INSPECTION OF ENVIRONMENTAL PROTECTION

Methodology of nature monitoring

Methodological guide for:

Species of animals:
4026 *Rhysodes sulcatus* (Fabricius, 1787)
by Paweł Sienkiewicz

Translated by
LIDEX Sp. z o.o.
ul. Magiera 16/17, 01-873 Warszawa

LIBRARY OF ENVIRONMENTAL MONITORING

Warszawa 2017

Contents:

4026 ***Rhysodes sulcatus*** (Fabricius, 1787)

Photo 1 Body profile of Rhysodes sulcatus: a) view from above; b) side view; c) view from below (© A. Mądra)

I. INFORMATION CONCERNING THE SPECIES

1. Systematic classification

Order: *Coleoptera* beetle

Family: *Rhysodidae*

2. Legal status and threat to species

International Law

Habitats Directive - Annex II

Domestic Law

Species protection - strict protection (species that require active protection)

IUCN Threat Category

IUCN - EN Red List

Polish Red Book of Animals. Invertebrates (2004) - EN

Red List for the Carpathians (2003) - not included

Species considered a relic of primeval forests, very sensitive to disturbances to forest ecosystems. Present throughout Europe in the past, now extinct in many European countries.

3. Description of the species

Rhysodes sulcatus is a small beetle; the size of adults reaches 6.5 to 8.2 mm. Chestnut-coloured, shiny body. Beetles of longitudinal shape, ensiform and visibly furrowed, hairless (Fig. 1). A triangular

head with 11-member, beady tentacles. Head surface with two deep hollows. A bell-shaped protergum with three deep furrows running along. Side furrows at protergum base are notably widened. Bottom of furrows strongly lined, hence a matt appearance. Fine rotten wood often lies in furrows (protergum looks dirt-covered). Protergum between furrows is notably protuberant and shiny (roll-shaped forms). Scutellum nearly invisible. Ensiform covers, rounded at edges. Every cover contains 7 furrows, the bottom of which is thickly accentuated by a single row of points. Ribs on covers are smooth, wider than furrows, and shiny. Membranous wings under covers - flying beetle. Massive, relatively long legs with five-member feet.

A grown larva is ca. 9 mm long and 1.5 mm wide (head up to 1.0 mm). Cream-white colour with brownish, chitinised (hardened) elements. A pupa is ca. 6.5 mm long. Pre-imago stages described in detail by Burakowski (1975). They are not used for monitoring.

Adult form of Rhysodes sulcatus cannot be mistaken for other indigenous insect species (provided the individual is carefully looked at, applying a 5-fold magnitude at the least).

Photo 2 Rhysodes sulcatus on an exposed patch of moss growing on a decaying log (© L. Buchholz, W. Różański)

4. Biology of the species

The most detailed description of the growth of Rhysodes sulcatus is in Burakowski's work (1975). A new generation of beetles appears already in late July and early August. At this time the Rhysodes lives mainly in hiding, in decaying deadwood. It has also been found under loose bark, in tree cracks, galleries used by xylophagous beetles (among others, such species as Ceruchus chrysomelinus, horned stag beetle Sinodendron cylindricum). Copulation occurs after overwintering, in spring (in laboratories - even until September). Females place eggs in decayed, lying, sometimes standing stumps or logs, on which larvae feed later. Larvae drill a network of galleries (1.2-2.0 mm in diameter) parallel to the log axis, thriving on decaying remnants of wood. Hence the importance of proper humidity in places of growth and advanced stage of wood tissue decay. Larvae have been

observed in stumps decomposed by fungi that produce white and red decay (the author has noticed that for coniferous trees - mostly in stumps decomposed by red decay, while for broadleaf trees - mainly in stumps with white decay). Larvae growth probably lasts two years (younger and older stages have been observed simultaneously). Afterwards, the larva builds a pupa cradle of short, thin wood fibers; then it pupates. Pupation occurs in July; this stage of growth lasts about 2-3 weeks. Swarming occurs in May and early June of the next year, while the *Rhysodes* has been seen flying into barrier traps until the end of June. During its mating flights, *Rhysodes* often selects well-exposed places and sits on bright surfaces (for example, on a sunlit spot on decayed stump, on a sheet of paper, etc. - Photo 2). It has been observed to thrive in beech Fagus spp., oak *Quercus* spp., poplar *Populus* spp. as well as fir *Abies* spp., and spruce *Picea* spp. In the course of monitoring, and on basis of literature, beech and fir have been singled out as the preferred host plants for *Rhysodes sulcatus* (Kryzhanovskiy 1983, Kubisz 2004, Sienkiewicz 2004). Also, beetles have been observed feeding on birch Betula spp. (Plewa, Niemiec 2010).

5. Habitat requirements

Rhysodes sulcatus preferably thrives in old, primeval and natural forests (Fig. 3), that have a diversified species structure (both in terms of age and species, adapted to local biogeographic conditions), rich in various forms of deadwood (with a high share of large timber) in different stages of decomposition (ca. 5% stand volume as a minimum, optimum share of deadwood above 15%). This beetle is obligatory saproxylic, an actual primeval forest relic (not found in forests excessively altered by silviculture, even those with proper habitats for growth; only nearly-extinct populations may be found in forests that have been relatively recently transformed - to a rather minor extent). In such forests, mainly microhabitats composed of deeply decayed and humid (mainly lying) stumps with diameters of over 20 cm are colonised. Colonisation of primarily large timber (stumps with a diameter of over 40 cm), regardless of the age of decaying tree, has been observed.

Photo 3 *Rhysodes sulcatus*' habitat: fir forest (left), beech forest (right) (© Z. Maciejewski)

After the swarming period (mid-June to mid-July) adult beetles are observed under the loose bark of, e.g. firs (chunks and lying logs) in between the II and III decomposition stages (see methodology). But, this is not where *Rhysodes* thrives; this is where it seeks shelter.

