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Data Descriptor

Dataset: Fauna of Adult Ground Beetles (Coleoptera, Carabidae) of the National Park "Smolny" (Russia)

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Abstract: (1) Background: Protected areas are "hotspots" of biodiversity in many countries. In such areas, ecological systems are preserved in their natural state, which allows them to protect animal populations. In several protected areas, the Coleoptera biodiversity is studied as an integral part of the ecological monitoring of the ecosystem state. This study was aimed to describe the Carabidae fauna in one of the largest protected areas of European Russia, namely National Park "Smolny". (2) Methods: The study was conducted in April–September 2008, 2009, 2017–2021. A variety of ways was used to collect beetles (by hand, caught in light traps, pitfall traps, and others). Seasonal dynamics of the beetle abundance were studied in various biotopes. Coordinates were fixed for each observation. (3) Results: The dataset contains 1994 occurrences. In total, 32,464 specimens of Carabidae have been studied. The dataset contains information about 131 species of Carabidae beetles. In this study, we have not found two species (*Carabus estreicheri* and *Calathus ambiguus*), previously reported in the fauna of National Park "Smolny". (4) Conclusions: The Carabidae diversity in the National Park "Smolny" is represented by 133 species from 10 subfamilies. Ten species (*Carabus cancellatus, Harpalus laevipes, Carabus hortensis, Pterostichus niger, Poecilus versicolor, Pterostichus melanarius, Carabus glabratus, Carabus granulatus, Carabus arvensis baschkiricus, Pterostichus oblongopunctatus*) constitute the majority of the Carabidae fauna. Seasonal dynamics are maximal in spring; the number of ground beetles decreases in biotopes by autumn.

Dataset: https://www.gbif.org/dataset/0d66d2e0-9d2a-46c6-a136-1ddb669396e6.

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Keywords: dataset; occurrences; data paper; Coleoptera; Carabidae; Republic of Mordovia

1. Summary

Protected areas are currently considered the main tool for counteracting the biodiversity loss and habitat destruction around the world. Their establishment and maintenance of their functioning contribute to the preservation of species diversity [1,2], the improvement of the environmental status of previously disturbed habitats [3,4], and the counteracting of illegal poaching [5]. On the regional scale, protected areas are recognized as local biodiversity hotspots of plants [6], and animals [7]. To date, the global network of protected areas covers about 15% of the global land surface [8]. Nevertheless, to justify the protected area establishment, the insect diversity is rarely applied, with rare exceptions. This is caused mainly by difficulties in obtaining the taxonomic and distribution knowledge about various taxonomic insect groups [9]. Therefore, in many regions of the world, the insect diversity is still largely unexplored in protected areas, with rare exceptions [10,11]. This condition highlights a need for the study of the effectiveness of protected areas in preserving the insect diversity in various regions of the world.

The Carabidae family is the most studied group of Coleoptera in forest habitats. Due to their high plasticity, Carabidae beetles are found in a variety of biotopes. Carabidae play a considerable role in ecosystems as entomophages regulating the number of terrestrial vertebrates, and are considered economically useful [12,13]. This group is a bioindicator of the ecosystem state [14–19]. The Carabidae family includes eurytopic beetles (found in various biotopes), and species inhabiting forest (found in woodland ecosystems), open (found in fields and meadows), and coastal (associated with wetlands and water banks) biotopes, and peatlands [20–23]. As inhabitants of the ground layer of ecosystems, Carabidae species are found in a sufficient number in a wide variety of habitats, including areas suffering from anthropogenic impacts [24–26]. There are many reasons leading to recent changes in ecosystems. Urbanization, pollution with various toxic chemicals, regular fires, deforestation, climate changes, and biological invasions have recently had a considerable impact on biodiversity [11,27–33].

The aim of this study was to describe a set of recent data on the occurrence of Carabidae (Coleoptera) in the National Park "Smolny". This dataset was recently published in GBIF as the Darwin Core Archive [34]. This is the first complete description of the Carabidae fauna of a large, protected area located in the center of European Russia.

