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Office of Chemical Safety and
Pollution Prevention

Systematic Review Protocol for 1,2-Dichloroethane

Systematic Review Support Document for the Risk Evaluation

CASRN 107-06-2

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1 INTRODUCTION

The U.S. Environmental Protection Agency (EPA or the Agency) Office of Pollution Prevention and Toxics (OPPT) applies systematic review principles in the development of risk evaluations under the amended Toxic Substances Control Act (TSCA). TSCA section 26(h) requires EPA to use scientific information, technical procedures, measures, methods, protocols, methodologies, and models consistent with the best available science and base decisions under section 6 on the weight of scientific evidence. Within the TSCA risk evaluation context, the weight of scientific evidence is defined as "a systematic review method, applied in a manner suited to the nature of the evidence or decision, that uses a pre-established protocol to comprehensively, objectively, transparently, and consistently identify and evaluate each stream of evidence, including strengths, limitations, and relevance of each study and to integrate evidence as necessary and appropriate based upon strengths, limitations, and relevance" (40 CFR 702.33) (Figure 1-1).

To meet the TSCA section 26(h) science standards, EPA used the TSCA systematic review process described in the *Draft Systematic Review Protocol Supporting TSCA Risk Evaluations for Chemical Substances: A Generic TSCA Systematic Review Protocol* (also referred to as the "[2021] Draft Systematic Review Protocol" or "draft protocol") (U.S. EPA, 2021). Section 3 of the Draft Systematic Review Protocol depicts the steps in which information is identified and whether it undergoes the formal systematic review process in U.S. EPA (2021). Information attained via the systematic review process is integrated with information attained from sources of information that do not undergo systematic review (*e.g.,* EPA-generated model outputs) to support a weight of scientific evidence analysis.

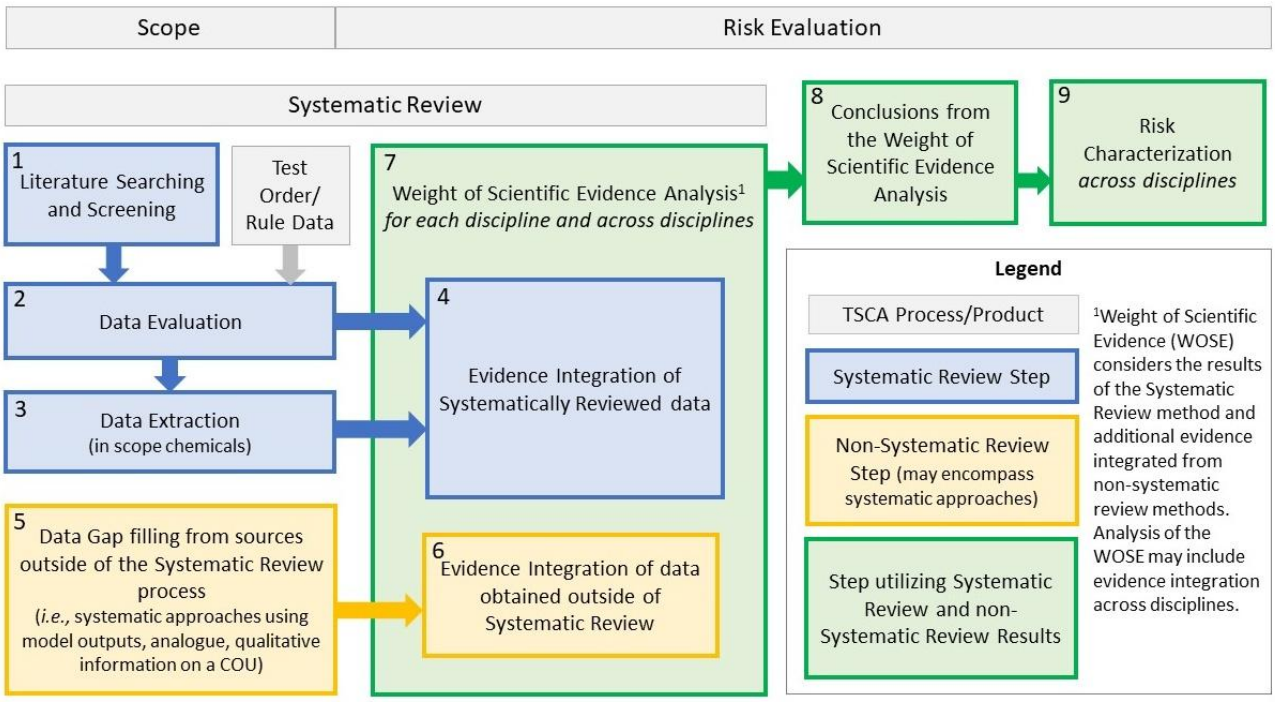

Figure 1-1. Overview of the TSCA Risk Evaluation Process with Identified Systematic Review Steps

The process complements the risk evaluation process in that it is used to develop the exposure and hazard assessments based on reasonably available information. EPA defines "reasonably available information" to mean information that the Agency possesses or can reasonably obtain and synthesize for use in risk evaluations, considering the deadlines for completing the evaluation (40 CFR 702.33).

2 CLARIFICATIONS AND UPDATES TO THE 2021 DRAFT SYSTEMATIC REVIEW PROTOCOL

In 2021, EPA released the Draft Systematic Review Protocol (U.S. EPA, 2021) with chemical-specific methodologies, a framework of systematic review approaches under TSCA, to address comments received on a precursor systematic review approaches framework, the *Application of Systematic Review in TSCA Risk Evaluations* (U.S. EPA, 2018). In April 2022, the Science Advisory Committee on Chemicals (SACC) provided comments on the 2021 Draft Systematic Review Protocol and additional comments on OPPT's systematic review approaches were garnered during the public comment period. In lieu of an update to the 2021 Draft Systematic Review Protocol, this chemical-specific systematic review protocol for the *Risk Evaluation for 1,2-Dichloroethane* (U.S. EPA, 2026n) describes some clarifications and different approaches that were implemented than those described in the 2021 Draft Systematic Review Protocol in response to (1) SACC comments, (2) public comments, or (3) to reflect chemical-specific risk evaluation needs.

2.1 Clarifications

The chemical-specific systematic review protocol is used to transparently document any updates or clarifications made to the systematic review process used for considering information identified for a given TSCA risk evaluation, as compared to those published in the Draft Systematic Review Protocol (U.S. EPA, 2021). Throughout the draft protocol, there were some terms used that were not explicitly defined, resulting in their different uses within the document (U.S. EPA, 2021). Table 2-1 lists the terms that were updated to resolve some of the confusion expressed by the public and the SACC comments regarding the implementation of the respective systematic review-related step. One main clarification is that *all references that undergo systematic review are considered for use in the risk evaluation*, even those that do not meet the various discipline and sub-discipline screening criteria or those that are categorized as supplemental information at title and abstract (TIAB) or full-text screening.

Section 4.2.5 of the 2021 Draft Systematic Review Protocol describes how data sources (*e.g.,* individual references, databases) may be tagged and linked when the same information is present in multiple publications (U.S. EPA, 2021). References will generally undergo data quality evaluation and extraction if there are data that pass screening criteria; however, to prevent the same data from being represented multiple times and conflating the amount of available data there is on a subject area, if two or more references contain the same data/information, EPA selects the reference(s) that most thoroughly describes the extractable data/information (indicated as the parent reference in DistillerSR). If two references portray the same data/information from the same dataset, only one is counted in the overall dataset while the other is no longer considered (*i.e.,* deduplication). If two references contain data/information about the same dataset, but one of those references only provides additional contextual information or summary statistics (*e.g.,* mean), both data sources are linked but the extractable data/information from both may be combined in DistillerSR. This enables the capture of key data/information while avoiding double-counting the data/information of interest. The linked reference containing most of the data/information, which are evaluated and extracted, is identified in DistillerSR as the parent or primary reference; the "complementary child reference" in DistillerSR does not undergo independent data evaluation and extraction but is evaluated and extracted in combination with the parent reference. Linking the references in DistillerSR allows the reference with more limited data/information or only contextual information to be tracked and utilized to evaluate the extracted data/information in the other related studies. The child reference may undergo data quality evaluation and extraction if there are additional unique and original data/information that passes screening criteria.

Section 4.5 of the 2021 Draft Systematic Review Protocol describes how data may be obtained using TSCA authorities and test orders. One update to that section is that in addition to requiring data reporting under TSCA sections 4 (test order), 8(a) (Chemical Data Reporting) and 8(d) (Health and Safety Data Reporting), *EPA may also require data reporting under TSCA section 8(c)* (Call-in of Adverse Reactions Records). Appendix 5.3 also describes how information may be submitted to EPA under other TSCA authorities (*e.g.,* TSCA sections 4, 5, 6, 8(d) and 8 (e), as well as FYI submissions).

Section 5 of the 2021 Draft Systematic Review Protocol describes how EPA conducts data quality evaluation of data/information sources considered for a respective chemical risk evaluation, with Section 5.2 specifically explaining the terminology used to describe both metric and overall data/information source quality determinations (U.S. EPA, 2021). To respond to both SACC and public comments regarding the inappropriate use of quantitative methodologies to calculate both "metric rankings" and "overall study rankings," *EPA decided to not implement quantitative methodologies to attain either metric and overall data/information source quality determinations* and therefore updated the terminology used for both metric ("metric ranking") and overall data/information source ("overall study ranking") quality determinations (Table 2-1) Subsequently terminology for both individual metric and overall information source quality determinations has been updated to "metric rating" and "overall quality determination," respectively. The word "level" was also often used synonymously and inconsistently with the word "ranking" in the 2021 Draft Systematic Review Protocol; that inconsistency has been rectified, resulting in the word "level" no longer being used to indicate either metric or overall data/information source quality determinations (U.S. EPA, 2021).

Sections 4.3.2.1.3 and 6 of the 2021 Draft Systematic Review Protocol describe when EPA may reach out to authors of data/information sources to obtain raw data or missing elements that are important to support the data evaluation and data integration steps (U.S. EPA, 2021). In such cases, the request(s) for additional data/information, number of contact attempts, and responses from the authors are documented. EPA's outreach is considered unsuccessful if those contacted do not respond to email or phone requests within 1 month of initial attempt(s) of contact. One important clarification to this guidance is that *EPA may reach out to authors anytime during the systematic review process for a given data/information source or reference, and that contacting authors does not explicitly happen during the data quality evaluation or extraction step.*

Table 2-1. Terminology Clarifications Between the 2021 Draft Systematic Review Protocol and the Draft Risk Evaluation for 1,2-Dichloroethane

2021 Draft Systematic Review Protocol Term	1,2-Dichloroethane Systematic Review Protocol Term Update	Clarification
"Title and abstract" or "title/abstract"	"Title and abstract"	To increase consistency, the term "title and abstract" will be used to refer to information specific to "title and abstract" screening.
Variations of how "include," "on topic" or "PECO[a]/PESO[b]/RESO[c] relevant" implied a reference was considered for use in the risk evaluation, whereas "exclude," "off topic" or	Meets/does not meet PECO/PESO/RESO screening criteria	The term "include" or "exclude" falsely suggests that a reference was or was not, respectively, considered in the risk evaluation. There was also confusion regarding whether "on topic" and "PECO[a]/PESO[b]/RESO[c] relevant" were synonymous and suggested those references were explicitly considered for use in the risk evaluation (and by default, "off topic" and "not PECO[a]/PESO[b]/RESO[c] relevant" references were not).

2021 Draft Systematic Review Protocol Term	1,2-Dichloroethane Systematic Review Protocol Term Update	Clarification
"not PECO/PESO/RESO relevant" implied a reference was *not* considered for use in the risk evaluation.		References that meet the screening criteria proceed to the next systematic review step; however, all references that undergo systematic review at any time are considered in the risk evaluation. Information that is categorized as supplemental or does not meet screening criteria are generally less relevant for quantitative use in the risk evaluation but may be considered if there is a data need identified. For instance, mechanistic studies are generally categorized as supplemental information at either title and abstract or full-text screening steps but may undergo the remaining systematic review steps if there is a relevant data need for the risk evaluation (*e.g.,* dose-response, mode of action).
Database source not unique to a chemical	Database	Updated term and definition of "Database": Data obtained from databases that collate information for the chemical of interest using methods that are reasonable and consistent with sound scientific theory and/or accepted approaches and are from sources generally using sound methods and/or approaches (*e.g.,* state or federal governments, academia). Example databases include STORET (STOrage and RETrieval) and the Massachusetts Energy and Environmental Affairs Data Portal. The term in the 2021 Draft Systematic Review Protocol (see Table_Apx N-1) incorrectly suggested that databases that contain information on a singular chemical are not considered (U.S. EPA, 2021). Furthermore, the wording "large" was removed to prevent confusion and the incorrect suggestion that there is a data size requirement for databases that contain information that may be considered for systematic review.
Metric ranking or level	Metric Rating	As explained above, EPA is not implementing quantitative methodologies to indicate metric quality determinations, therefore the term "ranking" is inappropriate. The term "level" was inconsistently used to indicate metric quality determinations previously; therefore, EPA is removing the use of this term to reduce confusion when referring to metric quality determinations. The term "Rating" is more appropriate to indicate the use of professional judgement to determine a quality level for individual metrics.
Overall study ranking or level	Overall Quality Determination (OQD)	As explained above, EPA is not implementing quantitative methodologies to indicate overall data/information source quality determinations, therefore the term "ranking" is inappropriate. The term

2021 Draft Systematic Review Protocol Term	1,2-Dichloroethane Systematic Review Protocol Term Update	Clarification
		"level" was inconsistently used to indicate overall data/information source quality determinations previously; therefore, EPA is removing the use of this term to reduce confusion when referring to overall data/information source quality determinations. The term "Rating" is more appropriate to indicate the use of professional judgement to determine a quality level for the overall data/information source quality determination.
Sub-discipline	No change in term	Sub-discipline explicitly indicates the two categories of receptor-based studies relevant to evaluate human health hazard (discipline): epidemiological (human receptor) or human health animal model toxicological studies (non-human animal receptor). Although environmental hazard is a discipline, Appendix T incorrectly suggested that environmental hazard is a sub-discipline in the 2021 Draft Systematic Review Protocol.
Evidence Stream	No change in term	Evidence streams were updated for both environmental and human health hazard disciplines to more appropriately categorize the hazardous endpoints that were considered. Please see additional descriptions of the evidence stream updates in Section 6.5 below.

[a] "PECO" stands for population, exposure, comparator or scenario, and outcomes.
[b] "PESO" stands for pathways or processes, exposure, setting or scenario, and outcomes.
[c] "RESO" stands for receptors, exposure, setting or scenario, and outcomes.

3 DATA SEARCH

As described in Section 4 of the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021), EPA conducts a comprehensive search for reasonably available information to support the TSCA risk evaluations. Chemical-specific literature searches are conducted as described in Section 4.2.1 of the 2021 Draft Systematic Review Protocol for all disciplines (*i.e.,* physical and chemical properties, fate, engineering, exposure, environmental hazard, and human health hazard) (U.S. EPA, 2021). Additional details on the chemical verification process, and the methodology used to search for chemical-specific peer-reviewed and gray literature are available in Sections 4.2 and 4.3 of the 2021 Draft Systematic Review Protocol, respectively (U.S. EPA, 2021). The search for peer-reviewed and gray literature relevant references was completed in September and May 2019, respectively. Appendix Section C.1.3 contains the specific search strings used to identify peer-reviewed literature on 1,2-dichloroethane (U.S. EPA, 2021). All reasonably available information submitted to EPA under TSCA authorities was considered.

An updated literature search for potential additional sources of information and data that might support the 1,2-dichloroethane risk evaluation was conducted in April 2025. Details for the updated literature search and consideration of the new information are described in Section 3.1 of this chemical-specific systematic review protocol.

3.1 Multi-Disciplinary Updates and Clarifications to the Data Search

For the *Risk Evaluation for 1,2-Dichloroethane* (U.S. EPA, 2026n), the literature search was conducted as described in Section 4 of the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021), where the peer-reviewed and gray literature updated search followed the approach outlined in Sections 4.2 and 4.3 of the 2021 Draft Systematic Review Protocol, respectively (U.S. EPA, 2021). Occasionally additional data sources relevant for the risk evaluation may be identified after the initial search for peer-reviewed and gray literature; these data sources will then undergo systematic review for the relevant discipline(s). Additionally, each discipline utilizes different strategies (*e.g.,* search strings) to attain their discipline-specific pools of data sources that undergo systematic review.

Updated Literature Search

An update to the peer-reviewed literature search to capture information published since September 2019 was performed in April 2025 to identify any potential additional data sources for environmental and human health hazard that might have been identified since the initial literature search was conducted in 2019 for 1,2-dichloroethane. Other disciplines considered to have sufficient information from the initial literature search in 2019 as well as additional sources (*e.g.,* assessor identified references, studies recommended by stakeholders) to support the *Risk Evaluation for 1,2-Dichloroethane* (U.S. EPA, 2026n) and did not proceed with an update to the peer-reviewed literature. Table 3-1 lists the details for the literature search strategies for 1,2-dichloroethane. To clarify, the literature search strategy as described in Section 4 of the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021) was the same for the initial search in 2019 as it was for the search in February 2025. For full transparency, the literature results in Table 3-1 indicate the number of references obtained during the initial search, the updated search, as well as the total number of references identified for 1,2-dichloroethane. The literature search strategies described in Table 3-1 are chemical-specific but discipline-agnostic. To identify discipline-specific pools of data sources for environmental and human health hazard that underwent systematic review, EPA applied discipline-specific strategies (*e.g.,* search strings). Details on the applied discipline-specific strategies and number of references identified for environmental and human health hazard as a result of the updated literature search are described in Section 3.6.

Table 3-1. Peer Literature Search Strategies for 1,2-Dichloroethane

Source	Search Strategy
ProQuest	TIAB("1,2-Dichloroethane" OR "ethylene dichloride" OR "107-06-2" OR "1,2-DCA" OR "Ethambutol hydrochloride" OR "Ethane, 1,2-dichloro-" OR "ethylene chloride" OR "1,2-dichloro ethane" OR "Dichloretan" OR "Ethylenedichloride" OR "1,2-DCE" OR "Dichloroethane, 1,2-" OR "sym-Dichloroethane" OR "Destruxol" OR "Brocide" OR "1,2-Dichlorethane" OR "Glycol dichloride" OR "Dutch oil" OR "ethane dichloride" OR "1,2-Ethylene dichloride" OR "1,2-Dichloroethan" OR "Freon 150")
PubMed	("1,2-Dichloroethane"[tw] OR "ethylene dichloride"[tw] OR "107-06-2"[rn] OR "1,2-DCA"[tw] OR "Ethambutol hydrochloride"[tw] OR "Ethane, 1,2-dichloro-"[tw] OR "ethylene chloride"[tw] OR "1,2-dichloro ethane"[tw] OR "Dichloretan"[tw] OR "Ethylenedichloride"[tw] OR "1,2-DCE"[tw] OR "Dichloroethane, 1,2-"[tw] OR "sym-Dichloroethane"[tw] OR "Destruxol"[tw] OR "Brocide"[tw] OR "1,2-Dichlorethane"[tw] OR "Glycol dichloride"[tw] OR "Dutch oil"[tw] OR "ethane dichloride"[tw] OR "1,2-Ethylene dichloride"[tw] OR "1,2-Dichloroethan"[tw] OR "Freon 150"[tw])
Scopus	TITLE-ABS({1,2-Dichloroethane} OR {ethylene dichloride} OR {107-06-2} OR {1,2-DCA} OR {Ethambutol hydrochloride} OR {Ethane, 1,2-dichloro-} OR {ethylene chloride} OR {1,2-dichloro ethane} OR {Dichloretan} OR {Ethylenedichloride} OR {1,2-DCE} OR {Dichloroethane, 1,2-} OR {sym-Dichloroethane} OR {Destruxol} OR {Brocide} OR {1,2-Dichlorethane} OR {Glycol dichloride} OR {Dutch oil} OR {ethane dichloride} OR {1,2-Ethylene dichloride} OR {1,2-Dichloroethan} OR {Freon 150})
WoS	TS=("1,2-Dichloroethane" OR "ethylene dichloride" OR "107-06-2" OR "1,2-DCA" OR "Ethambutol hydrochloride" OR "Ethane, 1,2-dichloro-" OR "ethylene chloride" OR "1,2-dichloro ethane" OR "Dichloretan" OR "Ethylenedichloride" OR "1,2-DCE" OR "Dichloroethane, 1,2-" OR "sym-Dichloroethane" OR "Destruxol" OR "Brocide" OR "1,2-Dichlorethane" OR "Glycol dichloride" OR "Dutch oil" OR "ethane dichloride" OR "1,2-Ethylene dichloride" OR "1,2-Dichloroethan" OR "Freon 150")
Literature Results	*Initial Search* – 7,477, *Update Search*: 1,498, *Total Literature*: 8,975

SWIFT-Review Validation

EPA received comments regarding the need for more details on using and validating SWIFT-Review to determine discipline-specific peer-reviewed reference sets considered for use in TSCA risk evaluations. In response to those comments, the Agency conducted validation exercises to clarify the search process and build consistency among all the disciplines. The 2021 Draft Systematic Review Protocol contains validation results for the use of SWIFT-Review to determine which peer-reviewed references may be relevant for the characterization of occupational exposure and environmental releases and general population, consumer, and environmental exposure for the respective chemical risk evaluations. However, to expand upon the information provided in the 2021 Draft Systematic Review Protocol, EPA validated references relevant for determining chemical-specific peer-reviewed reference sets for the characterization of physical and chemical properties, environmental fate and transport properties, and environmental and human health hazard. The Agency manually screened the references found in the overall peer-reviewed search results that did not undergo TIAB screening (*i.e.,* references that were not identified using a discipline-specific search string). If a reference that did not undergo further review after TIAB screening was found to meet the screening criteria for a respective discipline (*e.g.,* data needs on physical chemical properties, environmental fate and transport properties, and environmental and human health hazard) and identified for the chemical of interest, it was flagged as a false negative. This analysis validated and verified the use of the search terms in SWIFT-Review, as it showed that less than five percent of references were false negatives across all three disciplines. This method was repeated for several of the TSCA High Priority Substances to build confidence in the discipline-specific search strings.

Supplemental Search for Dermal Absorption Data

Dermal absorption studies are needed to accurately assess dermal exposure associated with specific conditions of use. Typically, dermal absorption studies are identified as supplemental studies within the

human health hazard discipline using the hazard PECOs presented in Appendix H of the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021). However, dermal absorption data may not meet the screening criteria for other disciplines; these criteria are also presented in Appendix H of U.S. EPA (2021).

To identify any additional studies not found during hazard screening that might be potentially relevant for characterizing dermal absorption and exposure, EPA developed a key word list (identified as a search string in Section 3.7.1 below) and used SWIFT-Review to search/filter the data sources that were previously identified in the 1,2-dichloroethane chemical search conducted in 2019. EPA followed processes described in the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021): Section 4.2.2 outlines when EPA uses supplemental searching and filtering; and Section 4.2.4 presents the process of using SWIFT-Review to filter data sources identified in the initial chemical search.

Additional Gray Literature Sources

Physical and Chemical Properties: In addition to the gray literature sources listed in Appendix E of the 2021 Draft Systematic Review Protocol, an additional database was added to the list of gray literature sources for physical and chemical properties. The National Institutes for Standards and Technology (NIST) Chemistry Webbook was searched in September 2021 to capture spectroscopic data, specifically ultraviolet and visible absorption (UV-Vis) data, if recorded. This source may also provide thermodynamic data that informs chemical stability and behavior under various conditions.

General Population, Consumer, and Environmental Exposure: In addition to the gray literature sources listed in Appendix E of the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021), three additional sources were added in April 2023 to capture database outputs from several governmental sources. All three datasets were accessed directly and uploaded into HERO. EPA used data it collected in support of compliance with the Safe Drinking Water Act. This includes data for 1,2-dichloroethane collected pursuant to the Agency's Six-Year Review 3 (SYR 3) of Drinking Water, which includes national compliance monitoring data. EPA also downloaded data from the Centers for Disease Control and Prevention's National Health and Nutrition Examination Survey (NHANES) as well as the Water Quality Portal (WQP), the latter results from a collaboration between EPA, the U.S. Geological Survey, and the National Water Quality Monitoring Council.

Because the literature pool for many chemicals, including 1,2-dichloroethane, includes a record from EPA's STORET database, which has been retired, EPA downloaded all the data for this chemical from the WQP, the successor database that now contains data from STORET. This data was uploaded into HERO and added to the literature pool that is considered for systematic review. In addition, to obtain information on 1,2-dichloroethane exposures to the U.S. population, EPA added data from NHANES to its literature pool. At the time of download, the table with data for 1,2-dichloroethane available from CDC was "Analysis of Whole Blood, Serum, and Urine Samples, NHANES 1999–2018."

