Towards a Global Soil Biodiversity Observatory

This global survey on soil biodiversity was elaborated as part of the International Network on Soil Biodiversity (NETSOB) activities, aiming to provide essential information that will lay the groundwork for the establishment of a Global Soil Biodiversity Observatory (GLOSOB). The International Network on Soil Biodiversity (NETSOB) is a timely response by the global community to improve understanding of soil biodiversity, its conservation, and sustainable use worldwide.

INSTRUCTIONS

This online survey is divided into 11 sections: 1) General information; 2) Microbes and microbial activity; 3) Microfauna (including Protozoa); 4) Mesofauna; 5) Macrofauna; 6) Megafauna; 7) Community level/functional assessments of soil biodiversity; 8) Soil biodiversity inventory/monitoring activities; 9) Ecosystem services, applications, and threats to soil biodiversity; 10) Education/Communication activities; 11) Public policies related to soil biodiversity.

The survey has multiple windows. A few questions are obligatory (marked with an asterisk), while most questions are optional. Non-relevant questions to you can be skipped. Answering the complete survey (i.e., all questions) takes max. 30 minutes. In most cases, i.e., for those who work with only one or a few groups of soil biota, filling out the survey should take at most 10-20 minutes. Your responses will be critical to fill gaps in the state of knowledge on soil biodiversity globally. Thank you!

IMPORTANT

Please note that the link to the survey is unique to your e-mail address. Please do not forward it to anyone else. If your connection fails, you can re-access the questionnaire through the link provided to you. Once all questions are answered (or skipped), you must go to the last page and SEND the questionnaire. Once sent, you will not be able to access the survey anymore. However, a copy of your answers will be sent to you by e-mail and you may print them if you so desire.

DEADLINE

25th of March, 2022

Any questions or comments can be directed to the GSP Secretariat at FAO (GSP-Secretariat@fao.org)

SOP Soil Biodiversity

Disclaimer

* 1. The answers and data obtained from the questionnaires will be treated anonymously and your personal data will be maintained confidentially by the FAO, not passed on to third parties, and only be used for possible future communications related to soil biodiversity.

If you agree to this, please click on **I agree** and continue by filling out the survey.

- I agree
- I don't agree

SOP Soil Biodiversity

General information

* 2. E-mail:

* 3. First name:

* 4. Last name(s):

* 5. Gender:

* 6. What region are you located in/or in which region do you currently work? Please select all appropriate options.

- [ ] Africa
- [ ] Asia
- [ ] Europe and Eurasia
- [ ] Latin America and the Caribbean (including Mexico)
- [ ] North Africa and Near East
- [ ] North America
- [ ] Pacific
- [ ] Sub-Saharan Africa

* 7. Country (where you currently work, not necessarily your country of origin):

8. Institution name (which you are representing):

9. Institutional/Laboratory Website:

* 10. Type of organization you work for:

- [ ] Government
- [ ] Farmer or Farmer's organization
- [ ] Private Sector
- [ ] Research Organization
- [ ] Intergovernmental Organization
- [ ] Educational institution
- [ ] Civil Society Organization
- [ ] Non-governmental Organization
- [ ] Advisory/consultancy
- [ ] Self-employed/independent professional/freelancer/activist
- [ ] Other (specify)

11. If you work with applied aspects of soil biodiversity, what is your focus?

- [ ] Agricultural/forestry/pastoral management
- [ ] Preservation/conservation practice
- [ ] Pharmaceutical products
- [ ] Food industry/soil biodiversity-based food (insects, invertebrates, mushrooms, etc.)
- [ ] Activities associated with ecotourism and/or heritage
- [ ] Environmental awareness/tools
- [ ] Other (specify)

12. ***Ecoregions of the world***

In which ecoregions of the world do you work/or have you worked? Please select all appropriate options.

- [ ] Tropical and Subtropical Moist Broadleaf Forests
- [ ] Tropical and Subtropical Dry Broadleaf Forests
- [ ] Tropical and Subtropical Coniferous Forests
- [ ] Temperate Broadleaf and Mixed Forests
- [ ] Temperate Coniferous Forests
- [ ] Boreal Forests/Taiga
- [ ] Tropical and Subtropical Grasslands, Savannas, and Shrublands
- [ ] Temperate Grasslands, Savannas Shrublands
- [ ] Flooded Grasslands and Savannas
- [ ] Montane Grasslands and Shrublands
- [ ] Tundra
- [ ] Mediterranean Forests, Woodlands, and Scrub
- [ ] Deserts and Xeric Shrublands
- [ ] Mangroves
- [ ] Lakes
- [ ] Polar Desert, Rock and/or Ice
- [ ] All
- [ ] None
- [ ] Other (please specify)

* 13. Level at which you work: Please select all appropriate options.