Rhysodes sulcatus is found in lowlands, highlands and low mountainous areas, in broadleaf and mixed forests (throughout Europe in the past). As regards the association with habitat types of the I Habitats Directive, *Rhysodes sulcatus* lives in Central Europe's mountain beech forests with sycamore

(habitat code 9140), highland mixed fir forest (91P0), acidic mountain and high-mountain spruce forests (9410).

6. Species distribution

Apart from lists of wrinkled bark bettle positions drawn for the needs of the Polish Redbook of Animals, and the monitoring of selected invertebrates in the Białowieża Forest (European Natural Forest centre of the Forest Research Institute), no planned research on the current distribution of this species has been carried out in Poland.

According to the available information, *Rhysodes sulcatus* currently lives in the Białowieża Forest, Roztocze National Park, Lublin region, Holy Cross (Świętokrzyskie) mountains, probably in the Low Beskids (Jaśliska Sanctuary), Upper Silesia, Knyszyn Forest, and in the area of Hrubieszów (Kubisz 2004, Plewa, Niemiec 2010, Sienkiewicz 2004) (Fig. 1). In the past it used to live in the Upper Silesia, the area of Warsaw, Jarosław and in many positions near Przemyśl. Numerous positions of *Rhysodes* were found in 2010 in the Bircza Forest District (Buchholz et al., 2011), in the Przemyśl Foothills, in remnants of natural forests, some of which had already been thinned out (possibly due to unawareness of the contemporary presence of *Rhysodes* in the region).

In order to determine the current distribution of *Rhysodes sulcatus* in Poland, inventories should be carried out covering old positions and sites where, according to current data, proper habitat conditions still exist.

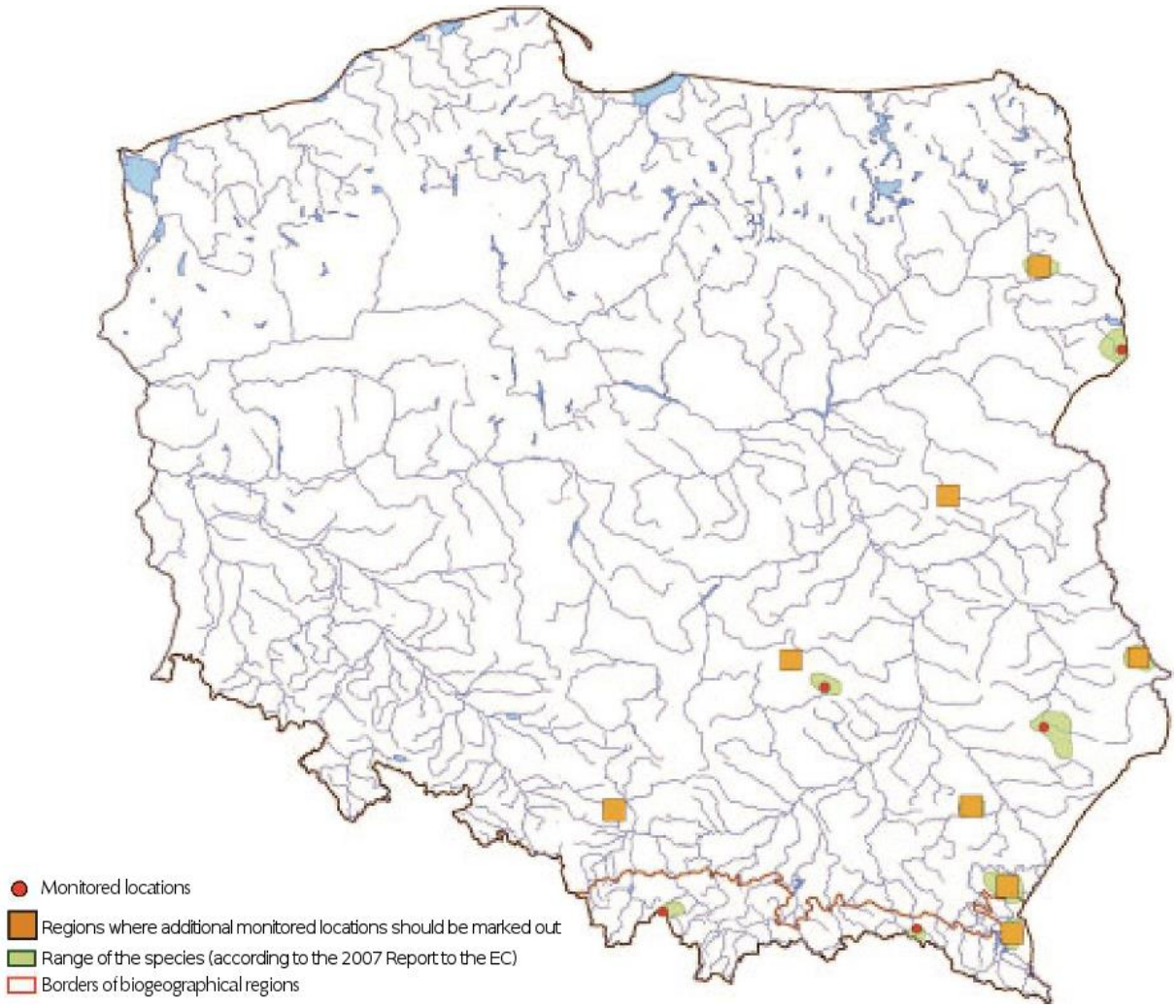

Fig. 1 Distribution of the positions of *Rhysodes sulcatus* in Poland in the context of its geographical range

II. METHODOLOGY

1. Concept of monitoring of the species

The concept of monitoring the *Rhysodes sulcatus* is based on author's experience and available literature. Due to its low numbers, endangered status and hiding lifestyle, it is not possible to determine its relative abundance at the site. The population status may only be determined by the presence of *Rhysodes* and the number of detected individuals. Due to the sensitivity of the *Rhysodes sulcatus* to changes in its life environment, the method of screen (barrier) traps to catch imagines is recommended as the basic way to detect its presence. Beetles caught live should be returned to the environment. Only if this method fails, imagines should be searched for at sites where they thrive, meaning rotten logs of host trees. The methodology does not provide for seeking larvae. They live in hiding and are easy to overlook in deadwood or be mistaken for the larvae of other insects of similar shapes.

