Dataset of long-term monitoring of ground-dwelling ants (Hymenoptera: Formicidae) in the influence areas of a hydroelectric power plant on the Madeira River in the Amazon Basin

Itanna O. Fernandes‡, Jorge L.P. de Souza‡§

‡ Instituto Nacional de Pesquisas da Amazônia - INPA, Coordenação em Biodiversidade - CBio, Av: André Araújo, 2936. Petrópolis, 69067-375, Manaus, Brazil
§ Programa de Pós-Graduação em Ciência e Tecnologia para Recursos Amazônicos, Instituto de Ciências Exatas e Tecnologia (ICET), Itacoatiara, Brazil

Corresponding author: Itanna O. Fernandes (itanna.fernandes@gmail.com), Jorge L.P. de Souza (souza.jorge@gmail.com)

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Abstract

Background

Biodiversity loss is accelerating rapidly in response to increasing human influence on the Earth’s natural ecosystems. One way to overcome this problem is by focusing on places of human interest and monitoring the changes and impacts on the biodiversity. This study was conducted at six sites within the influence area of the Santo Antônio Hydroelectric Power Plant in the margins of the Madeira River in Rondônia State. The sites cover a latitudinal gradient of approximately 100 km in the Brazilian Amazon Basin. The sampling design included six sampling modules with six plots (transects) each, totaling 30 sampling plots. The transects were distributed with 0 km, 0.5 km, 1 km, 2 km, 3 km and 4 km, measured
perpendicularly from the river margin towards the interior of the forest. For sampling the
ground-dwelling ants, the study used the ALL (ants of the leaf litter) protocol, which is
standardized globally in the inventories of ant fauna. For the purpose of impact indicators,
the first two campaigns (September 2011 to November 2011) were carried out in the pre-
filling period, while campaigns 3 to 10 (February 2012 to November 2014) were carried out
during and after the filling of the hydroelectric reservoir. A total of 253 events with a total of
9,165 occurrences were accounted during the monitoring. The ants were distributed in 10
subfamilies, 68 genera and 324 species/morphospecies. The impact on ant biodiversity
during the periods before and after filling was measured by ecological indicators and by the
presence and absence of some species/morphospecies. This is the first study, as far as we
know, including taxonomic and ecological treatment to monitor the impact of a hydroelectric
power plant on ant fauna.

New information

Until recently, most studies conducted on hydroelectric plants, located in the Amazon
Basin, were carried out after the implementation of dams in order to assess their impacts
on the environment and biodiversity (Benchimol and Peres 2015, Latrubesse et al. 2017,
Sá-Oliveira et al. 2015). Recent studies on dam impacts have begun to be conducted prior
to dam implementation (e.g. Bobrowiec and Tavares 2017, Fraga et al. 2014, Moser et al.
2014), thus providing a better overview of the impact and a better assessment of its
magnitude.

Keywords

Formicidae, biodiversity, species occurrence, standardized sampling protocol, tropical
forest.

Introduction

Biodiversity loss is accelerating rapidly in response to increasing human influence on the
Earth’s natural ecosystems (Pimm et al. 1995, Vitousek 1997). Knowing the spatial and
temporal organization of species in natural environments is essential for the understanding
and conservation of biodiversity (Barton et al. 2013), as well as fostering land management
decisions (Evans and Viengkham 2001). Large-scale, spatially structured sampling is a
powerful tool to help land managers decide where to pursue conservation action most
effectively (Turner et al. 1995). Even today, it is difficult to access accurate information on
the spatial distribution of most organisms and their relationships with environmental
variables at large scales, despite the availability of many methods for biodiversity planning
and conservation (Barlow et al. 2010, Gibson et al. 2011, Margules et al. 2002). There are
databases on species richness (Costello et al. 2013), but richness alone has limited use for
conservation, because it does not give information on many endemic species or the
complementarity of species compositions between regions (Groc et al. 2014, Lamoreux et al. 2005, Sarkar and Margules 2002). Furthermore, most assessments of species–habitat relationships can be compromised if the sampling design of surveys is not spatially clear (Gotelli et al. 2011).

Invertebrate populations can indicate longer-term general ecosystem change, such as restoration of mine sites or climate change (e.g., McGeoch 1998, Bisevac and Majer 1999, Parmesan et al. 1999, York 2000). However, despite recognition that monitoring invertebrates is an important endeavour, widely accepted by national and international funding agencies, monitoring efforts have rarely generated returns commensurate to their investment. All too frequently, insect monitoring lacks both specific goals and a framework detailing how results will be integrated into management decision-making.

One way to overcome these situations is by using good bioindicators taxa, as well as ants, considered particularly useful for monitoring for a number of reasons. Ants are one of the most successful groups of organisms on the planet (Hölldobler and Wilson 1990). To date, approximately 13,360 species of ants (antcat.org), all eusocial, have been described and hundreds of new species are described each year. Ant biologists estimate that the Formicidae family could include no fewer than 20,000 species (Hölldobler and Wilson 1990). All species of ants occupy a nest structure, either temporarily or permanently. These structures can be preexisting cavities or even made their own bodies (e.g. army ants) that do not involve much, if any, excavation or direct modification of the surrounding environments (Guénard 2013). They are abundant and ubiquitous in both intact habitat and disturbed areas (Andersen 1990, Majer 1983, Hoffmann et al. 2000), sampling is relatively easy without requiring enormous expertise (Greenslade and Greenslade 1984, Fisher 1999, Agosti and Alonso 2000, Alonso 2000), and ants have proven sensitive and rapid responders to environmental variables (Campbell and Tanton 1981, Major 1983, Andersen 1990). Moreover, ants are important functionally at many different trophic levels (Alonso 2000), and they play critical ecological roles in soil turnover and structure (Humphreys 1981, Lobry de Bruyn and Conacher 1994), nutrient cycling (Levieux 1983, Lal 1988), plant protection, seed dispersal, and seed predation (Ashton 1979, Beattie 1985, Christian 2001). Together, these qualities suggest ants merit monitoring for their own sake, as they provide high information content about an ecologically and numerically dominant group (Underwood and Fisher 2006). Despite the increased availability of methods for conservation planning, adequate information about the spatial distribution of biodiversity in large regions, such as the Amazon Basin, remains sparse for most biological groups (Margules et al. 2002).