- [ ] Local
- [ ] National (country level)
- [ ] Regional (continent or several countries)
- [ ] Global

14. What main land use system(s) do you work/have you worked with? Please select all appropriate options.

- [ ] Annual crops
- [ ] Perennial crops
- [ ] Integrated/Mixed agroecosystems (agroforestry, agropastoral, agrosilviculture, etc.)
- [ ] Pastoral systems
- [ ] Forest Plantations
- [ ] Urban
- [ ] Native vegetation
- [ ] Grasslands
- [ ] Land reclamation areas
- [ ] Degraded areas
- [ ] Caves
- [ ] All
- [ ] None
- [ ] Other (specify)

* 15. Which groups of soil organisms or topics related to soil biodiversity do you work with (please select all appropriate options)

- [ ] Microbes (bacteria, Archaea, fungi, virus, algae and lichens) and microbial biomass/activity
- [ ] Microfauna (nematodes, protists, Tardigrada, Rotifera)
- [ ] Mesofauna
- [ ] Macrofauna
- [ ] Megafauna
- [ ] Community level/functional assessments of soil biodiversity
- [ ] Soil biodiversity inventory/monitoring activities
- [ ] Ecosystem services, applications and threats to soil biodiversity
- [ ] Education/communication activities
- [ ] Public policies related to soil biodiversity

Microbes and microbial activity

(bacteria, Archaea, fungi, virus, algae and lichens)

In this section we expect you to provide information about methods you use/used to assess microbial diversity, activity and metabolism, and the main purpose(s) of your work. This information will provide an overview of the main microbes, assessment methods and functions studied worldwide.

* 16. Do you work with Microbiota?

Yes

No

Microbes

* 17. What microbes do you work with?

- [ ] Bacteria (including Cyanobacteria, Actinomycetes)
- [ ] Archaea
- [ ] Fungi
- [ ] Virus
- [ ] Algae
- [ ] Lichens

Microbes

* 18. Do you evaluate soil microbial diversity based on culture-dependent methods?

- Yes
- No

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Culture-dependent methods

19. Which culture-dependent methods do you currently use to evaluate microbial biodiversity? Please select all appropriate options.

- [ ] Genomics and molecular taxonomy of cultivated microbes
- [ ] Phenotypic characterization
- [ ] Transcriptomics
- [ ] Metabolomics
- [ ] Proteomics
- [ ] Community-level physiological profile (CLPP)
- [ ] MALDI-TOF Mass Spectrometry
- [ ] Other (specify)

Genomics and molecular taxonomy of cultivated microbes

20. If you work with genomics and molecular taxonomy of cultured microbes, what methods do you apply?

If not applicable, press "next".

- [ ] Fingerprinting (e.g., PFGE, PCR-RFLP, rep-PCR, RAPD, etc.)
- [ ] Marker gene sequencing
- [ ] Genome sequencing

Genome sequencing of culture-dependent microbes

21. If you work with genome sequencing, which platform do you use?

- [ ] Illumina
- [ ] 454
- [ ] IonTorrent
- [ ] MinIon
- [ ] PacBio
- [ ] Other (specify)

Phenotypic characterization of culture-dependent microbes

22. If you perform phenotypic characterization, which methods do you use?

If not applicable, press "next".

- [ ] Morphological characters
- [ ] Biochemical/physiological characters

Culture-independent/molecular methods

* 23. Do you evaluate soil microbial diversity based on culture-independent/molecular methods?

- ◯ Yes
- ◯ No

Culture-independent/molecular methods:

24. Which culture-independent/molecular methods do you currently use to evaluate microbial biodiversity? Please select all appropriate options.

- [ ] Fingerprinting
- [ ] High-throughput sequencing/Metabarcoding/Metataxonomics
- [ ] Metagenomics
- [ ] Metaproteomics
- [ ] Environmental metabolomics
- [ ] Metatranscriptomics
- [ ] Microarrays
- [ ] Quantitative PCR
- [ ] Direct identification
- [ ] Others

Culture-independent/molecular methods:

25. Which method of fingerprinting do you use?

- [ ] DGGE/TGGE
- [ ] T-RFLP/LH-PCR
- [ ] RISA/ARISA
- [ ] PLFA/FAME
- [ ] RFLP
- [ ] Protein profiles
- [ ] Other (specify)

High-throughput sequencing/Metabarcoding/Metataxonomics

26. If you work with high-throughput sequencing/metabarcoding/metataxonomics, which markers do you use?

If not applicable, press "next".

- [ ] 16S - Bacteria and Archaea
- [ ] 18S - Fungi
- [ ] ITS - Fungi
- [ ] Virus
- [ ] Other (specify)

27. Which method of High-throughput sequencing/Metabarcoding/Metataxonomics do you use?

If not applicable, press "next".

- [ ] Illumina
- [ ] 454
- [ ] Ion Torrent
- [ ] Other (specify)
- [ ] Minlon
- [ ] PacBio

Direct identification

28. If you perform direct identification, which method of direct identification do you use?

If not applicable, press "next".

- [ ] Microscopy
- [ ] Fluorescence In Situ Hybridization (FISH)
- [ ] Arbuscular mycorrhizal fungi (AMF) spore observation

SOP Soil Biodiversity

29. For what purpose are you evaluating the microbes? Please select all appropriate options.

- [ ] Impacts of management practices/land use systems
- [ ] Taxonomy/biodiversity surveys
- [ ] Impacts of organisms on soil properties/ecosystem services
- [ ] Education/awareness raising
- [ ] Biotechnology/pharmaceuticals/food industry
- [ ] Human/animal health
- [ ] Pest/disease control
- [ ] Bioindicators
- [ ] Bioremediation
- [ ] Monitoring
- [ ] Mapping
- [ ] Nature-based Solutions
- [ ] Laboratory analysis and assays
- [ ] Economic valuation
- [ ] Risk assessment/ecotoxicology
- [ ] Other (specify)

* 30. If more details are needed regarding the methodologies and Standard Operating Procedures (SOPs) you uses to measure soil microbial diversity, would you agree to answer a new questionnaire?

- ◯ Yes
- ◯ No

Soil microbial activity: quantitative methods to assess soil microbial activity

Including mycorrhizal fungi

* 31. Do you evaluate soil microbial activity based on quantitative methods?