2. Data Description

2.1. Dataset Name

Each observation includes basic information such as location (latitude/longitude), date of observation, observer name, and identifier name (Table 1). The coordinates were determined on the studied site using a GPS device, or after special investigation using Google Maps. A total of 32,464 specimens were studied.

Table 1. Description of the data in the dataset.

Column Label	Column Description
eventID	An identifier for the set of information associated with an event (occurs in one place in one time).
occurrenceID	An identifier for the occurrence (as opposed to a particular digital record of the occurrence).
basisOfRecord	The specific nature of the data record: HumanObservation.
scientificName	The full scientific name including the genus name and the lowest level oftaxonomic rank with the authority.
kingdom	The full scientific name of the kingdom in which the taxon is classified.
taxonRank	The taxonomic rank of the most specific name in the scientificName.
decimalLatitude	The geographic latitude of location in decimal degree.
decimalLongitude	The geographic longitude of location in decimal degrees.
geodeticDatum	The ellipsoid, geodetic datum, or spatial reference system (SRS) upon which the geographic coordinates given in decimalLatitude and decimalLongitude as based.
country	The name of the country in which the location occurs.
countryCode	The standard code for the country in which the location occurs.
individualCount	The number of individuals represented present at the time of the occurrence.
eventDate	The date when material from the trap was collected or the range of dates during which the trap collected material.
year	The integer day of the month on which the event occurred.
month	The ordinal month in which the event occurred.
day	The integer day of the month on which the event occurred.
samplingProtocol	The names of, references to, or descriptions of the methods or protocols used during an event.
recordedBy	A person, group, or organization responsible for recording the original occurrence.
identifiedBy	A list of names of people who assigned the taxon to the subject.

2.2. Figures, Tables, and Schemes

The dataset contains information about 131 species of Carabidae beetles from ten subfamilies found during our field studies (Table 2). In addition, Table 2 includes two Carabidae species (*Carabus estreicheri* and *Calathus ambiguus*) that were not found by us but reported previously in the National Park "Smolny" in the literature. Thus, in total, the Carabidae fauna of the National Park "Smolny" includes 133 species.

Table 2. Diversity of Carabidae species in the National Park "Smolny".

Subfamily, Species	Approximate Estimate of the Species Abundance
Carabinae	
Calosoma inquisitor (Linnaeus, 1758)	common species
Calosoma sycophanta (Linnaeus, 1758)	single individual
Carabus arvensis baschkiricus Breuning, 1932	numerous species
Carabus cancellatus Illiger, 1798	numerous species
Carabus coriaceus Linnaeus, 1758	numerous species
Carabus estreicheri Fischer von Waldheim, 1820	
Carabus glabratus Paykull, 1790	numerous species
Carabus granulatus Linnaeus, 1758	numerous species
Carabus hortensis Linnaeus, 1758	numerous species
Carabus convexus Fabricius, 1775	common species
Carabus schoenherri Fischer von Waldheim, 1820	single individual
Carabus stscheglowi Mannerheim, 1827	common species
Cychrus caraboides (Linnaeus, 1758)	common species
Cicindelinae	
Cicindela campestris Linnaeus, 1758	common species
Cicindela hybrida Linnaeus, 1758	common species
Cylindera germanica (Linnaeus, 1758)	single individual
Broscinae	
Broscus cephalotes (Linnaeus, 1758)	single individual
Elaphrinae	
Elaphrus cupreus Duftschmid, 1812	common species
Harpalinae	
Agonum duftschmidi J. Schmidt, 1994	rare species
Agonum fuliginosum (Panzer, 1809)	common species
Agonum gracilipes (Duftschmid, 1812)	common species
Agonum micans (Nicolai, 1822)	single individual
Agonum piceum (Linnaeus, 1758)	single individual
Agonum sexpunctatum (Linnaeus, 1758)	single individual
Agonum viduum (Panzer, 1796)	rare species
Amara aenea (De Geer, 1774)	common species
Amara aulica (Panzer, 1796)	single individual
Amara bifrons (Gyllenhal, 1810)	common species
Amara communis (Panzer, 1797)	numerous species
Amara consularis (Duftschmid, 1812)	single individual
Amara convexior Stephens, 1828	single individual
Amara eurynota (Panzer, 1796)	single individual
Amara famelica C.C.A. Zimmermann, 1832	rare species
Amara familiaris (Duftschmid, 1812)	rare species
Amara fulva (O.F. Müller, 1776)	numerous species
Amara gebleri Dejean, 1831	single individual
Amara ingenua (Duftschmid, 1812)	single individual
Amara lunicollis Schiødte, 1837	common species
Amara majuscula (Chaudoir, 1850)	single individual
Amara nitida Sturm, 1825	common species
Amara ovata (Fabricius, 1792)	common species
Amara plebeja (Gyllenhal, 1810)	single individual
Amara praetermissa (C.R. Sahlberg, 1827)	single individual
Amara similata (Gyllenhal, 1810)	rare species