More than a hundred hydropower dams have already been built in the Amazon Basin and numerous proposals for further dam constructions are under consideration (Latrubesse et al. 2017). Recent scientific reviews have considered the environmental impacts of damming Amazonian rivers (Davidson et al. 2012, Castello and Macedo 2015, Winemiller et al. 2016, Fearnside 2016). The accumulated negative environmental effects of existing dams, not to mention proposed dams (if constructed), have triggered massive hydrophysical and biotic disturbances affecting the Amazon Basin’s floodplains, estuaries...
and sediment plumes (Latrubesse et al. 2017), as well as causing losses in river connectivity (Anderson et al. 2018).

The Santo Antônio Hydroelectric Power Plant became operational at the beginning of 2016 in the Madeira River in Rondônia State. Prior to the construction of the Santo Antônio Plant, the fauna and flora of the impacted area were surveyed in environmental impact studies commissioned by the Brazilian Institute of Environment (IBAMA). The Santo Antônio Hydroelectric Power Plant and its accompanying reservoir represent the first time in history, as far as we know, in which a monitoring program of invertebrates was conducted to evaluate the influence before and after the total filling of the dam in the Amazon Basin.

**Project description**

**Title:** Environmental monitoring of ants (Hymenoptera: Formicidae) in the influence areas of the Santo Antônio Hydroelectric Power Plant in the Madeira River in the Brazilian Amazon

**Personnel:** Itanna Oliveira Fernandes, Jorge Luiz Pereira de Souza

**Study area description:** The study was conducted at six sites associated with the Brazilian Biodiversity Research Program (PPBio) — Pedras, Búfalos, Morrinhos, Jaci-Paraná MD, Jaci-Paraná ME and Teotônio modules — within the influence area of the Santo Antônio Hydroelectric Power Plant in the margins of the Madeira River in Rondônia State.

**Design description:** Ants were sampled in permanent plots with five samples per sampling method. We used the RAPELD sampling design, which is based on a system of trails and permanent plots where a diverse range of taxa can be sampled (Costa and Magnusson 2010, Magnusson et al. 2005, Magnusson et al. 2013). The permanent plots are 250 m long and positioned to follow terrain contours to minimize the effects of topographical variation within plots. In each module, transects have a 1 km distance from each other, following the same spatial design.

**Sampling methods**

**Study extent:** The sites cover a latitudinal gradient of approximately 100 km in the Brazilian Amazon Basin. The sampling design included six sampling modules with six transects (Pedras, Búfalos, Morrinhos, Jaci-Paraná MD, Jaci-Paraná ME and Teotônio modules), each totalling 30 sampling plots. The transects were distributed 0 km, 0.5 km, 1 km, 2 km, 3 km and 4 km from the river's edge, measured perpendicularly from the river margin towards the interior of the forest. For the purpose of impact indicators, the first two campaigns (September 2011 to November 2011) were carried out in the pre-filling period, while campaigns 3 to 10 (February 2012 to November 2014) were carried out after the filling of the hydroelectric reservoir. The campaigns were conducted during the dry and
rainy seasons of the Amazon over four years, with intervals of three months between each campaign (whenever possible).

**Sampling description:** Ants were sampled in permanent plots with five samples per sampling method along the transects 0 km, 0.5 km, 1 km, 2 km, 3 km and 4 km (Fig. 1). We used the RAPELD sampling design, which is based on a system of trails and permanent plots where a diverse range of taxa can be sampled (Costa and Magnusson 2010, Magnusson et al. 2005, Magnusson et al. 2013). The permanent plots are 250 m long and positioned to follow terrain contours to minimize the effects of topographical variation within plots. In each site, plots were 1 km apart from each other, following the same spatial design.

![Image of transects and sampling plots](image)

**Figure 1.** Transects of each module to collect ants in the influence areas of the Santo Antônio Hydroelectric Power Plant, Porto Velho - RO, with perpendicular distances from the river margin. In details are each transect with a 1 km distance from each other following the same spatial design and each sampling plot in the permanent plots of 250 m length.

The protocol adopted for collection of litter ants is called the ALL protocol (leaflet ants), which is globally standardized on inventories of a litter of ant fauna (Agosti and Alonso 2000). Ground-dwelling ants collected in plots using litter samples were processed in Winkler extractors. Litter-dwelling ants were sampled from a 1 m² litter in sampling plots located at 50 m intervals along the center line of each transect. Using a Winkler extractor with a 1 cm² mesh sieve, the leaves were sifted through a wire sieve of 1 cm² mesh size by shaking the sifter vigorously at least 15 times. The ants were extracted from the sifted litter and placed in a mesh bag inside a cotton bag for 24 hours (Fig. 2). If the sifted leaf litter volume exceeded the capacity of a single mini-Winkler extractor, a second extractor was used. In behavioural response to litter drying, the ants migrate from the suspended sample and fall into a container partially filled with alcohol at the bottom of the bag (Agosti et al. 2000, Bestelmeyer et al. 2000) (Fig. 3). The litter-sampling procedures were undertaken...
between 8:00 am and 5:00 pm. All ants were first identified to genus using the taxonomic keys provided by Baccaro et al. 2015. Then, they were sorted into species and morphospecies. We used available taxonomic keys or compared with specimens in collections previously identified by experts. A unique identification was given for each morphospecies based on morphological differences from related species. The morphotyping was the same for all collection sites. Vouchers are deposited in the invertebrate collection of the National Institute of Amazonian Research (INPA).

Figure 2. doi
Sample from 1 m² leaf litter of each sampling plot located at 50 m intervals along the transect and mesh sieve used to separate the leaves from the invertebrates.