3.2 Physical and Chemical Properties

The searches for peer-reviewed and gray literature are as described in Sections 4.2 and 4.3, respectively, in the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021). Specifically, SWIFT-Review was used to identify peer-reviewed references that are predicted to be the most relevant for evaluating physical and chemical properties for 1,2-dichloroethane. The search string used for physical and chemical properties in SWIFT-Review was developed by EPA's ORD in collaboration with Sciome and is presented in Appendix G, Section G-1, Table_Apx G-1 of the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021). As mentioned above in Section 3.1, the search string used to identify potentially relevant peer-reviewed data references for evaluation of the physical and chemical properties of 1,2-

dichloroethane were validated. When the search string terms are identified in the title, abstract or as a keyword of a given reference in SWIFT-Review, those references proceed with title and abstract screening.

3.3 Environmental Fate and Transport Properties

The searches for peer-reviewed and gray literature are as described in Sections 4.2 and 4.3, respectively, in the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021). Specifically, SWIFT-Review was used to identify peer-reviewed references that are predicted to be the most relevant for evaluating environmental fate and transport properties for 1,2-dichloroethane. The search string used for environmental fate and transport literature in SWIFT-Review was developed by EPA's Office of Research and Development in collaboration with Sciome and is presented in Appendix G, Section G.2, Table_Apx G2 of the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021). As mentioned above in Section 3.1, the search string used to identify potentially relevant peer-reviewed data references for evaluation of the environmental fate and transport properties of 1,2-dichloroethane were validated. When the search string terms are identified in the title, abstract or as a keyword of a given reference in SWIFT-Review, those references proceed with TIAB screening.

3.4 Environmental Release and Occupational Exposure

The searches for peer-reviewed and gray literature are as described in Sections 4.2 and 4.3, respectively, in the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021). Specifically, SWIFT-Review was used to identify peer-reviewed references that are predicted to be the most relevant for evaluating environmental release and occupational exposure for the *Risk Evaluation for 1,2-Dichloroethane* (U.S. EPA, 2026n). As described in Sections 4.2.4.2 of the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021), EPA identified on-topic and off-topic references from the broad search results of the 1,2-dichloroethane peer-reviewed literature as positive and negative "seeds" to classify which references contained environmental release and occupational exposure to prioritize for further review. When the relevant references were identified in SWIFT Review, those references proceeded with title and abstract screening.

3.5 General Population, Consumer, and Environmental Exposure

The peer-reviewed and gray literature searches for general population, consumer, and environmental exposure are as described in Sections 4.2 and 4.3, respectively, in the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021). Specifically, SWIFT-Review was used to identify peer-reviewed references that are predicted to be the most relevant for evaluating general population, consumer, and environmental exposures to 1,2-dichloroethane. As described in Sections 4.2.4.2 of the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021), EPA identified on-topic and off-topic references from the broad search results of the peer-reviewed literature as positive and negative "seeds" to classify which references on general population, consumer, and environmental exposures to prioritize for further review. As noted in Section 3.1, three additional references were added to the literature search protocol to capture database data from the WQP, NHANES, and SYR 3. The database data were compared to other database and monitoring data found during the literature search to ensure no duplication of data. A record from a predecessor database to Water Quality Portal, EPA's STORET database, that was found during the literature search was not counted as a separate reference, to avoid double-counting data. There were no other changes to the process identified in the 2021 Draft Systematic Review Protocol for information considered for the evaluation of general population, consumer, and environmental exposure to 1,2-dichloroethane (U.S. EPA, 2021).

3.6 Environmental and Human Health Hazard

The searches for peer-reviewed and gray literature are as described in Sections 4.2 and 4.3, respectively, in the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021). Specifically, SWIFT-Review was used to identify peer-reviewed references that are predicted to be the most relevant for evaluating environmental and human health hazard for 1,2-dichloroethane. Specifically, search strings were developed for the two hazard disciplines by EPA's Office of Research and Development (ORD) in collaboration with SWIFT-Review developer, Sciome. As mentioned above in Section 3.1, the search string used to identify potentially relevant peer-reviewed data references for evaluation of the environmental and human health hazard of 1,2-dichloroethane were validated. When the search string terms are identified in the title, abstract or as a keyword of a given reference in SWIFT-Review, then those references proceed with TIAB screening. The environmental and human health hazard search strings are provided online (accessed September 3, 2025).

As described in Sections 6.5.1 and 6.5.2, data needs were identified during evidence integration, where information from sources that either did or did not undergo systematic review on 1,2-dichloroethane was considered.

An additional check was performed during evidence integration to make sure that all relevant epidemiology literature on 1,2-dichloroethane was obtained during the literature search. This check involved reviewing the ATSDR Toxicological Profile for 1,2-Dichloroethane and the EPA Provisional Peer-Reviewed Toxicity Values for 1,2-dichloroethane for epidemiology references and crosschecking those reference lists with the references obtained from the initial literature search on 1,2-dichloroethane. Through this check, it was determined that 22 potentially relevant epidemiology references had not been captured by the initial literature search. These 22 references were put through TIAB screening and subsequent systematic review steps if they met screening criteria.

In response to public comments between the draft and final risk evaluation for 1,2-dichloroethane, ten additional animal toxicity studies (HERO IDs 5431770, 7697643, 7697651, 10065280, 10190107, 18158, 10065941, 12815808, 12815852, 12815856) were considered to inform potential human health hazard. These 10 studies were screened to determine if they met the PECO screening criteria as described in Section 4.6.

Also, in response to public comments between the draft and final risk evaluation for 1,2-dichloroethane, four additional epidemiology studies (HERO IDs 4821835, 12833880, 9089870, and 7714001) were considered in assessing human health hazard. These four studies were screened to determine whether they met the PECO screening criteria for epidemiology studies as described in Section 4.6 of this systematic review protocol. All four references met the full text PECO screening criteria. Therefore, data quality evaluation and extraction were conducted for these additional references.

In addition to the references identified through the ATSDR Toxicological Profile and EPA Provisional Peer-Reviewed Toxicity Values as well as references recommended by SACC and received through public comments, an update to the peer-reviewed literature search to capture information published since September 2019 was performed in April 2025 to identify any potential additional data sources for environmental and human health hazard for 1,2-dichloroethane as described in Section 3.1. The literature search performed in April 2025 utilized the same search strategy as in the initial literature search in 2019 with a minor revision to improve an epidemiological information filter that is part of the standard filter set for human health hazard. Then, the results from the search strategy went through an additional round of a series of specific search strategies to identify information to be considered for the evaluation of environmental hazard.

For epidemiologic information, the improved filter aimed to increase the sensitivity of the search for epidemiologic quantitative analysis information. For environmental hazard information, the specific search strategies were utilized to prioritize specific needs and/or to fill data gaps. The priority for environmental hazard was to identify sources for the risk evaluation of 1,2-dichloroethane reporting algae, avian, benthic, and plant data. Details on the improved filter for epidemiologic quantitative analysis information and the series of specific search strategies applied to identify environmental hazard for the updated literature search performed in April 2025 are listed in Table_Apx A-1. All together (environmental hazard, epidemiologic, and animal model data relevant to human health hazard), EPA identified a total of 176 additional sources from the updated peer-reviewed literature search for hazard for 1,2-dichloroethane. Out of the 176 references, the improved filter for epidemiologic quantitative analysis and the series of specific search strategies for environmental hazard resulted in the identification of 85 references. All additional sources were screened as described in Section 4.6. Most of the references that were identified during the updated literature search had already been identified via the additional sources (*i.e.*, ATSDR and EPA Provisional Peer-Reviewed Toxicity Values check, SACC, and public comments).

3.7 Dermal Absorption

As explained above in Section 3.1, EPA used a key word list (search string) to filter the literature identified in the 2019 1,2-dichloroethane search to find potentially relevant information for the characterization of dermal absorption of 1,2-dichloroethane. The search string is listed below (Section 3.7.1).

3.7.1 Dermal Absorption Search String

("Dermal flux" OR "Skin flux" OR "Dermal penetration" OR "Skin penetration" OR "Dermal absorption fraction" OR "Absorption fraction" OR "Neat Kp" OR "Aqueous Kp" OR "Kp" OR "Skin permeability coefficient" OR "Permeability coefficient" OR "Skin permeation coefficient" OR "Permeation coefficient" OR "Skin permeation" OR "Skin absorption" OR "Dermal absorption" OR "Dermal permeation" OR "OECD 427" OR "OECD 428").

4 DATA SCREENING

Sections 4.2.5 and 4.3.2 of the 2021 Draft Systematic Review Protocol describe how TIAB and full-text screening respectively, are conducted to identify references that may contain relevant information for use in risk evaluations under TSCA using discipline-specific screening criteria (U.S. EPA, 2021). Specifically, TIAB screening efforts may be conducted using the specialized web-based software programs DistillerSR[1] and SWIFT-Active-Screener,[2,3] and the below sub-sections will describe whether TIAB screening was done manually in DistillerSR or utilized machine learning to help prioritize reference screening in SWIFT-Active-Screener. Additional details on how SWIFT Active-Screener utilizes a machine-learning algorithm to automatically compute which unscreened documents are most likely to be relevant[4] are available in Section 4.2.5 of the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021). During TIAB screening, if it was unclear whether a reference met the screening criteria (*e.g.,* PECO/RESO/PESO statements) without having the full reference to review, or if a reference was determined to meet the screening criteria, that reference advanced to full-text screening if the full reference could be retrieved and generated into a Portable Document Format (PDF).

Literature inventory trees were introduced in the scoping process for the risk evaluations that began systematic review in 2019 in response to comments received from the SACC and public to better illustrate how references underwent various systematic review steps (*e.g.,* TIAB and FT screening). As explained in Section 2.1.2 of the *Final Scope of the Risk Evaluation for 1,2-Dichloroethane; CASRN: 107-06-2* (U.S. EPA, 2020), literature inventory trees demonstrate how references that meet screening criteria progress to the next systematic review step. EPA used the Health Assessment Workplace Collaborative (HAWC) tool to develop web-based literature inventory trees that enhance the transparency of the decisions resulting from the screening processes.

Additional references that EPA has obtained via public comments and other sources were also considered in the systematic review process and are reflected in the interactive Health Assessment Workplace Collaborative[5] (HAWC) hyperlinks available in the figure captions below each respective literature inventory tree. The web-based interactive literature inventory trees in HAWC also allow users to directly access the references in the Health & Environmental Research Online (HERO) database (more details available in Section 1 of the 2021 Draft Systematic Review Protocol). Instructions for accessing information about references and data sources in each node via HERO are available in HAWC for each respective literature inventory tree. Each node indicates whether a reference has met screening criteria at different screening steps and/or contains types of content that may be discerned at that respective systematic review step (U.S. EPA, 2021). Furthermore, the sum of the numbers for the various nodes in the literature inventory trees may be smaller or larger than the preceding node because

[1] As noted on the DistillerSR web page (accessed September 3, 2025), this systematic review software "automates the management of literature collection, triage, and assessment using AI and intelligent workflows...to produce transparent, audit ready, and compliant literature reviews." EPA uses DistillerSR to manage the workflow related to screening and evaluating references; the literature search is conducted external to DistillerSR.

[2] SWIFT-Active Screener is another systematic review software that EPA is adopting in the TSCA systematic review process. From Sciome's SWIFT-Active Screener (accessed September 3, 2025) web page: "As screening proceeds, reviewers include or exclude articles while an underlying statistical model in SWIFT-Active Screener automatically computes which of the remaining unscreened documents are most likely to be relevant. This 'Active Learning' model is continuously updated during screening, improving its performance with each reference reviewed. Meanwhile, a separate statistical model estimates the number of relevant articles remaining in the unscreened document list."

[3] SWIFT is an acronym for "*Sciome Workbench for Interactive Computer-Facilitated Text-mining.*" SWIFT-Active Screener uses machine learning approaches to save screeners' time and effort.

[4] Description comes from the SWIFT-Active Screener (accessed September 3, 2025) web page.

[5] EPA HAWC (accessed March 10, 2026) is an application that allows to record and share the results of the systematic literature search, data extraction, and analyses that can then be publicly accessed online.

some studies may have unclear relevance or be relevant for many categories of information. The screening process for each discipline varies and the nodes in the literature inventory tree indicate the screening decisions determined for each reference and whether specific content could be determined; if no references had a specific screening decision and/or contained specific content relevant for a respective discipline, a node will not be present on the literature tree to depict this.

Occasionally some references or data sources are identified in the literature search because of the availability of the title and abstract; however, EPA may not be able to always locate the entire or original version. Therefore, references or data sources that meet TIAB screening criteria may be unattainable for full-text screening. The "PDF not available" node within the literature inventory tree refers to references that were identified in the literature search, but which EPA was unable to obtain the entire reference or source of information.

Although all information contained in references that enter systematic review is considered for use in the risk evaluation, the references that satisfy the screening criteria are generally deemed to contain the most relevant and useful information for characterizing the uses of, exposure to, and hazard associated with a chemical of interest and are generally utilized in the risk evaluation (and can be used later on to identify further data needs). On the other hand, data or information sources that do not satisfy the screening criteria outlined below may undergo data quality evaluation and extraction should a data need arise for the risk evaluation.

4.1 Multi-Disciplinary Updates and Clarifications to the Data Screening

As stated above in Section 1, all references that are found in the initial chemical-specific searches are considered for use in the respective chemical risk evaluation. Previously Section 4.2.5 of the 2021 Draft Systematic Review Protocol explained that references tagged as potentially having supplemental information may be considered for data quality evaluation and extraction. However, one clarification to that description is that even references that are tagged as not meeting TIAB or full-text screening criteria (*e.g.,* PECO/PESO/RESO) for a respective discipline or sub-discipline may also undergo additional screening to meet information needs that were not stated in the original screening criteria and be considered for data quality evaluation and extraction, should there be additional relevant information that may not have met the original screening criteria.

4.2 Physical and Chemical Properties

During data screening, EPA followed the process described in Appendix H, Section H-1 of the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021), to conduct title and abstract and full-text screening for 1,2-dichloroethane guided by the data or information needs on various physical and chemical properties or endpoints as listed in Table_Apx H-1 of the draft protocol. The same screening criteria was used during TIAB and FT screening for references considered for the evaluation of physical and chemical properties of 1,2-dichloroethane. Title and abstract screening was performed using SWIFT Active-Screener. Upon meeting screening criteria during full-text screening, data or information sources then undergo data quality evaluation and extraction. Figure 4-1 presents the number of references that report general physical and chemical property information that fulfilled the data needs for 1,2-dichloroethane and passed these criteria for TIAB and FT screening.

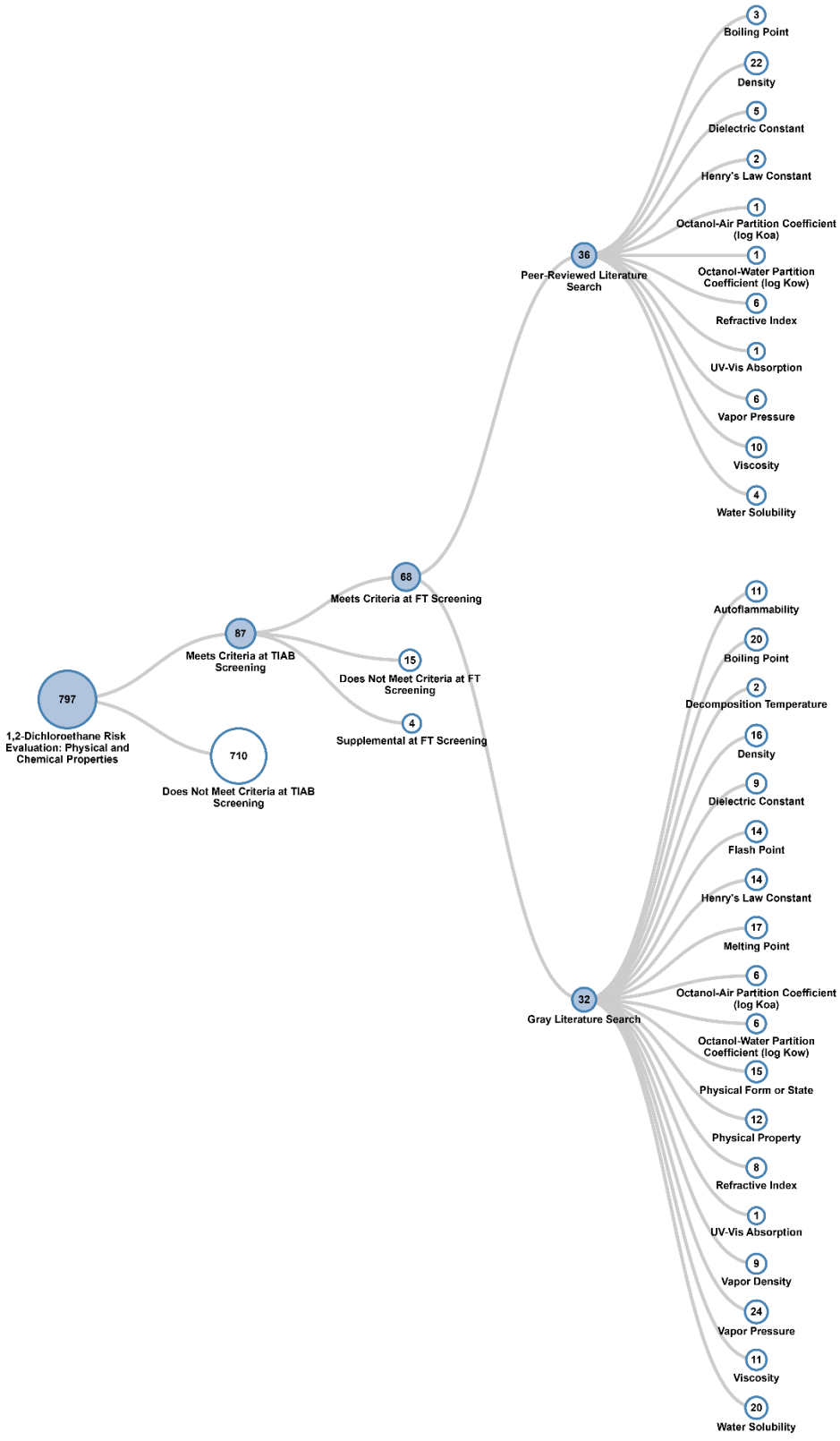

Figure 4-1. Literature Inventory Tree – Physical and Chemical Properties for 1,2-Dichloroethane
View the interactive literature inventory tree in HAWC. Data in this figure represent all references obtained from the publicly available databases and gray literature references searches that were included in systematic review as of February 26, 2026. Some studies may be found through multiple searches and may have more than one source tag in HERO.

4.3 Environmental Fate and Transport Properties

During data screening, EPA followed the process described in Appendix H, Section H-2 of the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021), to conduct TIAB and FT screening for 1,2-dichloroethane literature search results, as guided by the PESO statement. PESO stands for **P**athways or **P**rocesses, **E**xposure, **S**etting or **S**cenario, and **O**utcomes (see Table_Apx H-2 in 2021 Draft Systematic Review Protocol). The same PESO screening criteria was used during TIAB and FT screening for references considered for the evaluation of environmental fate and transport properties of 1,2-dichloroethane. TIAB screening was performed using SWIFT Active-Screener. Data or information sources that comply with the screening criteria specified in the PESO statement then undergo data quality evaluation and extraction. Figure 4-2 presents the number of references that report chemical-specific fate processes and endpoints, or environmental and exposure pathways that passed PESO screening criteria at TIAB and FT screening.

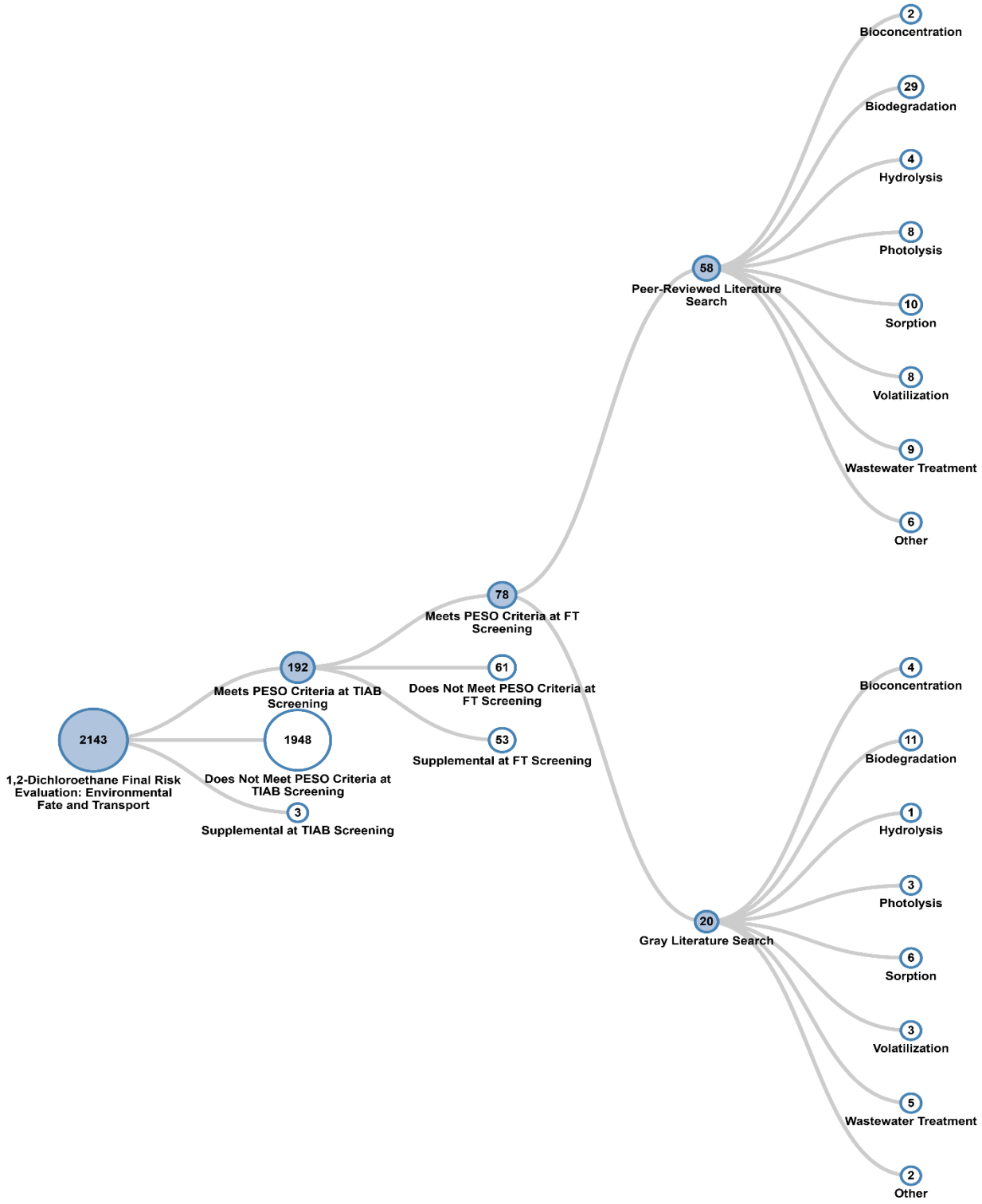

Figure 4-2. Literature Inventory Tree – Fate Properties for 1,2-Dichloroethane
View the interactive literature inventory tree in HAWC (accessed September 3, 2025). Data in this figure represent all references obtained from the publicly available databases and gray literature references searches that were included in systematic review as of December 23, 2025. Additional data may be added to the interactive version as they become available.

4.4 Environmental Release and Occupational Exposure

During data screening, EPA followed the process described in Appendix H, Section H.3 of the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021), to conduct title and abstract, and full-text screening for 1,2-dichloroethane literature search results, as guided by the RESO statement. RESO stands for **R**eceptors, **E**xposure, **S**etting or Scenario, and **O**utcomes. The same RESO statement was used during title and abstract, and full-text screening for references considered for the evaluation of environmental release and occupational exposure information for 1,2-dichloroethane. Title and abstract screening were performed using SWIFT Active-Screener. Data or information sources that comply with the screening criteria specified in the RESO statement then undergo data quality evaluation and extraction. Figure 4-3 presents the number of references that report general engineering data, environmental release, and occupational exposure data that passed RESO screening criteria at title and abstract, and full-text screening.