Table 2. *Cont.*

Subfamily, Species	Approximate Estimate of the Species Abundance
Amara spreta Dejean, 1831	single individual
Amara tibialis (Paykull, 1798)	single individual
Anisodactylus binotatus (Fabricius, 1787)	rare species
Anisodactylus nemorivagus (Duftschmid, 1812)	single individual
Anisodactylus signatus (Panzer, 1796)	rare species
Badister bullatus (Schrank, 1798)	single individual
Badister dilatatus Chaudoir, 1837	single individual
Badister lacertosus Sturm, 1815	common species
Badister sodalis (Duftschmid, 1812)	single individual
Calathus ambiguus (Paykull, 1790)	single individual
Calathus erratus (C.R. Sahlberg, 1827)	common species
Calathus fuscipes (Goeze, 1777)	single individual
Calathus melanocephalus (Linnaeus, 1758)	common species
Calathus micropterus (Duftschmid, 1812)	numerous species
Chlaenius tristis (Schaller, 1783)	single individual
Cymindis vaporariorum (Linnaeus, 1758)	single individual
Dolichus halensis (Schaller, 1783)	single individual
Harpalus affinis (Schrank, 1781)	rare species
Harpalus autumnalis (Duftschmid, 1812)	single individual
Harpalus distinguendus (Duftschmid, 1812)	rare species
Harpalus griseus (Panzer, 1796)	rare species
Harpalus hirtipes (Panzer, 1796)	single individual
Harpalus laevipes Zetterstedt, 1828	numerous species
Harpalus latus (Linnaeus, 1758)	numerous species
Harpalus luteicornis (Duftschmid, 1812)	single individual
Harpalus picipennis (Duftschmid, 1812)	single individual
Harpalus progrediens Schauberger, 1922	common species
Harpalus pygmaeus Dejean, 1829	single individual
Harpalus rubripes (Duftschmid, 1812)	common species
Harpalus rufipes (De Geer, 1774)	numerous species
Harpalus signaticornis (Duftschmid, 1812)	single individual
Harpalus smaragdinus (Duftschmid, 1812)	rare species
Harpalus tardus (Panzer, 1796)	numerous species
Harpalus xanthopus winkleri Schauberger, 1923	common species
Lebia chlorocephala (J.J. Hoffmann, 1803)	single individual
Lebia cruxminor (Linnaeus, 1758)	single individual
Lebia cyanocephala (Linnaeus, 1758)	single individual
Licinus depressus (Paykull, 1790)	single individual
Limodromus assimilis (Paykull, 1790)	numerous species
Limodromus krynickii (Sperk, 1835)	common species
Microlestes minutulus (Goeze, 1777)	single individual
Oodes helopioides (Fabricius, 1792)	rare species
Ophonus azureus (Fabricius, 1775)	single individual
Ophonus puncticeps Stephens, 1828	single individual
Ophonus rufibarbis (Fabricius, 1792)	single individual
Oxypselaphus obscurus (Herbst, 1784)	common species
Panagaeus bipustulatus (Fabricius, 1775)	rare species
Panagaeus cruxmajor (Linnaeus, 1758)	single individual
Poecilus cupreus (Linnaeus, 1758)	numerous species
Poecilus lepidus (Leske, 1785)	common species
Poecilus versicolor (Sturm, 1824)	numerous species
Polystichus connexus (Fourcroy, 1785)	single individual
Pterostichus aethiops (Panzer, 1796)	single individual
Pterostichus anthracinus (Illiger, 1798)	common species
Pterostichus diligens (Sturm, 1824)	rare species
Pterostichus mannerheimii (Dejean, 1831)	common species
Pterostichus melanarius (Illiger, 1798)	numerous species
Pterostichus minor (Gyllenhal, 1827)	common species
Pterostichus niger (Schaller, 1783)	numerous species