In addition to the population of *Rhysodes sulcatus*, key habitat factors are also monitored, the value of which determine the survival of a population at the given site. The indicators selected and described above apply to the microenvironment where larvae thrive and *Rhysodes* is present (deadwood in proper stage of decomposition) and the entire forest macroenvironment (mainly, the

natural feature of forest at the site and in its environs), the quality of which, together with the quality of microhabitat, determines the prospect of preserving the *Rhysodes sulcatus* population. Already completed observations show that altering the remnants of primeval and natural forests has contributed to the extinction of the *Rhysodes* population, e.g. in the Warsaw or Przemyśl regions (Gutowski, Bucholz 2000, Sienkiewicz 2004).

In the future, the suggested methodology may be tailored to the experience of successive phases of monitoring operations and independent research on the species.

2. Indicators and assessment of the species conservation status

Indicators of population and habitat status

Indicator	Measure	Measurement / determination method
Population		
Presence of imagines	Number of individuals	Hanging screen traps of ca. 1 sq. m. or searching the deadwood by monitoring contractor
Habitat		
Forest natural status	Descriptive indicator	Determining the degree of the natural state of forest, considering the conformity of actual species composition of stand with the potential composition adequate for the habitat, intensity of use in the past, stand origins and stand structure
Natural status of surrounding forests	Descriptive indicator	Determining the degree of the natural state of forest, considering the conformity of actual species composition of stand with the potential composition adequate for the habitat, intensity of use in the past, stand origins and stand structure
Species structure of stand at the site	Number of species	Counting the species considered the main host plants for Rhysodes sulcatus (beech, fir, spruce, in the I and II forest floors) and other host species in lower floors (oak, poplar, birch)
Stand species structure in area surrounding the site	Number of species	Counting the species considered the main host plants for Rhysodes sulcatus (beech, fir, spruce, in the I and II forest floors), and other host species in lower floors (oak, poplar, birch)
Age of trees in stand	Descriptive indicator	Determining the share of trees in 3 age classes - on-site expert assessment completed with data from the forest valuation report (or protection plan)
Volume of deadwood	Number of lying stumps with a diameter >40cm/100 m	Counting the lying stumps with a diameter above 40 cm on a transect that is 100 m long
Quality of deadwood	Wood decomposition classes (I, II, III, IV)[1]	Identifying the wood decomposition classes represented by lying stumps with a diameter >40 cm on a transect that is 100 m long

[1] I - healthy wood and phloem, II - hard wood, phloem decomposed, III - initial stage of wood decomposition, IV - advanced wood decomposition

Indicator/ Assessment[2]	FV	U1	U2
Population			
Presence of imagines	Observing or catching 4 individuals as a minimum	Observing or catching 1 individual as a minimum	No imagines observed despite good habitats and previous statements of the species at the site
Habitat			
Forest natural status	Natural or nearly natural forests, species structure consistent with potential plant community, produced by natural decomposing and renewal processes, with no evident traces of human activity (individual trees logged at most), complex stand structure	Forests of stand structure consistent with plant community, created by natural decomposing and renewal processes, or natural renewal associated with silviculture, extensively used for economic purposes ("thinning"), complex stand structure	Economic forests, intensely used, of species structure consistent with potential plant community, created by artificial renewal, stand structure usually simple
Natural status of surrounding forests	Natural or nearly natural forests, species structure consistent with potential plant community, produced by natural decomposing and renewal processes, with no evident traces of human activity (individual trees logged at most), complex stand structure	Forests of stand structure consistent with plant community, created by natural decomposing and renewal processes, or natural renewal associated with silviculture, extensively used for economic purposes ("thinning"), complex stand structure	Economic forests, intensely used, of species structure consistent with potential plant community, created by artificial renewal, stand structure usually simple
Species structure of stand at the site	Presence of at least one of the main host plants for Rhysodes sulcatus that are the main components of stand in I and II forest floors, and one species of main host plants in lower floors (beech Fagus sp., fir Abies alba, spruce Picea sp.)	Presence of at least one of the main host plants for Rhysodes sulcatus that are the main components of stand in I and II forest floors, and of one of other host plants in lower forest floors (oak Quercus sp., poplar Populus sp., birch Betula sp.)	No presence of any species of host plants as main component of stand in I and II forest floors
Stand species structure in area surrounding the site	Presence of at least one of the main host plants for Rhysodes sulcatus that are the main components of stand in I and II forest floors, and one species of main host plants in lower floors (beech Fagus sp., fir Abies alba, spruce Picea sp.)	Presence of at least one of the main host plants for Rhysodes sulcatus that are the main components of stand in I and II forest floors, and of one of other host plants in lower forest floors (oak Quercus sp., poplar Populus sp., birch Betula sp.)	No presence of any species of host plants as main component of stand in I and II forest floors
Age of trees in stand	Ancient forest with numerous (ca. 10%) trees above 150 years	Ancient forest composed of 100/150 years-old trees	Stand composed of trees younger than 100 years
Volume of deadwood	> 5 complete laying stumps	3-4 complete laying stumps	0-2 complete laying stumps
Quality of deadwood	All 4 classes present, or II, III and IV as a minimum	Classes II and IV present, or IV as a minimum	Classes I and/or II present, or no deadwood in place

Remark: At a higher number of measurement points at the monitored location on which we mark the transects we calculate the average, applying the rules of mathematics at rounding the results up to unity (see description of monitoring research).

