeae</i> oak forests and potential acreage for <i>Adenophora liliifolia</i> are decreasing.

A list of factors which may pose a threat to the species and/or its habitat over a longer term (future, anticipated impacts, such as for example planned investments, changes in management and use, urban sprawl pressure). Threats should be coded in accordance with Appendix E to the Standard Data Form for Natura 2000 sites. If there is no proper code - only a description should be provided in the table "Other information" in the field "Other comments".

Threats (foreseeable future impacts)				
Code	Name	Intensity	Impact	Synthetic description
164	Forest (tree) cutting	B	-	Due to the small acreage of lady bells, the cutting of even a few trees may result in excessive exposure of the forest floor and too fast an expansion of the underbrush, mostly hazel.
990	Other natural processes	X	-	Due to its small size, the population may be affected by unfavourable genetic factors.
300	Excavation of sand and gravel	C	-	The extraction of limestone contained in the bedrock used to have a negative impact on <i>Potentillo albae-Quercetum petraeae</i> oak forests and lady bells and this may continue in future.

Other information	
Other natural values	The site is situated in <i>Potentillo albae-Quercetum petraeae</i> oak forests (9110), which are of great natural value and are highly representative. They are inhabited by a number of rare and protected plants, for example: <i>Cimicifuga europaea</i> , <i>Lilium martagon</i> .
Other observations	All information that helps to interpret the results, e.g. weather anomalies
Methodological remarks	It is best to observe lady bells when they are in full bloom – from the end of July to the second decade of August. Most specimens bloom in the first decade of August.

Photographs to be enclosed: (specify the titles/number and authors of all photographs, in an electronic format, attached to the site observation forms – at least 2 photographs per stand – preferably a general view and the structure of the plant community with the monitored species.

Phytosociological relevés taken on an area of approximately 100 m² (no more than 200 m²), using the Braun-Blanquet method, in the habitat patch where the site of the species is situated, should be enclosed too. In justified cases, the area of the phytosociological relevé may be different.

4. Protection of the species

Lady bells are protected as a species. Passive protection measures are undertaken in protected areas: national parks and reserves, including the Kampinoski National Park and the “Dąbrowa Grotnicka” Reserve.

To ensure effective protection of lady bells, active protection measures should be taken at most sites. The most important measure is to reduce the density of underbrush (and possibly of trees). If bushes and trees grow back again after having been cut, the cutting should be repeated at specific intervals. It may be a good idea to consider litterfall raking in the vicinity of lady bells in order to reduce the quantity of organic matter covering the soil and to limit the eutrophication of *Potentillo albae-Quercetum petraeae* oak forests. The raking of leaves and the use of forests as a pasture for farm animals was a common practice in the past, which may have contributed to the development and survival of *Potentillo albae-Quercetum petraeae* oak forests in Poland (Jakubowska Gabara 1993).

It is necessary to secure a gene pool of native populations of *Adenophora liliifolia* ex situ by collecting seeds from wild populations. Thus derived plants should be grown in botanical gardens. In the case of sites with small-sized populations (consisting of several specimens), it must be done urgently, as they may disappear completely in the coming years.

At small sites, especially those situated at the edges of the range, e.g. at “Kwiatówka” site, the population of lady bells must be enhanced by ex situ cultivation of specimens from seeds sourced from local populations.

To ensure more effective protection of lady bells in the context of forest management, it is proposed to introduce zonal protection - inclusion of lady bells in Appendix no. 4 “Wild plant species requiring the establishment of special areas of conservation or sites” to the Regulation of the Minister of the Environment of 5 January 2012 (2012 Regulation).

It is necessary to implement forest and environment programmes (following the example of agricultural and environmental programmes) with a package of protective measures for plants listed in Annex II to the Habitats Directive.

At the same time, research must be conducted on the species ecology, focusing in particular on the type of seed bank in the soil, germination biology and the population dynamics.

5. References

- Buczek A. 2004. Stanowiska dzwonecznika wonnego *Adenophora liliifolia* na Równinie Bełżyckiej (Zachodnia Lubelszczyzna). Chrońmy Przyr. Ojcz. 60: 53–60.
- Ciosek M. 1998. Dzwonecznik wonny *Adenophora liliifolia* i inne rzadkie gatunki roślin w Kisielanach koło Siedlec. Chrońmy Przyr. Ojcz. 54 (6): 97.
- Ciosek M. T. 2006. The ladybells *Adenophora liliifolia* (L.) Besser in forest near Kiselany (Siedlce Upland, E Poland). Biodiv. Rev. Conserv. 3-4: 324-328.
- Durczak K. 1976. Dzwonecznik wonny *Adenophora liliifolia* rzadki gatunek elementu migracyjnego w Polsce. Chrońmy Przyr. Ojcz. 32: 42-44.
- Ellenberg H., Weber H. E., Düll R., Wirth V., Werner W., Paulissen D. 1992. Zeigerwerte von Pflanzen in Mitteleuropa. Scripta Geobotanica 18.2: 5-258.
- Gierczyk B., Sobon J. 2008. Nowe stanowiska chronionych, zagrożonych i rzadko spotykanych gatunków roślin naczyniowych w Polsce. Przegląd Przyrodniczy. XIX, 3-4. Świebodzin. 19-31.
- Głazek T. 1976. W sprawie ochrony ginącego gatunku dzwonecznika wonnego *Adenophora liliifolia* w Polsce. Chrońmy Przyr. Ojcz. 32: 44–46.