- Yes
- No

SOP Soil Biodiversity

Soil microbial activity: quantitative methods to assess soil microbial activity

32. Which methods do you currently use to evaluate microbial activity/processes? Please select all appropriate options.

- [ ] Soil respiration
- [ ] Nitrogen mineralization
- [ ] Nitrification potential
- [ ] CH_4 emissions
- [ ] N_2O emissions
- [ ] Enzymatic activity
- [ ] Mycorrhizal colonization
- [ ] Decomposition methods
- [ ] Other (specify)

Soil Respiration

33. Which method do you currently use to evaluate microbial soil respiration?

- [ ] Basal respiration
- [ ] Field measurements (soil chambers)

Enzymatic activity

34. If you study enzymatic activity, which ones do you evaluate?

If not applicable, press "next".

- [ ] Amidase
- [ ] Amylase
- [ ] Arylsulfatase
- [ ] Beta-glucosidase
- [ ] Cellulase
- [ ] Desydrogenase
- [ ] Phenol Oxidase
- [ ] Phosphatase
- [ ] Galactosidase
- [ ] Fluorescein Diacetate Hydrolysis
- [ ] Invertase
- [ ] Laccase
- [ ] N-Acetyl Glucosaminidase
- [ ] Protease
- [ ] Urease
- [ ] Xylanase
- [ ] Other (specify)

Mycorrhizal fungi

35. If you study mycorrhizal fungi, what attributes do you analyse?

If not applicable, press "next".

- [ ] Glomalin quantification
- [ ] Root infection/colonization

Decomposition methods

36. If you study decomposition, which methods do you use?

If not applicable, press "next".

- [ ] Tea Bag
- [ ] Litter bag
- [ ] Other (specify)

SOP Soil Biodiversity

37. For what purpose are you evaluating the microbes? Please select all appropriate options.

- [ ] Impacts of management practices/land use systems
- [ ] Taxonomy/biodiversity surveys
- [ ] Impacts of organisms on soil properties/ecosystem services
- [ ] Education/awareness raising
- [ ] Biotechnology/pharmaceuticals/food industry
- [ ] Human/animal health
- [ ] Pest/disease control
- [ ] Bioindicators
- [ ] Bioremediation
- [ ] Monitoring
- [ ] Mapping
- [ ] Nature-based Solutions
- [ ] Laboratory analysis and assays
- [ ] Economic valuation
- [ ] Risk assessment/ecotoxicology
- [ ] Other (specify)

* 38. If more details are needed regarding the methodologies and Standard Operating Procedures (SOPs) used to measure soil microbial activity, would you agree to answer a new questionnaire?

- ◯ Yes
- ◯ No

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Soil microbial biomass: quantitative methods to assess soil microbial biomass

* 39. Do you evaluate soil microbial biomass based on quantitative methods?

- ◯ Yes
- ◯ No

Soil microbial biomass: quantitative methods to assess soil microbial biomass

40. Which methods do you currently use to evaluate microbial biomass? Please select all appropriate options.

- [ ] Fumigation/incubation
- [ ] Fumigation/extraction
- [ ] Substrate-induced respiration
- [ ] Fungi ergosterol quantification
- [ ] Other (specify)

SOP Soil Biodiversity

Soil microbial biomass: quantitative methods to assess soil microbial biomass

41. For what purpose are you evaluating the microbes? Please select all appropriate options.

- [ ] Impacts of management practices/land use systems
- [ ] Taxonomy/biodiversity surveys
- [ ] Impacts of organisms on soil properties/ecosystem services
- [ ] Education/awareness raising
- [ ] Biotechnology/pharmaceuticals/food industry
- [ ] Human/animal health
- [ ] Pest/disease control
- [ ] Bioindicators
- [ ] Bioremediation
- [ ] Monitoring
- [ ] Mapping
- [ ] Nature-based Solutions
- [ ] Laboratory analysis and assays
- [ ] Economic valuation
- [ ] Risk assessment/ecotoxicology
- [ ] Other (specify)

* 42. If more details are needed regarding the methodologies and Standard Operating Procedures (SOPs) used to measure soil microbial biomass, would you agree to answer a new questionnaire?

- ◯ Yes
- ◯ No

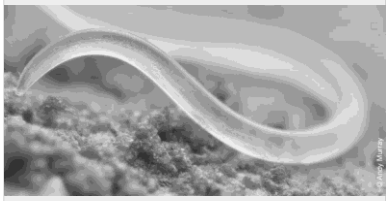
Microfauna

(nematodes, protists, tradigrada, rotifera)

In this section of the survey, we include questions related to the different taxa studied, the main methods used and the purpose(s) of your work. Our objective is to provide a state of the art on the research and various applications related soil microfauna around the world.

Protozoa were included here instead of the microbes section for historical rather than taxonomic reasons.

* 43. Do you work with Microfauna?