Figure 3. doi
Mini-Winkler extractors composed by a mesh bag filled with sifted sample inside and a cotton bag outside. In response to the drying, the ants migrate from the suspended sample and fall into a container partially filled with alcohol at the bottom of the bag.
Geographic coverage

**Description:** Areas of Santo Antônio Hydroelectric Power-Plant in Rondônia, Brazil.

**Coordinates:** -9.25 and -8.59 Latitude; -64.45 and -63.88 Longitude.

Taxonomic coverage

**Description:** The ants were identified by species and morphospecies, as well as subfamily. Some genera were recorded for the first time in South America (*Syscia* Roger, 1861) and others in Rondônia State (*Nylanderia* Emery, 1906; *Eurhopalothrix* Brown & Kempf, 1961; *Lachnomyrnex* Wheeler, 1910; *Mycetarotes* Emery, 1913; *Mycetophylax* Emery, 1913; *Nesomyrmex* Wheeler, 1910; and *Rhopalothrix* Mayr, 1870). We also obtained new records of the following species for Rondônia State: *Fulakora degenerata*, *Tapinoma melanocephalum*, *Neivamyrnex adenpos*, *Gnamptogenys acuminata*, *Gnamptogenys caelata*, *Gnamptogenys kempfi*, *Cephalotes pellans*, *Hylomyrma immanis*, *Rogeria blanda*, *Strumigenys deinomastax*, *Strumigenys infidelis*, *Wasmannia rochai*, *Wasmannia scrobifera*, *Anochetus mayri*, *Anochetus neglectus*, *Anochetus targionii* and *Leptogenys unistimulosa*. A total of 46,342 individuals were collected during four years of field collections. A list of all the ants identified in subfamilies (10), genera (68) and species/morphospecies (324). More information about the ecological data and occurrence is available in Suppl. materials 1, 2.