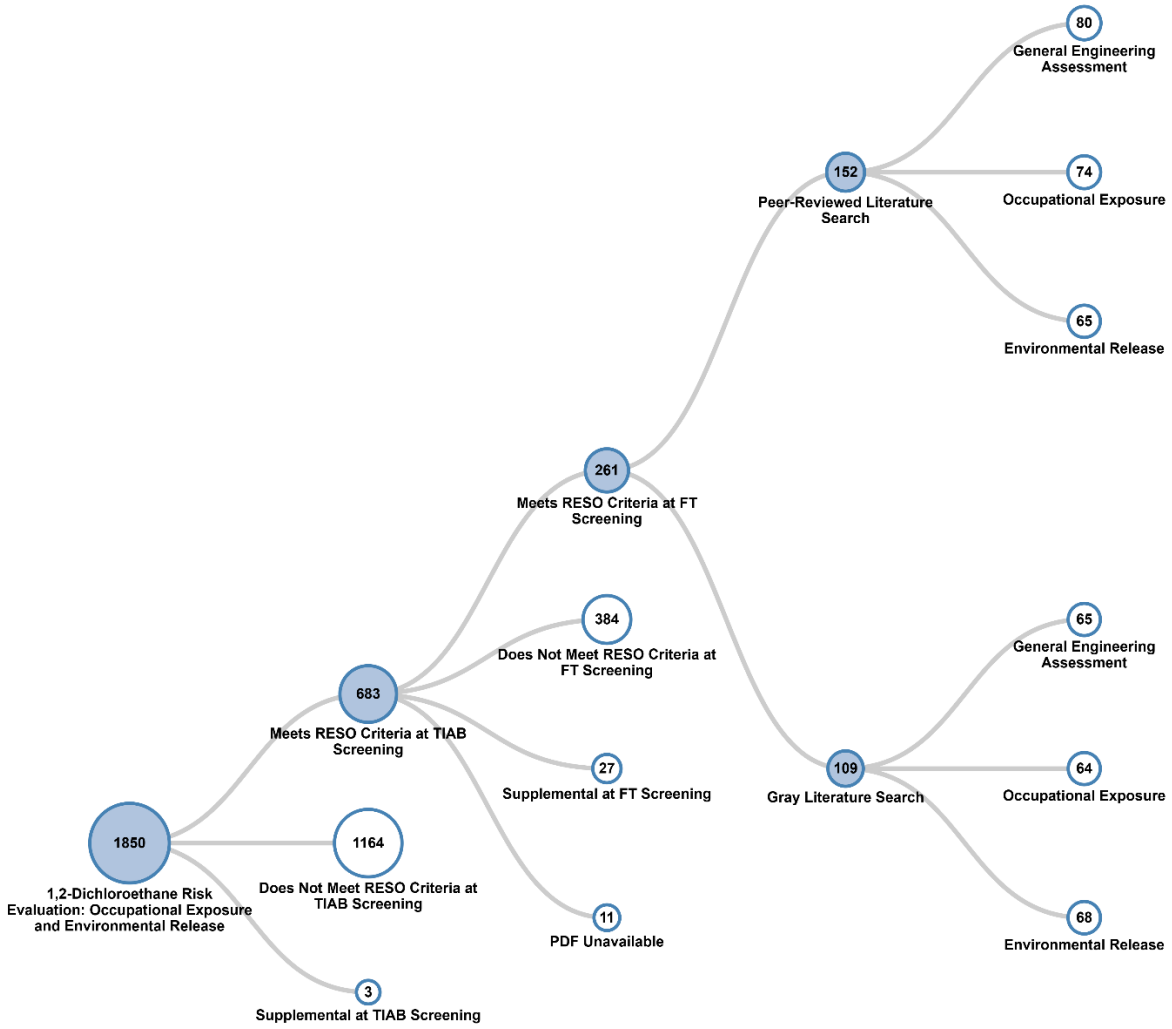

Figure 4-3. Literature Inventory Tree – Environmental Release and Occupational Exposure for 1,2-Dichloroethane

View the interactive literature inventory tree in HAWC. Data in this figure represents all references obtained from the publicly available databases and gray literature references searches that were included in systematic review as of April 17, 2026. Additional data may be added to the interactive version as they become available.

4.5 General Population, Consumer, and Environmental Exposure

During data screening, EPA followed the process described in Appendix H.4 of the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021), to conduct TIAB and full-text screening for 1,2-dichloroethane literature search results, as guided by the PECO statement. PECO stands for **P**opulation, **E**xposure, **C**omparator or Scenario, and **O**utcomes for Exposure Concentration or Dose. The same PECO statement was used during TIAB and full-text screening for references considered for the evaluation of general population, consumer, and environmental exposure information for 1,2-dichloroethane. TIAB screening was performed using SWIFT Active-Screener. Figure 4-4 presents the number of references that report general population, consumer, and environmental exposure data that passed PECO screening criteria at TIAB and full-text screening.

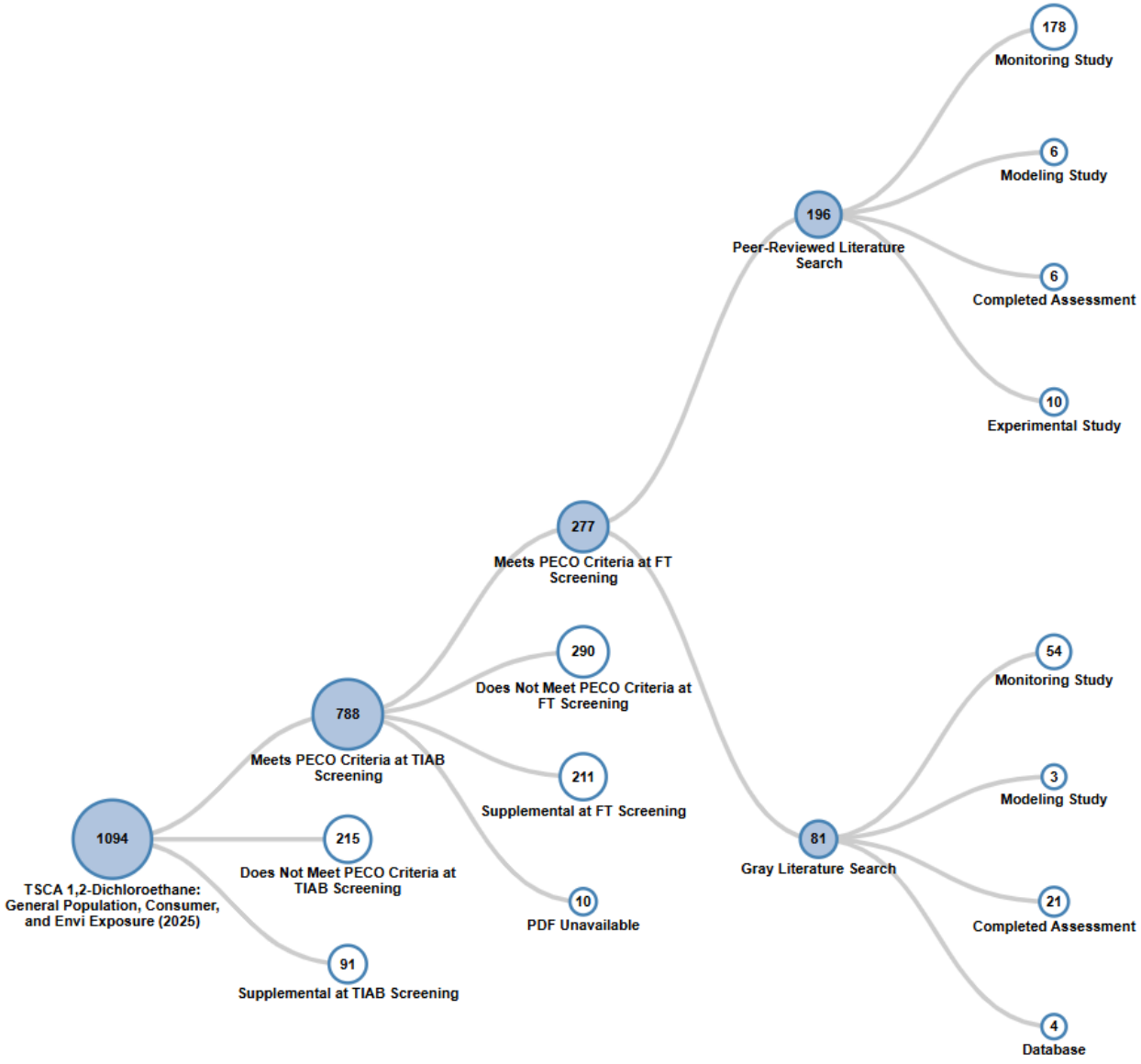

Figure 4-4. Literature Inventory Tree – General Population, Consumer and Environmental Exposure Search Results for 1,2-Dichloroethane

View the interactive literature inventory tree in HAWC (accessed April 27, 2026). Data in this figure represent all references obtained from the publicly available databases and gray literature references searches that were included in systematic review as of September 15, 2023. Additional data may be added to the interactive version as they become available.

4.6 Environmental and Human Health Hazard

During data screening, EPA followed the process described in Section 4.2.5 and Appendix H.5.2 of the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021), to conduct TIAB and full-text screening for 1,2-dichloroethane literature search results, as guided by the PECO statement. PECO stands for **P**opulation, **E**xposure, **C**omparator or Scenario, and **O**utcomes. The same PECO statement was used to screen references identified in the initial search in September 2019, the updated search in April 2025, and via additional sources (*i.e.*, ATSDR and EPA Provisional Peer-Reviewed Toxicity Values check, SACC, and public comments). Also, the same PECO statement was used during TIAB and full-text screening for references considered for the evaluation of environmental and human health hazard resulting from exposure to 1,2-dichloroethane. With respect to TIAB screening, EPA utilized machine learning to help prioritize reference screening in SWIFT-Active-Screener. Full-text screening occurred in DistillerSR for references that either met the PECO screening criteria or if it was unclear to the Agency whether the reference would meet the PECO screening criteria based on the information available in the title and abstract. Figure 4-5 presents the number of references that report environmental and human health hazard data that passed PECO screening criteria at TIAB and full-text screening.

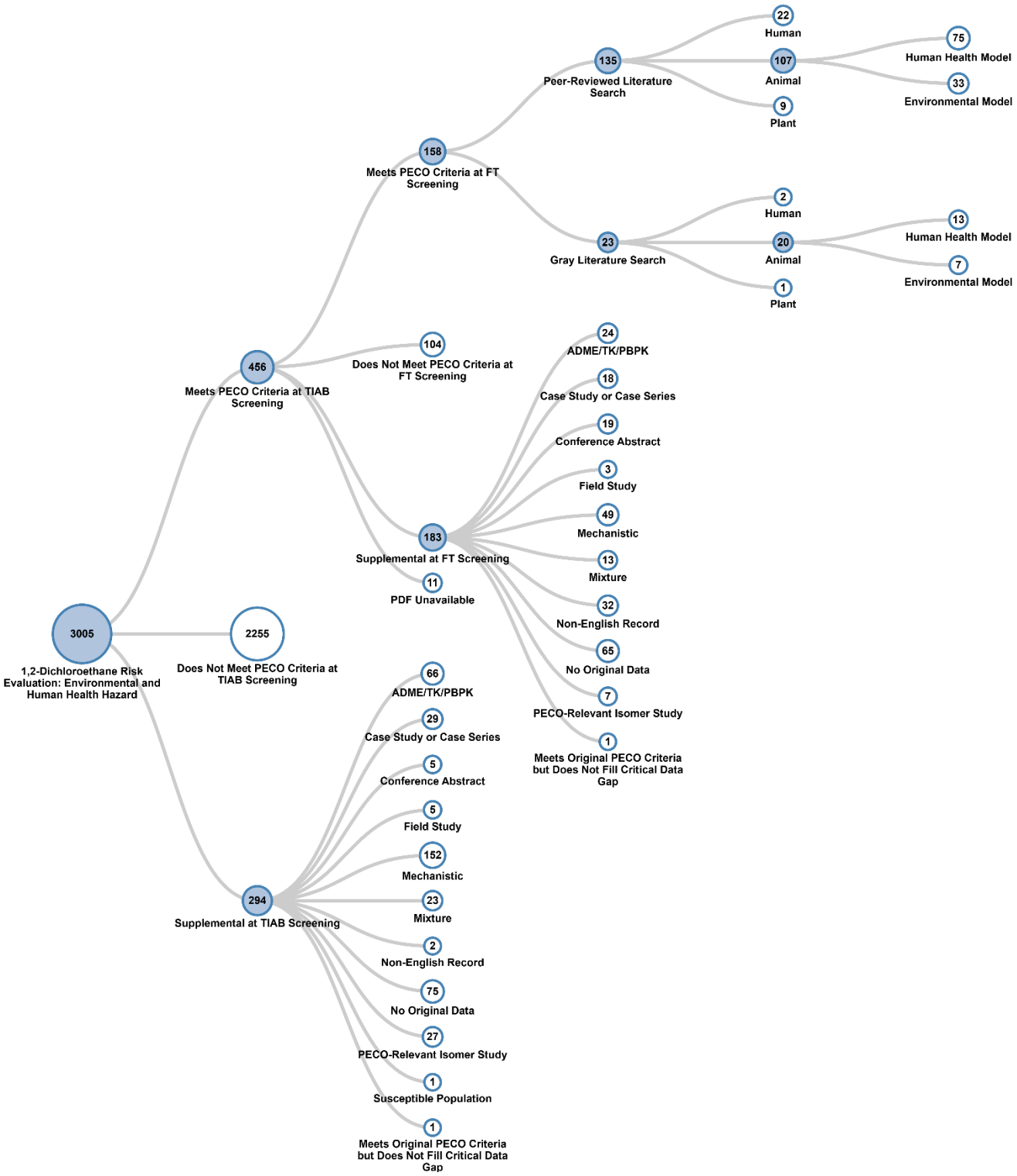

Figure 4-5. Literature Inventory Tree – Environmental and Human Health Hazard for 1,2-Dichloroethane

View the interactive literature inventory tree in HAWC (accessed April 7, 2026). Data in this figure represents all references obtained from the publicly available databases and gray literature references searches that were included in systematic review as of March 25, 2026. Additional data may be added to the interactive version as they become available.

As described in Section 3.4, an update to the peer-reviewed literature search to capture information published since September 2019 was performed in May 2025, and EPA identified 176 new additional sources of data. Of the new additional sources of data that EPA identified for 1,2-dichloroethane from the updated peer-reviewed literature search for environmental and human health hazard information, 176 references went through TIAB screening. Of these 176 references, 20 references met the PECO screening criteria during TIAB screening or were unclear to EPA whether the reference met the PECO screening criteria and proceeded to full-text screening. Upon completion of full-text screening, EPA identified 7 references (HERO IDs: 3634375, 7697647, 10065941, 12815808, 12815852, 12815856, and 12833880) that met the full-text screening criteria and moved to the data evaluation and extraction step of the systematic review process.

4.7 Dermal Absorption

EPA developed a PECO statement (Table 4-1) to conduct both TIAB and full-text screening of references considered for the evaluation of dermal absorption resulting from 1,2-dichloroethane exposure. EPA used

Table 4-2 to identify supplemental studies that may also inform dermal absorption and exposure for 1,2-dichloroethane. Each reference was manually screened by two reviewers at the TIAB and full-text screening steps or only at full-text, as relevant for the type of data source (peer reviewed vs. gray). Figure 4-6 presents the outcome of applying the search strings presented in Section 3.7.1 and the PECO screening criteria below.

Table 4-1. PECO Statement for Dermal Exposure References for 1,2-Dichloroethane

PECO Element	Evidence
P	Tests of the single toxicants on *ex vivo* tissues (including permeation and retention studies) or on live, whole, taxonomically verifiable organisms are included. **Human:** Any population and life stage (occupational or general population, including children and other sensitive populations). **Animal:** All human health models, including (but not limited to) rat, mouse, rabbit, dog, hamster, guinea pig, cat, non-human primate, and pig. **Supplemental:** Tests using 3D human skin equivalent/reconstructed tissue models (*e.g.,* EpiDerm, EPISKIN) or any other *in vitro* systems are considered supplemental.
E	**Human and Animal:** Any quantified dermal exposure to 1,2-dichloroethane (CASRN 107-06-2) either alone or in a vehicle, including exposure that occurs *in vivo* or *ex vivo* for any duration. Studies are included only if exposure is intentional and quantified. If exposure is not intentional and is not experimentally controlled, the study is excluded. For example, studies of absorption in workers will be excluded, even if exposure has been quantified. Studies assessing exposures to mixtures (*i.e.,* containing substances other than a vehicle) will be included only if they also contain an exposure or treatment group assessing the chemical of interest alone or in aqueous solution. **Supplemental:** *In vitro* exposures and/or studies in which exposure occurs only to a mixture containing one or more of the chemicals of interest.
C	**Human and Animal:** Any or no comparison group.
O	**Human and Animal:** Any quantitative assessment of the rate or extent of dermal absorption of the substance. Measurements may include the amount of substance that has passed through the skin, or was retained in the skin, distributed within the organism (*e.g.,* blood and tissue concentrations), and/or excreted by the organism (*e.g.,* through urine, feces, or expired air). Absorption may be measured directly (by chemical analysis for the substance and/or its metabolites) or indirectly (*e.g.,* measurement of radioactivity if using a radio-labelled test substance). Absorption may be

PECO Element	Evidence
	quantified via determination of percent absorption, dermal/penetrative flux rate, or dermal penetration coefficient (Kp).

Table 4-2. Major Categories of "Potentially Relevant Supplemental Material"

Category	Evidence
In vitro studies	Tests using 3D human skin equivalent/reconstructed tissue models (*e.g.,* EpiDerm, EPISKIN) or any other *in vitro* systems.
Mixture studies	Experimental mixture studies that are not considered PECO-relevant because they do not contain an exposure or treatment group assessing only the chemical of interest, but that otherwise meet PECO criteria.
Non-English records	Non-English records that appear to meet PECO criteria.
Records with no original data	Records that do not contain original data, such as other agency assessments, informative scientific literature reviews, editorials, or commentaries that would otherwise meet PECO criteria. This also includes studies of dermal exposure/risk/modeling that may cite dermal absorption studies.
Conference abstracts	Records that would otherwise meet PECO criteria, but do not contain sufficient documentation to support study evaluation and data extraction.

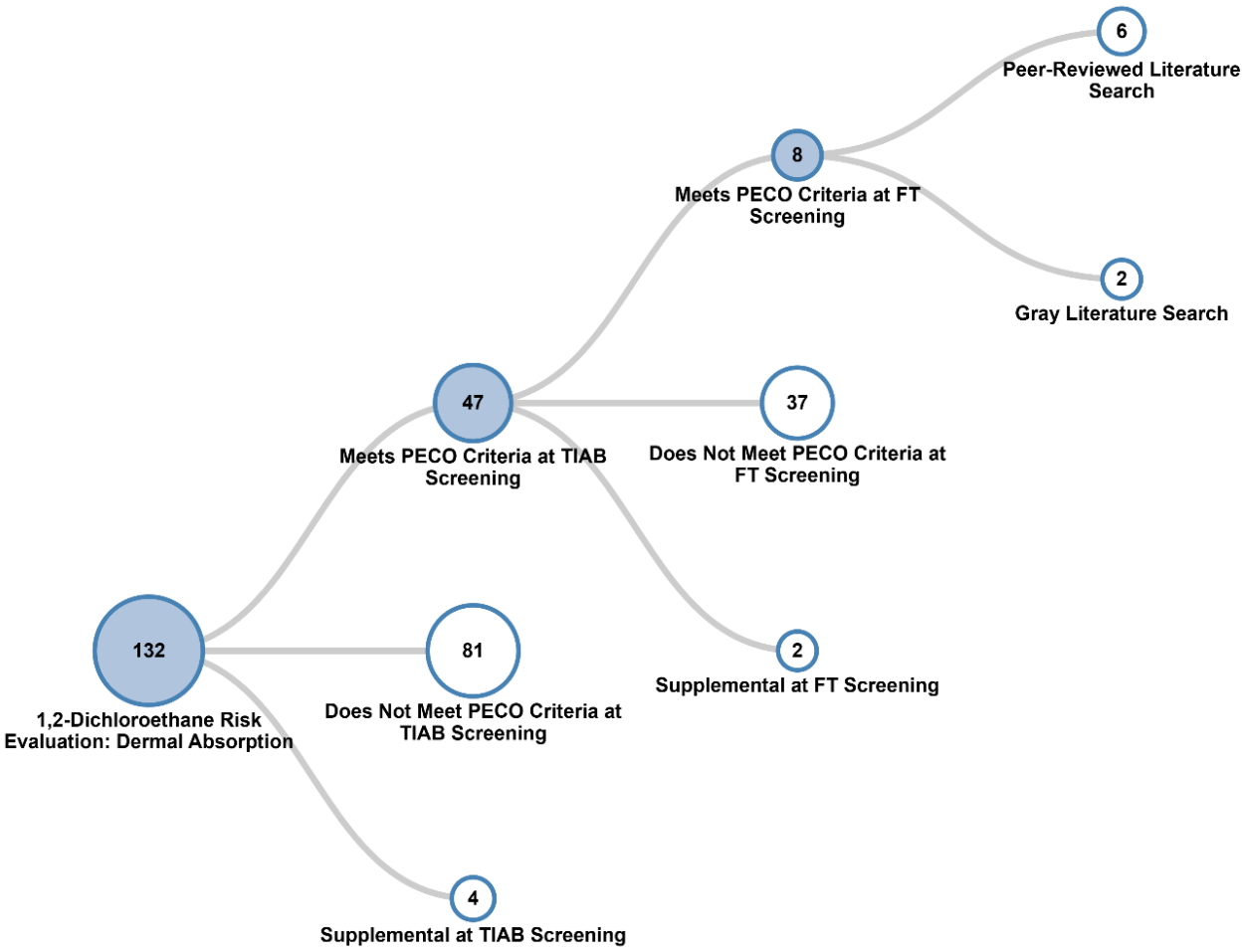

Figure 4-6. Literature Inventory Tree – Dermal Absorption for 1,2-Dichloroethane
View the interactive literature inventory tree in HAWC (accessed April 7, 2026). Data in this figure represent all references obtained from the publicly available databases and gray literature references searches that were included in systematic review for 1,2-dichloroethane as of February 27, 2026. Additional data may be added to the interactive version as they become available.

5 DATA EVALUATION AND DATA EXTRACTION

Data evaluation and extraction were conducted as described in Sections 5 and 6 of the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021). Data evaluation is the systematic review step in which EPA assesses quality of the individual data sources using the evaluation strategies and criteria for each discipline (*e.g.,* physical and chemical property data; fate and transport data; occupational exposure and environmental release data; general population, consumer, and environmental exposure data; environmental hazard; human health hazard) or sub-discipline (*e.g.,* animal toxicity or epidemiology). The data quality evaluation method uses a structured framework with predefined criteria for each type of data/information source. Data extraction is the systematic review step in which EPA uses structured forms or templates to extract quantitative and qualitative data and information from references that meet screening criteria. The overall goal is to provide transparency, consistency, and as much objectivity as possible to the data quality evaluation and extraction processes along with meeting the TSCA scientific standards in section 26(h).

References that meet screening criteria following full-text screening will generally proceed to data quality evaluation and extraction steps; however, one clarification to the procedures outlined in Section 6 of the 2021 Draft Systematic Review Protocol is that in situations where EPA is unable to extract data/information from sources that meet screening criteria (*e.g.,* formatting prohibits accurate extraction), that source may not have extracted data to present in the risk evaluation or respective supplemental documents. The systematic review supplemental files that contain results from the data quality evaluation and extraction systematic review steps may use updated templates from those that were provided in the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021) because the purpose of these supplemental documents is to accommodate the data needs for each respective risk evaluation. The following sections describe the data quality and extraction process followed by each discipline or sub-discipline to address various information needs for the *Risk Evaluation of 1,2-Dichloroethane* and any clarifications or updates regarding these systematic review steps as described in the draft protocol (U.S. EPA, 2021).

5.1 Physical and Chemical Properties

As described in the 2021 Draft Systematic Review Protocol, evaluation and extraction followed the steps outlined in Sections 5, 6, and 6.1 (U.S. EPA, 2021). The data quality criteria for physical and chemical property data are summarized in Appendix K of the 2021 Draft Systematic Review Protocol. The *Data Quality Evaluation and Data Extraction Information for Physical and Chemical Properties for 1,2-Dichloroethane* provides details of the data extracted and evaluated, including metric ratings and the overall study quality determination for each data source.