Table 2. *Cont.*

Subfamily, Species	Approximate Estimate of the Species Abundance
Pterostichus nigrita (Paykull, 1790)	numerous species
Pterostichus oblongopunctatus (Fabricius, 1787)	numerous species
Pterostichus ovoideus (Sturm, 1824)	single individual
Pterostichus quadrifoveolatus Letzner, 1852	common species
Pterostichus rhaeticus Heer, 1837	common species
Pterostichus strenuus (Panzer, 1796)	common species
Pterostichus uralensis (Motschulsky, 1850)	common species
Pterostichus vernalis (Panzer, 1796)	rare species
Stomis pumicatus (Panzer, 1796)	rare species
Syntomus truncatellus (Linnaeus, 1760)	single individual
Synuchus vivalis (Illiger, 1798)	common species
Loricerinae	
Loricera pilicornis (Fabricius, 1775)	rare species
Nebriinae	
Leistus ferrugineus (Linnaeus, 1758)	rare species
Leistus terminatus (Panzer, 1793)	common species
Notiophilus aquaticus (Linnaeus, 1758)	single individual
Notiophilus germinyi Fauvel, 1863	single individual
Notiophilus palustris (Duftschmid, 1812)	common species
Patrobinae	
Patrobus atrorufus (Strøm, 1768)	numerous species
Patrobus septentrionis Dejean, 1828	single individual
Scaritinae	
Clivina fossor (Linnaeus, 1758)	single individual
Dyschirius globosus (Herbst, 1784)	single individual
Trechinae	
Bembidion biguttatum (Fabricius, 1779)	single individual
Bembidion guttula (Fabricius, 1792)	single individual
Bembidion lampros (Herbst, 1784)	single individual
Bembidion mannerheimii C.R. Sahlberg, 1827	single individual
Bembidion properans (Stephens, 1828)	single individual
Bembidion quadrimaculatum (Linnaeus, 1760)	common species
Bembidion varium (G.-A. Olivier, 1795)	single individual
Trechus rivularis (Gyllenhal, 1810)	single individual
Trechus secalis (Paykull, 1790)	common species

Figure 1 shows the abundance (in an absolute number) of the most numerous Carabidae species. These ten species represent 95.9% of all studied individuals.

In nature, several factors influence the activity of Carabidae species, including temperature, humidity, microclimatic conditions, age groups, and others [35]. Temperature has long been considered the most important abiotic factor affecting the activity of Carabidae [36,37]. The seasonal and life-history fluctuations strongly influence both the abundance and distribution of Carabidae species in natural biotopes [38]. Figure 2 shows the seasonal dynamics of Carabidae beetles in three habitats in 2018. In all biotopes, in April–May, the maximum abundance of Carabidae beetles was observed. By autumn, there was a decrease in the beetle abundance in traps. Noteworthy, in spring, the dynamic density of Carabidae beetles in the mixed forest was considerably higher than in other habitats. However, by autumn, there was a sharp decrease in the number of individuals. This is probably caused by migration processes that are constantly observed in populations of beetles. Similar patterns of abundance dynamics were observed in 2019 in other mixed forests in the National Park "Smolny".