**Taxa included:**

| Rank        | Scientific Name                  | Common Name |
|-------------|----------------------------------|-------------|
| family      | Formicidae Latreille, 1809       | ant         |
| subfamily   | Agroecomyrmecinae Carpenter, 1930| ant         |
| genus       | Tatuidris Brown & Kempf, 1968    | ant         |
| species     | Tatuidris tatusia Brown & Kempf, 1968 | ant     |
| subfamily   | Amblyoponinae Forel, 1893        | ant         |
| genus       | Fulakora Mann, 1919              | ant         |
| species     | Fulakora degenerata (Borgmeier, 1957) | ant     |
| genus       | Prionopelta Mayr, 1866           | ant         |
| species     | Prionopelta sp. 1                | ant         |
| subfamily   | Dolichoderinae Forel, 1878       | ant         |
| genus       | Azteca Forel, 1878               | ant         |
| species     | Azteca cf. chartifex Emery, 1896 | ant         |
| species | Azteca sp. 1 | ant |
| species | Azteca sp. 2 | ant |
| species | Azteca sp. 3 | ant |
| species | Azteca sp. 4 | ant |
| species | Azteca sp. 5 | ant |
| genus    | Dolichoderus Lund, 1831 | ant |
| species | Dolichoderus bidens (Linnaeus, 1758) | ant |
| species | Dolichoderus bispinosus (Olivier, 1792) | ant |
| species | Dolichoderus cogitans Forel, 1912 | ant |
| species | Dolichoderus debilis Emery, 1890 | ant |
| species | Dolichoderus decollatus Smith, 1858 | ant |
| species | Dolichoderus imitator Emery, 1894 | ant |
| species | Dolichoderus longicollis MacKay, 1993 | ant |
| species | Dolichoderus septemspinosus Emery, 1894 | ant |
| species | Dolichoderus sp. 1 | ant |
| genus    | Linepithema Mayr, 1866 | ant |
| species | Linepithema sp. 1 | ant |
| genus    | Tapinoma Foerster, 1850 | ant |
| species | Tapinoma melanocaphalus (Fabricius, 1793) | ant |
| species | Tapinoma sp. 1 | ant |
| subfamily | Dorylinae Leach, 1815 | ant |
| genus    | Cheliomyrmex Mayr, 1870 | ant |
| species | Cheliomyrmex megalonyx Wheeler, 1921 | ant |
| genus    | Eciton Latreille, 1804 | ant |
| species | Eciton burchelli (Westwood, 1842) | ant |
| genus    | Labidus Jurine, 1807 | ant |
| species | Labidus praedator (Smith, 1858) | ant |
| species | Labidus spininodis (Emery, 1890) | ant |
| genus    | Neivamyrmex Borgmeier, 1940 | ant |
| species | Neivamyrmex adnepos (Wheeler, 1922) | ant |
| species | Neivamyrmex angustinodis (Emery, 1888) | ant |
| species       | Neivamyrmex sp. 3 | ant  |
|---------------|-------------------|------|
| genus         | Neocerapachys     | Neocerapachys sp. 3 ant |
| genus         | Borowiec, 2016    |      |
| species       | Neocerapachys     | Neocerapachys splendens (Borgmeier, 1957) ant |
| genus         | Roger, 1861       |      |
| species       | Syscia           | Syscia augustae (Wheeler, 1902) ant |
| subfamily     | Ectatomminae     | Ectatomminae Emery, 1895 ant |
| genus         | Emery, 1895       |      |
| species       | Ectatomma        | Ectatomma brunneum Smith, 1858 ant |
| genus         | Smith, 1858       |      |
| species       | Ectatomma edentatum | Roger, 1863 ant |
| species       | Ectatomma lugens | Ectatomma lugens Emery, 1894 ant |
| genus         | Emery, 1894       |      |
| species       | Gnamptogenys     | Gnamptogenys Roger, 1863 ant |
| genus         | Roger, 1863       |      |
| species       | Gnamptogenys     | Gnamptogenys acuminata (Emery, 1896) ant |
| species       | Gnamptogenys caelata | Kempf, 1967 ant |
| species       | Gnamptogenys ericae | (Forel, 1912) ant |
| species       | Gnamptogenys     | Gnamptogenys homi (Santschi, 1929) ant |
| species       | Gnamptogenys kempf | Lenko, 1964 ant |
| species       | Gnamptogenys     | Gnamptogenys moelleri (Forel, 1912) ant |
| species       | Gnamptogenys     | Gnamptogenys pleurodon (Emery, 1896) ant |
| species       | Gnamptogenys     | Gnamptogenys relicta (Mann, 1916) ant |
| species       | Gnamptogenys sp. 1 |      |
| species       | Gnamptogenys     | Gnamptogenys sp. 11 ant |
| species       | Gnamptogenys     | Gnamptogenys sp. 3 ant |
| species       | Gnamptogenys     | Gnamptogenys sp. 5 ant |
| species       | Gnamptogenys     | Gnamptogenys tortuolosa (Smith, 1858) ant |
| genus         | Typhlomyrmex     | Typhlomyrmex Mayr, 1862 ant |
| species       | Typhlomyrmex sp. 1 |      |
| subfamily     | Formicinae       | Formicinae Latreille, 1809 ant |
| genus         | Acropyga         | Acropyga Roger, 1862 ant |
| species       | Acropyga sp. 1   |      |
| genus         | Brachymyrmex     | Brachymyrmex Mayr, 1868 ant |
|              |                  |      |
| Species          | Description                                      | Ant species |
|------------------|--------------------------------------------------|-------------|
| *Brachymyrmex*   | sp. 1                                            | ant         |
| *Brachymyrmex*   | sp. 2                                            | ant         |
| *Brachymyrmex*   | sp. 3                                            | ant         |
| *Brachymyrmex*   | sp. 4                                            | ant         |
| *Brachymyrmex*   | sp. 5                                            | ant         |
| *Brachymyrmex*   | sp. 6                                            | ant         |
| *Camponotus*     | Mayr, 1861.                                      | ant         |
| *Camponotus*     | atriceps (Smith, 1858)                           | ant         |
| *Camponotus*     | blandus (Smith, 1858)                            | ant         |
| *Camponotus*     | cameranoi Emery, 1894                           | ant         |
| *Camponotus*     | crassus Mayr, 1862                              | ant         |
| *Camponotus*     | fastigatus Roger, 1863                          | ant         |
| *Camponotus*     | femoratus (Fabricius, 1804)                      | ant         |
| *Camponotus*     | novogranadensis Mayr, 1870                      | ant         |
| *Camponotus*     | rapax (Fabricius, 1804)                         | ant         |
| *Camponotus*     | rectangularis Emery, 1890                       | ant         |
| *Camponotus*     | serieiventris (Guérin-Méneville, 1838)           | ant         |
| *Camponotus*     | sp. 5                                            | ant         |
| *Camponotus*     | sp. 6                                            | ant         |
| *Gigantiops*     | Roger, 1863                                      | ant         |
| *Gigantiops*     | destructor (Fabricius, 1804)                     | ant         |
| *Nylanderia*     | Emery, 1906                                      | ant         |
| *Nylanderia*     | cf. caeciliae (Forel, 1899)                      | ant         |
| *Nylanderia*     | cf. fulva (Mayr, 1862)                          | ant         |
| *Nylanderia*     | cf. guatemalensis (Forel, 1885)                  | ant         |
| *Nylanderia*     | sp. 3                                            | ant         |
| *Nylanderia*     | sp. 5                                            | ant         |
| Myrmicinae       | Lepeletier de Saint-Fargeau, 1835                | ant         |
| *Acromyrmex*     | Mayr, 1865                                       | ant         |
| *Acromyrmex*     | cf. subterraneus (Forel, 1893)                   | ant         |
| *Allomerus*      | Mayr, 1878                                       | ant         |
| species          | genus                   | year     |
|------------------|-------------------------|----------|
| Allomerus octoarticulatus | Apterostigma Mayr, 1865 | ant      |
| Apterostigma auriculatum  | Mayr, 1925              | ant      |
| Apterostigma gr. pilosum  |                       |          |
| Atta Fabricius, 1804     | Apterostigma Mayr, 1865 | ant      |
| Atta cephalotes (Linnaeus, 1758) |                    | ant      |
| Atta sexdens (Linnaeus, 1758) |                   | ant      |