5.2 Environmental Fate and Transport Properties

As described in the 2021 Draft Systematic Review Protocol, evaluation and extraction followed the steps outlined in Sections 5, 6, and 6.2 (U.S. EPA, 2021). The data quality criteria for environmental fate data are summarized in Appendix L of the systematic review protocol. Appendix L.4 describes how the overall quality of fate data or information were weighted according to an ordinal system corresponding to High (1), Medium (2), or Low (3) to quantitatively or qualitatively support the risk evaluations. EPA does not plan to use data rated as Uninformative (4). Table_Apx L-4 illustrates the possible quality rankings across the selected metrics for environmental fate data with examples in Table_Apx L-5, Table_Apx L-6, and Table_Apx L-7 (U.S. EPA, 2021). Specific fate data quality ranking quality criteria are in Table_Apx L8. The Systematic Review Supplemental File of Data Quality Evaluation and Data Extraction Information for Environmental Fate and Transport Properties Data provides details of the

data extracted and evaluated, including metric rating and the overall study quality determination for each data source.

5.3 Environmental Release and Occupation Exposure

As described in the 2021 Draft Systematic Review Protocol, evaluation and extraction followed the steps outlined in Sections 5, 6, and 6.2. The data quality criteria for environmental release and occupational exposure data are summarized in Appendix M of the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021). The *Data Quality Evaluation and Data Extraction Information for Environmental Release and Occupational Exposure for 1,2-Dichloroethane* (U.S. EPA, 2026d) details the data extracted and evaluated, including metric rating and the overall study quality determination for each data source.

5.4 General Population, Consumer, and Environmental Exposure

As described in the 2021 Draft Systematic Review Protocol, data quality evaluation and extraction generally followed the steps outlined in Section 5 and 6 (U.S. EPA, 2021). However, a few updates were made to the data quality evaluation metrics for some evidence streams (*i.e.,* study types) since the metrics were published in the 2021 Draft Systematic Review Protocol. Most of the changes were editorial or minor clarifications, including the standardization of some metrics that apply to multiple evidence streams, where appropriate. For example, in the quality assurance/quality control (QA/QC) metric for evaluating monitoring and experimental evidence streams, the acronym QA/QC was defined and replaced all references to quality assurance and quality control when occurring separately or together, and the term "QA/QC techniques" was changed to "QA/QC measures," which already appeared in the metrics.

A few metrics applicable to multiple evidence streams were slightly modified to better fit some of the unique situations that frequently arise for a certain type of evidence stream (*e.g.,* databases). For example, some metrics were updated to clarify the intent of the metric and better account for variation in types of evidence included in one grouping (*e.g.,* experiments involving chamber studies vs. product concentration assessments). The domains did not change however, see below for the changes and updates made to the data evaluation metrics for the respective evidence types (*i.e.,* monitoring, experimental studies and databases) as presented in Section 5.4.1. No changes were made to the data evaluation metrics for modeling data, as described in Appendix N.6.2, or to the data evaluation metrics for completed exposure assessments and risk characterizations, as described in Appendix N.6.7 in the 2021 Draft Systematic Review Protocol, respectively (U.S. EPA, 2021). Data quality evaluations for all the references that met PECO screening criteria are included in the *Data Quality Evaluation Information for General Population, Consumer, and Environmental Exposure for 1,2-Dichloroethane* (U.S. EPA, 2026f).

Data extraction of general population, consumer, and environmental exposure data and information was conducted as described in Section 6 of the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021). However, with respect to information stored within databases, if EPA has access to the data tables, EPA does not conduct a separate data extraction because the data are more accessible and have additional context in the original database format. Data present in the database when the database underwent full-text screening are available in the HERO database, along with the date the data were downloaded. If a reference (*e.g.,* peer-reviewed reference) presents data from a database that did not undergo systematic review directly (*e.g.,* a foreign database that is not publicly accessible), the data would be extracted from the reference to the extent possible; this did not apply to references that underwent systematic review for this chemical.

As mentioned above in Section 1, references may not undergo data extraction, regardless of the overall quality determination, if they contain no extractable data points (*e.g.,* values are contained in a non-digitizable figure or are representative of unspecified media or treatment processes). On the other hand, there are references that have many reported endpoints that meet PECO screening criteria for a respective chemical risk evaluation, making it difficult to include all the data in the chemical-specific data extraction supplemental file. When a reference meets PECO screening criteria, the reference receives a data quality evaluation, and the data in the reference are still considered in the Risk Evaluation, whether or not the included data are extracted in DistillerSR and appear among the chemical-specific extractions in the Systematic Review Supplemental File: Data Extraction Information for General Population, Consumer, and Environmental Exposure. In addition, there may be other reasons that EPA decides not to extract all the data from a reference that undergoes data evaluation; EPA extracts the data that are most relevant, given the needs of the assessment. Decisions about whether to limit extractions to certain timeframes or certain countries were made on an evidence stream by evidence stream basis based on available data and the conditions of use being evaluated to better characterize general population, consumer, and environmental exposure and meet assessment needs.

This constitutes an update to Section 6 of the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021). While EPA may not extract all the data from all sources, EPA extracted data from all studies from the U.S. and other high-income countries containing monitoring data collected within 15 years of the literature search (*i.e.,* since 2004)—except for references containing dietary data. Dietary data were not extracted because bioaccumulation of 1,2-dichloroethane in food is not anticipated and any presence would be expected to be incidental concentrations not associated with TSCA releases. EPA also extracted other older data that were most relevant for characterizing exposure, use conditions, patterns of use, and product characteristics in the United States. For example, the Agency extracted all modeling papers from any country and any timeframe, in part because so few modeling references were found through systematic review. Extraction forms, templates, and decisions are tailored to fit the data extraction needs for each risk evaluation.

The types of fields extracted vary by evidence stream and generally followed Section 6.3 of the 2021 Draft Systematic Review Protocol with regard to the data characteristics captured (U.S. EPA, 2021). Examples of types of data extracted and the extraction formats for the evidence streams identified through systematic review to evaluate environmental, general population, and consumer exposure data are listed in the extraction tables provided in the *Data Extraction Information for General Population, Consumer, and Environmental Exposure for 1,2-Dichloroethane* (U.S. EPA, 2026b).

5.4.1 Data Quality Evaluation Metric Updates

The data evaluation metrics for the monitoring, experimental, and database evidence streams, are presented below in Table 5-1, Table 5-2, and Table 5-3, respectively. Each table shows which data evaluation metrics changed since the publication of the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021). Other data quality criteria for studies on consumer, general population, and environmental exposure appear in Appendix N of the Protocol. For the modeling, completed exposure assessments, and risk characterization evidence streams, there were no changes made to the data evaluation metrics since the 2021 Draft Systematic Review Protocol was published. The criteria for modeling studies appear in Table_Apx N-9 of the Protocol, and criteria for completed exposure assessments and risk characterizations appear in Table_Apx N-19. In some cases, references can meet the criteria for two exposure evidence streams, and they can also be reviewed and meet criteria for other disciplines. Upon review, each study is evaluated and extracted using the criteria for the most appropriate and applicable evidence streams given the information therein. In order to make it easier for the reader to see changes

made to the data evaluation metrics, the following conventions are used: text inserted is underlined and text deleted is in ~~strikethrough~~.

Table 5-1. Updated Data Quality Evaluation Criteria for Monitoring Data Sources

Data Quality Rating	Description
Domain 1. Reliability	
Metric 1. Sampling methodology	
High	Samples were collected according to publicly available SOPs that are scientifically sound and widely accepted (*i.e.,* from a source generally ~~using~~ known to use sound methods and/or approaches) for the chemical and media of interest. Example SOPs include USGS' "National Field Manual for the Collection of Water-Quality Data," EPA's "Ambient Air Sampling" (SESDPROC-303-R5), etc. OR The sampling protocol used was not a publicly available SOP from a source generally known to use ~~using~~ sound methods and/or approaches, but the sampling methodology is clear, appropriate (*i.e.,* scientifically sound), and similar to widely accepted protocols for the chemical and media of interest. All pertinent sampling information is provided in the data source or companion source. Examples include: • sampling equipment • sampling procedures/regime • sample storage conditions/duration • performance/calibration of sampler • study site characteristics • matrix characteristics
Medium	Sampling methodology is discussed in the data source or companion source and is generally appropriate (*i.e.,* scientifically sound) for the chemical and media of interest; however, **one or more pieces of sampling information is not described.** The missing information is unlikely to have a substantial impact on results. OR Standards, methods, protocols, or test guidelines may not be widely accepted, but a successful validation study for the new/unconventional procedure was conducted prior to the sampling event and is consistent with sound scientific theory and/or accepted approaches. Or a review of information indicates the methodology is acceptable and differences in methods are not expected to lead to lower quality data.
Low	Sampling methodology is only briefly discussed; therefore, **most sampling information is missing** and likely to have a substantial impact on results. AND/OR The sampling methodology **does not represent best sampling methods, protocols, or guidelines** for the chemical and media of interest (*e.g.,* outdated [but still valid] sampling equipment or procedures, long storage durations). AND/OR There are **some inconsistencies** in the reporting of sampling information (*e.g.,* differences between text and tables in data source, differences between standard method and actual procedures reported to have been used, etc.) that led to a low confidence in the sampling methodology used.
Critically Deficient	The sampling methodology is not discussed in the data source or companion source. AND/OR

Data Quality Rating	Description
	Sampling methodology is not scientifically sound or is not consistent with widely accepted methods/approaches for the chemical and media being analyzed (*e.g.,* inappropriate sampling equipment, improper storage conditions). AND/OR There are **numerous inconsistencies** in the reporting of sampling information, resulting in high uncertainty in the sampling methods used.
Not rated/ Not applicable	
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 2. Analytical methodology	
High	Samples were analyzed according to publicly available analytical methods that are scientifically sound and widely accepted (*i.e.,* from a source generally ~~using~~ known to use sound methods and/or approaches) and are appropriate for the chemical and media of interest. Examples include EPA SW-846 Methods, NIOSH Manual of Analytical Methods 5th Edition, etc. OR The analytical method used was not a publicly available method from a source generally ~~using~~ known to use sound methods and/or approaches, but the methodology is clear and appropriate (*i.e.,* scientifically sound) and similar to widely accepted protocols for the chemical and media of interest. All pertinent sampling information is provided in the data source or companion source. Examples include: • extraction method • analytical instrumentation (required) • instrument calibration • limit of quantitation (LOQ), LOD, detection limits, and/or reporting limits • recovery samples • biomarker used (if applicable) • matrix-adjustment method (*i.e.,* creatinine, lipid, moisture)
Medium	Analytical methodology is discussed in detail and is clear and appropriate (*i.e.,* scientifically sound) for the chemical and media of interest; however, **one or more pieces of analytical information is not described**. The missing information is unlikely to have a substantial impact on results. AND/OR The analytical **method may not be standard/widely accepted, but a method validation study was conducted** prior to sample analysis and is expected to be consistent with sound scientific theory and/or accepted approaches. AND/OR Samples were collected at a site and immediately analyzed using an on-site mobile laboratory, rather than shipped to a stationary laboratory.
Low	Analytical methodology is only briefly discussed. Analytical instrumentation is provided and consistent with accepted analytical instrumentation/methods. However, **most analytical information is missing** and likely to have a substantial impact on results. AND/OR Analytical method **is not s**tandard/widely accepted, and method validation is limited or not available. AND/OR

Data Quality Rating	Description
	Samples were analyzed using field screening techniques. AND/OR LOQ, LOD, detection limits, and/or reporting limits not reported. AND/OR There are **some inconsistencies or possible errors** in the reporting of analytical information (*e.g.,* differences between text and tables in data source, differences between standard method and actual procedures reported to have been used, etc.) which leads to a lower confidence in the method used.
Critically Deficient	Analytical methodology is not described, **including analytical instrumentation** (*i.e.,* HPLC, GC). AND/OR Analytical methodology is not scientifically appropriate for the chemical and media being analyzed (*e.g.,* method not sensitive enough, not specific to the chemical, out of date). AND/OR There are numerous inconsistencies in the reporting of analytical information, resulting in high uncertainty in the analytical methods used.
Not rated/ Not applicable	
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 3. Selection of biomarker of exposure	
High	Biomarker in a specified matrix is known to have an accurate and precise quantitative relationship with external exposure, internal dose, or target dose (*e.g.,* previous studies (or the current study) have indicated the biomarker of interest reflects external exposures). AND Biomarker (parent chemical or metabolite) is derived from exposure to the chemical of interest.
Medium	Biomarker in a specified matrix has accurate and precise quantitative relationship with external exposure, internal dose, or target dose. AND Biomarker is derived from multiple parent chemicals, not only the chemical of interest, **but** there is a stated method to apportion the estimate to only the chemical of interest
Low	Biomarker in a specified matrix has accurate and precise quantitative relationship with external exposure, internal dose, or target dose. AND Biomarker is derived from multiple parent chemicals, not only the chemical of interest, **and** there is NOT an accurate method to apportion the estimate to only the chemical of interest. OR Biomarker in a specified matrix is a poor surrogate (low accuracy and precision) for exposure/dose.
Critically Deficient	Not applicable. A study will not be deemed critically deficient based on the use of biomarker of exposure.
Not rated/ Not applicable	Metric is not applicable to the data source.
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*

Data Quality Rating	Description
Domain 2. Representative	
Metric 4. Geographic area	
High	Geographic location(s) is reported, discussed, or referenced.
Medium	Not applicable. This metric is dichotomous (*i.e.,* high vs. critically deficient).
Low	Not applicable. This metric is dichotomous (*i.e.,* high vs. critically deficient).
Critically Deficient	Geographic location is not reported, discussed, or referenced.
Not rated/ Not applicable	
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 5. Temporality	
High	Timing of sample collection for monitoring data is consistent with current or recent exposures **(within 5 years)** may be expected.
Medium	Timing of sample collection for monitoring data **is less consistent** with current or recent exposures **(>5 to 15 years)** may be expected.
Low	Timing of sample collection for monitoring data is not consistent with when current exposures **(>15 years old)** may be expected and likely to have a substantial impact on results.
Critically Deficient	Timing of sample collection for monitoring data is **not reported, discussed, or referenced.**
Not rated/ Not applicable	
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 6. Spatial and temporal variability	
High	Sampling approach accurately captures variability of environmental contamination in population/scenario/media of interest based on the heterogeneity/homogeneity and dynamic/static state of the environmental system. For example: • **Large sample size** (*i.e.,* ≥10 or more samples for a single scenario). • Use of replicate samples • Use of systematic or continuous monitoring methods. • Sampling over a sufficient period of time to characterize trends. • For urine, 24-hour samples are collected (vs. first morning voids or spot). • For biomonitoring studies, the timing of sample collected is appropriate based on chemical properties (*e.g.,* half-life), the pharmacokinetics of the chemical (*e.g.,* rate of uptake and elimination), and when the exposure event occurred.
Medium	Sampling approach likely captures variability of environmental contamination in population/scenario/media of interest based on the heterogeneity/homogeneity and dynamic/static state of the environmental system. Some uncertainty may exist, but it is unlikely to have a substantial impact on results. For example:

Data Quality Rating	Description
	• **Moderate sample size** (*i.e.,* 5–10 samples for a single scenario), or • Use of judgmental (non-statistical) sampling approach, or • No replicate samples • For urine, first morning voids or pooled spot samples
Low	Sampling approach poorly captures variability of environmental contamination in population/scenario/media of interest. For example: • **Small sample size** (*i.e.,* <5 samples), or • Use of haphazard sampling approach, or • No replicate samples, or • Grab or spot samples in single space or time, or • Random sampling that does not include all periods of time or locations, or • For urine, un-pooled spot samples.
Critically Deficient	Sample size is not reported. **Single sample** collected per dataset. For biomonitoring studies, the timing of sample collected is not appropriate based on chemical properties (*e.g.,* half-life), the pharmacokinetics of the chemical (*e.g.,* rate of uptake and elimination), and when the exposure event occurred.
Not rated/ Not applicable	
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 7. Exposure scenario	
High	The data closely represent relevant exposure scenario (*i.e.,* the population/scenario/media of interest). Examples include: • amount and type of chemical/product used • source of exposure • method of application or by-stander exposure • use of exposure controls • microenvironment (location, time, climate)
Medium	The data likely represent the relevant exposure scenario (*i.e.,* population/scenario/media of interest). **One or more key pieces of information may not be described** but the deficiencies are unlikely to have a substantial impact on the characterization of the exposure scenario. AND/OR If surrogate data, activities seem similar to the activities within scope.
Low	The data lack multiple key pieces of information, and the deficiencies are likely to have a substantial impact on the characterization of the exposure scenario. AND/OR There are **some inconsistencies or possible errors** in the reporting of scenario information (*e.g.,* differences between text and tables in data source, differences between standard method and actual procedures reported to have been used, etc.) that leads to a lower confidence in the scenario assessed. AND/OR If surrogate data, activities have lesser similarity but are still potentially applicable to the activities within scope.

Data Quality Rating	Description
Critically Deficient	If reported, the exposure scenario discussed in the monitored study does not represent the exposure scenario of interest for the chemical.
Not rated/ Not applicable	
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Domain 3. Accessibility/clarity	
Metric 8. Reporting of results	
High	Supplementary or raw data (*i.e.,* individual data points) are reported, allowing summary statistics to be calculated or reproduced. AND Summary statistics are detailed and complete. Example parameters include: • description of dataset summarized (*i.e.,* location, population, dates, etc.) • range of concentrations or percentiles • number of samples in dataset • frequency of detection • measure of variation (coefficient of variation [CV], standard deviation) • measure of central tendency (mean, geometric mean, median) • test for outliers (if applicable) AND Both adjusted and unadjusted results are provided (*i.e.,* correction for void completeness in urine biomonitoring, whole-volume or lipid adjusted for blood biomonitoring, wet or dry weight for environmental tissue samples or soil samples) [only if applicable].
Medium	Supplementary or raw data (*i.e.,* individual data points) are not reported, and therefore summary statistics cannot be reproduced. AND/OR Summary statistics are reported but are missing one or more parameters (see description for high). AND/OR Only adjusted or unadjusted results are provided, but not both [only if applicable].
Low	Supplementary data are not provided, and summary statistics are missing most parameters (see description for high). AND/OR There are some inconsistencies or errors in the results reported, resulting in low confidence in the results reported (*e.g.,* differences between text and tables in data source, less appropriate statistical methods).
Critically Deficient	There are numerous inconsistencies or errors in the calculation and/or reporting of results, resulting in highly uncertain reported results.
Not rated/ Not applicable	
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 9. Quality assurance	

Data Quality Rating	Description
High	The study quality assurance/quality control (QA/QC) measures and all pertinent ~~quality assurance~~ QA/QC information is provided in the data source or companion source. Examples include: • field, laboratory, and/or storage recoveries • field and laboratory control samples • baseline (pre-exposure) samples • biomarker stability • completeness of sample (*i.e.,* creatinine, specific gravity, osmolality for urine samples) AND No QA/QC ~~quality control~~ issues were identified, or any identified issues were minor and adequately addressed (*i.e.,* correction for low recoveries, correction for completeness).
Medium	The study applied and documented ~~quality assurance/quality control~~ QA/QC measures; however, **one or more pieces of QA/QC information is not described.** Missing information is unlikely to have a substantial impact on results. AND No QA/QC ~~quality control~~ issues were identified, or any identified issues were minor and addressed (*i.e.,* correction for low recoveries, correction for completeness).
Low	QA/QC measures ~~Quality assurance/quality control techniques~~ and results were not directly discussed but are implied through the study's use of standard field and laboratory protocols. AND/OR Deficiencies were noted in ~~quality assurance/quality control~~ QA/QC measures that are likely to have a substantial impact on results. AND/OR There are some inconsistencies in the ~~quality assurance~~ QA/QC measures reported, resulting in low confidence in the QA/QC ~~quality assurance/control~~ measures taken and results (*e.g.,* differences between text and tables in data source).
Critically Deficient	QA/QC issues have been identified which significantly interfere with the overall reliability of the study.
Not rated/ Not applicable	
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Domain 4. Variability and uncertainty	
Metric 10. Variability and uncertainty	
High	The study characterizes variability in the population/media studied. AND Key uncertainties, limitations, and data gaps have been identified. AND The uncertainties are minimal and have been characterized.
Medium	The study has limited characterization of variability in the population/media studied. AND/OR The study has limited discussion of key uncertainties, limitations, and data gaps. AND/OR Multiple uncertainties have been identified but are unlikely to have a substantial impact on results.

Data Quality Rating	Description
Low	The characterization of variability is absent. AND/OR Key uncertainties, limitations, and data gaps are not discussed. AND/OR Uncertainties identified may have a substantial impact on the exposure the exposure assessment
Critically Deficient	Estimates are highly uncertain based on characterization of variability and uncertainty.
Not rated/ Not applicable	
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*

Table 5-2. Updated Evaluation Criteria for Experimental Data Sources

Data Quality Rating	Metric Description
Domain 1. Reliability	
Metric 1. Sampling methodology and conditions	
High	Samples were collected according to publicly available SOPs, methods, protocols, or test guidelines that are scientifically sound and widely accepted from a source generally known to use sound methods and/or approaches such as EPA, NIST, American Society for Testing and Materials, ISO, and ACGIH. OR The sampling protocol used was not a publicly available SOP from a source generally known to use sound methods and/or approaches, but the sampling methodology is clear, appropriate (*i.e.,* scientifically sound), and similar to widely accepted protocols for the chemical and media of interest. All pertinent sampling information is provided in the data source or companion source. Examples include: sampling conditions (*e.g.,* temperature, humidity) sampling equipment and procedures sample storage conditions/duration performance/calibration of sampler
Medium	Sampling methodology is discussed in the data source or companion source and is generally appropriate (*i.e.,* scientifically sound) for the chemical and media of interest, however, one or more pieces of sampling information is not described. The missing information is unlikely to have a substantial impact on results. OR Standards, methods, protocols, or test guidelines may not be widely accepted, but a successful validation study for the new/unconventional procedure was conducted prior to the sampling event and is consistent with sound scientific theory and/or accepted approaches.
Low	Sampling methodology is only briefly discussed. Therefore, most sampling information is missing and likely to have a substantial impact on results. AND/OR

Data Quality Rating	Metric Description
	The sampling methodology does not represent best sampling methods, protocols, or guidelines for the chemical and media of interest (*e.g.,* outdated (but still valid) sampling equipment or procedures, long storage durations). AND/OR There are some inconsistencies in the reporting of sampling information (*e.g.,* differences between text and tables in data source, differences between standard method and actual procedures reported to have been used, etc.) which lead to a low confidence in the sampling methodology used.
Critically Deficient	The sampling methodology is not discussed in the data source or companion source. AND/OR Sampling methodology is not scientifically sound or is not consistent with widely accepted methods/approaches for the chemical and media being analyzed (*e.g.,* inappropriate sampling equipment, improper storage conditions). AND/OR There are numerous inconsistencies in the reporting of sampling information, resulting in high uncertainty in the sampling methods used.
Not rated/ Not applicable	
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 2. Analytical methodology	
High	Samples were analyzed according to publicly available analytical methods that are scientifically sound and widely accepted (*i.e.,* from a source generally using sound methods and/or approaches) and are appropriate for the chemical and media of interest. Examples include EPA SW-846 Methods, NIOSH Manual of Analytical Methods 5th Edition, etc. OR The analytical method used was not a publicly available method from a source generally known to use sound methods and/or approaches, but the methodology is clear and appropriate (*i.e.,* scientifically sound) and similar to widely accepted protocols for the chemical and media of interest. All pertinent analytical ~~sampling~~ information is provided in the data source or companion source. Examples include: extraction method analytical instrumentation (required) instrument calibration LOQ, LOD, detection limits, and/or reporting limits recovery samples biomarker used (if applicable) matrix-adjustment method (*i.e.,* creatinine, lipid, moisture)
Medium	Analytical methodology is discussed in detail and is clear and appropriate (*i.e.,* scientifically sound) for the chemical and media of interest; however, one or more pieces of analytical information is not described. The missing information is unlikely to have a substantial impact on results. AND/OR The analytical method may not be standard/widely accepted, but a method validation study was conducted prior to sample analysis and is expected to be consistent with sound scientific theory and/or accepted approaches. AND/OR

Data Quality Rating	Metric Description
	Samples were collected at a site and immediately analyzed using an on-site mobile laboratory, rather than shipped to a stationary laboratory.
Low	Analytical methodology is only briefly discussed. Analytical instrumentation is provided and consistent with accepted analytical instrumentation/methods. However, most analytical information is missing and likely to have a substantial impact on results. AND/OR Analytical method is not standard/widely accepted, and method validation is limited or not available. AND/OR Samples were analyzed using field screening techniques. AND/OR LOQ, LOD, detection limits, and/or reporting limits not reported. AND/OR There are some inconsistencies or possible errors in the reporting of analytical information (*e.g.,* differences between text and tables in data source, differences between standard method and actual procedures reported to have been used, etc.) which leads to a lower confidence in the method used.
Critically Deficient	Analytical methodology is not described, including analytical instrumentation (*i.e.,* HPLC, GC). AND/OR Analytical methodology is not scientifically appropriate for the chemical and media being analyzed (*e.g.,* method not sensitive enough, not specific to the chemical, out of date). AND/OR There are numerous inconsistencies in the reporting of analytical information, resulting in high uncertainty in the analytical methods used.
Not rated/ Not applicable	
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
<u>Metric 3.</u> Selection of biomarker of exposure	
High	Biomarker in a specified matrix is known to have an accurate and precise quantitative relationship with external exposure, internal dose, or target dose (*e.g.,* previous studies (or the current study) have indicated the biomarker of interest reflects external exposures). AND Biomarker (parent chemical or metabolite) is derived from exposure to the chemical of interest.
Medium	Biomarker in a specified matrix has accurate and precise quantitative relationship with external exposure, internal dose, or target dose. AND Biomarker is derived from multiple parent chemicals, not only the chemical of interest, **but** there is a stated method to apportion the estimate to only the chemical of interest
Low	Biomarker in a specified matrix has accurate and precise quantitative relationship with external exposure, internal dose, or target dose. AND Biomarker is derived from multiple parent chemicals, not only the chemical of interest, **and** there is NOT a stated method to apportion the estimate to only the chemical of interest.