Yes

No

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Microfauna

44. Substrate:

- [ ] Root
- [ ] Soil
- [ ] Root and soil
- [ ] Animalia (vertebrates, insects and other invertebrates)
- [ ] Other (specify)

45. Methods currently used? Please select all appropriate options:

- [ ] Blender
- [ ] Centrifuge-flotation/sucrose solution; sieving and sugar centrifugation; density flotation
- [ ] Decanting and Sieving
- [ ] Misting or Mist chamber
- [ ] Elutriation
- [ ] Baermann funnel technique
- [ ] Modified Baermann
- [ ] Root incubation technique
- [ ] Maceration/Filtration technique
- [ ] Maceration/Flocculation/Flotation
- [ ] Molecular techniques (e.g., 18S, ITS)
- [ ] In vitro culture
- [ ] Wet funnels
- [ ] Soil suspension
- [ ] Direct counting
- [ ] Dilution
- [ ] Filtering
- [ ] Functional approach
- [ ] Light-cooling extraction
- [ ] Direct wet extraction
- [ ] Other (specify)

46. References - Please select all appropriate responses and/or provide references to other method(s) used:

- [ ] Baermann (1917) (funnel technique - nematodes)
- [ ] Jenkins (1964) (centrifugal/flotation - nematodes)
- [ ] Whitehead & Hemming (1965) (funnel technique - nematodes)
- [ ] Flegg (1967) (decanting and sieving - nematodes)
- [ ] Coolen & D'Herde (1972) (maceration/flocculation/flotation - nematodes)
- [ ] Lüftenegger et al., (1988) (direct counting/soil suspension - protozoa)
- [ ] Coûteaux & Palka (1988) (direct counting - protozoa)
- [ ] Heal (1964) (in vitro culture - protozoa)
- [ ] Heal (1971) (in vitro culture - protozoa)
- [ ] Butler (1995) (soil suspension - protozoa)
- [ ] Devetter (2010) (funnel and filtering - rotiferers)
- [ ] Other (specify)

47. For what purpose are you evaluating the microfauna?

- [ ] Impacts of management practices/land use systems
- [ ] Taxonomy/biodiversity surveys
- [ ] Impacts of organisms on soil properties/ecosystem services
- [ ] Education/awareness raising
- [ ] Biotechnology/pharmaceuticals/industry
- [ ] Human/animal health
- [ ] Pest/disease control
- [ ] Biological model
- [ ] Biological control
- [ ] Bioindicators
- [ ] Bioremediation
- [ ] Monitoring
- [ ] Mapping
- [ ] Nature-based Solutions
- [ ] Laboratory analysis and assays
- [ ] Economic valuation
- [ ] Risk assessment/ecotoxicology
- [ ] Other (specify)

48. Main taxa that are the aim of your work (please select all appropriate options). If overall soil microfauna community, please tick the box *"All"* :

- [ ] Entomopathogenic nematodes
- [ ] Other pathogenic nematodes
- [ ] Plant parasitic nematodes
- [ ] Free-living nematodes
- [ ] Tardigrada
- [ ] Rotifera
- [ ] Protists (protozoa)
- [ ] All
- [ ] Other (specify)

49. Are you active in taxonomy?

- ◯ Yes
- ◯ No

50. What organisms are your taxonomic specialty? Please select all options that apply:

- [ ] Entomopathogenic nematodes
- [ ] Other pathogenic nematodes
- [ ] Plant parasitic nematodes
- [ ] Free-living nematodes
- [ ] Tardigrada
- [ ] Rotifera
- [ ] Protists (protozoa)
- [ ] All

SOP Soil Biodiversity

* 51. If more details are needed regarding the methodologies and Standard Operating Procedures (SOPs) used to measure soil microfauna, would you agree to answer a new questionnaire?

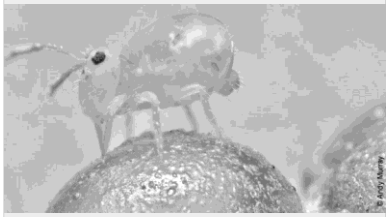
- Yes
- No

Mesofauna

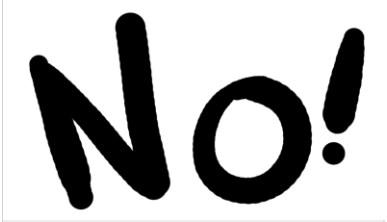
In this section of the survey, we include questions related to the different taxa studied, the main methods used and the purpose(s) of your work. Our objective is to provide a state of the art on the research and various applications related to soil mesofauna worldwide.

Includes Mites, springtails, Symphyla, Pauropoda, Protura, pseudoscorpions, enchytraeids, micro-Hymenoptera and Coleoptera.

* 52. Do you work with Mesofauna?



Yes



No

Mesofauna

53. Do you work with litter and/or soil?

- ◯ Litter
- ◯ Soil
- ◯ Both

54. Main extraction method(s) used?

- ◯ Direct
- ◯ Indirect
- ◯ Both

Direct extraction

55. Main direct extraction method used? Please select all that apply:

- [ ] Hand sorting
- [ ] Wet sieving
- [ ] Flotation

Indirect extraction

56. Main indirect extraction method used? Please select all that apply:

- [ ] Berlese-Tüllgren
- [ ] Kempson apparatus
- [ ] Pitfall traps/Provid
- [ ] Winkler
- [ ] Wet funnel
- [ ] Wetsieving

57. Main direct extraction method used? Please select all that apply:

- [ ] Hand sorting
- [ ] Wet sieving
- [ ] Flotation

58. Main indirect extraction method used? Please select all that apply:

- [ ] Berlese-Tüllgren
- [ ] Kempson apparatus
- [ ] Pitfall traps/Provid
- [ ] Winkler

SOP Soil Biodiversity

59. References - Please select all appropriate responses and/or provide references to the main method(s) used:

- [ ] Berlese (1905)
- [ ] Tüllgren (1917)
- [ ] Kempson et al. (1963)
- [ ] O'Connor (1955)
- [ ] ISO
- [ ] Pitfall/Winkler/or other method (please provide references)