- Jakubowska–Gabara J. 1993. Recesja zespołu świetlistej dąbrowy *Potentillo albae*-*Quercetum* Libb. w Polsce. Wyd. Uniw. Łódzkiego, Łódź.
- Kaźmierczakowa R., Zarzycki K. (red.) 2001. Polska czerwona księga roślin. Paprotniki i rośliny kwiatowe. Polish red data book of plants. Pteridophytes and flowering plants. Instytut Botaniki im. W. Szafera PAN i Instytut Ochrony Przyrody PAN, Kraków.
- Kącki Z. (red.) 2003. Zagrożone gatunki flory naczyniowej Dolnego Śląska. Endangered vascular plants of Lower Silesia. Instytut Biologii Roślin Uniwersytetu Wrocławskiego, Polskie Tow. Przyjaciół Przyrody „Pro Natura”, Wrocław.
- Korzeniak U., Nobis M. 2004. *Adenophora liliifolia* (L.) Ledeb. ex A. DC. Dzwonecznik wonny. [w:] Sudnik–Wójcikowska B., Werblan–Jakubiec H. (red). Gatunki roślin. Poradniki ochrony siedlisk i gatunków Natura 2000 – podręcznik metodyczny. Tom 9. Ministerstwo Środowiska, Warszawa, 69–71.
- Kucharczyk M. 2007. Dzwonecznik wonny *Adenophora liliifolia*. Transition Facility 2004. „Opracowanie planów renaturalizacji siedlisk przyrodniczych i siedlisk gatunków na obszarach Natura 2000 oraz planów zarządzania dla wybranych gatunków objętych Dyrektywą Ptasia i Dyrektywą Siedliskową”, Lublin. [<http://natura2000.mos.gov.pl/natura2000/pl/dokumenty/n4/4068.pdf>]
- Nobis M., Piwowarczyk R. 2002. Nowe stanowiska *Adenophora liliifolia* (Campanulaceae) na Przedgórzu Iłżeckim (Wyżyna Małopolska). *Fragm. Flor. Geobot. ser. Polon.* 9: 380-383.
- Piękoś–Mirkowa H., Mirek Z. 2003. Flora Polski. Atlas roślin chronionych. Multico Oficyna Wydawnicza, Warszawa. Str. 88–89.
- Piękoś–Mirkowa H., Mirek Z. (red.) 2008. Czerwona księga roślin naczyniowych Karpat Polskich. Instytut Ochrony Przyrody PAN, Instytut Botaniki im. W. Szafera PAN, Kraków.
- Rapa A. 2010. Raport z przeprowadzonego w latach 2009-2010 monitoringu gatunku *Adenophora liliifolia* w obszarze kontynentalnym. GIOŚ, Warszawa.
- Rapa A. 2012. Nowe stanowisko *Adenophora liliifolia* w Dąbrowie koło Zaklikowa (Wyżyna Lubelska). *Chrońmy Przyr. Ojcz.* 68 (1): 70-74.
- Rozporządzenie 2001. z dnia 11 września 2001 r. w sprawie określenia listy gatunków roślin rodzimych dziko występujących objętych ochroną gatunkową ścisłą i częściową oraz zakazów właściwych dla tych gatunków i odstępstw od tych zakazów. (Dz. U. Nr 106, poz. 1176 z dnia 29 września 2001 r.).
- Rozporządzenie 2004. Rozporządzenie Ministra Środowiska z dnia 9 lipca 2004 r. w sprawie gatunków dziko występujących roślin objętych ochroną (Dz. U. Nr 168, poz. 1764).
- Tacik T. 1971. Rodzina: Campanulaceae, Dzwonkowate [w:] Pawłowski B., Jasiewicz A. (red.) Flora polska. Rośliny naczyniowe Polski i ziem ościennych. T. 12. PWN, Warszawa -Kraków, s. 50-99.
- Wcisło H. 1983 Cytological observations on *Campanulaceae* from Poland. *Acta Biol.Cracov. Ser. Bot.* 25:1-13.
- Zarzycki K., Trzcińska-Tacik H., Różański W., Szeląg Z., Wołek J., Korzeniak U. 2002. Ecological indicator values of vascular plants of Poland. *Ekologiczne liczby wskaźnikowe roślin naczyniowych Polski. Biodiversity of Poland 2.* IB im. W. Szafera PAN, Kraków.
- Żukowski W., Jackowiak B. (red.) 1995. Ginące i zagrożone rośliny naczyniowe Pomorza Zachodniego i Wielkopolski. Endangered and threatened vascular plants of Western Pomerania and Wielkopolska. *Prace Zakładu Taksonomii Roślin UAM w Poznaniu* 3: 7–141.

Compiled by: **Adam Rapa**