| Basiceros Schulz, 1906     | Carebara Westwood, 1840 | ant      |
| Basiceros militaris (Weber, 1950) |                | ant      |
| Blepharidatta Wheeler, 1915 |                  | ant      |
| Blepharidatta brasiliensis Wheeler, 1915 |            | ant      |
| Carebara Westwood, 1840    | Carebara Westwood, 1840 | ant      |
| Carebara gr. lignata       |                        | ant      |
| Carebara sp. 1             |                        | ant      |
| Carebara sp. 2             |                        | ant      |
| Carebara sp. 5             |                        | ant      |
| Carebara urichi (Wheeler, 1922) |                 | ant      |
| Cephalotes Latreille, 1802 |                       | ant      |
| Cephalotes atratus (Linnaeus, 1758) |                | ant      |
| Cephalotes minutus (Fabricius, 1804) |              | ant      |
| Cephalotes pellans De Andrade, 1999 |           | ant      |
| Cephalotes pusillus (Klug, 1824) |                    | ant      |
| Cephalotes sp. 1           |                        | ant      |
| Cephalotes sp. 2           |                        | ant      |
| Cephalotes sp. 3           |                        | ant      |
| Crematogaster Lund, 1831   |                        | ant      |
| Crematogaster acuta (Fabricius, 1804) |            | ant      |
| Crematogaster brasiliensis Mayr, 1878 |                   | ant      |
| Crematogaster carinata Mayr, 1862 |                 | ant      |
| Crematogaster curvispinosa Mayr, 1862 |            | ant      |
| Crematogaster flavosensitiva Longino, 2003 |         | ant      |
| species | Crematogaster limata Smith, 1858 | ant |
| species | Crematogaster longispina Emery, 1890 | ant |
| species | Crematogaster nigropilosa Mayr, 1870 | ant |
| species | Crematogaster sotobosque Longino, 2003 | ant |
| species | Crematogaster sp. 2 | ant |
| species | Crematogaster stollii Forel, 1885 | ant |
| species | Crematogaster tenuicula Forel, 1904 | ant |
| genus | Cyphomyrmex Mayr, 1862 | ant |
| species | Cyphomyrmex laevigatus Weber, 1938 | ant |
| species | Cyphomyrmex minutus Mayr, 1862 | ant |
| species | Cyphomyrmex peltatus Kempf, 1966 | ant |
| species | Cyphomyrmex rimosus (Spinola, 1851) | ant |
| species | Cyphomyrmex cf. salvini Forel, 1899 | ant |
| species | Cyphomyrmex sp. 12 | ant |
| species | Cyphomyrmex sp. 13 | ant |
| species | Cyphomyrmex sp. 3 | ant |
| species | Cyphomyrmex sp. 4 | ant |
| genus | Eurhopalothrix Brown & Kempf, 1961 | ant |
| species | Eurhopalothrix pilulifera Brown & Kempf, 1960 | ant |
| genus | Hylomyrma Forel, 1912 | ant |
| species | Hylomyrma dentiloba (Santschi, 1931) | ant |
| species | Hylomyrma cf. dolichops Kempf, 1973 | ant |
| species | Hylomyrma immanis Kempf, 1973 | ant |
| species | Hylomyrma longiscapa Kempf, 1961 | ant |
| species | Hylomyrma cf. reitteri (Mayr, 1887) | ant |
| species | Hylomyrma sp. 2 | ant |
| species | Hylomyrma sp. 3 | ant |
| genus | Lachnomyrmex Wheeler, 1910 | ant |
| species | Lachnomyrmex sp. 1 | ant |
| genus | Megalomyrmex Forel, 1885 | ant |
| species | Megalomyrmex balzani Emery, 1894 | ant |
| species                          | Genus                                      | Ant species |
|---------------------------------|--------------------------------------------|-------------|
| *Megalomyrmex cuatiara*          | *Monomorium*                               | *M. pharaonis* (Linnaeus, 1758) |
| *Megalomyrmex drifti*           | *Mycetarotes*                              | *M. goeldii* (Forel, 1911) |
| *Megalomyrmex goeldii*          | *Mycetarotes*                              | *M. strigatus* (Mayr, 1887) |
| *Megalomyrmex leoninus*         | *Mycetaphylax*                             | *M. cf. lectus* (Forel, 1911) |
| *Megalomyrmex sp. 2*            | *Mycetaphylax*                             | *M. sp. 1* |
| *Megalomyrmex sp. 5*            | *Mycetaphylax*                             | *M. sp. 2* |
| *Megalomyrmex sp. 8*            | *Mycetaphylax*                             | *M. sp. 3* |
| *Megalomyrmex wallacei*         | *Mycocepurus*                              | *M. goeldii* (Forel, 1893) |
| *Megalomyrmex sp. 2*            | *Mycocepurus*                              | *M. sp. 1* |
| *Megalomyrmex sp. 5*            | *Mycocepurus*                              | *M. sp. 2* |
| *Megalomyrmex sp. 8*            | *Mycocepurus*                              | *M. sp. 3* |
| *Myrmicocrypta*                 | *Nesomyrmex*                               | *N. pleuriticus* (Kempf, 1959) |
| *Myrmicocrypta sp. 1*           | *Ochetomyrmex*                             | *O. semipolitus* (Mayr, 1878) |
| *Myrmicocrypta sp. 2*           | *Octostruma*                               | *O. balzani* (Emery, 1894) |
| *Myrmicocrypta sp. 3*           | *Octostruma*                               | *O. iheringi* (Emery, 1888) |
| *Nesomyrmex*                    |                                            | *N. wheeler* (1910) |
| *Mycocepurus*                   |                                            | *M. goeldii* (Forel, 1893) |
| *Mycocepurus sp. 1*             |                                            | *M. sp. 1* |
| *Mycocepurus sp. 2*             |                                            | *M. sp. 2* |
| *Mycocepurus sp. 3*             |                                            | *M. sp. 3* |
| *Myrmicocrypta*                 |                                            | *M. pleuriticus* (Kempf, 1959) |
| *Ochetomyrmex*                  |                                            | *O. semipolitus* (Mayr, 1878) |
| *Octostruma*                    |                                            | *O. balzani* (Emery, 1894) |
| *Octostruma iheringi*           |                                            | *O. iheringi* (Emery, 1888) |
| *Octostruma sp. 1*              |                                            | *O. sp. 1* |
| species | Octostruma sp. 2 | ant |
| species | Octostruma sp. 3 | ant |
| genus   | Oxyepoecus | Santschi, 1926 | ant |
| species | Oxyepoecus ephippiatus Albuquerque & Brandão, 2004 | ant |
| genus   | Pheidole Westwood, 1839 | ant |
| species | Pheidole fracticeps Wilson, 2003 | ant |
| species | Pheidole biconstricta Mayr, 1870 | ant |
| species | Pheidole flavens Roger, 1863 | ant |
| species | Pheidole vorax (Fabricius, 1804) | ant |
| species | Pheidole sp. 1 | ant |
| species | Pheidole sp. 4 | ant |
| species | Pheidole sp. 6 | ant |
| species | Pheidole sp. 4 | ant |
| species | Pheidole sp. 6 | ant |
| species | Pheidole sp. 10 | ant |
| species | Pheidole sp. 11 | ant |
| species | Pheidole sp. 12 | ant |
| species | Pheidole sp. 14 | ant |
| species | Pheidole sp. 15 | ant |
| species | Pheidole sp. 16 | ant |
| species | Pheidole sp. 17 | ant |
| species | Pheidole sp. 18 | ant |
| species | Pheidole sp. 19 | ant |
| species | Pheidole sp. 2 | ant |
| species | Pheidole sp. 20 | ant |
| species | Pheidole sp. 21 | ant |
| species | Pheidole sp. 22 | ant |
| species | Pheidole sp. 23 | ant |
| species | Pheidole sp. 24 | ant |
| species | Pheidole sp. 26 | ant |
| species | Pheidole sp. 27 | ant |
| species  | Pheidole sp. 28 | ant     |
|----------|----------------|---------|
| species  | Pheidole sp. 29 | ant     |
| species  | Pheidole sp. 3  | ant     |
| species  | Pheidole sp. 30 | ant     |
| species  | Pheidole sp. 32 | ant     |
| species  | Pheidole sp. 40 | ant     |
| species  | Pheidole sp. 41 | ant     |
| species  | Pheidole sp. 42 | ant     |
| species  | Pheidole sp. 43 | ant     |
| species  | Pheidole sp. 44 | ant     |
| species  | Pheidole sp. 45 | ant     |
| species  | Pheidole sp. 46 | ant     |
| species  | Pheidole sp. 47 | ant     |
| species  | Pheidole sp. 48 | ant     |
| species  | Pheidole sp. 49 | ant     |
| species  | Pheidole sp. 5  | ant     |
| species  | Pheidole sp. 50 | ant     |
| species  | Pheidole sp. 51 | ant     |
| species  | Pheidole sp. 52 | ant     |