60. For what purpose are you evaluating the mesofauna? Please select all appropriate options.

- [ ] Impacts of management practices/land use systems
- [ ] Taxonomy/biodiversity surveys
- [ ] Impacts of organisms on soil properties/ecosystem services
- [ ] Education/awareness raising
- [ ] Biotechnology/pharmaceuticals/industry
- [ ] Human/animal health
- [ ] Pest/disease control
- [ ] Bioindicators
- [ ] Bioremediation
- [ ] Monitoring
- [ ] Mapping
- [ ] Nature-based Solutions
- [ ] Laboratory analysis and assays
- [ ] Economic valuation
- [ ] Risk assessment/ecotoxicology
- [ ] Other (specify)

61. Main taxa that you work with? Please select all options that apply.

If the taxon/taxa of your specialty is/are not listed, please choose *"Other"* and provide the name(s).

- [ ] All
- [ ] Acari
- [ ] Collembola
- [ ] Diplura
- [ ] Protura
- [ ] Myriapoda (Symphyla, Pauropoda)
- [ ] Pseudoscorpionida
- [ ] Enchytraeida
- [ ] Hymenoptera
- [ ] Coleoptera
- [ ] Diptera
- [ ] Other (specify)

- [ ] None of the above

62. Are you active in taxonomy?

- ◯ Yes
- ◯ No

63. What animals are your taxonomic specialty? Please select all that apply.

If the taxon/taxa of your specialty is/are not listed, please choose *"Other"* and provide the name(s).

- [ ] Acari
- [ ] Collembola
- [ ] Diplura
- [ ] Protura
- [ ] Dermaptera
- [ ] Myriapoda (Symphyla, Pauropoda)
- [ ] Pseudoscorpionida
- [ ] Enchytraeida
- [ ] Hymenoptera
- [ ] Coleoptera
- [ ] All
- [ ] Other (specify)

SOP Soil Biodiversity

* 64. If more details are needed regarding the methodologies and Standard Operating Procedures (SOPs) used to measure soil mesofauna, would you agree to answer a new questionnaire?

- Yes
- No

Macrofauna

In this section of the survey, we include questions related to the different taxa studied, the main methods used and the purpose(s) of your work. Our objective is to provide a state of the art on the research and various applications related to soil macrofauna worldwide.

Includes large animals generally visible to the naked eye, such as: earthworms, termites, ants, centipedes, millipedes, beetles, spiders and other large arachnids, isopods, molluscs, cockroaches, earwigs, crickets, true bugs, cicadas, Diplura, etc.

* 65. Do you work with Macrofauna?

Yes

No

Macrofauna

66. Do you work with litter and/or soil?

- Soil
- Litter
- Both

67. What extraction method(s) do you use?

- Direct
- Indirect
- Both

Direct extraction

68. Main direct extraction method used? Please select all that apply:

- [ ] Hand sorting
- [ ] Wet sieving
- [ ] Flotation

Indirect extraction

69. Main indirect extraction method used? Please select all that apply:

- [ ] Berlese-Tüllgren
- [ ] Kempson apparatus
- [ ] Pitfall traps/Provid
- [ ] Winkler

70. Main direct extraction method used? Please select all that apply:

- [ ] Hand sorting
- [ ] Wet sieving
- [ ] Flotation

71. Main indirect extraction method used? Please select all that apply:

- [ ] Berlese-Tüllgren
- [ ] Kempson apparatus
- [ ] Pitfall traps/Provid
- [ ] Winkler

SOP Soil Biodiversity

Macrofauna

72. References - Please select all that apply:

- [ ] Anderson and Ingram (1993)/TSBF
- [ ] Bignell et al. (2008)
- [ ] Kempson et al. (1963)
- [ ] Berlese (1905)
- [ ] Tüllgren (1917)
- [ ] ISO
- [ ] Pitfall/Winkler/or other method (please provide references)

73. For what purpose are you evaluating the macrofauna? Please select all options that apply.

- [ ] Impacts of management practices/land use systems
- [ ] Taxonomy/biodiversity surveys
- [ ] Impacts of organisms on soil properties/ecosystem services
- [ ] Education/awareness raising
- [ ] Biotechnology/pharmaceuticals/industry
- [ ] Human/animal health
- [ ] Pest/disease control
- [ ] Bioindicators
- [ ] Bioremediation
- [ ] Monitoring
- [ ] Mapping
- [ ] Nature-based Solutions
- [ ] Laboratory analysis and assays
- [ ] Economic valuation
- [ ] Risk assessment/ecotoxicology
- [ ] Other (specify)

74. Main taxa that you work with? Please select all options that apply:

If the taxon/taxa of your specialty is/are not listed, please choose *"Other"* and provide the name(s).

- [ ] All
- [ ] Crassiclitellata (Oligochaeta)
- [ ] Hymenoptera
- [ ] Isoptera
- [ ] Coleoptera
- [ ] Arachnida
- [ ] Myriapoda (Chilopoda, Diplopoda)
- [ ] Isopoda
- [ ] Diptera (larvae)
- [ ] Orthoptera
- [ ] Mollusca
- [ ] Heteroptera
- [ ] Dermaptera
- [ ] Diplura
- [ ] Other (specify)

75. Are you active in taxonomy?

- ◯ Yes
- ◯ No

76. What animals are your taxonomic specialty? Please select all options that apply.

If the taxon/taxa of your specialty is/are not listed, please choose *"Other"* and provide the name(s).