Cardinal indicators

- forest natural status at the site
- volume of deadwood
- quality of deadwood

[2] FV - proper state, U1 - unsatisfactory, U2 - negative

Assessment of population status

The indicator assessment is equivalent to an estimate of population

Assessment of habitat status

To assess the habitat status, we attribute a determined point score to the assessments of individual indicators: FV - 2, U1 - 1, U2 - 0. Then we sum up the points and perform a complex assessment of habitat status, according to the following rule:

- ≥ 10 points - FV, provided all cardinal indicators are assessed as FV, and none of other indicators is assessed as U2;
- ≥ 7 points - U1, provided at least 2 cardinal indicators are assessed as FV, the third not less than U1 and no more than two of the other indicators are assessed as U2; < 5 points for cardinal indicators - U2.

Conservation prospects

Assessment of the prospects of preserving the *Rhysodes sulcatus* is an attempt to anticipate its protection status over the next 10-15 years by the contractor of monitoring operations (expert assessment). If this perspective offers the chance to preserve the proper status or improve the inadequate status, then the preserving prospects should be assessed as adequate (FV). If we expect the adequate status to deteriorate or the inadequate status to continue, then the preserving prospects should be assessed as unsatisfactory (U1). If we expect the current unsatisfactory status to deteriorate or the bad status to continue, then we assess the prospects as negative (U2). When assessing the prospects, the state of isolation of the population subject to monitoring, the status of forest environment and the way it is used should be considered. The way the forest is used is relevant for the prospects of preserving the species. The populations that are still surviving within the area heavily impacted by silviculture will most probably gradually disappear.

Overall assessment

The lowest assessment of one parameter is decisive for the assessment of the overall species protection status at the site.

3. Description of monitoring studies

Selection of monitoring areas and their suggested size

The monitored location of the species is any section of the forest environment where the presence of *Rhysodes sulcatus* has been observed in recent years, or where it used to be observed, and an adequate habitat is still in place. The said section should not be divided into smaller fragments in any manner, to avoid complicating the dispersion of species within the monitored location. Monitoring locations may significantly differ in terms of area. They should be as extensive as possible, thus stable in environmental terms; optimal area above 100 ha. For larger monitored locations, the monitoring of population status and habitat indicators assessed on transects should be performed on several monitoring plots. Proposed density of such plots - not less than 1 per 50 ha of forest.

All currently detected locations of *Rhysodes sulcatus* should be monitored, meaning the ones located in the Knyszyn, Białowieża, Suchedniów Forests, the Strzelecki Forests, in Roztocze, Upper

Silesia, Sandomierz Forest, Przemyśl Foothills, Babia Góra National Park, the Low Beskids (cf. Fig. 1) and (in the initial phase of monitoring at least) also the historical positions where habitats adequate for the species still exist and the presence of populations not yet extinct may be expected (e.g. Pieniny Mountains, Janów Forests). Also, it is worthy to try to find the *Rhysodes* in the Magury National Park and Bieszczady National Park, where habitats adequate for the species could have been preserved. Locations for monitoring have been proposed on the basis of literature and author's personal observations.

Study method

The method of observing individual indicators on-site is set out below. To effectively perform on-site operations, the attached diary may be used (Tab. 3).

Determining population status indicators

The sole indicator of the population status of a species as rare and sensitive as *Rhysodes sulcatus* is the presence of imagines, considering the number of individuals observed. In order to determine it, two procedures are proposed:

- basic - catch using screen traps (e.g. IBL-2 type),
- complementary - search penetrating the life/growth environment with a solid knife or hatchet.

Catch into screen traps

For the catch, available screen traps of the IBL-2 type or other may be used. It is important that the collection container into which the insects fall is provided with a drain strainer in the bottom and have a capacity of even up to 2 litres. We insert sawdust mixed with moss into the container. The purpose is to boost the chance of survival of Rhysodes in the trap, because the found individuals shall be released to the environment. Such traps should be controlled every 2-3 days and after every major rainfall. On this occasion also the filling should be replaced, if it is excessively soaked. The use of 3 screen traps per 50 ha is recommended. Traps should be exposed from mid-May to mid-June (4 weeks) or even to the end of June (depending on weather conditions). We conclude the catch by traps when 4 *Rhysodes sulcatus* individuals are stated, thus giving the highest assessment of the population status (Tab. 2). If after 4 weeks of exposing the trap a lower number of individuals is stated, then we remain at the U1 assessment of population status. The hanging of 3 traps on each plot of the position would be advantageous, in various places with abundant deadwood (the species - as most insects - will be distributed in concentrations, thus we reduce the risk of its strongly invasive detecting).

Searching the environments where it lives and thrives

The method consists in actively penetrating deadwood of IV decomposition class. Therefore, it is a highly invasive method that affects the microhabitat of *Rhysodes* (that is why we apply it when the beetle is not detected by catching into traps). The tools needed to apply this method include a solid knife (sheath) or hatchet to break the logs of deadwood, which are then penetrated to state the presence of *Rhysodes*. Up to 10 lying logs should be penetrated, preferably of fir and beech, of IV decomposition class. Logs lying by or on a transect, 100 m long, should be selected and penetrated during the assessment of the habitat status (description below). The best time for research is from mid-August even until October. The rot is penetrated until 4 *Rhysodes sulcatus* individuals are found or 10 logs analysed.