Data Quality Rating	Metric Description
	OR Biomarker in a specified matrix is a poor surrogate (low accuracy and precision) for exposure/dose.
Critically Deficient	Not applicable. A study will not be deemed critically deficient based on the use of biomarker of exposure. ~~Biomarker in a specified matrix is a poor surrogate (low accuracy and precision) for exposure/dose.~~
Not rated/ Not applicable	Metric is not applicable to the data source.
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Domain 2. Representative	
Metric 4. Testing scenario	
High	Testing conditions closely represent relevant exposure scenarios (*i.e.,* population/scenario/media of interest). Examples include: • amount and type of chemical/product used • source of exposure/test substance • method of application or by-stander exposure • use of exposure controls • microenvironment (location, time, climate, temperature, humidity, pressure, airflow) AND Testing conducted under a broad range of conditions for factors such as temperature, humidity, pressure, airflow, and chemical mass/weight fraction (if appropriate).
Medium	The data likely represent the relevant exposure scenario (*i.e.,* population/scenario/media of interest). One or more key pieces of information may not be described but the deficiencies are unlikely to have a substantial impact on the characterization of the exposure scenario. AND/OR If surrogate data, activities seem similar to the activities within scope.
Low	The data lack multiple key pieces of information and the deficiencies are likely to have a substantial impact on the characterization of the exposure scenario. AND/OR There are some inconsistencies or possible errors in the reporting of scenario information (*e.g.,* differences between text and tables in data source, differences between standard method and actual procedures reported to have been used, etc.) which leads to a lower confidence in the scenario assessed. AND/OR If surrogate data, activities have lesser similarity but are still potentially applicable to the activities within scope. AND/OR Testing conducted under a single set of conditions, except for experiments to determine a weight fraction or concentration in a product.
Critically Deficient	Testing conditions are not relevant to the exposure scenario of interest for the chemical.
Not rated/ Not applicable	

Data Quality Rating	Metric Description
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 5. Sample size and variability	
High	Sample size is reported and large enough (*i.e.,* ≥ 10 samples) to be reasonably assured that the samples represent the scenario of interest. AND Replicate tests performed and variability across tests is characterized (if appropriate).
Medium	Sample size is moderate (*i.e.,* 5 to ~~10~~ ≤10 samples), thus the data are likely to represent the scenario of interest. AND Replicate tests performed and variability across tests is characterized (if appropriate).
Low	Sample size is small (*i.e.,* <5 samples), thus the data are likely to poorly represent the scenario of interest. AND/OR Replicate tests were not performed.
Critically Deficient	Sample size is not reported. AND/OR Single sample collected per dataset, except for experiments to determine a weight fraction or concentration in a product. AND/OR For biomonitoring studies, the timing of sample collected is not appropriate based on chemical properties (*e.g.,* half-life), the pharmacokinetics of the chemical (*e.g.,* rate of uptake and elimination), and when the exposure event occurred.
Not rated/ Not applicable	
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 6. Temporality	
High	Source(s) of tested items appears to be current (within 5 years).
Medium	Source(s) of tested items is less consistent with when current or recent exposures (>5 to 15 years) are expected.
Low	Source(s) of tested items is not consistent with when current or recent exposures (>15 years) are expected or is not identified.
Critically Deficient	Temporality of tested items is not reported, discussed, or referenced.
Not rated/ Not applicable	
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Domain 3. Accessibility/clarity	
Metric 7. Reporting of results	

Data Quality Rating	Metric Description
High	Supplementary or raw data (*i.e.,* individual data points) are reported, allowing summary statistics to be calculated or reproduced. AND Summary statistics are detailed and complete. Example parameters include: description of dataset summarized (*i.e.,* location, population, dates, etc.) range of concentrations or percentiles number of samples in dataset frequency of detection measure of variation (CV, standard deviation) measure of central tendency (mean, geometric mean, median) test for outliers (if applicable) AND Both adjusted and unadjusted results are provided (*i.e.,* correction for void completeness in urine biomonitoring, whole-volume or lipid adjusted for blood biomonitoring) [only if applicable].
Medium	Supplementary or raw data (*i.e.,* individual data points) are not reported, and therefore summary statistics cannot be reproduced. AND/OR Summary statistics are reported but are missing one or more parameters (see description for high). AND/OR Only adjusted or unadjusted results are provided, but not both [only if applicable].
Low	Supplementary data are not provided, and summary statistics are missing most parameters (see description for high). AND/OR There are some inconsistencies or errors in the results reported, resulting in low confidence in the results reported (*e.g.,* differences between text and tables in data source, less appropriate statistical methods).
Critically Deficient	There are numerous inconsistencies or errors in the calculation and/or reporting of results, resulting in highly uncertain reported results.
Not rated/ Not applicable	
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 8. Quality assurance	
High	The study applied quality assurance/quality control (QA/QC) measures and all pertinent QA/QC ~~quality assurance~~ information is provided in the data source or companion source. Examples include: • laboratory, and/or storage recoveries. • laboratory control samples. • baseline (pre-exposure) samples. • biomarker stability • completeness of sample (*i.e.,* creatinine, specific gravity, osmolality for urine samples) AND No QA/QC ~~quality control~~ issues were identified, or any identified issues were minor and adequately addressed (*i.e.,* correction for low recoveries, correction for completeness).

Data Quality Rating	Metric Description
Medium	The study applied and documented ~~quality assurance/quality control~~ QA/QC measures; however, one or more pieces of QA/QC information is not described. Missing information is unlikely to have a substantial impact on results. AND No QA/QC ~~quality control~~ issues were identified, or any identified issues were minor and addressed (*i.e.,* correction for low recoveries, correction for completeness).
Low	QA/QC ~~Quality assurance/quality control techniques~~ measures and results were not directly discussed but are ~~can be~~ implied through the study's use of standard field and laboratory protocols. AND/OR Deficiencies were noted in QA/QC ~~quality assurance/quality control~~ measures that are likely to have a substantial impact on results. AND/OR There are some inconsistencies in the QA/QC ~~quality assurance~~ measures reported, resulting in low confidence in the ~~quality assurance/control~~ QA/QC measures taken and results (*e.g.,* differences between text and tables in data source).
Critically Deficient	QA/QC issues have been identified which significantly interfere with the overall reliability of the study.
Not rated/ Not applicable	
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Domain 4. Variability and uncertainty	
Metric 9. Variability and uncertainty	
High	The study characterizes variability in the population/media studied. AND Key uncertainties, limitations, and data gaps have been identified. AND The uncertainties are minimal and have been characterized.
Medium	The study has limited characterization of variability in the population/media studied. AND/OR The study has limited discussion of key uncertainties, limitations, and data gaps. AND/OR Multiple uncertainties have been identified but are unlikely to have a substantial impact on results.
Low	The characterization of variability is absent. AND/OR Key uncertainties, limitations, and data gaps are not discussed. AND/OR Uncertainties identified may have a substantial impact on ~~the exposure~~ the exposure assessment
Critically Deficient	Estimates are highly uncertain based on characterization of variability and uncertainty.
Not rated/ Not applicable	

Data Quality Rating	Metric Description
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*

Table 5-3. Updated Data Evaluation Criteria for Database Data

Data Quality Rating	Description
Domain 1. Reliability	
Metric 1. Sampling methodology	
High	Widely accepted sampling methodologies (*i.e.,* from a source generally known to use ~~using~~ sound methods and/or approaches) were used to generate the data presented in the database. Example SOPs include USGS's "National Field Manual for the Collection of Water-Quality Data," EPA's "Ambient Air Sampling" (SESDPROC-303-R5), etc.
Medium	One or more pieces of sampling methodology information is not described, but missing information is unlikely to have a substantial impact on results. OR The sampling methodologies were consistent with sound scientific theory and/or accepted approaches based on the reported sampling information but may not have followed published procedures from a source generally known to use sound methods and/or approaches.
Low	The sampling methodology was not reported in data source or readily available companion data source.
Critically Deficient	The sampling methodologies used were not appropriate for the chemical/media of interest in the database (*e.g.,* inappropriate sampling equipment, improper storage conditions).
Not rated/ Not applicable	
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 2. Analytical methodology	
High	Widely accepted analytical methodologies (*i.e.,* from a source generally using sound methods and/or approaches) were used to generate the data presented in the database. Example SOPs include EPA SW-846 Methods, NIOSH Manual of Analytical Methods 5th Edition, etc.
Medium	The analytical methodologies were consistent with sound scientific theory and/or accepted approaches based on the reported analytical information but may not have followed published procedures from a source generally known to use sound methods and/or approaches.
Low	The analytical methodology was not reported in data source or companion data source.
Critically Deficient	The analytical methodologies used were not appropriate for the chemical/media of interest in the database (*e.g.,* method not sensitive enough, not specific to the chemical, out of date).
Not rated/ Not applicable	
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*

Data Quality Rating	Description
Domain 2. Representative	
Metric 3. Geographic area	
High	Geographic location(s) is reported, discussed, or referenced.
Medium	Not applicable. This metric is dichotomous (*i.e.,* high vs. critically deficient).
Low	Not applicable. This metric is dichotomous (*i.e.,* high vs. critically deficient).
Critically Deficient	Geographic location is not reported, discussed, or referenced.
Not rated/ Not applicable	
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 4. Temporal	
High	The data reflect current conditions (within 5 years) AND/OR Database contains robust historical data for spatial and temporal analyses (if applicable).
Medium	The data are less consistent with current or recent exposures (>5 to 15 years) AND/OR Database contains sufficient historical data for spatial and temporal analyses (if applicable).
Low	Data are not consistent with when current exposures (>15 years old) may be expected AND/OR Database does not contain enough historical data for spatial and temporal analyses (if applicable).
Critically Deficient	Timing of sample data is not reported, discussed, or referenced.
Not rated/ Not applicable	
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 5. Exposure scenario	
High	The data closely represent relevant exposure scenario (*i.e.,* the population/scenario/media of interest). Examples include: amount and type of chemical/product used source of exposure method of application or by-stander exposure use of exposure controls microenvironment (location, time, climate)
Medium	The data likely represent the relevant exposure scenario (*i.e.,* population/scenario/media of interest). **One or more key pieces of information may not be described** but the deficiencies are unlikely to have a substantial impact on the characterization of the exposure scenario. AND/OR If surrogate data, activities seem similar to the activities within scope.

Data Quality Rating	Description
Low	The data lack multiple key pieces of information and the deficiencies are likely to have a substantial impact on the characterization of the exposure scenario. AND/OR There are **some inconsistencies or possible errors** in the reporting of scenario information (*e.g.,* differences between text and tables in data source, differences between standard method and actual procedures reported to have been used, etc.) which leads to a lower confidence in the scenario assessed. AND/OR If surrogate data, activities have lesser similarity but are still potentially applicable to the activities within scope.
Critically Deficient	If reported, the exposure scenario discussed in the monitored study does not represent the exposure scenario of interest for the chemical.
Not rated/ Not applicable	
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Domain 3. Accessibility/clarity	
Metric 6. Availability of database and supporting documents	
High	Database is widely accepted and/or from a source generally known to use sound methods and/or approaches (*e.g.,* raw data from NHANES, STORET).
Medium	The database may not be widely known or accepted (*e.g.,* state-maintained databases), but the database is adequately documented with most or all of the following information: Within the database, metadata is present (sample identifiers, annotations, flags, units, matrix descriptions, etc.) and-data fields are generally clear and defined. A user manual and other supporting documentation is available, or there is sufficient documentation in the data source or companion source. Database quality assurance and data quality control measures are defined and/or a QA/QC protocol was followed.
Low	The database may not be widely known or accepted, and only limited database documentation is available (see the medium rating).
Critically Deficient	No information is provided on the database source or availability to the public.
Not rated/ Not applicable	
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 7. Reporting of results	
High	The database or information source reporting the analysis of the database data is well organized and understandable by the target audience. AND Summary statistics in the data source are detailed and complete. Example parameters include: • description of dataset summarized (*i.e.,* location, population, dates, etc.) • range of concentrations or percentiles

Data Quality Rating	Description
	• number of samples in dataset • frequency of detection • measure of variation (CV, standard deviation) • measure of central tendency (mean, geometric mean, median) • test for outliers (if applicable)
Medium	The database or information source reporting the analysis of the database data is well organized and understandable by the target audience. AND/OR Summary statistics are missing one or more parameters (see description for high).
Low	The database or information source reporting the analysis of the database data is unclear or not well organized. AND/OR Summary statistics are missing most parameters (see description for high) AND/OR There are some inconsistencies or errors in the results reported, resulting in low confidence in the results reported (*e.g.,* differences between text and tables in data source, less appropriate statistical methods).
Critically Deficient	There are numerous inconsistencies or errors in the calculation and/or reporting of results, resulting in highly uncertain reported results. AND/OR The information source reporting the analysis of the database data is missing key sections or lacks enough organization and clarity to locate and extract necessary information.
Not rated/ Not applicable	
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Domain 4. Variability and uncertainty	
Metric 8. Variability and uncertainty	
High	Variability, key uncertainties, limitations, and/or data gaps have been identified. AND/OR The uncertainties are minimal and have been characterized.
Medium	The study has limited discussion of variability, key uncertainties, limitations, and/or data gaps. AND/OR Multiple uncertainties have been identified but are unlikely to have a substantial impact on results.
Low	Variability, key uncertainties, limitations, and data gaps are not discussed. AND/OR Uncertainties identified may have a substantial impact on the exposure the exposure assessment
Critically Deficient	Estimates are highly uncertain based on characterization of variability and uncertainty.
Not rated/ Not applicable	
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*

5.5 Environmental and Human Health Hazard

Details regarding the evaluation and extraction of environmental and human health hazard information from references that passed PECO screening criteria are available in Sections 5 and 6.4 of the 2021 Draft Systematic Review Protocol. Data quality criteria for environmental studies, animal and *in vitro* toxicity studies and epidemiological studies are available in Appendix P, Q, and R in the 2021 Draft Systematic Review Protocol, respectively (U.S. EPA, 2021). The below-listed supplemental documents provide details of the data evaluated and extracted. Data evaluation information for each discipline (*i.e.,* environmental and human health hazard) is contained in separate supplemental documents and includes metric ranking and the overall study quality determination for each data source. On the other hand, data extraction information for both disciplines are contained in a single supplemental document to increase the ease of accessing hazard data that may be relevant for both environmental- and human health-related receptors. One clarification that applies to the data extraction of human health hazard data is that all the data extraction was conducted in DistillerSR. In regards to the environmental hazard data, for references that meet PECO screening criteria at full text screening, the available environmental hazard data were extracted from those references in the ECOTOXicology Knowledgebase (ECOTOX) database and then imported into DistillerSR.

- *Data Quality Evaluation Information for Environmental Hazard for 1,2-Dichloroethane* (U.S. EPA, 2026e)
- *Data Quality Evaluation Information for Human Health Hazard Epidemiology for 1,2-Dichloroethane* (U.S. EPA, 2026h)
- *Data Quality Evaluation Information for Human Health Hazard Animal Toxicology for 1,2-Dichloroethane* (U.S. EPA, 2026g)
- *Data Extraction Information for Environmental Hazard and Human Health Hazard Animal Toxicology and Epidemiology for 1,2-Dichloroethane* (U.S. EPA, 2026a)

5.5.1 Environmental Hazard

As described in Appendix R of the 2021 Draft Systematic Review Protocol, references that met PECO screening criteria at full text screening underwent data quality evaluation (U.S. EPA, 2021). Likewise, for references that met PECO screening criteria at full text screening underwent data extraction as described in Section 6.4.1 of the Draft Systematic Review Protocol (U.S. EPA, 2021). One clarification regarding the extraction of environmental hazard data is that all of the extracted data, except those with confidential business information claims, will be available in the ECOTOX database, which is publicly available.

Data gaps were identified for 1,2-dichloroethane for sediment-dwelling organisms. 1,1-Dichloroethane, 1,1,2-trichloroethane, and 1,2-dichlopropane studies submitted under the TSCA section 4(a)(2) Test Order authority were selected for read-across of 1,2-dichloroethane benthic environmental hazard based on structural similarity, physical and chemical similarity, and toxicological similarity. Below is the list of HERO IDs that underwent data quality evaluation and extraction for 1,1-dichloroethane, 1,1,2-trichloroethane and 1,2-dichlopropane to fill in the data gaps identified.

Table 5-4. List of HERO IDs by Chemical Selected Representing Studies Used for Read-Across of 1,2-Dichloroethane

Chemical	HERO ID
1,1-Dichloroethane (Analog)	11589134
1,1,2-Trichloroethane (Analog)	10706027
1,2-Dichloropropane (Analog)	11424404

The data evaluation and extraction information for all 1,2-dichloroethane references, and for the 1,1-dichloroethane, 1,1,2-trichloroethane and 1,2-dichlopropane test order studies that were included in the risk evaluation can be found in the supplemental files:

- *Data Quality Evaluation Information for Environmental Hazard Data for 1,2-Dichloroethane* (U.S. EPA, 2026e)
- *Data Extraction Information for Environmental Hazard, Human Health Hazard Animal Toxicology and Epidemiology for 1,2-Dichloroethane* (U.S. EPA, 2026a)

5.5.2 Human Health Hazard

As described in Appendices Q and R of the 2021 Draft Systematic Review Protocol, references that met PECO screening criteria at full text screening underwent data quality evaluation (U.S. EPA, 2021). Likewise, for references that met PECO screening criteria at full text screening underwent data extraction as described in Section 6.4.1 of the draft protocol. Any clarifications or updates regarding the data quality evaluation or extraction of data from references that met PECO screening criteria at full text screening will be discussed further below for epidemiological and animal toxicity studies.

5.5.2.1 Epidemiology Studies

For 1,2-dichloroethane, all references that met PECO screening criteria and were categorized as having epidemiological information for the evaluation of human health hazard underwent data quality evaluation and data extraction as described in Appendix Section R and Section 6.4.1 of the Draft Systematic Review Protocol, respectively (U.S. EPA, 2021). There were no changes to the data evaluation domains and metrics or data extraction methodologies since the draft protocol was published.

5.5.2.2 Animal Toxicity Studies

Although there were no updates made to the data extraction methodologies described in the 2021 Draft Systematic Review Protocol for references with potentially relevant animal toxicity studies for the evaluation of human health hazard, EPA did update language in some of the metrics used to conduct data quality evaluation for those references. Updates to the data evaluation metrics from the versions published in Appendix Q.4.2 of the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021) are shown below in Table 5-5. Language that was inserted since the draft protocol was published is **bolded**, and language removed is shown in ~~strikethrough~~. Language was removed from metric 12 to ensure the metric rating was not discounted due to assessment of liver metabolism via an injection pathway. The description for the rating of high for metric 12 was updated to clarify that the caveat of 10 or more air changes/hour applies only to dynamic whole-body chambers. For metrics not listed below, no changes were made since the 2021 draft protocol was published (U.S. EPA, 2021).

Table 5-5. Updated Data Quality Evaluation Criteria for Animal Toxicity Studies

Data Quality Rating	Description
Metric 12. Exposure route and method Were the route and method of exposure reported and suited to the test substance (*e.g.,* accounting for volatility, ~~injection was not used for assays of liver metabolism~~, an appropriate vehicle was used when necessary)? For nose-only or head-only inhalation studies, were the animals appropriately acclimated or was the lack of acclimation controlled for?	
High	The route and method of exposure were reported and were suited to the test substance (see above) For inhalation studies, a dynamic, nose-only or head-only chamber was used~~. with greater than 10 or more air changes/hour~~. While dynamic nose-only (or head-only) studies are generally preferred, dynamic whole-body chambers are acceptable for gases **as long as there were 10 or more air changes/hour**.
Medium	There were minor limitations regarding the route and method of exposure, but the researchers took appropriate steps to mitigate the problem (*e.g.,* attempted to minimize headspace for volatile compounds in drinking water). These limitations are unlikely to have a substantial impact on results. For inhalation studies, a dynamic whole-body chamber was used for vapors that may condense (assume most will condense at high concentrations unless otherwise stated) or for aerosols, having 10 or more air changes/hour. A medium rating can also be assigned if the study indicates a dynamic chamber but not the number of air changes.
Low	There were deficiencies regarding the route and method of exposure that are likely to have a substantial effect on results. Researchers may have attempted to correct the problem, but the success of the mitigating action was unclear. For inhalation studies, there are significant flaws in the design or operation of the inhalation chamber, such as uneven distribution of test substance in a whole-body chamber, having less than 10 air changes/hour in a whole-body chamber, or using a whole-body chamber that is too small for the number and volume of animals exposed. OR Only very minimal if any details about the methods for inhalation exposure administration (as described above) were reported, resulting in significant uncertainty about the true exposure parameters.
Critically Deficient	The route or method of exposure was not reported OR An inappropriate route or method (*e.g.,* administration of a volatile organic compound via the diet) was used for the test substance without taking steps to correct the problem (*e.g.,* mixing fresh diet). These are serious flaws that makes the study unusable. For inhalation studies, either a static chamber was used, there is no description of the inhalation chamber, or an atypical exposure method was used, such as allowing a container of test substance to evaporate in a room.
Not rated/ Not applicable	Do not select for this metric.
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*

The data evaluation and extraction information for all 1,2-dichloroethane references that were included in the risk evaluation can be found in the supplemental files:

- *Data Quality Evaluation Information for Environmental Hazard for 1,2-Dichloroethane* (U.S. EPA, 2026e)
- *Data Quality Evaluation Information for Human Health Hazard Animal Toxicology for 1,2-Dichloroethane* (U.S. EPA, 2026g)
- *Data Quality Evaluation Information for Human Health Hazard Epidemiology for 1,2-Dichloroethane* (U.S. EPA, 2026h)
- *Data Extraction Information for Environmental Hazard and Human Health Hazard Animal Toxicology and Epidemiology for 1,2-Dichloroethane* (U.S. EPA, 2026a)

5.6 Dermal Absorption

EPA's general approach to data evaluation and extraction of relevant data sources under TSCA is described in Sections 5 and 6, respectively of the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021). For each study, one reviewer conducts the initial review, and a second reviewer provides the QC review. EPA uses DistillerSR to evaluate and extract dermal absorption studies; the information from DistillerSR is then coded for output into tables that accompany the published risk evaluations. EPA evaluated and extracted dermal absorption studies that met the PECO screening criteria described above in Section 4.7.

Animal *in vivo* dermal absorption studies were evaluated using an extensively modified version of the animal toxicity data quality metrics shown in Appendix Q.4.2 of U.S. EPA (2021). To evaluate *in vitro/ex vivo* dermal absorption studies, EPA developed data evaluation metrics from the metrics used to evaluate *in vitro* mechanistic studies and presented a draft version of these metrics in Appendix S of the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021). The sections below identify updates to these *in vivo* and *in vitro/ex vivo* criteria made since publication of the draft protocol.