- [ ] Crassiclitellata (Oligochaeta)
- [ ] Hymenoptera
- [ ] Isoptera
- [ ] Coleoptera
- [ ] Arachnida
- [ ] Chilopoda
- [ ] Diplopoda
- [ ] Isopoda
- [ ] Diptera
- [ ] Orthoptera
- [ ] Mollusca
- [ ] Heteroptera
- [ ] Dermaptera
- [ ] Diplura
- [ ] All
- [ ] Other (specify)

SOP Soil Biodiversity

* 77. If more details are needed regarding the methodologies and Standard Operating Procedures (SOPs) used to measure soil biodiversity, would you agree to answer a new questionnaire?

- Yes
- No

Megafauna (soil dwelling vertebrates)

In this section of the survey, we include questions related to the different taxa studied, the main methods used and the purpose(s) of your work. Our objective is to provide a state of the art on the research and various applications related to soil megafauna worldwide.

* 78. Do you work with Megafauna?

Yes

No

Megafauna (soil dwelling vertebrates)

79. For what purpose are you evaluating the megafauna? Please select all options that apply.

- [ ] Impacts of management practices/land use systems
- [ ] Taxonomy/biodiversity surveys
- [ ] Impacts of organisms on soil properties/ecosystem services
- [ ] Education/awareness raising
- [ ] Biotechnology/pharmaceuticals/industry
- [ ] Human/animal health
- [ ] Pest/disease control
- [ ] Monitoring
- [ ] Mapping
- [ ] Nature-based Solutions
- [ ] Laboratory analysis and assays
- [ ] Economic valuation
- [ ] Risk assessment/ecotoxicology
- [ ] Other (specify)

80. References - Please provide any references to the method(s) used:

81. Main taxa that you work with? Please select all that apply.

Here we list some of the most representative groups of the soil macrofauna. If the taxa you work with is not listed, please choose *"Other"* and add the name of the taxa. If overall soil megafauna community, please tick the box *"All"*:

- [ ] All
- [ ] Urodela (Salamandridae)
- [ ] Gymnophiona
- [ ] Rodentia
- [ ] Soricidae
- [ ] Talpidae
- [ ] Cingulata (Armadillos), Pholidota (Pangolins)
- [ ] Squamata (Snakes, Amphisbaenas, etc.)
- [ ] Aves (birds, e.g., owls that make holes in the ground)
- [ ] Other (specify)

82. Are you active in taxonomy?

- ◯ Yes
- ◯ No

83. What animals are your taxonomic specialty? Please select all that apply:

If the taxa/taxon of your specialty is not listed, please choose *"Other"* and provide the name.

- [ ] All
- [ ] Urodela (Salamandridae)
- [ ] Gymnophiona
- [ ] Rodentia
- [ ] Soricidae
- [ ] Talpidae
- [ ] Cingulata (Armadillos), Pholidota (Pangolins)
- [ ] Squamata (Snakes, Amphisbaenas, etc.)
- [ ] Aves (birds, e.g., owls that make holes in the ground)
- [ ] Other (specify)

SOP Soil Biodiversity

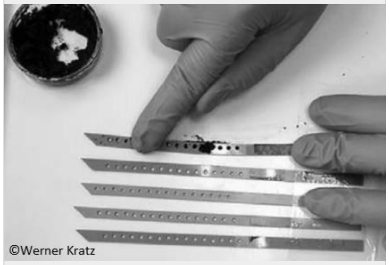
* 84. If more details are needed regarding the methodologies and Standard Operating Procedures (SOPs) used to measure soil megafauna, would you agree to answer a new questionnaire?

- Yes
- No

Community level/functions

This section has questions related to the main methods associated to the measurement of soil microbial/fauna communities and/or their functions.

* 85. Do you work with Community level/functional assessments of soil biodiversity?



Yes

No

Community level/functions

86. Which method(s)/approach(es) do you use to evaluate microbial/fauna communities and/or functions? Please select all options that apply.

- [ ] Foodweb
- [ ] Semi field models (e.g. TME, mesocosms, microcosms, etc)
- [ ] Ecotoxicological tests (habitat function)
- [ ] Feeding activity (e.g. bait-lamina)
- [ ] Decomposition (e.g. litter bag, tea bag)
- [ ] Bioturbation
- [ ] Trait-based
- [ ] Molecular method (e.g., environmental DNA)
- [ ] Other (specify)

87. References (please select all that apply and/or provide any references to the other method/s you may use):

- [ ] Burrows (2002) (microcosms)
- [ ] Edwards (2004) (microcosms)
- [ ] Schaeffer et al., (2010) (TME)
- [ ] OECD (ecotoxicological tests)
- [ ] ISO (ecotoxicological tests)
- [ ] Von Törne (1990) (bait-lamina)
- [ ] Other (specify)

* 88. If more details are needed regarding the methodologies and Standard Operating Procedures (SOPs) used to measure soil fauna/microbial community level/functions, would you agree to answer a new questionnaire?

- ◯ Yes
- ◯ No

SOP Soil Biodiversity

Soil biodiversity inventory/ monitoring program

This section has questions related to soil biodiversity inventories and/or monitoring programs and mapping/activities at various levels (local, regional, national, global), and the main taxa involved.

* 89. Have you been involved in a soil biodiversity inventory or monitoring program/activities?