Rot should be analysed carefully to avoid destroying the whole log, which represents the environment where *Rhysodes* lives and thrives. Penetrating of perimeter fragments of a log every 3 m is recommended.

Determining habitat status indicators

The selected habitat status indicators that are crucial for the quality of the life environment of the *Rhysodes sulcatus* are set in tables 2 and 3 and stated below. To determine them, expert knowledge, access to statements of management and a measure to determine the transect are needed.

Forest natural status. This indicator determines the scope of forest deformation against its primeval form, which is the proper place where the monitored species thrives. It is an expert assessment based on field observations and data from the forest valuation report. Special attention should be dedicated to the consistency of actual stand species structure with the potential structure proper to the habitat, intensity of use in the past, origins of stand (natural renewal and decomposition processes, natural renewal prompted by silviculture, artificial plantings) and stand structure (complexity of spatial distribution of plants). When assessing this parameter, the work by Kucharczyk (2008) may be useful, as it sets the described components of natural forest status assessment in the form of a table. On the other hand, the concept of "stand structure" needs explanation. It should be understood as the spatial and age distribution of trees growing at monitored location of *Rhysodes*. We also perform a preliminary (visual) assessment of deadwood resources. This element will be assessed in more detail according to the below stated indicators. We may single out the complex and simple stand structure.

Complex stand structure - trees of all age classes, floor-structured, irregularly distributed on the plot (due to environmental conditions); multi-species stand (not all species must be represented in the highest floor of the stand). We observe many lying and standing dead trees (e.g. we always have several such trees within our viewing range - deadwood quite regularly lies on forest bottom, sometimes in major concentrations).

Simple stand structure - trees grow as in a typical economic forest. No trees of the top age classes, lower forest floors less represented or often missing, trees mostly distributed on the plot in regular shapes due to planned planting, the main (productive) stand dominated by one or two species of trees. We observe laying and standing dead trees only sporadically or not at all.

Natural status of surrounding forests. Indicator description as above. The forest deformation status in the area around the location is another important element of assessment of the survival prospects of the *Rhysodes sulcatus* at the site as such, the more so when the position is relatively small (up to ca 300 ha).

Stand species structure at the site. Current experience shows that the most important tree species in which *Rhysodes* thrives are fir Abies alba and beech Fagus sylvatica, while in north-eastern Poland - spruce *Picea abies*. To determine the value of the indicator, the presence of main species of host trees should be detected and it is necessary to determine how many of them are the main components of the stand (mainly of ancient forest, but also the forest II floor) and how many main and other species of host trees are in lower floors. Other host trees: poplar, oak and birch.

Stand species structure in area surrounding the site. As above. The "area around" is a stretch of forest around the site, 500 m wide. This indicator is also useful to assess the prospects of preserving the *Rhysodes sulcatus* at the site. It is more important at smaller locations.

Age of trees in stand. This indicator allows assessing how well the "primeval" form of the forest has been preserved, which also translates into the chances of preserving the *Rhysodes* population at

the location. The share of many old trees (ca. 10%), aged above 150 years, is the status that should be pursued in forests where the species lives. The age of trees in the stand is determined by an expert assessment and on basis of data from the forest valuation report.

Volume of deadwood (number of laying stumps of diameter above 40 cm). This indicator is determined by the transect method (5 randomly chosen transects per 100 ha). Along the route that is 100 m long and 10 m wide we count the stumps with diameters of above 40 cm that lie on the forest bottom (due to the plot size or other field conditions, the transect may be composed of sections 100 m long in total). The volume of dead trees (number of lying logs) compared to its quality is the main indicator that applies directly to places where *Rhysodes* thrives and the prospects of preserving these microbiotops at the site.

Quality of deadwood (decomposition classes I, II, III, IV). We observe the quality of deadwood on transect when determining the volumes of deadwood. The best habitat condition occurs when all decomposition classes are in place. It guarantees the continuous existence of the microhabitat the *Rhysodes sulcatus* needs to thrive (deadwood of IV class of decomposition). Decomposition classes (Gutowski et al. 2004):

I healthy wood and phloem;
II thick wood, decomposed phloem;
III initial stage of wood decomposition;
IV wood heavily decomposed.

Apart from the above indicators, in order to fully identify the living conditions of the *Rhysodes sulcatus* the type of decay in which it was found should be observed as well as the state of rot humidity. We also record all information on the species of trees where the presence of *Rhysodes* has been ascertained. We record this information in the field diary that should be attached to the monitoring documentation.

A diary to be filled during field operations

Location:			
Position no./transect no.:			
Area [ha]:		Stand age:	Continuity of forest presence YES/NO
GPS:	N		
	E		
Filling date:		Filled by:	
POPULATION			
Number of *Rhysodes sulcatus* individuals	In traps:	In logs:	
	1.	1.	6.
	2.	2.	7.
	3.	3.	8.
	4.	4.	9.
		5.	10.
HABITAT			
Natural status of stand:	**At the site:**	**In the surrounding area:**	REMARKS: [e.g.: tree species where *Rhysodes* is found, threats, impact of surroundings, number of documenting photo, alien species, protected species and rare accompanying species]
a) a natural or nearly natural forest, species structure consistent with potential plant community, created by natural decomposition and renewal processes, without evident traces of human activity (individual trees logged at most), complex stand structure			
b) a forest with the species structure consistent with potential plant community, created by natural decomposition and renewal processes or natural renewal associated with silviculture, extensively used ("thinning") for economic purposes, complex stand structure			
c) an economic forest that is intensely used, of species structure consistent with potential plant community created by artificial renewal, stand structure usually simple			
Species structure:	**At the site:**	**In the surrounding area:**	
a) 1 main species in I and II floor, 1 main species in lower floors - as a minimum			
b) Only one of the identified host species represents the main component of the stand (I and II floors)			
c) None of the host species represent the main component of stand (I and II floor)			
Age of trees in the stand at the site:		Volume of deadwood [> 40 cm]	
a) Numerous trees (ca 10%) aged above 150		a) ≥ 5 stumps	
b) Trees aged 100-150		b) 3-4 stumps	
c) Trees under 100 years		c) 0-2 stumps	
Quality of deadwood:		**Additional observations:**	
a) All 4 classes present or II, III and IV at least		Type of rot where species is found:	a) Brown
b) Classes II and IV present or IV at least			b) White
c) Classes I and/or II present or no deadwood in place		Humidity of decay where the species is found:	a) Wet
			b) Humid
			c) Dry