Data extraction involves cataloguing experimental methods and results from the evaluated references. For *in vivo* studies, EPA extracts data on the matrices measured (*e.g.,* urine, carcass, exhaled air) and other information. For *in vitro* studies, the Agency extracts information on the type of skin used (*e.g.,* source and area of body, thickness), the diffusion cell exposure set up (flow-through or static), and other data. For both *in vivo* and *in vitro/ex vivo* studies, EPA identifies the species used, whether skin was occluded, and information on the test substance and vehicle. As relevant, the Agency extracts Kp/flux as well as fraction absorption information.

If adequate data are available from *in vivo* or *in vitro/ex vivo* (excised skin) studies, EPA will not evaluate, extract, or quantitively use data from the 3D human skin studies in risk evaluations. Currently, the 3D human skin equivalent models are not recommended by OECD Guidance (OECD Series on Testing and Assessment No. 156 (September 2022)) (IOMC ED, 2022) for use in evaluating risks. However, EPA may discuss the 3D models when integrating evidence and may consider evaluating them if no other experimental dermal absorption information is available. EPA did not identify 3D human skin studies for 1,2-dichloroethane.

For 1,2-dichloroethane, EPA evaluated two *in vivo* animal studies (rat, guinea pig) and six *in vitro* studies (human, pig, and guinea pig skin) from the literature searching and filtering of dermal absorption information. EPA assigned a medium OQD to the *in vivo* Fisher 344 rat study and an uninformative OQD to the *in vivo* guinea pig study. EPA assigned an OQD of high to an *in vitro* excised human skin study (Labcorp Early Development, 2024) conducted in response to a test order issued by EPA. Of the other *in vitro* studies, one portion of an *in vitro* study using human skin received an OQD of uninformative whereas other *in vitro* OQDs were either medium or low. *Data Quality Evaluation and*

Data Extraction Information for Dermal Absorption for 1,2-Dichloroethane (U.S. EPA, 2026c) provides details of the data extracted and evaluated, including metric rankings and the OQDs for evaluated data sources.

5.6.1 Data Quality Metrics – Animal *In Vivo*

Animal *in vivo* dermal absorption studies were evaluated using an extensively modified version of the animal toxicity data quality metrics shown in Appendix Q.4.2 of the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021). The domains are identical except Domain 4 now refers to test models (instead of test *animals*). EPA used OECD guidelines to develop the criteria for the evaluation of *in vivo* dermal absorption references (IOMC ED, 2022; OECD, 2011, 2004a, b). Specifically, metrics were modified to address the standards used (metric 5), consistency of in exposure administration (metric 7), reporting of concentrations used (metric 8), exposure duration (metric 9), exposure groups and concentration (metric 10), characteristics of test animals and number of animal per group based on OECD 427 (metrics 11 and 13), outcome assessment methodology based on guidelines (metric 14), evaluation per group (metric 16), confounding variables (metrics 17 and 18), data analysis, interpretation, and reporting (metrics 19, 20, and 21). The full set of data quality metrics for *in vivo* animal studies are shown below.

Table 5-6. Data Quality Criteria for *In Vivo* Animal Dermal Absorption Studies

Data Quality Rating	Description
Domain 1. Test substance	
Metric 1. Test substance identity Was the test substance identified definitively (*i.e.,* established nomenclature, CASRN, physical nature, physical and chemical properties, and/or structure reported, including information on the specific form tested [*e.g.,* salt or base, valence state, isomer, if applicable] for materials that may vary in form)? If test substance was a mixture, were mixture components and ratios characterized?	
High	The test substance (*i.e.,* chemical of interest) was identified definitively (*i.e.,* nomenclature, CASRN, structure) and where applicable the specific form (*e.g.,* particle characteristics for solid state materials, salt or base, valence state, hydration state, isomer, radiolabel, etc.) was definitively and completely characterized. For mixtures, the components and ratios were characterized (*i.e.,* provided as concentration, ratio of percentage of the mixture or product). Additionally, for radiolabeled substances, the location of the radiolabel within the substance should be indicated, ideally with the radiolabel in a metabolically stable position
Medium	The test substance (*i.e.,* chemical of interest) was identified and the specific form was characterized (where applicable). For mixtures, some components and components and ratios were identified and characterized but at least the chemical of interest has a percentage/concentration reported. There were minor uncertainties (*e.g.,* minor characterization details were omitted such as about the radiolabel) that were unlikely to have a substantial impact on results
Low	The test substance and form (if applicable) were identified and the components and ratios of mixtures were characterized, but there were uncertainties regarding test substance identification or characterization that are likely to have a substantial impact on the results (*e.g.,* no information on isomer (or enantiomer) composition of differences could affect toxicokinetic properties, limited particle size information, omitted details regarding branched or straight chain structure).

Data Quality Rating	Description
Critically Deficient	The test substance identity and form (the latter if applicable) could not be determined from the information provided (*e.g.,* nomenclature was unclear and CASRN or structure were not reported) OR For mixtures, the components and ratios were not characterized.
Not rated/ Not applicable	Do not select for this metric
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 2. Test substance source Was the source of the test substance reported, including manufacturer and batch/lot number for materials that may vary in composition? If synthesized or extracted, was test substance identity verified by analytical methods?	
High	The source of the test substance was reported as a manufacturer or the production process was specifically identified. The batch/lot number was identified (for materials that may vary in composition), and the chemical identity was either certified by the source in the publication or could be verified on a manufacturer's website. OR The test substance identity was analytically verified by the laboratory that performed the toxicity study.
Low	The test substance was synthesized or extracted by a source other than the manufacturer [and no production process was identified]. OR The source was not reported. AND The test substance identity was NOT analytically verified by the performing laboratory.
Not rated/ Not applicable	Do not select for this metric
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 3. Test substance purity Was the purity or grade (*i.e.,* analytical, technical) of the test substance (including the radiolabeled substance) reported and adequate? Were impurities identified? Were impurities present in quantities that could influence the results? ~~Note that formaldehyde and other chemicals may require additional guidance that may differ from the guidance below.~~	
High	For discrete substances, the test substance purity **(including radiolabel)** and composition were such that any observed effects were highly likely to be due to the nominal test substance itself (*e.g.,* highly pure at >98% or analytical grade test substance or a formulation of lower purity that contains ingredients considered to be inert, such as water). ~~The radiopurity ideally should be greater than 95% and reasonable effort should be made to identify impurities present at or above 2%.~~ AND All components, including impurities and residual chemicals, were identified and the chemical of interest was the main component **(including the radiolabeled portion).**
Medium	The nature and quantity of reported impurities are such that study results were not likely to be substantially impacted by the impurities (impurities not known to induce outcome of interest at low levels, impurities are inert or GRAS, etc.).

Data Quality Rating	Description
	Regardless of the nature and purity, for discrete chemicals, the purity of the chemical of interest should be >70%, unless water is the only impurity.
Low	Purity and/or grade of test substance were not reported **(for both the labeled and unlabeled chemical).**
Critically Deficient	The nature and quantity of reported impurities (**for unlabeled and labeled substances)** were such that study results were likely to be due to one or more of the impurities. AND/OR For discrete chemicals, purity was <70% **(for unlabeled and labeled substances)** with an impurity other than water.
Not rated/ Not applicable	Do not select for this metric
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Domain 2. Test design	
Metric 4. Randomized allocation of animals Did the study explicitly report randomized allocation of animals to study groups?	
Medium	The study reported that animals were randomly allocated into study groups **OR** Allocation was performed with an unbiased method with a non-random component to ensure similar baseline characteristics across groups (*e.g.,* methods that account for body weight to ensure appropriate distribution across groups)
Low	The study did not report how animals were allocated to study groups, or there were deficiencies regarding the allocation method that are likely to have a substantial impact on results (*e.g.,* allocation by animal number).
Critically Deficient	The study reported using a biased method to allocate animals to study groups (*e.g.,* judgement of investigator). This is a serious flaw that makes the study unusable.
Not rated/ Not applicable	Do not select for this metric
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 5. Standards for tests For assays with established criteria, were the test validity, acceptability, reliability, and/or QC criteria reported and consistent with current standards and guidelines? Were sufficient data provided to determine that the standards/guidelines have been met? **See Guidance for Reviewers to view examples of various criteria.** Example criteria: *Percent recovery:* 100 ± 10% of the radioactivity as stated in OECD TG 427; 100 ± 20% for volatile and unlabeled compounds as stated in OECD GD 28. *Coefficient of Variation*: **OECD 156 states that if the coefficient of variation is greater than 25%, then apply an adjustment.** ~~Variance across replicates should be measured and indicated when standard deviation exceeds 25%.~~	
Medium	Criteria used to determine the validity acceptability, reliability, and/or quality of the experiment (*e.g.,* percent recovery considered acceptable) were reported and consistent with

Data Quality Rating	Description
	current standards and guidelines, as/if applicable and authors stated that results met those criteria, or the results provided enough detail to compare with the criteria.
Low	Few or no QC criteria were reported, however, the reported results provided enough information to evaluate how the study compared against the criteria stated in the study and/or external criteria and standards.
Critically Deficient	Inadequate information was provided on the standards used to evaluate the study results AND 1) the authors did not report whether the test met pre-established criteria, OR 2) inadequate data on results were presented to demonstrate the validity, acceptability, and reliability of the test when compared with current standards and guidelines or the pre-established standards/criteria identified by the authors. In this case, adequate QC cannot be performed.
Not rated/ Not applicable	Do not select for this metric
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Domain 3. Exposure characterization	
Metric 6. Preparation and storage of test substance (chemical) Did the study characterize preparation of the test substance and storage conditions? Were the frequency of preparation and/or storage conditions appropriate to the test substance stability and solubility (if applicable)?	
High	The test substance preparation and/or storage conditions (*e.g.,* test substance stability, homogeneity, mixing temperature, stock concentration, stirring methods, storage conditions) were reported and appropriate for the test substance and application scenario (*e.g.,* stability and solubility in diluents or solvents confirmed especially if they differ from what is used commercially; volatile test substances prepared and stored in sealed containers; same stock solution for all exposure concentrations).
Medium	The test substance preparation and storage conditions were reported, but minor limitations in the test substance preparation and/or storage conditions were identified (*e.g.,* test substance formulations were stirred instead of centrifuged for a specific number of rotations per minute). OR There is an omission of details that are unlikely to have a substantial impact on results (*e.g.,* preparation/administration of test substance is described, but storage of stock solution is not reported; however, storage is unlikely to affect results based on likely stability over the time frame of the test or the physical and chemical properties of the chemical make concerns about volatility or solubility unlikely).
Low	Deficiencies in reporting of test substance preparation, and/or storage conditions are likely to have a substantial impact on results (*e.g.,* available information on physical and chemical properties suggests that stability and/or solubility of test substance in diluent/solvent may be poor). OR Information on preparation and storage was *not* reported and lack of details could substantially impact results (*e.g.,* preparation for volatile or low-solubility chemicals).

Data Quality Rating	Description
Critically Deficient	Serious flaws reported regarding test substance preparation and/or storage conditions will have critical impacts on dose/concentration estimates and make the study unusable (*e.g.,* instability of test substance, test substance volatilized rapidly from storage containers).
Not rated/ Not applicable	Do not select for this metric
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 7. Consistency of exposure administration Were exposures administered consistently across study groups (*e.g.,* consistent volumes/area of skin surface used for application that are ~ 5-10% of animal body surface (*e.g.,* 10 cm^2 for the rat), same area/location of body used for application)?	
High	Details of exposure administration were reported and exposures were administered consistently across study groups in a scientifically sound manner (*e.g.,* consistent volume and area of skin surface used for application, same area of body used for application for each animal and dose group).
Medium	Details of exposure administration were reported, but minor limitations in administration of exposures (*e.g.,* slight variations in surface area) were identified that are unlikely to have a substantial impact on results. OR Details of exposure administration are incompletely reported, but the missing information is unlikely to have a substantial impact on results.
Low	Details of exposure administration were reported, but deficiencies in administration of exposures (*e.g.,* moderate differences in of skin surface area used for application) that were reported or inferred from the text are likely to have a substantial impact on results. OR Details of exposure administration are insufficiently reported and the missing information is likely to have a substantial impact on results
Critically Deficient	Exposures were not administered consistently across and/or within study groups (*e.g.,* large differences in volume and area of skin surface used for application) resulting in serious flaws that make the study unusable.
Not rated/ Not applicable	Do not select for this metric.
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 8. Reporting of concentrations Were exposure doses/concentrations or amounts of test substance applied to the skin reported without ambiguity (*e.g.,* point estimate instead of range, analytical instead of nominal, weight by weight vs. volume by volume)? Note: Ambiguity also applies to doses/concentrations if values were only reported as points on a figure without numerical values.	
High	The exposure doses/concentrations or amounts of test substance were reported without ambiguity (*e.g.,* point estimate instead of range, analytical/measured instead of nominal, weight vs. volume).
Medium	The exposure doses/concentrations or amounts of test substance were reported with some ambiguity (*e.g.,* range instead of point estimate OR nominal instead of analytical/measured, unclear if weight or volume-based).

Data Quality Rating	Description
Low	The exposure doses/concentrations or amounts of test substance were reported but with substantial ambiguity about precision (*e.g.,* only an estimated range AND only nominal instead of analytical measurements).
Critically Deficient	The exposure doses/concentrations or amounts of test substance were not reported, resulting in serious flaws that make the study unusable.
Not rated/ Not applicable	Do not select for this metric.
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 9. Exposure duration Was the exposure duration (*e.g.,* hours) reported and was it appropriate for this study type and/or outcome(s) of interest? Was the duration of exposure relevant to conditions of use and physical-chemical properties of the test substance? Did measurements continue post-exposure to account for retained dose in skin?	
High	The exposure duration (*e.g.,* hours) was reported and was appropriate based on the expected human exposure duration (typically at least 6 hours up to 24 hours following chemical application; if experiment continues beyond 1 day, measurements should continue daily in order to evaluate all excreta and tissues). A shorter exposure duration may also be included but is less useful unless the substance is volatile, the results demonstrate that absorption approached completion (*e.g.,* nothing left in the skin wash or tape strip samples), or the timepoint is used only for Kp/flux measurements.
Low	The duration(s) of exposure differed from current standards and guidelines for studies of this type (typically <6 to 24 hours prior to washing with excreta and/or measurements not continued without justification), and the differences may have a substantial impact on results.
Critically Deficient	No information on exposure duration(s) was reported OR the exposure duration was not appropriate OR Duration(s) differed significantly from studies of the same or similar types and these differences (most likely shorter duration) are likely to have a substantial impact on interpretation of results.
Not rated/ Not applicable	Do not select for this metric.
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 10. Number of exposure groups and concentrations spacing Were the number of exposure groups/tested concentrations and dose/concentration spacing appropriate and justified by study authors (*e.g.,* to mimic a specific type of human exposure) and adequate for addressing the purpose of the study across a wide range of conditions of use (COUs) (*e.g.,* dilute, concentrated, and neat)?	
High	There were three or more dose groups tested and dose/concentration spacing were justified by study authors (*e.g.,* to mimic a specific type of human exposure) and were adequate for addressing the purpose of the study.
Medium	There were less than three group tested, however the choice of groups and diluent(s) were justified and are appropriate for common formulations. Any uncertainties given the reduced number of groups testes are minor relative to the difficulty of performing *in vivo* absorption testing.

Data Quality Rating	Description
Low	There were major limitations regarding the number of exposure groups and/or applied dose/concentration spacing (*e.g.,* dose and diluent testes are not very relevant to most exposure scenarios and only one dose/concentration tested), restricting the applicability of the results to only a subset of COUs and weight fractions.
Critically Deficient	The number of exposure groups and dose/concentrations spacing were not reported.
Not rated/ Not applicable	Do not select for this metric.
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Domain 4. Test model	
Metric 11. Test animal characteristics Were the animal species, strain, sex, age, and starting body weight reported? Was the test animal from a commercial source or in-house colony? Was the test species and strain an appropriate animal model for the evaluation of the specific(s) of interest (*e.g.,* routinely used for similar study types)? Per OECD 427, male rats of 200–250g are suitable, particularly in the upper half of this range. The most sensitive sex should be used if there is evidence that one sex is more sensitive.	
High	The test animal species, strain, sex, age, and starting body weight were reported, and the test animal was obtained form a commercial source or laboratory-maintained colony. The test species and strain were an appropriate animal model for the evaluation of dermal absorption.
Medium	Minor uncertainties in the reporting of test animal characteristics (*e.g.,* age, or starting body weight) are unlikely to have a substantial impact on results. The test animals were obtained from a commercial source in-house colony, and the test species/strain/sex was an appropriate animal model for the evaluation of dermal absorption.
Low	The source or sex of the test animal was not reported. These deficiencies are likely to have a substantial impact on results. OR the test animal (species, strain, sex, life-stage, source) was not the best choice for the evaluation of dermal absorption.
Critically Deficient	The test animal species and any other necessary descriptive information were not at all reported.
Not rated/ Not applicable	Do not select for this metric.
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 12. Adequacy and consistency of animal husbandry conditions	
High	All husbandry conditions were reported (*e.g.,* temperature, humidity, light-dark cycle, diet, water availability) and were adequate and the same for control and exposed populations, such that the only difference was exposure.
Medium	Most husbandry conditions were reported (see High bin) and were adequate and similar for all groups. Some differences in conditions were identified among groups, but these differences were considered minor uncertainties or limitations that are unlikely to have a substantial impact on results.

Data Quality Rating	Description
Low	Husbandry conditions were not sufficiently reported to evaluate if husbandry was adequate and whether differences occurred between control and exposed populations. These deficiencies are likely to have a substantial impact on results.
Critically Deficient	There were significant differences in husbandry conditions between control and exposed groups (*e.g.,* temperature, humidity, light-dark cycle). **OR** Animal husbandry conditions deviated from customary practices in ways likely to impact study results (*e.g.,* injuries and stress due to cage overcrowding). These are serious flaws that makes the study unusable.
Not rated/ Not applicable	Do not select for this metric.
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 13. Number of animals per group Was the number of replicates per dose/concentration group appropriate for the study type and outcome analysis? OECD 427 states that "a group of at least four animals of one sex should be used for each test preparation and each scheduled termination time	
Medium	The number of animals per dose/concentration and timepoint group were reported and was appropriate (*e.g.,* acceptable data from a minimum of four animals per group, all from the same sex).
Low	The number of animals per dose/concentration and timepoint group was reported but was less than recommended by current standards and guidelines (*i.e.,* less than four animals tested or sexes were mixed). This is likely to have an impact on results. OR The number of replicates per dose/concentration was not reported.
Critically Deficient	The number of animals per study group was insufficient to characterize dermal absorption (*e.g.,* less than four replicates per test preparation produced acceptable data).
Not rated/ Not applicable	Do not select for this metric.
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Domain 5. Outcome assessment	
Metric 14. Outcome assessment methodology Did the outcome assessment methodology address or report the intended absorption measurement of interest? Was the outcome assessment methodology (including measurement technique and timing of measurement[s]) appropriate for the associated conditions of use (COUs) and the dosing scenario? Were blood, urine, feces, and exhaled air (if necessary) individually collected at sampling time? [reference guidance notes re: infinite, nondepletable doses]	
High	The outcome assessment methodology addressed the intended absorption measurement AND was sensitive for the outcome(s) of interest and followed OECD guidance documents. The selected formulations are reasonable for the chemical of interest and would result in a sufficiently conservative estimate representative of conditions of use for the chemical of interest (*e.g.,* use of IPM as a diluent). All relevant bodily fluids were collected and measured.

Data Quality Rating	Description
	For percent absorption calculations finite dosing is required, normally 1-5 mg/cm^2 for a solid and up to 10 µL/cm^2 for liquids of test material, unless otherwise justified
Medium	The outcome assessment methodology used partially addressed the intended outcomes(s) of interest and deviations were explained, but minor uncertainties (*e.g.,* dosing was slightly below or above the recommendations for finite or infinite scenarios, did not assess all bodily fluids) are unlikely to have a substantial impact on results. If Kp determinations are presented, they should be from infinite dose or nondepletable conditions while finite dosing is required for percent absorption calculations. For infinite dose testing of solids, occlusion is required and at least 10 mg/cm^2 of pure substance must be used to establish an undepletable dose, regardless of concentration. For infinite dose testing of liquids/dilutions, occlusion is required, and flux must remain constant and steady-state throughout the duration of the experiment. Kp/flux measurements *in vivo* have substantial uncertainties, however a medium score can be achieved if efforts are taken to account for mass balance and ADME throughout the body (*e.g.,* shorter timepoints for measurement, collection of several tissues/excreta, see guidance notes).
Low	Significant deficiencies in the implementation of the reported outcome assessment methodology were identified (*e.g.,* a volatile diluent was used with a volatile test substance, etc.) OR The outcome assessment methodology was not clearly reported and it was unclear whether methods were sensitive for the outcome of interest. This is likely to have a substantial impact on results. For Kp/flux measurements, a low is assigned if efforts were not taken to account for potential missing absorbed dose through ADME processes (*e.g.,* only one tissue measured and/or delayed measurements that did not capture immediate absorption). Kp measurements are also downgraded if it is unclear whether the applied dose is non-depletable.
Critically Deficient	The reported assessment methodology was not sensitive to the outcome(s) of interest. For example, percentage absorption was determined only from an infinite dose, and/or Kp/flux was derived from a clearly finite dose, and statistics could not easily be calculated independently, or no relevant bodily fluids/tissues were assessed. These are serious flaws that make the study unusable.
Not rated/ Not applicable	Do not select for this metric.
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 15. Consistency of outcome assessment Was the outcome assessment carried out consistently (*i.e.,* using the same protocol) across study groups (*e.g.,* assessment at the same time after initial exposure in all study groups)?	
High	Details of the outcome assessment protocol were reported, and outcomes were assessed consistently across study groups (*e.g.,* at the same time after initial exposure) using the same protocol in all study groups, the duration of exposure was the same across groups, the time periods when excreta were obtained were consistent across groups, etc.
Medium	There were minor differences in the timing of outcome assessment across study groups, or incomplete reporting of minor details of outcome assessment protocol execution were

Data Quality Rating	Description
	explained, but these uncertainties or limitations are unlikely to have substantial impact on results.
Low	Details regarding the execution of the study protocol for outcome assessment (*e.g.,* timing of assessment across groups) were confusing, limited, or not reported nor deviations explained, and these deficiencies are likely to have a substantial impact on results.
Critically Deficient	There were large inconsistencies in the execution of study protocols for outcome assessment across study groups. These are serious flaws that make the study unusable.
Not rated/ Not applicable	Do not select for this metric.
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 16. Sampling adequacy and sensitivity Was the reported sampling size adequate for the outcome(s) of interest, including number of evaluations per exposure group, and endpoint (*e.g.,* scintilliation counts/sample)?	
High	The study reported adequate sampling for the outcome(s) of interest including number of evaluations per exposure group, and measurement sensitivity (*e.g.,* scintillation counts/sample and/or duration of radioactivity detection, adequate signal to noise [*i.e.,* background] ratio for detection [*e.g.,* signal 3x noise]). The sampling intervals should be adequate to allow estimation of dermal absorption.
Medium	Details regarding sampling were reported, but minor limitations were identified in the reported sampling of the outcome(s) of interest and were explained. However, those limitations are unlikely to have a substantial impact on results.
Low	Details regarding sampling of outcomes were not fully reported nor explained and the omissions are likely to have a substantial impact on results.
Critically Deficient	Reported sampling was not adequate and/or serious uncertainties or limitations were identified in how the study carried out the sampling of the outcome(s) of interest (*e.g.,* replicates from control and test concentrations were evaluated at different times).
Not rated/ Not applicable	Do not select for this metric.
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Domain 6. Confounding/variable control	
Metric 17. Confounding variables in test design and procedures Were there confounding differences among the study groups that could influence the outcome assessment (*e.g.,* differences in size of skin area exposed to the chemical, differences in test substance lot or batch that might have different purities)?	
High	There were no reported differences among study group parameters (*e.g.,* test substance lot or batch, initial starting weights) that could influence the outcome assessment.
Medium	Although the study did not report all information to determine whether confounding bias may exist, reported information did not identify differences (or identified only minor differences) among study groups in the above listed confounding factors. Minor differences were reported and explained in initial conditions that are unlikely to have a substantial impact on results.