| species  | Pheidole sp. 53 | ant     |
| species  | Pheidole sp. 54 | ant     |
| species  | Pheidole sp. 55 | ant     |
| species  | Pheidole sp. 7  | ant     |
| species  | Pheidole sp. 8  | ant     |
| species  | Pheidole sp. 9  | ant     |
| genus    | Rhopalothrix Mayr, 1870 | ant     |
| species  | Rhopalothrix sp. 1 | ant     |
| species  | Rhopalothrix sp. 2 | ant     |
| genus    | Rogeria Emery, 1894 | ant     |
| species  | Rogeria alzatei Kugler, 1994 | ant     |
| species  | Rogeria cf. betti Mann, 1922 | ant     |
| species | name | ant |
|---------|------|-----|
| species | R. blanda (Smith, 1858) | ant |
| species | R. cf. cornuta Kugler, 1994 | ant |
| species | R. cf. cuneola Kugler, 1994 | ant |
| species | R. leptonana Kugler, 1994 | ant |
| species | R. sp. 1 | ant |
| species | R. sp. 2 | ant |
| genus | Sericomymex Mayr, 1865 | ant |
| species | S. sp. 1 | ant |
| species | S. sp. 2 | ant |
| genus | Solenopsis Westwood, 1840 | ant |
| species | S. cf. castor Forel, 1893 | ant |
| species | S. cf. clytemnestra Emery, 1896 | ant |
| species | S. geminata (Fabricius, 1804) | ant |
| species | S. gr. molest | ant |
| species | S. cf. loretana Santschi, 1936 | ant |
| species | S. cf. saevissima (Smith, 1855) | ant |
| species | S. sp. 3 | ant |
| species | S. sp. 5 | ant |
| species | S. sp. 7 | ant |
| species | S. substituta Santschi, 1925 | ant |
| genus | Stegomyrmex Emery, 1912 | ant |
| species | S. cf. olindae Feitosa, Brandão & Diniz, 2008 | ant |
| genus | Strumigenys Smith, 1860 | ant |
| species | S. appretiata (Borgmeier, 1954) | ant |
| species | S. beebei (Wheeler, 1915) | ant |
| species | S. deinomastax (Bolton, 2000) | ant |
| species | S. denticulata Mayr, 1887 | ant |
| species | S. elongata Roger, 1863 | ant |
| species | S. infidelis Santschi, 1919 | ant |
| species | S. inusitata (Lattke, 1992) | ant |
| species | S. cf. perparva Brown, 1958 | ant |
| Species | Scientific Name |
|---------|----------------|
| species | *Strumigenys smithii* Forel, 1886 |
| species | *Strumigenys* sp. 1 |
| species | *Strumigenys* sp. 10 |
| species | *Strumigenys* sp. 13 |
| species | *Strumigenys* sp. 14 |
| species | *Strumigenys* sp. 15 |
| species | *Strumigenys* sp. 2 |
| species | *Strumigenys* sp. 3 |
| species | *Strumigenys* sp. 4 |
| species | *Strumigenys* sp. 5 |
| species | *Strumigenys* sp. 6 |
| species | *Strumigenys* sp. 7 |
| species | *Strumigenys* sp. 8 |
| species | *Strumigenys* sp. 9 |
| species | *Strumigenys* cf. *trinidadensis* Wheeler, 1922 |
| species | *Strumigenys trudifera* Kempf & Brown, 1969 |
| species | *Strumigenys zeteki* (Brown, 1959) |
| genus   | *Trachymyrmex* Forel, 1893 |
| species | *Trachymyrmex* cf. *bognioni* (Forel, 1912) |
| species | *Trachymyrmex* cf. *cornetzi* (Forel, 1912) |
| species | *Trachymyrmex* cf. *diversus* Mann, 1916 |
| species | *Trachymyrmex* cf. *farinosus* (Emery, 1894) |
| species | *Trachymyrmex* cf. *mandibularis* Weber, 1938 |
| species | *Trachymyrmex* cf. *opulentus* (Mann, 1922) |
| species | *Trachymyrmex* cf. *ruthae* Weber, 1937 |
| species | *Trachymyrmex* sp. 10 |
| species | *Trachymyrmex* sp. 3 |
| species | *Trachymyrmex* sp. 7 |
| species | *Trachymyrmex* sp. 8 |
| species | *Trachymyrmex* sp. 9 |
| genus   | *Tranopelta* Mayr, 1866 |
| species       | Tranopelta gilva Mayr, 1866 | ant       |
|--------------|-----------------------------|-----------|
| species      | Tranopelta sp. 1             | ant       |
| genus        | Wasmannia Forel, 1893        | ant       |
| species      | Wasmannia auropunctata (Roger, 1863) | ant |
| species      | Wasmannia rochii Forel, 1912 | ant       |
| species      | Wasmannia scrobifera Kempf, 1961 | ant |
| species      | Wasmannia sp. 1              | ant       |
| subfamily    | Ponerinae Lepeletier de Saint-Fargeau, 1835 | ant |
| genus        | Anochetus Mayr, 1861         | ant       |
| species      | Anochetus diegensis Forel, 1912 | ant |
| species      | Anochetus emarginatus (Fabricius, 1804) | ant |
| species      | Anochetus horridus Kempf, 1964 | ant |
| species      | Anochetus mayri Emery, 1884  | ant       |
| species      | Anochetus neglectus Emery, 1894 | ant |
| species      | Anochetus targionii Emery, 1894 | ant |
| genus        | Dinoponera Roger, 1861       | ant       |
| species      | Dinoponera gigantea (Perty, 1833) | ant |
| genus        | Hypoponera Santschi, 1938    | ant       |
| species      | Hypoponera sp. 1             | ant       |
| species      | Hypoponera sp. 16            | ant       |
| species      | Hypoponera sp. 2             | ant       |
| species      | Hypoponera sp. 3             | ant       |
| species      | Hypoponera sp. 4             | ant       |
| species      | Hypoponera sp. 5             | ant       |
| species      | Hypoponera sp. 6             | ant       |
| species      | Hypoponera sp. 7             | ant       |
| species      | Hypoponera sp. 8             | ant       |
| species      | Hypoponera sp. 9             | ant       |
| genus        | Leptogenys Roger, 1861       | ant       |
| species      | Leptogenys unistimulosa Roger, 1863 | ant |
| genus        | Mayaponera Schmidt & Shattuck, 2014 | ant |
| species       | Mayaponera constricta (Mayr, 1884) | ant |
|--------------|-------------------------------------|-----|
| genus        | Neoponera Emery, 1901               | ant |
| species      | Neoponera apicalis (Latreille, 1802)| ant |
| species      | Neoponera caviniolus Mann, 1916     | ant |
| species      | Neoponera commutata (Roger, 1860)   | ant |
| species      | Neoponera laevigata (Smith, 1858)   | ant |
| species      | Neoponera unidentata (Mayr, 1862)  | ant |
| species      | Neoponera venusta Forel, 1912      | ant |
| species      | Neoponera verenae Forel, 1922      | ant |
| genus        | Odontomachus Latreille, 1804       | ant |
| species      | Odontomachus bauri Emery, 1892     | ant |
| species      | Odontomachus caelatus Brown, 1976  | ant |
| species      | Odontomachus chelifer (Latreille, 1802) | ant |
| species      | Odontomachus haematodus (Linnaeus, 1758) | ant |
| species      | Odontomachus hastatus (Fabricius, 1804) | ant |
| species      | Odontomachus laticeps Roger, 1861  | ant |
| species      | Odontomachus meinerti Forel, 1905  | ant |
| species      | Odontomachus sp. 1                 | ant |
| species      | Odontomachus sp. 2                 | ant |
| genus        | Pachycondyla Smith, 1858           | ant |
| species      | Pachycondyla crassinoda (Latreille, 1802) | ant |
| species      | Pachycondyla harpax (Fabricius, 1804) | ant |
| species      | Pachycondyla impressa (Roger, 1861) | ant |
| species      | Pachycondyla sp. 1                 | ant |
| species      | Pachycondyla sp. 2                 | ant |
| species      | Pachycondyla sp. 3                 | ant |
| species      | Pachycondyla striata Smith, 1858   | ant |
| genus        | Pseudoponera Emery, 1900           | ant |
| species      | Pseudoponera stigma (Fabricius, 1804) | ant |
| genus        | Rasopone Schmidt & Shattuck, 2014  | ant |
| species      | Rasopone arhuaca (Forel, 1901)     | ant |
genus  Simopelta  Mann, 1922  ant
species  Simopelta anomma  Fernandes et al., 2015  ant
species  Simopelta jeckylli  (Mann, 1916)  ant
genus  Thaumatomyrmex  Mayr, 1887  ant
species  Thaumatomyrmex atrox  Weber, 1939  ant
subfamily  Proceratiinae  Emery, 1895  ant
genus  Discothyrea  Roger, 1863  ant
species  Discothyrea denticulata  Weber, 1939  ant
species  Discothyrea humilis  Weber, 1939  ant
species  Discothyrea sexarticulata  Borgmeier, 1954  ant
subfamily  Pseudomyrmecinae  Smith, 1952  ant
genus  Pseudomyrmex  Lund, 1831  ant
species  Pseudomyrmex ita  (Forel, 1906)  ant
species  Pseudomyrmex simplex  (Smith, 1877)  ant
species  Pseudomyrmex sp. 2  ant
species  Pseudomyrmex sp. 3  ant
species  Pseudomyrmex tenuis  (Fabricius, 1804)  ant
species  Pseudomyrmex termitarius  (Smith, 1855)  ant