- ◯ Yes
- ◯ No

SOP Soil Biodiversity

90. Have you contributed to any of the following soil biodiversity assessments? Please select all options that apply.

- [ ] Soil microbial communities
- [ ] Soil fauna communities
- [ ] Assessment/inventories of endangered species
- [ ] Innovations and practices of farmers
- [ ] Indigenous and traditional knowledge
- [ ] Maps/surveys
- [ ] None
- [ ] Others (specify)

SOP Soil Biodiversity

91. Does your country have a national soil inventory that includes soil biodiversity?

- Yes
- No
- I don't know

92. Which main groups of organisms were included?

- [ ] Microbes
- [ ] Microfauna
- [ ] Mesofauna
- [ ] Macrofauna
- [ ] Megafauna

SOP Soil Biodiversity

93. Does your country have a monitoring program involving soil biodiversity?

- Yes
- No
- I don't know

94. At what level:

- [ ] Local
- [ ] State/Province
- [ ] National

95. Which taxa were/are involved in the monitoring program?

- [ ] Microbes
- [ ] Microfauna
- [ ] Mesofauna
- [ ] Macrofauna
- [ ] Megafauna

SOP Soil Biodiversity

96. Have you been involved in any mapping exercises on soil biodiversity?

- Yes
- No

97. At what scale?

- [ ] Local
- [ ] State/Province
- [ ] National
- [ ] Regional (Continental)
- [ ] Global

98. If yes, please provide hyperlink and/or reference to the study.

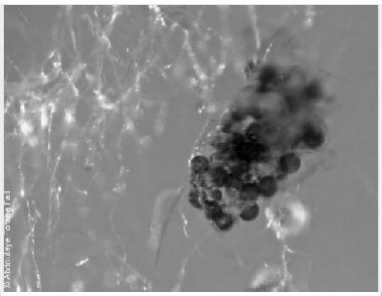
SOP Soil Biodiversity

99. If you have developed and maintained a soil biodiversity database (e.g., as part of a national soil survey programme) please provide reference or a hyperlink.

Ecosystem Services, applications and threats to soil biodiversity

This section includes questions regarding ecosystem services and their valuation, the main practical applications of soil biodiversity, threats and barriers to conservation.

* 100. Do you work with Ecosystem Services?



Yes

No

SOP Soil Biodiversity

Ecosystem Services, applications and threats to soil biodiversity

101. What soil ecosystem services provided by soil biodiversity do you work with? Please select all options that apply and provide/list the indicator(s) you use.

- [ ] Soil formation
- [ ] Biodiversity conservation
- [ ] Nutrient cycling (Decomposition, N_2 fixation, Mineralization, etc.)
- [ ] Soil erosion and flood control
- [ ] Pollination
- [ ] Seed dispersal
- [ ] Pest and disease regulation
- [ ] Atmospheric composition and climate regulation (Emission of GHG, Carbon sequestration, etc.)
- [ ] Recycling of waste biomass
- [ ] Pollutant immobilization/degradation and soil bioremediation
- [ ] Regulation of water supply and quality
- [ ] Pharmaceutical or biotechnological products
- [ ] Food, fiber and fuel production and quality
- [ ] Human health
- [ ] Educational, cultural or recreational uses
- [ ] Habitat for organisms
- [ ] Others (please list)

102. What indicators do you use related to soil biodiversity, for the ecosystem services listed above?

- [ ] Microbes/Microbial biomass and/or activity
- [ ] Microfauna
- [ ] Mesofauna
- [ ] Macrofauna
- [ ] Megafauna
- [ ] Diversity indexes/other indexes
- [ ] Endangered species (presence, absence, richness)
- [ ] Functional traits
- [ ] Bioturbation
- [ ] Decomposition/mineralization/respiration rate
- [ ] Metabolic/enzymatic activity
- [ ] Greenhouse gas emissions
- [ ] Ecological interactions (predation, parasitism, symbiosis, competition, etc.)
- [ ] Primary productivity/yield
- [ ] Water infiltration
- [ ] Others (please specify)

103. In case you study economic valuation of ecosystem services, please select the options that apply:

- [ ] Soil formation
- [ ] Biodiversity conservation
- [ ] Nutrient cycling (Decomposition, N2 fixation, Mineralization, etc.)
- [ ] Soil erosion and flood control
- [ ] Pollination
- [ ] Seed dispersal
- [ ] Pest and disease regulation
- [ ] Atmospheric composition and climate regulation (Emission of GHG, Carbon sequestration, etc.)
- [ ] Recycling of waste biomass
- [ ] Pollutant immobilization/degradation and soil bioremediation
- [ ] Regulation of water supply and quality
- [ ] Pharmaceutical or biotechnological products
- [ ] Food, fiber and fuel production and quality
- [ ] Human health
- [ ] Educational, Cultural or Recreational uses
- [ ] Habitat for organisms
- [ ] Other (specify)

104. What approach have you used for economic valuation

- [ ] Market-based techniques
- [ ] Revealed preference techniques
- [ ] Declared preference techniques (willingness to pay):
- [ ] Other (specify)

SOP Soil Biodiversity

Revealed preference techniques

105. If you use revealed preference techniques, what method do you apply?

- [ ] Replacement cost
- [ ] Avoided cost
- [ ] Mitigation or restoration cost
- [ ] Travel cost
- [ ] Hedonic pricing
- [ ] Other (please specify)

SOP Soil Biodiversity

Declared preference techniques (willingness to pay):

106. If you use declared preference (willingness to pay), what method do you apply?

If not applicable, press "next".

- [ ] Contingent valuation
- [ ] Choice experiments
- [ ] Other (please specify)

SOP Soil Biodiversity

107. What are the main practical applications of soil biodiversity related to soil **microbes** that you work with or use? Please select all options that apply.