Data Quality Rating	Description
Low	Reported information indicated moderate differences among the study groups with respect to body weight changes or other differences that may be attributed to systemic toxicity, or there were other major inconsistencies across study groups (*e.g.,* body weight variation was greater than 20% compared to mean).
Critically Deficient	There were significant differences among the study groups with respect to above considerations that make the data unreliable (*e.g.,* exposed skin was excessively hairy in one rodent compared to another, clear signs of damaged skin in some animals due to experimental procedures.
Not rated/ Not applicable	Do not select for this metric.
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 18. Confounding variables in outcomes unrelated to exposure Were there differences among the study groups unrelated to exposure to test substance (*e.g.,* solubility in formulation) that could influence the outcome assessment? Were there differences among the study groups in animal attrition or health outcomes unrelated to exposure (*e.g.,* infection, damaged tissue) that could influence the outcome assessment? Professional judgement should be used to determine whether such differences would invalidate the study.	
High	There were no reported differences among the study animals or groups in test model unrelated to exposure (*e.g.,* solubility in formulation). Details regarding animal attrition and health outcomes unrelated to exposure (*e.g.,* infection, skin damage unrelated to treatment) were reported for each study group and there were no differences among groups that could influence the outcome assessment.
Medium	Authors reported that one or more animals or groups experienced disproportionate outcomes unrelated to exposure (*e.g.,* solubility issues, formulation-specific irritation), but data from the remaining exposure replicates or groups were valid and is unlikely to have a substantial impact on results. OR There was no information either to support or dismiss the suggestion that there were differences among groups in animal attrition, health outcomes unrelated to exposure, or solubility that could influence the outcome assessment.
Low	Data on outcome differences unrelated to exposure (*e.g.,* technical errors or variation in isolation of bodily fluids across test groups) were not reported for each study replicate or group and the missing information is likely to have a substantial impact on results.
Critically Deficient	There is evidence of insolubility in the formulation such that it was not properly demonstrating a diluted solution. OR Reported information indicated that study groups experienced attrition (*e.g.,* premature death) or health outcomes unrelated to exposure (*e.g.,* infection) that would render the full study (*i.e.,* all dose groups) unreliable considering the short-term duration.
Not rated/ Not applicable	Do not select for this metric.
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Domain 7. Data presentation and analysis	

Data Quality Rating	Description
Metric 19. Data analysis Were statistical methods, calculations methods, and/or data manipulation clearly described and appropriate for dataset(s)? Were absorption estimates **presented** ~~measured~~ across a time series for each compartment of the test system? **Did the results vary widely?**	
High	Statistical methods (including any calculations or data transformations) were clearly described or had only minor omissions and were appropriate for the dataset(s). Percent~~age~~ absorption estimates were measured across a time series for each compartment of the test system, and Kp/flux measurements were based on the linear/steady-state part of the absorption curve. Calculated absorption estimates properly accounted for outliers consistently across replicates/timepoints. **The coefficient of variation (CV) was ≤25% across samples, timepoints, dose groups in an individual experiment.**
Low	Statistical analysis was performed but not described adequately to understand what was performed or whether it was properly applied (*e.g.,* determination of outliers) **or** statistical analysis was inconsistently/inappropriately applied across replicates and datasets (*e.g.,* ~~absorption not measured across time series,~~ inconsistent exclusion of outliers {perhaps due to integrity failure} across measurements ~~but coefficient of variation for several replicates (SD relative to mean) was < 25%~~). OR Absorption estimates were not presented across a time series for each scenario ~~component~~. OR **[The CV was > 25% and ≤50% for more than half the samples across animals, replicates, media (*e.g.,* receptor fluid, timepoints) within an individual scenario in a study.] OR [The CV was >50% for more than half the samples within an individual scenario in a study, and data** are **available for EPA to calculate an alternate (upper end) value to account for variability in the results.]**
Critically Deficient	Statistical analysis was performed using an inappropriate method (*e.g.,* parametric test for non-normally distributed data) ~~and/or coefficient of variation for several replicates (SD relative to mean) was >25%.~~ OR Statistical analysis was not performed. **OR The coefficient of variation (CV) was >50% for more than half the samples (*e.g.,* across samples, timepoints, dose groups) for an individual experiment.** AND Data enabling an independent statistical analysis **or to calculate an upper end value for fraction absorbed/Kp** were not provided. These are serious flaws that make the study unusable.
Not rated/ Not applicable	Statistical analysis was not possible (n = 1−2) or not necessary **(clearly negative findings across all groups).**
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 20. Data interpretation Is the interpretation of results consistent with standards and guidelines? For example, did reported absorption estimates account for sufficient recovery? Was the combined amount of test substance in the skin (after removing appropriate tape strips if tape strips were used), blood, tissues, excreta, carcass and cage wash counted in the overall estimate? Was Kp vs. fractional absorption results derived from the appropriate exposure conditions (infinite dose vs. finite dose, respectively)?	

Data Quality Rating	Description
High	Recovery of applied test substance was adequate (mean of 100% ± 10% or ± 20% for volatile chemicals; recoveries outside this range must be justified) or the absorption estimate was normalized to account for any reduction below these levels. Both the skin compartment and any tape-stripping washes after the first two were included in the absorption estimate. AND Assay results were correctly interpreted relative to the properties of the test substance and the assay setup (sufficient duration to capture all absorption if not evaporated, proper interpretation of finite vs. infinite dose).
Medium	Absorption estimates were calculated improperly or incompletely (*e.g.,* skin compartment not included, values not normalized if recovery less than adequate); however, simple independent data analysis is possible to overcome these issues.
Low	There are major uncertainties based on insufficient or incorrect interpretation of the results by the authors (*e.g.,* characterization of infinite vs. finite doses); however, EPA is able to estimate results with some level of confidence.
Critically Deficient	The reported scoring and/or evaluation criteria were very inconsistent with established practices, resulting in the interpretation of data results that are seriously flawed and highly misleading relative to the properly interpreted results (*e.g.,* study author claims 5% absorption but correct analysis results in 40% absorption; only percentage absorption **but not flux** is reported for **an infinite** ~~a finite~~ dose) and therefore not usable for any scenarios AND EPA is unable to confidently interpret the correct results based on the reported data.
Not rated/ Not applicable	Do not select for this metric.
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 21. Reporting of data Were the data for all outcomes presented? Were data reported by exposure group? Per OECD 427, data should be presented as dislodgeable dose, skin compartment, blood concentration, excreta/expired air, and quantity remaining in carcass or removed organs. Irritation should also be reported if identified.	
High	Data for exposure-related findings were presented by exposure group (*e.g.,* all timepoints, formulations, concentrations, finite vs. infinite dose) and tissue compartments/bodily fluids of interest. Negative findings were reported qualitatively or quantitatively.
Medium	Data for exposure-related findings were reported for most, but not all, treatment levels (all tissue compartments/bodily fluids). The minor uncertainties in outcome reporting are unlikely to have substantial impact on results (*e.g.,* intermediate timepoints not included in the data tables but the full curve is included).
Low	Data for exposure-related findings were not shown for each treatment group, but results were described in the text. OR Data were reported inconsistently or with errors, however EPA was able to interpret the correct results with some level of confidence. OR Continuous data were presented without measures of variability or n/group.
Critically Deficient	Data presentation was inadequate (*e.g.,* the report does not differentiate among findings in multiple exposure groups) OR

Data Quality Rating	Description
	Major inconsistencies were present in reporting of results that render the findings unreliable and EPA is unable to confidently fill in gaps or make assumptions to make up for these uncertainties.
Not rated/ Not applicable	Do not use for this metric.
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*

5.6.2 Data Quality Metrics – *In Vitro/Ex Vivo*

Table 5-7 presents the *in vitro/ex vivo* dermal absorption data evaluation criteria, as modified since publication of Appendix S of the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021). Language that was inserted is **bolded** and language removed is shown as ~~strikethrough~~. EPA used OECD guidelines to develop and update the criteria for the evaluation of *in vitro/ex vivo* dermal absorption references (IOMC ED, 2022; OECD, 2011, 2004a, c). For metrics 1, 3, 5, and 6 and 10-21, EPA made changes to the wording were made to provide context and/or clarity to the evaluation question and/or metric rankings. For metrics 4, 5, 7, 10 language was added in the places that were marked as TBD in Appendix S of U.S. EPA (2021). For metric 4, the wording originally used for the medium ranking was changed to indicate a high ranking and wording was added to the medium ranking. EPA also updated the low and critically deficient ranking descriptions. For metric 8, EPA removed the high ranking, and the description was incorporated into the medium ranking. EPA updated metric 19 to address data variability (the coefficient of variation) and revised metric 20 to clarify language and consider whether the reference calculated appropriate values (Kp/flux vs. fraction absorbed). The full set of *in vitro/ex vivo* data quality metrics are shown below.

Table 5-7. Updated Data Evaluation Criteria for *In Vitro*/*Ex Vivo* Dermal Absorption Studies

Data Quality Rating	Description
Domain 1. Test substance	
Metric 1. Test substance identity Was the test substance identified definitively (*i.e.,* established nomenclature, CASRN, physical nature, physical and chemical properties, and/or structure reported, including information on the specific form tested [*e.g.,* salt or base, valence state, isomer, if applicable] for materials that may vary in form)? If test substance was a mixture, were mixture components and ratios characterized?	
High	The test substance (*i.e.,* chemical of interest) was identified definitively (*i.e.,* nomenclature, CASRN, structure) and where applicable the specific form (*e.g.,* particle characteristics for solid state materials, salt or base, valence state, hydration state, isomer, radiolabel, etc.) was definitively and completely characterized. For mixtures, the components and ratios were characterized (*i.e.,* provided as concentration, ratio of percentage of the mixture or product). Additionally, for radiolabeled substances, the location of the radiolabel within the substance should be indicated, ideally with **the radiolabel** ^{14}~~C~~ in a metabolically stable position.

Data Quality Rating	Description
Medium	The test substance (*i.e.,* chemical of interest) was identified and the specific form was characterized (where applicable). For mixtures, some components and components and ratios were identified and characterized but at least the chemical of interest has a percentage/concentration reported. There were minor uncertainties (*e.g.,* minor characterization details were omitted **such as about the** radiolabel ~~details~~) that were unlikely to have a substantial impact on results.
Low	The test substance and form (if applicable) were identified, and the components and ratios of mixtures were characterized, but there were uncertainties regarding test substance identification or characterization that are likely to have a substantial impact on the results (*e.g.,* no information on isomer (or enantiomer) composition of differences could affect toxicokinetic properties, limited particle size information, omitted details regarding branched or straight chain structure).
Critically Deficient	The test substance identity and form (the latter if applicable) could not be determined from the information provided (*e.g.,* nomenclature was unclear and CASRN or structure were not reported) OR For mixtures, the components and ratios were not characterized.
Not rated/ Not applicable	Do not select for this metric
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 2. Test substance source Was the source of the test substance reported, including manufacturer and batch/lot number for materials that may vary in composition? If synthesized or extracted, was test substance identity verified by analytical methods?	
High	The source of the test substance was reported as a manufacturer or the production process was specifically identified. The batch/lot number was identified (for materials that may vary in composition), and the chemical identity was either certified by the source in the publication or could be verified on a manufacturer's website. OR The test substance identity was analytically verified by the laboratory that performed the toxicity study.
Low	The test substance was synthesized or extracted by a source other than the manufacturer [and no production process was identified]. OR The source was not reported. AND The test substance identity was NOT analytically verified by the performing laboratory.
Not rated/ Not applicable	Do not select for this metric
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 3. Test substance purity Was the purity or grade (*i.e.,* analytical, technical) of the test substance (including the radiolabeled substance) reported and adequate? Were impurities identified? Were impurities present in quantities that could influence the results?	
High	For discrete substances, the test substance **(including radiolabel)** purity and composition were such that any observed effects were highly likely to be due to the nominal test substance itself

Data Quality Rating	Description
	(*e.g.,* highly pure at >98% or analytical grade test substance or a formulation of lower purity that contains ingredients considered to be inert, such as water). All components, including impurities and residual chemicals, were identified and the chemical of interest was the main component **(including the radiolabeled portion)**.
Medium	The nature and quantity of reported impurities **(of the unlabeled and labeled portions of the chemical)** are such that study results were not likely to be substantially impacted by the impurities (impurities not known to induce outcome of interest at low levels, impurities are inert or GRAS, etc.). Regardless of the nature and purity, for discrete chemicals, the purity of the chemical of interest should be >70%, unless water is the only impurity.
Low	Purity and/or grade of test substance were not reported **(for both the labeled and unlabeled chemical).**
Critically Deficient	The nature and quantity of reported impurities **(for unlabeled and labeled substances)** were such that study results were likely to be due to one or more of the impurities. ~~This is a serious flaw that makes the study unusable.~~ AND/OR **For discrete chemicals, purity (for labeled and unlabeled substances) was <70% with an impurity other than water.**
Not rated/ Not applicable	Do not select for this metric
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Domain 2. Test design	
Metric 4. Reference compounds Were the results of a reference compound (*e.g.,* caffeine, testosterone, benzoic acid) run concurrently or separately and recently by the same laboratory and reported in the study? Was the absorption response appropriate? **Alternately, has the performing lab demonstrated previous technical sufficiency in dermal absorption studies?** ~~[TBD: need to decide how important it is to have reference compounds]~~	
High	**An appropriate concurrent reference compound was tested or data from a historical reference compound was provided, and an appropriate response was observed. Any uncertainties (*e.g.*, omission of minor details regarding exposure or response) are minor.**
Medium	~~When applicable, an appropriate concurrent or historical reference compound was used, and an appropriate response was observed. Any uncertainties (*e.g.*, omission of minor details regarding exposure or response) are minor.~~ **An appropriate concurrent or historical reference compound was used, but there were some deficiencies regarding the reference compound exposure or response (*e.g.,* the response was not well described, it is unclear whether the response was acceptable).**
Low	~~When applicable, an appropriate concurrent or historical reference compound was used, but there were deficiencies regarding the reference compound exposure or response (*e.g.*, the response was not described).~~ ~~OR~~ ~~No reference compound was used or reported.~~ **No appropriate reference compound was used or reported AND there is no established history of test performance in the performing laboratory.**

Data Quality Rating	Description
Critically Deficient	Reference compounds were run but ~~an inadequate response for the reference compounds (outside historical controls results~~) indicates ~~that the assay would not accurately measure absorption.~~ **the response was unacceptable (*e.g.,* outside historical control results), raising concerns about the validity of the assay.**
Not rated/ Not applicable	Do not select for this metric.
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 5. Assay procedures Were assay methods and procedures (*e.g.,* diffusion cell set up, temperature, humidity, physiological ~~conductivity~~ **compatibility** of receptor fluid, volumes applied ~~and surface area of skin~~, **amount of test substance per surface area of skin**, use/measurement of occlusion or carbon trap, materials and procedures used for tape stripping, capture of volatile compounds if required) described in detail and applicable/justified? ~~See other metrics for additional assay procedures (*e.g.,* metrics 1–3 for test substance information; metric 11 for exposure duration; metric 15 for replicates per group).~~ **Do the study methods describe how they ensure that quantification of the receptor fluid is adequately sensitive (*e.g.,* sufficient signal-to-noise ratio, high enough specific activity of radiolabel, sufficient amount of time or number of scintillations detected).** **Diffusion cell setup should indicate static vs. flow-through, and for flow-through the flow rate should be indicated.** ~~OECD 428, OECD GD28 and OECD GD156 should be consulted and used to consider quality ratings.~~	
High	Study authors described the methods and procedures (*e.g.,* diffusion cell set up, temperature, humidity, physiological ~~conductivity~~ **compatibility** of receptor fluid, volumes applied and surface area of skin, use/measurement of occlusion or carbon trap, **specific activity of radiolabel**, materials and procedures used for tape stripping, capture of volatile compounds if required) used for the test in detail **and justified any relevant choices**. Either a static cell or flow-through system was used, with either constant stirring (static cell) or an appropriate flow- rate (flow-through). **These methods were appropriate based on the TGs and GDs above.**
Medium	Methods and procedures were partially described **(*e.g.,* all but temperature and humidity are described)** but appeared to be appropriate ~~(*e.g.,* TBD)~~, so the omission of details is unlikely to have a substantial impact on results.
Low	The methods and procedures were not well described or deviated from customary practices **(*e.g.,*** ~~TBD~~ **absence of occlusion or carbon trap for volatile test substance)** and this is likely to have a substantial impact on results; **however, conservative statistical adjustments could possibly account for these deviations.**
Critically Deficient	Assay methods and procedures were not appropriate **and would result in unusable data that cannot be statistically accounted for** (*e.g.,* ~~TBD~~ **failure to use a diffusion cell with sufficient seal, too low volume/mass of test substance applied per surface area, tape stripping and wash fractions combined and not measured independently).**
Not rated/ Not applicable	Do not select for this metric
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*

Data Quality Rating	Description
Metric 6. Standards for tests For assays with established criteria, were the test validity, acceptability, reliability, and/or QC criteria reported and consistent with current standards and guidelines? **Were sufficient data provided to determine that the standards/guidelines have been met?** Example criteria: *Percent recovery:* 100±10% of the radioactivity as stated in OECD TG 428; 100±20% for volatile and unlabeled compounds as stated in OECD GD 28. ***Coefficient of Variation*: Variance across replicates should be measured and indicated when standard deviation exceeds 25%.** ***Skin integrity:* (1) Tritiated water – a.) a 'limit value' for a maximum Kp of 4.5×10^{-3} cm/h (Guth et al. 2015 [Tox In Vitro 29:113-23]; Meidan and Roper, 2008 [Tox In Vitro 22:1062-9]) and mean Kp of 2.5×10−3 cm/h (Bronaugh et al. 1986 [Br J Dermatol 115:1-11]) for human *ex vivo* skin and b.) percent absorption (≤0.6% of applied dose in 1 hour) (Learn et al.– Poster from Charles River Labs).** **(2) Electrical conductance - minimal threshold of 17 kilo-ohms (Fasano et al., 2002) [Tox In Vitro 16:731-740]). (3) Trans-epidermal water loss – Less than 10 grams/m^2/h (Zhang, 2018) [Tox In Vitro 51: 129-135] (4) Other internal reference standard methods (*e.g.,* 3H-labeled compounds, methylene blue) as cited in Guth et al. 2015.** **See Guidance for Reviewers to view examples of various criteria.** ~~*Skin integrity:* (1) Tritiated water – minimal flux threshold TBD (2) Electrical conductance – minimal threshold of 17 kilo-ohms (Fasano et al., 2002).~~ ~~OECD 428, OECD GD28, and OECD GD156 should be consulted; deviations should be explained.~~	
Medium	**Criteria used to determine the** ~~The test~~ validity acceptability, reliability, and/or **quality of the experiment** ~~QC criteria~~ (*e.g.,* threshold for skin integrity, percent recovery considered acceptable) were reported and consistent with current standards and guidelines, as/if applicable **and authors stated that results met those criteria or the results provided enough detail to compare with the criteria**
Low	**Few or no QC criteria were reported, however, the reported results provided enough information to evaluate how the study compared against the criteria stated in the study and/or external criteria and standards.** ~~Some QC criteria were not reported~~.
Critically Deficient	Inadequate **information was provided on the standards used to evaluate the study results AND 1) the authors did not report whether the test met pre-established criteria,** OR 2**) inadequate** data **on results** were **presented** ~~provided~~ to demonstrate **the** validity, acceptability, and reliability of the test when compared with current standards and guidelines **or the pre-established standards/criteria identified by the authors. In this case, adequate QC cannot be performed.**
Not rated/ Not applicable	Do not select for this metric
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Domain 3. Exposure characterization	
Metric 7. Preparation and storage of test substance (chemical) Did the study characterize preparation of the test substance and storage conditions? Were the frequency of preparation and/or storage conditions appropriate to the test substance stability and solubility (if applicable)?	

Data Quality Rating	Description
High	The test substance preparation and/or storage conditions (*e.g.,* test substance stability, homogeneity, mixing temperature, stock concentration, stirring methods, storage conditions) were reported and appropriate for the test substance (*e.g.,* stability and solubility in diluents or solvents confirmed especially if they differ from what is used commercially; volatile test substances prepared and stored in sealed containers; same stock solution for all exposure concentrations).
Medium	The test substance preparation and storage conditions were reported, but minor limitations in the test substance preparation and/or storage conditions were identified (*e.g.,* **test substance formulations were stirred instead of centrifuged for a specific number of rotations per minute** ~~TBD~~). OR There is an omission of details that are unlikely to have a substantial impact on results (*e.g.,* preparation/administration of test substance is described, but storage is not reported; however, storage is unlikely to affect results based on likely stability over the time frame of the test or the physical and chemical properties of the chemical make concerns about volatility or solubility unlikely).
Low	Deficiencies in reporting of test substance preparation, and/or storage conditions are likely to have a substantial impact on results (*e.g.,* available information on physical and chemical properties suggests that stability and/or solubility of test substance in diluent/solvent may be poor). OR Information on preparation and storage was *not* reported and lack of details could substantially impact results (*e.g.,* preparation for volatile or low-solubility chemicals).
Critically Deficient	Serious flaws reported regarding test substance preparation and/or storage conditions will have critical impacts on dose/concentration estimates and make the study unusable (*e.g.,* instability of test substance, test substance volatilized rapidly from storage containers).
Not rated/ Not applicable	Do not select for this metric
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 8. Consistency of exposure administration Were exposures administered consistently across study groups (*e.g.,* consistent volumes and area of skin surface for application)?	
~~High~~	~~Details of exposure administration were reported and exposures were administered consistently across study groups in a scientifically sound manner (*e.g.,* consistent volumes, thickness and area of skin surface for application,).~~
Medium	Details of exposure administration were reported or inferred from the text, **and** ~~but the minor limitations in administration of~~ exposures **were administered consistently across study groups in a scientifically sound manner** (*e.g.,* **consistent volumes** ~~slight variation in volume~~, thickness and area **of** ~~or~~ skin surface ~~used~~ for application). **Any minor deviations/limitations are considered)** ~~that were identified~~ are unlikely to have a substantial impact on results. OR Details of exposure administration are incompletely reported, but the missing information is unlikely to have a substantial impact on results.

Data Quality Rating	Description
Low	Details of exposure administration were reported, but deficiencies in administration of exposures (*e.g.,* moderate differences in volume, thickness, and area of skin surface used for application) that were reported or inferred from the text are likely to have a substantial impact on results. OR Details of exposure administration are insufficiently reported and the missing information is likely to have a substantial impact on results
Critically Deficient	Exposures were not administered consistently across and/or within study groups (*e.g.,* large differences in volume, thickness, and area of skin surface used for application) resulting in serious flaws that make the study unusable.
Not rated/ Not applicable	Do not select for this metric.
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 9. Reporting of concentrations Were exposure doses/concentrations or amounts of test substance reported without ambiguity (*e.g.,* point estimate instead of range, analytical instead of nominal)? Note: Ambiguity also applies to doses/concentrations if values were only reported as points on a figure without numerical values.	
High	The exposure doses/concentrations or amounts of test substance were reported without ambiguity (*e.g.,* point estimate instead of range, analytical/measured instead of nominal).
Medium	The exposure doses/concentrations or amounts of test substance were reported with some ambiguity (*e.g.,* range instead of point estimate OR nominal instead of analytical/measured).
Low	The exposure doses/concentrations or amounts of test substance were reported but with substantial ambiguity about precision (*e.g.,* only an estimated range AND only nominal instead of analytical measurements).
Critically Deficient	The exposure doses/concentrations or amounts of test substance were not reported, resulting in serious flaws that make the study unusable.
Not rated/ Not applicable	Do not select for this metric.
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 10. Exposure duration Was the exposure duration (*e.g.,* hours) reported and was it appropriate for this study type and/or outcome(s) of interest? **Was the duration of exposure relevant to conditions of use and physical-chemical properties of the test substance? Did measurements continue post-exposure to account for retained dose in skin?** ~~[TBD: add text about human exposure relevancy]~~.	
High	The exposure duration (*e.g.,* hours) was reported and was appropriate for the study type and/or outcome(s) of interest (*e.g.,* at least 6 to 10 hours prior to washing and up to at least 24 hours **total including** post-washing). A shorter exposure duration may also be included but is less useful unless the substance is demonstrated to be volatile, **the results demonstrate that absorption approached completion (*e.g.*, nothing left in the skin wash or tape strip samples),** or the timepoint is used only for Kp/flux measurements.
Low	The duration(s) of exposure differed slightly from current standards and guidelines for studies of this type (*e.g.,* <6 to 10 hours prior to washing and less than 24 hours **total including** post-washing), **and** ~~but~~ the differences **may** ~~are unlikely to~~ have a substantial impact on results.