Temporal coverage

Notes: 2011-09-02 through 2011-09-09, 2011-11-17 through 2012-12-03, 2012-02-28 through 2012-03-12, 2012-05-30 through 2012-06-11, 2013-09-19 through 2013-01-31, 2013-04-18 through 2013-04-28, 2013-06-28 through 2013-07-05, 2013-10-20 through 2013-09-26, 2014-01-17 through 2014-01-27, 2014-11-13 through 2014-11-23

Collection data

Collection name: Instituto Nacional de Pesquisas da Amazônia - INPA/ Coleção de Invertebrados/ HYM

Specimen preservation method: alcohol, pinned
Usage rights

Use license: Other

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Data resources

Data package title: Environmental monitoring of ants (Hymenoptera: Formicidae) in the influence areas of Santo Antônio Hydroelectric Power-Plant in Rondônia, Brazil.

Alternative identifiers: 914c3b86-f2a1-4d5e-b343-b2597b9d4542, https://ipt.sibbr.gov.br/sibbr/resource?r=ant_monitoring_in_santo_antonio_hydroelectric_power_plant_rondonia

Number of data sets: 2

Data set name: Environmental monitoring of ants (Hymenoptera: Formicidae) in the influence areas of Santo Antônio Hydroelectric Power-Plant in Rondônia, Brazil.

Character set: Event

Data format: Darwin Core

Description: Biodiversity loss is accelerating rapidly in response to increasing human influence on the Earth’s natural ecosystems. One way to overcome this problem is by focusing on places of human interest and monitoring the changes and impacts on the biodiversity. This study was conducted at six sites within the influence area of the Santo Antônio Hydroelectric Power Plant in the margins of the Madeira River, Rondônia. The sites cover a latitudinal gradient of approximately 100 km in the Brazilian Amazon Basin. The sampling design included six sampling modules with six transects in each module, totaling 30 sampling plots in each module. Transects were distributed with 0 km, 0.5 km, 1 km, 2 km, 3 km, and 4 km, measured perpendicularly from the river margin towards the interior of the forest. For sampling the ground-dwelling ants, we used the ALL (ants of the leaf litter) protocol, which is standardized globally in the inventories of ant fauna. For the purpose of impact indicators, the first two campaigns (September 2011 to November 2011) were carried out in the pre-filling period, while campaigns 3 to 10 (February 2012 to November 2014) were carried out during and after the filling of the hydroelectric reservoir. A total of 253 events with a total of 9,165 occurrences were accounted during the monitoring. The ants were distributed in 10 subfamilies, 68 genera, and 324 species/morphospecies (Fig. 4). The impact on ant biodiversity during the periods before and after filling was measured by ecological indicators and by the presence and absence of some species/morphospecies. This is the first study, as far as we know, including taxonomic and ecological treatment to monitor the impact of a hydroelectric power plant on ant fauna.
Figure 4. doi
Species occurrence before and after reservoir filling in the Santo Antônio Hydroelectric Power Plant. Dotted lines mark the 95% confidence intervals.