Time and frequency of studies

Monitoring operations should be performed in spring, from May to June (start depending on phenologic situation) and from August even to November (possibly penetrating the deadwood when the trap method fails).

During the first 12 years of species monitoring the assessment of population status is recommended to be performed every 3 years. In the later period, this should be performed every 6

years at the best assessed sites and still every 3 years at the sites subject to the renewal of habitat conditions. We return to 3-year periods of populations monitoring when we see negative changes in habitats or when the assessment of population status is much worse than in the previous phase of operations (e.g. with FV or U1 on U2). It is proposed to assess the habitat conditions every 3 years, even at positive assessments, to rapidly detect the negative trends. For positions subject to strict protection - every 6 years.

Equipment and materials used in the studies

- barrier traps, e.g. IBL-2 or IBL2-bis type;
- measuring tape;
- magnifying glass (5x zoom as a minimum);
- knife (sheath) or hatchet;
- GPS receiver;
- photo camera with macro mode;
- topographic map scale 1: 5000;
- field diary and observation records, notebook.

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

Species observation sheet for a monitored location	
Code and name of species	Code of the species as in the Habitats Directive, Polish and Latin names, author, as in the current terminology 4026 zagłębek bruzdkowany Rhysodes sulcatus (Fabricius, 1787)
Name of the site	Name of the monitored location .....
Type of the site	Reference/research Reference
Protected areas where the site is located	Natura 2000, nature reserves, national and landscape parks, sites of ecological interest, documentation sites, etc. Świętokrzyski National Park, PLH260002 Łysogóry
Geographic coordinates	State the geographic coordinates of position (GPS) N XX°XX'XX.X"; E XX°XX'XX.X"
Elevation a.s.l.	State elevation a.s.l. of the site or range from... to... 320-612 m a.s.l.
Area of the site	State in ha, a, m^2 3721 ha
Description of the site	Description is supposed to help identify the site. Describe the location and features of terrain and access route to the site. The site is composed of the following elements located within and in the vicinity of strictly protected areas: "Łysica", "Święty Krzyż", Świętokrzyski National Park forest. The site includes 3 points of species monitoring by the barrier traps method: Święta Katarzyna, unit ..... (XXoXX'XX''N - XXoXX'XX''E), Dębno, unit ……. (XXoXX'XX'''N - XXoXX'XX''E) and Święty Krzyż, unit ……. (XXoXX'XX''N - XXoXX'XX''E). Points are located outside strictly protected areas, but no protection operations have been performed over the last several years in the area of their location (passive protection is applied).
Profile of species habitat at the site	Brief description of species habitat at the site Main plant communities represented therein include: Carpathian beech forest (Dentario glandulosae-Fagetum) with large share of fir in the stand and fertile mixed fir forest, known as the Polish fir forest (Abietetum polonicum). Forests at the site are highly natural, currently in the phase of spontaneous renewal of the ecological structure that is typical for such forests of this ecological structure (differing ages and species of trees, abundance of the so-called deadwood in various forms and phases of decomposition, etc.). Renaturalisation processes seem to be significantly stimulated by the vicinity of extensive, strictly protected areas of several hundred hectares that had been given such status already in the 1920s. ("Łysica", "Święty Krzyż") constitute a refuge of, among others, entomofaunas of highly natural forests. Within the site, the forest communities mentioned in the description are present, with tree stands mostly above 100 years old and more or less numerous firs, beeches and individual pines, sometimes as old as about 150-250 years. The forest features a certain number of dying and dead trees, including old trees of large sizes (both standing and chunks or windthrows), the number varies in different sections of the site and it is the highest in strictly protected areas and their direct vicinity. Abundance of the so-called deadwood (volume of above-ground large timber with a diameter > 15 cm [excluding stumps of cut trees and underground parts of dead trees, even of windthrows]) in units where species monitoring points are located (as at the end of 2009), range as follows: unit ..... - 0.5-10 m^3/ha, unit ..... - 10-20 m^3/ha, unit ..... - 20-30 m^3/ha (data from an unpublished study by W. Świątkowski: Opracowanie wyników inwentaryzacji posuszu, złomów i wywrotów wykonanych na obszarze ochrony czynnej więtokrzyskiego Parku Narodowego w latach 2007 i 2008. Bodzentyn, 2009).