Before our studies, 89 species were known in the Carabidae fauna of the National Park "Smolny" [39–41]. These were mainly common and eurybiont species. Such a low level of the revealed beetle diversity was primarily caused by the small number of special studies of the wide habitat diversity, and the variability of the time of the conducted studies. The higher diversity of Carabidae fauna was found because in 2017–2021, research tasks were clearly established, and insect collections were abundant and seasonality-based. To date, the Carabidae fauna of the National Park "Smolny" includes 133 species, which belong to ten subfamilies.

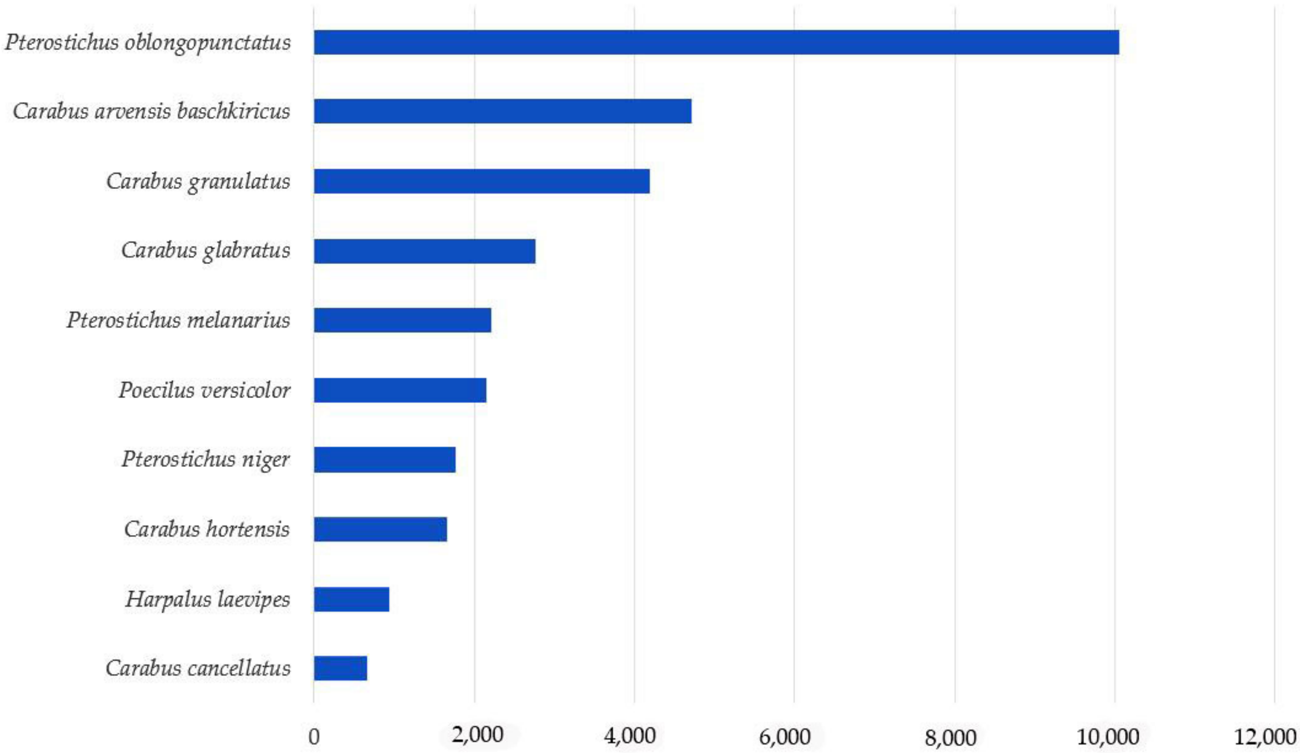
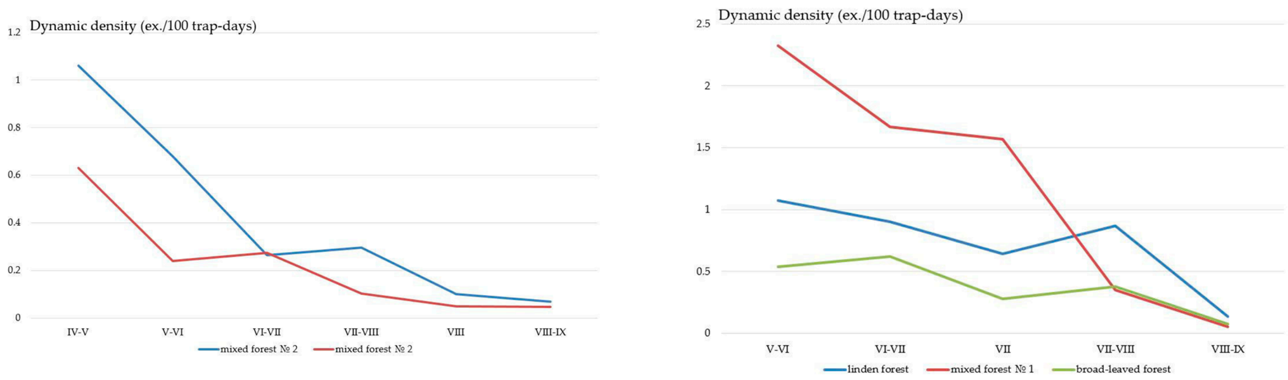