- [ ] Biological nitrogen fixation
- [ ] Phosphate solubilization
- [ ] Potassium solubilization
- [ ] Plant growth promotion
- [ ] Bioremediation
- [ ] Biological control of pests and diseases
- [ ] Bioindicators of soil health
- [ ] Industry - enzymes, polysaccharides, antibiotics
- [ ] Monitoring of antimicrobial resistance
- [ ] Biodiversity inventories
- [ ] Taxonomy
- [ ] Other (specify)

108. What are the main practical applications of soil biodiversity related to soil **fauna** that you work with or use? Please select all options that apply.

- [ ] Bioindicators to assess soil health
- [ ] Assessment and monitoring of soil pollution and risk assessment
- [ ] Inoculation to increase plant productivity and/or soil restoration
- [ ] Biodiversity inventories
- [ ] Plant growth promotion
- [ ] Biological control of pests and diseases
- [ ] Pollination
- [ ] Pharmaceutical products (antimicrobials/antibiotics)
- [ ] Biomass production for animal feed
- [ ] Bioturbation and/or soil physical quality improvement
- [ ] Composting and/or decomposition of organic materials
- [ ] Tools for environmental education
- [ ] Nutrient cycling
- [ ] Taxonomy
- [ ] Other (specify)

109. Which of the following threats to soil biodiversity have you dealt with? Please select all options that apply.

- [ ] Over-use of chemical control mechanisms (e.g. pesticides, herbicides)
- [ ] Monoculture
- [ ] Soil compaction
- [ ] Over-use of fertilizers
- [ ] Over-grazing
- [ ] Deforestation and habitat fragmentation
- [ ] Fire
- [ ] Tillage
- [ ] Surface sealing
- [ ] Urbanization
- [ ] Salinization and sodification
- [ ] Erosion and landslides
- [ ] Climate change
- [ ] Invasive species
- [ ] Pollution
- [ ] Agricultural intensification
- [ ] Loss of soil organic matter and carbon
- [ ] Ecosystem-level biodiversity loss
- [ ] Mining activities
- [ ] Other (specify)

110. What are the barriers to implement a better soil biodiversity uses/applications in the country where you work? Please select all options that apply.

- [ ] Lack of information and knowledge
- [ ] Lack of capacity
- [ ] Lack of infrastructure
- [ ] Policy and institutional constraints
- [ ] Overly theoretical approach and lack of applicability
- [ ] Lack of research at national level
- [ ] Lack of financial resources
- [ ] None
- [ ] Unknown
- [ ] Other (specify)

Education and communication activities

Education and communication activities are fundamental aspects that support soil biodiversity conservation initiatives. In this section, you will find questions related to the means, methods and target audience.

* 111. Do you work with education and communication activities related to soil biodiversity?

Yes

No

Education and communication activities in soil biodiversity

112. Is your work in soil biodiversity:

- [ ] Demanded/in service of a institution or organization
- [ ] Curricular activity/discipline
- [ ] Extra-curricular activity
- [ ] Voluntary initiative

113. Methods used:

- [ ] Theoretical
- [ ] Practical
- [ ] Theoretical and practical
- [ ] Print media (newspapers, magazines)
- [ ] Broadcast media (TV, Radio)
- [ ] Internet (site, blog, social media)
- [ ] Games, apps
- [ ] Art
- [ ] Other (specify)

114. Please cite any relevant reference(s), site(s), link(s):

115. What is the main target audience of education/communication actions?

- [ ] Basic education students
- [ ] University level students
- [ ] Farmers
- [ ] Community organizations
- [ ] Native peoples
- [ ] General population
- [ ] Policy makers
- [ ] Researchers

* 116. If more details are needed regarding your relationship with soil biodiversity education/communication activities, would you agree to answer a new questionnaire?

- Yes
- No

SOP Soil Biodiversity

Public policies related to soil biodiversity

In this section you will find questions about the existence of legal frameworks and public policies aimed at the conservation and sustainable management of soil biodiversity.

117. In your sphere of activity (local, national, regional or global) is there any legal framework (laws, norms, protocols) that directly or indirectly promotes the conservation and/or the sustainable management of soil biodiversity?

- Yes
- No
- I don't know

SOP Soil Biodiversity

Public policies related to soil biodiversity

118. Is there any public policy on Soil Biodiversity in your country? If yes, please provide details (website, code of law, references, etc.).

- No
- I don't know
- Yes

SOP Soil Biodiversity

119. What is the category of the public policy aimed at promoting the direct or indirect conservation of soil biodiversity?

- [ ] Financing, lines of credit or application of subsidies
- [ ] Technical assistance and training/capacity building
- [ ] Regulation and/or fiscalization
- [ ] Soil biodiversity monitoring
- [ ] Establishment of conservation areas

SOP Soil Biodiversity

120. Is there any national or regional measure in place to protect soil biodiversity in your area/country? If yes, please provide details (website, code of law, references, etc.)

- No
- I don't know
- Yes

SOP Soil Biodiversity

121. What is the main focus related to soil biodiversity public policy in your country?

- [ ] Protection
- [ ] Conservation
- [ ] Sustainable Use

SOP Soil Biodiversity

122. Are you aware of any international legal instrument to protect soils that is relevant to soil biodiversity? If yes, please provide details:

- No
- I don't know
- Yes

Please click "Done" to finalize and send the survey.

Thank you for your participation!