Species observation sheet for a monitored location	
Information on the species at the site	Synthetic data on the presence of the species at the site (last observed in particular), research completed until now and other relevant facts; results of assessments of previous years Rhysodes sulcatus was first stated at the site Pasmo Łysogórskie (Łysogóry Range) by P. Sienkiewicz (2004: Polish Red Book of Animals. Invertebrates: 91-92) based on the information from L. Buchholz and D. Kubisz on observing this species within the "Święty Krzyż" strictly protected area in 2002. M. Bidas and L. Buchholz (2007: Wiad. Entomol., 24, 4: 289-291) give other observation locations of the species at the site, found in strictly protected areas "Święty Krzyż" and "Łysica" - observations apply to numerous individuals seen in the years 1990-2007. During the observations performed in 2008 and 2009, also using barrier traps, the species was found in numerous places at the Pasmo Łysogórskie (Łysogóry Range) site. In 2008 two individuals were observed in the Dąbrowa protection zone (unit .....) In 2009 40 individuals were observed in total: 8 in protection zone Dębno (unit .....), 8 in protection zone Święta Katarzyna (unit .....), 23 in protection zone Święty Krzyż (unit .....), 1 in protection zone Jastrzębi Dół (unit .....). Species last observed at the site on 10 June 2010.
Observer	Name/surname of monitoring contractor Lech Buchholz PhD, Eng.
Dates of observations	Dates of all observations 02.05.2010; 06.05.2010; 11.05.2010; 14.05.2010; 20.05.2010; 23.05.2010; 01.06.2010; 04.06.2010

Species protection status at the site			
Parameter/indicators	**Indicator value and comment**	**Assessment**	
Population			
Presence of imagines	>10 indiv. Various observations of the species at the site prove that its large population is surviving here. More than 10 individuals have been caught into screen traps.	FV	FV
Habitat			
Forest natural status	Forest more or less natural, but with unnatural stand age structure (outside strictly protected areas).	FV	FV
Natural status of surrounding forests	Most of the site borders with non-forest (arable) areas, whereas in the Świętokrzyski National Park, the stand structure of forests adjacent to the position is similar to the site, meaning it is almost natural, except for the economic stands of Łagów Forest District (adjacent to the site in the south-east), the structure of which is significantly altered.	U1	
Species structure of stand at the site	Stands have high shares of both main host trees - fir and beech. Stands diverse in terms of species structure, proper for fertile beech forests with a high share of fir, Polish fir and some other forest communities. The admixture also features other tree species, such as rowan Sorbus aucuparia, sycamore Acer pseudoplatanus and Scots pine Pinus sylvestris.	FV	
Stand species structure in area surrounding the site	Stands have high shares of both main host trees - fir and beech.	FV	
Age of trees in stand	A significant part of the site (mainly in strictly protected areas) features numerous very old trees (approaching the age of physiologic death). In certain places the age of oldest trees in stands is too low (in many areas of the site outside strictly protected areas those trees are 100-150 years old).	FV	
Volume of deadwood	3-7 / 100 m 3-7 dead trees (felled) on 100-m-long transects close to monitoring points, of which ca. 30% are of higher dimension (diameter above 50 cm)	FV	
Quality of deadwood	Trees in all decomposition phases present	FV	
Conservation prospects	Brief forecast of population and habitat status of the species in the site in the next 10-15 years in the context of their current status and observed evolution, considering all actions and plans that may impact the species and its habitat. Thanks to the strategy of protecting the habitat within the site, currently followed by the Świętokrzyski National Park, prospects of preserving the species are good.	FV	
Overall assessment			**FV**

A list of the most important current and predictable impacts (threats) on the species and its habitat in the studied site (including current use, planned investments, planned changes in management and use); coding of impacts/threats as in Annex E to the Standard Data Form for Natura

2000 areas; effect of the impact: "+" - positive, "-" - negative, "0" - neutral; intensity of the impact:A - high, B - moderate, C - low.

Current impacts				
Code	**Name of activity**	**Intensity**	**Impact**	**Synthetic description**
166	Removal of dead and dying trees	C	-	Currently, impacts mainly due to wood theft (of dying trees, chunks and windthrows)
501	Paths, pedestrian and bicycle trails	C	-	Damaging the dying and dead trees (also chunks and windthrows) along trails by tourists (ripping bark off such trees); easier access for collectors and insect traders
790	Other types of pollution or human impacts	C	-	Dumping trash in forests (also pesticide packaging), polluting air and soil by local emissions from chimneys of farms located close to the site
990	Other natural processes	A	+	Spontaneous revival of the natural ecological forest structure, due to expanding range of passive protection

Threats (foreseeable future impacts)				
Code	**Name**	**Intensity**	**Impact**	**Synthetic description**
166	Removal of dead and dying trees	C	-	Threat mainly due to wood theft (of dying trees, chunks and windthrows)
501	Paths, pedestrian and bicycle trails	C	-	Damaging dying and dead trees (also chunks and windthrows) along trails by tourists (ripping bark off such trees)
790	Other types of pollution or human impacts	C	-	Dumping trash in forests (also pesticide packaging), polluting air and soil by local emissions from chimneys of farms located close to the site

Other information	
Other natural values	Other animal and plant species from the annexes of Habitats and Bird Directives, observed during monitoring operations: endangered and rare species (Redbook), protected species (cite abundance in scale: abundant, average, scarce). During the research, the presence of many interesting species of beetles has been certified at the site. The following have been observed, among others: blue ground beetle Carabus intricatus, Ceruchus chrysomelinus, Ampedus melanurus, Peltis grossa, Cucujus cinnaberinus.
Alien and invasive species	Observed alien and invasive species (cite abundance in scale: low numbers, average numbers, high numbers) Not observed.
Implemented protection measures	E.g. strict protection, mowing, rising the water level, pasturage, other renaturing operations Increasing the resources of lying deadwood in the habitat
Proposed protection measures	As above Leaving old trees and all forms of deadwood
Methodological remarks	Information relevant for further planning of monitoring (procedure of operations, indicators that should be assessed in monitoring and their indexation, regionally optimal timing of research, etc.) None
Other remarks	All information that helps to interpret the results, e.g. weather anomalies No remarks
Photographic documentation	Attached to database (electronic version): At least 3 photos per site (species, microhabitat and macrohabitat), site boundaries marked on a proper cartographic base