Figure 1. The total abundance of ten Carabidae species collected during the conducted study in the National Park "Smolny".



(**a**) (**b**)

Figure 2. Seasonal dynamics of the abundance of Carabidae beetles in various biotopes of the National Park "Smolny": (**a**) 2018; (**b**) 2019.

For comparison, the Carabidae diversity of the Mordovia State Nature Reserve, the most closely located to the National Park "Smolny", accounts for 241 species [42,43]. At the same time, the largest number of species was identified as a result of continuous long-term research programs in 2008–2020. However, it is worth it to note that the mentioned Mordovia State Nature Reserve is a unique forest area with a considerable variety of ecosystems, where fauna and flora have been preserved for more than 85 years. The National Park "Smolny" is a younger forest system formed after the cutting of pine forests, deciduous forests, and mixed forests in the early 1990s. Therefore, the biodiversity level is expectedly lower in this protected area.

3. Methods

3.1. Study Area

National Park "Smolny" is situated in the northeastern part of the Republic of Mordovia (center of European Russia), 54.72–54.88° N, 45.07–45.62° E. Its area is 363.86 km^2 (Figure 3). The pine (*Pinus sylvestris* L.) is the main forest-forming tree species in the south of the area of the National Park "Smolny". Broadleaf forests predominate in the northern part of the protected area, where the main forest-forming species are oak (*Quercus robur* L.), linden (*Tilia cordata* Mill.), maple (*Acer platanoides* L.), rarer ash (*Fraxinus excelsior* L.), and elm (*Ulmus* spp.). Secondary (appeared after cut or burnt pine forests) forest communities are formed by the birch (*Betula pendula* Roth). They are situated mainly in the southern part of the National Park "Smolny". Secondary (appeared after cut oak and lime forests) forests formed by the aspen (*Populus tremula* L.) are distributed in the northern part of the protected area. The spruce (*Picea abies* L.) does not form self-sustainable forests by occurring rarely in pine or mixed forests. In the floodplain areas of the Alatyr River and its main tributaries, the black alder (*Alnus glutinosa* (L.) Gaertn.) forms small forest areas nearby of eutrophic mires, and water bodies [44,45].