| Column label          | Column description                                                                 |
|-----------------------|-------------------------------------------------------------------------------------|
| eventID               | An identifier for the set of information associated with an Event (something that occurs at a place and time). |
| eventDate             | The date-time or interval during which an Event occurred. For occurrences, this is the date-time when the event was recorded. |
| eventTime             | The time or interval during which an Event occurred.                                  |
| habitat               | A category or description of the habitat in which the Event occurred.                 |
| samplingProtocol      | The name of, reference to, or description of the method or protocol used during an Event. |
| samplingEffort        | The amount of effort expended during an Event.                                         |
| eventRemarks          | Comments or notes about the Event.                                                    |
| sampleSizeUnit        | The unit of measurement of the size (time duration, length, area or volume) of a sample in a sampling event. |
| sampleSizeValue       | A numeric value for a measurement of the size (time duration, length, area or volume) of a sample in a sampling event. |
| fieldNotes            | The text of notes taken in the field about the Event.                                 |
| continent             | The name of the continent in which the Location occurs.                               |
| country               | The name of the country or major administrative unit in which the Location occurs     |
| countryCode           | The standard code for the country in which the Location occurs.                       |
| stateProvince         | The name of the next smaller administrative region than country (state, province, canton, department, region, etc.) in which the Location occurs. |
| Column label     | Column description                                                   |
|------------------|----------------------------------------------------------------------|
| county           | The full, unabbreviated name of the next smaller administrative region than stateProvince (county, shire, department, etc.) in which the Location occurs. |
| locality         | The specific description of the place.                               |
| locationRemarks  | Comments or notes about the Location.                                |
| decimalLongitude | The geographic longitude (in decimal degrees, using the spatial reference system given in geodeticDatum) of the geographic center of a Location. |
| decimalLatitude  | The geographic latitude (in decimal degrees, using the spatial reference system given in geodeticDatum) of the geographic center of a Location. |
| modified         | The most recent date-time on which the resource was changed.         |
| datasetName      | The name identifying the data set from which the record was derived. |
| type             | A list of nomenclatural types.                                      |
| language         | A language of the resource.                                          |
| institutionID    | An identifier for the institution having custody of the material referred to in the record. |
| institutionCode  | The acronym in use by the institution having custody of the material referred to in the record. |
| rightsHolder     | The organization owning the rights over the resource.                |

**Data set name:** Environmental monitoring of ants (Hymenoptera: Formicidae) in the influence areas of Santo Antônio Hydroelectric Power-Plant in Rondônia, Brazil.

**Character set:** Occurrence

| Column label     | Column description                                                   |
|------------------|----------------------------------------------------------------------|
| ID               | An identifier for the Identification (an identifier specific to the data set). |
| type             | A list of nomenclatural types.                                      |
| modified         | The most recent date-time on which the resource was changed.         |
| language         | A language of the resource.                                          |
| license          | A legal document giving official permission to do something with the resource. |
| rightsHolder     | The organization owning the material rights over the resource.       |
| institutionID    | An identifier for the institution having custody of the material referred to in the record. |
| institutionCode  | The acronym in use by the institution having custody of the material referred to in the record. |
| datasetName      | The name identifying the data set from which the record was derived. |
| basisOfRecord    | The specific nature of the data record.                              |
| dynamicProperties| A list of additional measurements, facts, characteristics, or assertions about the record. |
| occurrenceID     | An identifier for the Occurrence.                                    |
| Field                | Description                                                                 |
|----------------------|-----------------------------------------------------------------------------|
| recordNumber         | An identifier given to the Occurrence at the time it was recorded.          |
| recordedBy           | A list of names of people responsible for recording the original Occurrence. |
| organismQuantity     | A number for the quantity of organisms.                                     |
| organismQuantityType | The type of quantification system used for the quantity of organisms.       |
| sex                  | The sex of the biological individual(s) represented in the Occurrence.      |
| lifeStage            | The age class or life stage of the biological individual(s) at the time the Occurrence was recorded. |
| reproductiveCondition| The reproductive condition of the biological individual(s) represented in the Occurrence. |
| preparations         | A list of preparations and preservation methods for a specimen.            |
| disposition          | The current state of a specimen with respect to the collection identified in collectionCode or collectionID. |
| eventID              | An identifier for the set of information associated with an Event (something that occurs at a place and time). |
| identifiedBy         | A list of names of people who assigned the Taxon to the subject.           |
| scientificName       | An identifier for the nomenclatural details of a scientific name.          |
| kingdom              | The full scientific name of the kingdom in which the taxon is classified.   |
| phylum               | The full scientific name of the phylum or division in which the taxon is classified. |
| class                | The full scientific name of the class in which the taxon is classified.     |
| order                | The full scientific name of the order in which the taxon is classified.     |
| family               | The full scientific name of the family in which the taxon is classified.    |
| genus                | The full scientific name of the genus in which the taxon is classified.     |
| specificEpithet      | The name of the first or species epithet of the scientificName.             |
| taxonRank            | The taxonomic rank of the most specific name in the scientificName.        |
| vernacularName       | A common or vernacular name.                                               |

**Additional information**

Fernandes I (2017): Environmental monitoring of ants (Hymenoptera: Formicidae) in the influence areas of Santo Antônio Hydroelectric Power-Plant in Rondônia, Brazil. v1.7. Sistema de Informação sobre a Biodiversidade Brasileira - SiBBr. Dataset/Samplingevent. [https://ipt.sibbr.gov.br/sibbr/resource?r=ant_monitoring_in_santo_antonio_hydroelectric_power_plant_rondonia&v=1.7](https://ipt.sibbr.gov.br/sibbr/resource?r=ant_monitoring_in_santo_antonio_hydroelectric_power_plant_rondonia&v=1.7)
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Author contributions

All the authors have wrote, edited, built and analyzed the database.

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Supplementary materials

Suppl. material 1: A total of 253 events of collection in the influence areas of Santo Antônio Hydroelectric Power-Plant. [doi]

Authors: Itanna Oliveira Fernandes and Jorge Luiz Pereira de Souza
Data type: metadata (DwC-A) event
Filename: Event_collection.xlsx - Download file (91.17 kb)

Suppl. material 2: A total of 9,165 occurrences in the influence areas of Santo Antônio Hydroelectric Power-Plant. [doi]

Authors: Itanna Oliveira Fernandes and Jorge Luiz Pereira de Souza
Data type: metadata (DwC-A) occurrences
Filename: Occurrence_species:morphospecieslist.xlsx - Download file (1.71 MB)