5. Species protection

Rhysodes sulcatus is strictly protected in Poland, with the provision that protection should be active (Journal of Laws 2011.237.1419). The exact measures of this protection are not specified. Due to the character of biocenoses inhabited by this species, strict passive protection may be the only effective measure that should also improve the habitat conditions. Most of the current positions of *Rhysodes* are located in national parks and nature reserves, where populations are apparently well protected. It is the particular case of the healthiest populations in Roztocze and Świętokrzyski National Parks, and of not so healthy but stable populations of the Białowieża National Park. Nature reserve protection should also be planned in the area of the Bircza Forest District, which features the

third largest population of this beetle on many sites that are still under assessment. The presence of *Rhysodes* in the Babia Góra National Park and Natura 2000 Jaśliska Sanctuary (monitoring results in 2010 were negative) still needs to be confirmed. In the latter case, from the places where the species had been observed 11 years ago most of the lying fir and beech stumps that used to host the *Rhysodes sulcatus* have been removed. Therefore, specific silviculture procedures in areas where the species lives, which are not subject to strict protection, determine its survival. Hence the importance of silviculture that is "friendly" for the species at the sites of *Rhysodes* in economic forests, which means discontinuing all operations associated with economy. This is due to the sensitivity of *Rhysodes* to changes in the forest environment. In the current phase of identifying the biology and ecology of *Rhysodes sulcatus*, it should be assumed that only eliminating the silviculture from positions inhabited by *Rhysodes*, and reducing tourist traffic (excessive tourism alters the habitat structure, reducing the chances of preserving the population), will stop further extinction of this species in Poland (Burakowski 1975, Gutowski et al. 2000, Gutowski, Buchholz 2002, Nubisz 2004, Sienkiewicz 2004). What is more, the areas that comprise the positions of *Rhysodes* should be protected as extensively as possible (not smaller than 100 hectares of forest adequate in terms of species around an individual certification). It will allow, among others, protecting adequate numbers of microhabitats the beetle needs to thrive and its population to expand and stabilise (in terms of abundance and genetic diversity). The perfect solution would consist in creating "saproxylic corridors" to connect isolated populations, at least locally for a start.

As *Rhysodes sulcatus* may become the object of illegal trade on entomologic markets, the areas where it lives should be patrolled more intensely. Also, an education programme addressed to a broad target group should be developed, providing information on the extent of threat to saproxylic organisms. *Rhysodes* should be used as a case study to explain the role of this beetle as an umbrella species and a bioindicator for ecologically well preserved remnants of ancient wilderness.

6. References

Buchholz L., Komosiński K., Melke A., Michalski R., Szymczuk R., Koba Sienkiewicz P. 2011. Nowe dane o występowaniu Rhysodes sulcatus (Fabri.) (Coleoptera: Rhysodidae) na terenie Nadleśnictwa Bircza w północno-wschodniej Polsce. Wiad. Entomol. 30(3): 179-181.

Burakowski B. 1975. Description of larva and pupa of Rhysodes sulcatus (F.) (Coleoptera, Rhysodidae) and notes on the bionomy of his species. Annal. zool. 32, 12: 271-287.

Dz.U. 2011.237.1419: Rozporządzenie Ministra Środowiska w sprawie ochrony gatunkowej zwierząt. Gutowski J. 2010. Konarek tajgowy. Phryganophilus ruficollis. W: Makomaska-Juchiewicz M. (red.). Monitoring gatunków zwierząt. Przewodnik metodyczny. Część I. GIOŚ, Warszawa, s. 112-129.

Gutowski J. M., Bobiec A., Pawlaczyk P., Zub K. 2004. Drugie życie drzewa. WWF Polska, Warszawa - Hajnówka.

Gutowski J., Buchholz L. 2000. Owady leśne - zagrożenia i propozycje ochrony. W: Ochrona owadów w Polsce u progu integracji z Unią Europejską. Wiad. entomol. 18, Supl. 2: 43-72.

Konwerski S., Sienkiewicz P. 2002. Przyczynek do poznania chrząszczy Beskidu Niskiego. Nowy Pam. Fizjogr. 1(1): 85-88.

Kryzhanovskiy O. L. 1983. Zhuki podotriada Adephaga: semeistva Rhysodidae, Trachypachidae; semeistvo Carabidae (wodnaia chast i obzor fauny SSSR). Fauna SSSR, Zhestkokrylyie, t. 1, vyp. 2. Nauka, Leningrad.

Kubisz D. 2004. Rhysodes sulcatus (Fabricius, 1787) - zagłębek bruzdkowany. W: Adamski P., Bartel R., Bereszyński A., Kepel A., Witkowski Z. (red.). Gatunki zwierząt (z wyjątkiem ptaków). Poradnik

ochrony siedlisk i gatunków NATURA 2000 - poradnik metodyczny. Tom 6. Ministerstwo Środowiska, Warszawa, s. 127-129.

Kucharzyk S. 2008. Lasy o charakterze pierwotnym w Bieszczadzkim Parku Narodowym. Roczniki Bieszczadzkie 16: 19-32.

Sienkiewicz P. 2004. Rhysodes sulcatus (Fabricius, 1787). W: Głowaciński Z., Nowacki J. (red.) Polska czerwona księga zwierząt. Bezkręgowce. IOP PAN Kraków/AR w Poznaniu, s. 91-92.

Plewa R., Niemiec P. 2010. Nowe stanowiska Rhysodes sulcatus (Fabricius, 1787) (Coleoptera, Rhysodidae) w Polsce. Wiad. entomol. 29(1): 58-59.

Compiled by: **Paweł Sienkiewicz**