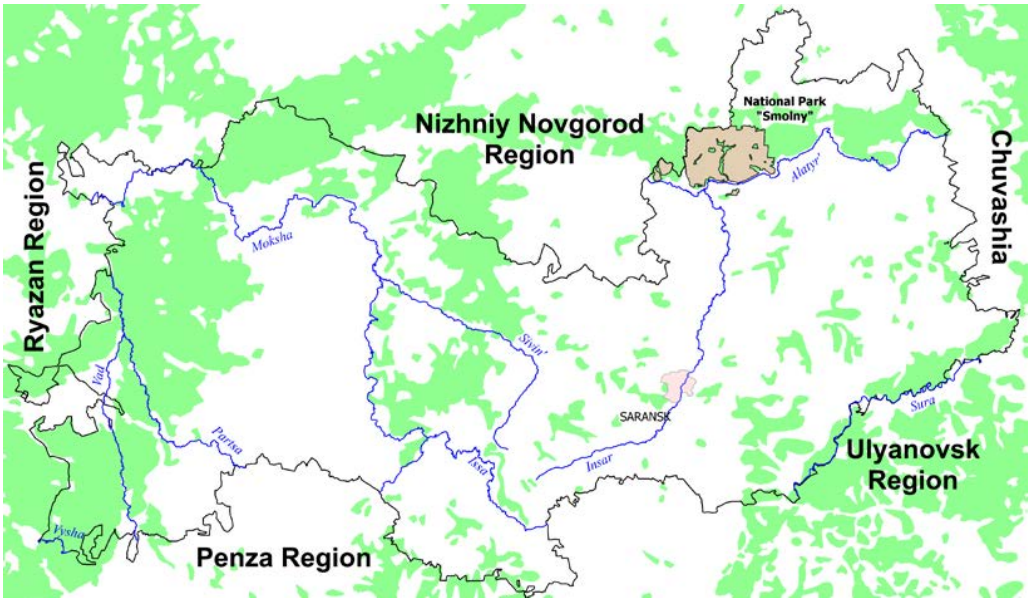


Figure 3. The location of the Republic of Mordovia and the area of obtaining information for the dataset (National Park "Smolny").

3.2. Research Design, Identification, and Taxonomic Position of Insects

We used traditional methods of collecting Carabidae beetles, including manual collection, light traps, pitfall traps, and partial beer traps [46,47]. Pitfall traps were installed during April–September 2008, 2009, 2017–2021. The traps were 0.5 L plastic cups containing 200 mL of a 4% formalin solution. We installed ten traps in each study site. The distance between the traps was 2 m. The selected material was identified by S.K. Alekseev. The identification was carried out according to Müller-Motzfeld [48] and Isaev [49]. We followed the nomenclature proposed by Kryzhanovskii et al. [50], and Lobl and Lobl [51]. To approximately estimate the species abundance, we used the following definitions. Single individual means that the solitary specimens of a species were found in 1–2 locations. Rare species refers to Carabidae beetles with an abundance of ten or less specimens found in 3–5 localities. Common species are Carabidae beetles with an abundance of 300 or a lower number of specimens found in 6–10 localities. Numerous species are beetles with an abundance of higher than 300 specimens found in at least 50% of the studied localities.

The assessment of the seasonal abundance of Carabidae species was carried out in several biotopes. The description of the studied biotopes is present below. In the linden forest, the first layer of the forest community was formed by *Tilia cordata* (70%), *Betula pendula* (10%), *Populus tremula* (10%), and *Quercus robur* (10%). The second layer was weakly expressed and formed by several undergrowth species. The shrub layer was sparse. The herb layer was represented by various species of Poaceae, Asteraceae, Apiaceae, and ferns. In the mixed forest, the first layer was formed by *Pinus sylvestris* (40%), *Tilia cordata* (20%), *Betula pendula* (20%), *Populus tremula* (5%), and *Quercus robur* (15%). The second layer was well expressed, represented by trees from the first forest layer. The shrub layer consisted of *Acer platanoides* L., *Euonymus verrucosus* Scop., *Sorbus aucuparia* L. The herb layer was represented by Asteraceae, and Apiaceae plants. In the broad-leaved forest, the first layer was formed by *Quercus robur* (60%), *Tilia cordata* (20%), *Betula pendula* (5%), *Populus tremula* (10%), and *Ulmus glabra* Huds. (5%). The second layer was less expressed. The shrub layer was sparse. The herb layer was not well-developed; it is represented by various Poaceae, Asteraceae, and Apiaceae plants. Insects have been collected from May to September. Dynamic density was expressed as the number of specimens per 100 trap days (ex./100 trap days).

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Conflicts of Interest: The authors declare no conflict of interest.

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