Data Quality Rating	Description
Critically Deficient	No information on exposure duration(s) was reported OR the exposure duration was not appropriate OR Duration(s) differed significantly from studies of the same or similar types **and these differences (most likely shorter duration)** . ~~These deficiencies~~ are likely to have a substantial impact on **interpretation of** results.
Not rated/ Not applicable	Do not select for this metric.
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 11. Number of exposure groups and concentrations spacing Were the number of exposure groups/**tested concentrations** and dose/concentration spacing **appropriate and** justified by study authors (*e.g.,* to mimic a specific type of human exposure) and adequate for addressing the purpose of the study **across a wide range of conditions of use (COUs) (*e.g.,* dilute, concentrated, and neat)?(***e.g.,* to evaluate dermal absorption)?	
High	**There were three or more dose** ~~The number of exposure~~ groups **tested** and dose/concentration spacing were justified by study authors (*e.g.,* to mimic a specific type of human exposure) and **were** ~~was~~ adequate for addressing the purpose of the study.
Low	There were ~~minor~~ limitations regarding the number of exposure groups and/or applied dose/concentration spacing (*e.g.,* unclear if lowest dose was low enough or the highest dose was high enough, **or less than three doses/concentrations tested), restricting the applicability of the results to only a subset of COUs and weight fractions**~~.), but the number of exposure groups and spacing of exposure levels were adequate and are unlikely to have a substantial impact on results.~~
Critically Deficient	The number of exposure groups and dose/concentration spacing were not reported ~~OR~~ ~~the number of exposure groups and dose/concentration spacing were not adequate and did not mimic expected human exposures.~~
Not rated/ Not applicable	Do not select for this metric.
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Domain 4. Test model	
Metric 12. Test model **(skin)** Were the test models (*e.g.,* viable skin, cadaver/cosmetic surgery skin, **animal skin**) and descriptive information (*e.g.,* tissue origin, anatomical site, tissue storage, **initial** integrity or viability) reported? What was the source of the test model? Was the model routinely used for the outcome of interest? For example, for human skin, split thickness (200–400µm), dermatomed skin is preferred.	
High	The test model (*e.g.,* viable skin, cadaver skin, cosmetic surgery **skin, animal** skin) and descriptive information (*e.g.,* tissue origin, anatomical site, tissue storage, integrity or viability, **lot/batch used**) were reported and the test model was routinely used for the outcome of interest.
Low	The test model was **insufficiently** reported **and reporting** ~~along~~ with limited descriptive ~~information.~~ ~~OR~~

Data Quality Rating	Description
	~~The test model was routinely used for the outcome of interest. Reporting~~ limitations **may** ~~are unlikely to~~ have a substantial impact on results.
Critically Deficient	The test model and necessary descriptive information were not **at all** reported OR the test model was not appropriate for evaluation of the specific ~~outcome of interest~~
Not rated/ Not applicable	Do not select for this metric.
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 13. Number/Replicates per group Was the number of replicates per dose/concentration group appropriate for the study type and outcome analysis?	
Medium	The number of replicates per dose/concentration were reported and was appropriate (*e.g.,* acceptable data from a minimum of four replicates per test preparation).
Low	The number of replicates per dose/concentration **and timepoint** was reported but was less than recommended by current standards and guidelines **(*i.e.,* <4 replicates for each test preparation according to OECD TG 428)**. This is likely to have an impact on results. OR The number of replicates per dose/concentration was not reported.
Critically Deficient	The number of organisms or tissues per study group and/or replicates per study group was insufficient to characterize dermal absorption (*e.g.,* less than four replicates per test preparation produced acceptable data).
Not rated/ Not applicable	**Do not select for this metric.** ~~Not applicable for qualitative studies not requiring any statistics.~~
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Domain 5. Outcome assessment	
Metric 14. Outcome assessment methodology Did the outcome assessment methodology address or report the intended outcome(s) of interest? Was the outcome assessment methodology (including ~~nature of endpoints evaluated~~, measurement technique and timing of measurement[s]) **appropriate** ~~sensitive~~ for the **associated conditions of use (COUs)**~~outcome(s) of interest (*e.g.,* measured endpoints that are able to detect a true effect~~)? OECD 428, OECD GD28 and **the dosing scenario?** ~~OECD GD156 should be consulted, and deviations should be documented and explained.~~	
High	The outcome assessment methodology addressed the intended outcome(s) of interest AND was sensitive for the outcome(s) of interest and followed OECD guidance documents. The **selected formulations are reasonable for the chemical of interest and would result in** ~~dosing reflected~~ a **sufficiently conservative estimate representative** ~~range~~ of conditions of use **for the chemical of interest (*e.g.,* use of IPM diluent).** ~~(COUs) to which humans are exposed~~. The infinite dose scenario **should be used** ~~is optimum~~ for Kp determinations while finite dosing is **required** ~~optimal~~ for **percent**~~%~~ absorption calculations.

Data Quality Rating	Description
	For finite~~The~~ dose **conditions, normally 1–5 mg/cm^2 of** ~~in the~~ **skin for a solid, and up to 10 µL/cm^2 for liquids of test material should be loaded, unless otherwise justified. For dilutions (*i.e.,* not neat test material), finite** ~~should be considered to be the potentially absorbable~~ dose **testing for each concentration of should ideally be conducted with application of 10 µL/cm^2 test material. For infinite dose testing of solids, it is required that at least 10 mg/cm^2 of pure substance be used to establish an undepletable dose, regardless of concentration. For infinite dose testing of liquids, at least 100 µL/cm^2 of pure substance should be used** to **establish an undepletable dose, regardless of concentration.** ~~calculate the final % absorption. Recovery is 90±10% or 80±20% for volatile substances.~~
Medium	The outcome assessment methodology used partially addressed the intended outcomes(s) of interest and deviations were explained, ~~(*e.g.,* mutation frequency evaluated in the absence of cytotoxicity in a gene mutation test)~~, but minor uncertainties **(*e.g.,* dosing was slightly below or above the recommendations for finite or infinite scenarios)** are unlikely to have a substantial impact on results.
Low	Significant deficiencies in the implementation of the reported outcome assessment methodology were identified (*e.g.,* **a volatile diluent was used with a volatile test substance** ~~matrix/assay interference, assay yielded anomalous results~~, etc.) OR The outcome assessment methodology was not clearly reported and it was unclear whether methods were sensitive for the outcome of interest. This is likely to have a substantial impact on results.
Critically Deficient	The reported assessment methodology was not sensitive to the outcome(s) of interest. For example, **percentage absorption was determined only from an infinite dose, and**/~~the reported measurement endpoint(s)~~ or **Kp/flux was derived from a finite dose, and statistics could** ~~timing were~~ not **easily be calculated independently.** ~~sensitive for the outcome(s) of interest (*e.g.,* cells were evaluated for chromosomal aberrations immediately after exposure to the test substance instead of after post-exposure incubation period).~~ These are serious flaws that make the study unusable.
Not rated/ Not applicable	Do not select for this metric.
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 15. Consistency of outcome assessment Was the outcome assessment carried out consistently (*i.e.,* using the same protocol) across study groups (*e.g.,* assessment at the same time after initial exposure in all study groups)?	
High	Details of the outcome assessment protocol were reported and outcomes were assessed consistently across study groups (*e.g.,* at the same time after initial exposure) using the same protocol in all study groups. All study groups utilized the same **vehicle for the** blank formulation as **for the study concentration groups** ~~a vehicle~~, the duration of exposure was the same across groups, the same receptor fluid composition was **used** ~~utilized~~ for each group, the sampling period was consistent across groups, etc.
Medium	There were minor differences in the timing of outcome assessment across study groups, or incomplete reporting of minor details of outcome assessment protocol execution were explained, but these uncertainties or limitations are unlikely to have substantial impact on results.

Data Quality Rating	Description
Low	Details regarding the execution of the study protocol for outcome assessment (*e.g.,* timing of assessment across groups) were confusing, limited, or not reported nor deviations explained (or cited to another publication with no description in the paper itself), and these deficiencies are likely to have a substantial impact on results.
Critically Deficient	There were large inconsistencies in the execution of study protocols for outcome assessment across study groups. These are serious flaws that make the study unusable.
Not rated/ Not applicable	Do not select for this metric.
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 16. Sampling adequacy **and sensitivity** Was the reported sampling size adequate for the outcome(s) of interest, including number of evaluations per exposure group, and endpoint (*e.g.,* **scintillation counts/sample)?**~~number of slides/cells/metaphases evaluated per test concentration)? OECD 428, OECD GD28, and OECD GD156 should be consulted, deviations should be explained.~~	
High	The study reported adequate sampling for the outcome(s) of interest including number of evaluations per exposure group, and **measurement sensitivity** ~~endpoint~~ (*e.g.,* scintillation counts/sample **and/or duration of radioactivity detection, adequate signal to noise [*i.e.,* background] ratio for detection [*e.g.,* signal 3× noise**]). The sampling intervals should be adequate to allow accurately graphically representing the results of the receptor fluid content of the test article versus time.
Medium	Details regarding sampling for the outcome(s) of interest were reported, but minor limitations were identified in the reported sampling of the outcome(s) of interest and were explained. However, those limitations are unlikely to have a substantial impact on results.
Low	Details regarding sampling of outcomes were not fully reported nor explained and the omissions are likely to have a substantial impact on results.
Critically Deficient	Reported sampling was not adequate for the outcome(s) of interest and/or serious uncertainties or limitations were identified in how the study carried out the sampling of the outcome(s) of interest (*e.g.,* replicates from control and test concentrations were evaluated at different times).
Not rated/ Not applicable	**N/A** ~~NA~~ should be used for assays/studies that do not require a certain number of slides/cells/metaphases etc. be sampled for scoring (*i.e.,* mutagenicity assays, mechanistic studies).
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Domain 6. Confounding/variable control	
Metric 17. Confounding variables in test design and procedures Were there confounding differences among the study groups in the size, and/or quality of tissues exposed that could influence the outcome assessment, **(*e.g.,* skin integrity)**?	
High	There were no differences reported among study group parameters (*e.g.,* test substance lot or batch, strain/batch/ lot number of ~~organisms~~ ~~or models used per group or size~~ **skin samples used per group or size**, and/or quality of tissues exposed) that could influence the outcome assessment. Skin integrity was ~~acceptable~~ **measured by preferable methods (*e.g.,* electrical resistance and TEWL). Results of skin integrity testing were acceptable for all replicates**

Data Quality Rating	Description
	and exposure groups (*e.g.,* >17 kilo-ohms based on electrical resistance, less than 10 grams/m^2/hr)
Medium	Minor differences were reported and explained in initial conditions that are unlikely to have a substantial impact on results (*e.g.,* tissues from two different lots were used and QC data were similar for both lots). Skin integrity ~~had variability but were acceptable~~ **was measured by a less desirable method (*e.g.,* tritiated water) , but results were acceptable (*e.g.,* a 'limit value' for Kp of 4.5E−03 cm/h or percent absorption of ≤0.6% of applied dose in 1 hour).** Outliers were statistically evaluated. **Most results of skin integrity testing were acceptable, and the number of replicates/donors was adequate after excluding any unacceptable results.**
Low	Initial strain/batch/lot number skin samples used per group, size, and/or quality of tissues exposed was not reported. These deficiencies are likely to have a substantial impact on results.
Critically Deficient	There were significant differences among the study groups with respect to the strain/batch/lot number of ~~organisms or models used per group or size and/or quality of tissues exposed (*e.g.,* initial number of viable bacterial cells were different for each replicate [105 cells in replicate 1, 108 cell in replicate 2, and 103 cells in replicate 3], tissues from two different lots were used for *in vitro* skin corrosion test, but the control batch quality for one lot was outside of the acceptability range). Skin integrity results were below thresholds. Recovery was below guidance limits or not quantified. Exposures did not reflect worker COUs.~~ **skin samples used per group or size and/or quality of tissues exposed (*e.g.,* several replicates demonstrated integrity issues)**. **Recovery varied greatly among replicates (*i.e.,* >10%). In this situation, results are not reliable for estimating actual absorption.**
Not rated/ Not applicable	Do not select for this metric.
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 18. Confounding variables in outcomes unrelated to exposure Were there differences among the study groups unrelated to exposure to test substance (*e.g.,* **solubility in receptor fluid** ~~contamination~~) that could influence the outcome assessment? Did the test material interfere in the assay (*e.g.,* altering fluorescence or absorbance, signal quenching by heavy metals, altering pH, solubility, or stability issues)?	
High	There were no reported differences among the study replicates or groups in test model unrelated to exposure (*e.g.,* **solubility in receptor fluid** ~~contamination~~) and the test substance did not interfere with the assay (*e.g.,* signal quenching by heavy metals). The test substance was demonstrated to be soluble in the receptor fluid.
Medium	Authors reported that one or more replicates or groups experienced disproportionate outcomes unrelated to exposure (*e.g.,* **solubility issues** ~~contamination~~), but data from the remaining exposure replicates or groups were valid and is unlikely to have a substantial impact on results. OR The test material interfered in the assay, but the interference did not cause substantial differences among the groups. OR Solubility in the receptor fluid was not demonstrated, but solubility is not likely to be an issue based on the expected concentration relative to the receptor fluid formulation.

Data Quality Rating	Description
Low	Data on outcome differences unrelated to exposure (including receptor fluid formulation) were not reported for each study replicate or group and the missing information is likely to have a substantial impact on results. OR Assay interference was present or inferred resulting in large variabilities among the groups.
Critically Deficient	There were indications of assay interference several replicates or groups or there is evidence of insolubility in the receptor fluid such that no outcomes could be assessed.
Not rated/ Not applicable	Do not select for this metric.
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Domain 7. Data presentation and analysis	
Metric 19. Data analysis Were statistical methods, calculations methods, and/or data manipulation clearly described and appropriate for dataset(s)? **Were absorption estimates presented across a time series for each compartment of the test system? Did the results vary widely?**	
High	Statistical methods (including any calculations or data transformations) were clearly described or had only minor omissions and were appropriate for the dataset(s). Percent~~age~~ absorption estimates were presented across a time series for each compartment of the test system, and Kp/flux measurements were based on the linear/steady-state part of the absorption curve. **Calculated absorption estimates properly accounted for outliers consistently across replicates/timepoints. The coefficient of variation (CV) was ≤25% for more than half of the samples across each individual scenario (across donors, replicates, media (*e.g.,* receptor fluid), timepoints) within the study.** ~~Any selection of outliers was justified.~~
Low	Statistical analysis was performed but not described adequately to understand what was performed or whether it was properly applied (*e.g.,* determination of outliers) **or** statistical analysis was inconsistently/inappropriately applied across replicates and datasets (*e.g.,* ~~absorption not measured across time series,~~ inconsistent exclusion of outliers **{perhaps due to integrity failure}** across measurements~~, coefficient of variation for several replicates (SD relative to mean) was <> 25%~~). **OR** **Absorption estimates were not presented across a time series for each scenario.** **OR** **[The CV was >25% and ≤ 50% for more than half the samples across donors, replicates, media (*e.g.,* receptor fluid, timepoints) within an individual scenario in a study**.] **OR [The CV was >50% for more than half the samples within an individual scenario in a study, and data** are **available for EPA to calculate an alternate (upper end) value to account for variability in the results.]**
Critically Deficient	Statistical analysis was performed using an inappropriate method (*e.g.,* parametric test for non-normally distributed data)~~, and/or coefficient of variation for several replicates (SD relative to mean) was >25%.~~ OR Statistical analysis was not performed. **OR The coefficient of variation (CV) was >50% for more than half the samples (across donors, replicates, media (*e.g.,* receptor fluid),** timepoints) **within an individual assay.** AND Data enabling an independent statistical analysis **or to calculate an upper end value for fraction absorbed/Kp** were not provided. These are serious flaws that make the study unusable.

Data Quality Rating	Description
Not rated/Not applicable	Statistical analysis was not possible (n = 1−2) or not necessary (clearly negative findings across all groups~~; Ames assay using 2-fold increase as benchmark~~).
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 20. Data interpretation **Is**~~Were the evaluation criteria reported and is~~ the interpretation of results consistent with standards and guidelines? **For example, did** reported absorption estimates account for sufficient recovery? Was the combined amount of test substance in the skin and receptor fluid counted in the overall estimate? **Was derivation of Kp vs. fractional absorption applied to the appropriate exposure conditions (infinite dose vs. finite dose, respectively)?**	
High	~~Study authors followed evaluation criteria for the test, and these were consistent with established practices~~ [a]. Recovery of applied test substance was adequate (90% for occluded or non-volatile substance, 80% for non-occluded, volatile ~~substance~~ **or unlabeled substance) or the absorption estimate was normalized to account for any reduction below these levels. Both the skin compartment and any tape-stripping washes after the first two were included in the absorption estimate**. **AND** Assay results were correctly interpreted relative to the properties of the test substance and the assay setup (sufficient duration to capture all absorption if not evaporated, proper interpretation of finite vs. infinite dose).
Medium	Absorption estimates were reported improperly **or incompletely** (*e.g.,* skin compartment not included, values not normalized if recovery less than adequate), however simple independent data analysis is possible to overcome these issues.
Low	**There are major uncertainties based on insufficient or incorrect interpretation of the results by the authors (*e.g.,* characterization of infinite vs. finite doses). However, EPA can estimate results with some level of confidence.** ~~Complex reanalysis of the data is required in order to obtain usable interpretations (*e.g.,* external outlier analysis may be required, Kp determination must be recalculated from the time series).~~
Critically Deficient	The reported **scoring**~~rating~~ and/or evaluation criteria were very inconsistent with established practices, resulting in the interpretation of data results that are seriously flawed and highly misleading relative to the properly interpreted results (*e.g.,* study author claims 5% absorption but correct analysis results in 40% absorption, only percentage absorption is reported from a finite dose) **and therefore not usable for any scenarios.**
Not rated/Not applicable	Do not select for this metric.
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*
Metric 21. Reporting of data Were the data for all outcomes presented? Were data reported by exposure group?	
High	Data for exposure-related findings were presented for all outcomes by exposure group **(*e.g.,* all timepoints, formulations, concentrations, finite vs. infinite dose)**. Negative findings were reported qualitatively or quantitatively.
Medium	Data for exposure-related findings were reported for most, but not all, outcomes by exposure group (*e.g.,* both short and long-term exposures). The minor uncertainties in outcome reporting are unlikely to have substantial impact on results **(*e.g.,* intermediate timepoints not included in the data tables but the full curve is included).**

Data Quality Rating	Description
Low	Data for exposure-related findings were not shown for each study group, but results were described in the text. OR Data were only reported for some outcomes. OR Continuous data were presented without measures of variability or n/group.
Critically Deficient	Data presentation was inadequate (*e.g.,* the report does not differentiate among findings in multiple exposure groups) OR Major inconsistencies were present in reporting of results that render the findings uncertain regarding hazard identification or dose- response.
Not rated/ Not applicable	Do not use for this metric.
Reviewer's comments	*[Document concerns, uncertainties, limitations, and deficiencies and any additional comments that may highlight study strengths or important elements such as relevance]*

6 EVIDENCE INTEGRATION

As described in Section 7 of the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021), evidence integration refers to the consideration of evidence obtained from systematic review and scientific information obtained from sources that did not undergo systematic review to implement a weight of scientific evidence approach. The weight of scientific evidence is defined as "a systematic review method, applied in a manner suited to the nature of the evidence or decision, that uses a pre-established protocol to comprehensively, objectively, transparently, and consistently identify and evaluate each stream of evidence, including strengths, limitations, and relevance of each study and to integrate evidence as necessary and appropriate based upon strengths, limitations, and relevance" (40 CFR 702.33). The consideration of the quality and relevance of the data, while taking into account the strengths and limitations of the data, to appropriately evaluate the evidence for this supplement, is described in Section 7 of the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021).

6.1 Physical and Chemical Properties

Section 7.1 in the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021) describes how information from data sources that undergo systematic review are integrated for use in risk evaluations under TSCA for physical and chemical property data. Appendix D.1 in the *Risk Evaluation for 1,2-Dichloroethane* provides the rationale for selecting data values from systematic review.

6.2 Environmental Fate and Transport

Sections 7.2 to 7.2.3.1 in the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021) describe how information from data sources that undergo systematic review are integrated for use in risk evaluations under TSCA for environmental fate and transport data. In some cases, multiple high-quality data values or a range of values may be given. Including multiple data values or a range of values provides some transparency on how 1,2-dichloroethane occurs in real world scenarios and to highlight the variability and/or potential uncertainties in any individual value. Some studies on biodegradation rates in the environment were obtained outside of systematic review but were put through the SR process in cases where there were to support a quantitative analysis. A determination of confidence in the range of fate endpoint(s) are also made based on the study quality of contributing data values. The main purpose of this determination is to evaluate how consistent the conclusions are for studies of congruent ratings. Interpretations regarding the strength of a study, model, or data point contribute to how these are individually judged and then considered together. This process culminates in a final judgment about the extent to which an endpoint is supported by the available evidence.

6.3 Environmental Release and Occupational Exposure

For evaluating environmental releases and occupational exposures of the various conditions of use (COUs), EPA first developed a map of COUs to broader occupational exposure scenario (OES) categories as shown in Table 3-1 of the *Risk Evaluation for 1,2-Dichloroethane* (U.S. EPA, 2026n). Specifically, EPA developed OES categories to group processes or applications with similar sources of release and occupational exposures that occur at industrial and commercial workplaces within the scope of the risk evaluation. For each OES, occupational exposure and environmental release results are expected to be representative of the entire population of workers and sites involved for the given OES in the United States.

Regarding the environmental release assessment, EPA identified release data for 1,2-dichloroethane in three programmatic databases: TRI, NEI, and DMR. As described in Section 3.1 of the *Risk Evaluation for 1,2-Dichloroethane* (U.S. EPA, 2026n), EPA estimated OES-specific releases using TRI and NEI

for air release estimates, DMR and TRI for water release estimates, and TRI for land release estimates. For those OESs where programmatic data was unavailable or available but not expected to capture the entirety of releases, EPA estimated releases using a modeling approach. Data on the number of associated release days was not available in TRI, NEI, DMR, or literature. Therefore, EPA used relevant generic scenarios to estimate the number of release days per OES. To estimate the number of sites using 1,2-dichloroethane within a COU, EPA relied on U.S. Census Bureau data. The sources used in the release assessment, as well as the approach for estimating releases, are described in detail in the *Environmental Release Assessment for 1,2-Dichloroethane* (U.S. EPA, 2026l).

Regarding the occupational exposure assessment, EPA assessed OES-specific exposures to workers and ONUs based on surrogate monitoring data, modeling approaches, and worker activity information from standard engineering sources and systematic review as described in the *Risk Evaluation for 1,2-Dichloroethane* (U.S. EPA, 2026n). Inhalation exposure monitoring data for 1,2-dichloroethane during manufacturing and processing were provided via a test order submission from the Vinyl Institute (Stantec ChemRisk, 2024). This data was used for the following OES: Manufacturing, Processing as a reactant, and Laboratory use. For the Processing into formulation, mixture or reaction product and Industrial and commercial non-aerosol cleaning and degreasing OESs EPA used inhalation data provided via a test order submission, which was existing data generated during the manufacture of an herbicide used worldwide where the 1,2-dichloroethane is used as a processing solvent (BASF, 2021). For the Industrial application of adhesives and sealants OES, surrogate monitoring data from trichloroethylene was used to estimate inhalation exposures. Dermal exposure data was not available for 1,2-dichloroethane; therefore, EPA used a modeling approach. Where available, EPA used literature search data and generic scenarios for estimation of associated exposure days. To estimate the number of workers and ONUs potentially exposed to 1,2-dichloroethane within a condition of use, EPA relied on U.S. Census Bureau data. The approach for estimating occupational exposures is described in detail in the *Occupational Exposure Assessment for 1,2-Dichloroethane* (U.S. EPA, 2026m).

6.4 General Population, Consumer, and Environmental Exposure

As described in Section 3.2 of the *Risk Evaluation for 1,2-Dichloroethane* (U.S. EPA, 2026n), EPA collected facility-specific releases and summarized the releases by COU where supporting data existed. Release data for 1,2-dichloroethane are from industrial and commercial sources as reported in TRI, NEI and DMR. Environmental media (*i.e.,* water, soil, and air) concentrations were estimated based on the reported releases. Monitoring data from EPA monitoring databases (*i.e.,* Water Quality Portal, UCMR, and Ambient Monitoring Technology Information Center) were extracted and provide general ranges of chemical concentrations found in the corresponding sampled media. Monitoring data are rarely associated with specific facility releases as that would require that the monitoring data be both spatially and temporally aligned to facility releases. Thus, environmental media concentrations estimate using facility reported releases were used as inputs for the general population exposure modeling. General population, consumer, and environmental exposures were evaluated for the inhalation, dermal, and ingestion exposure pathways based on environmental media concentration estimates.

6.4.1 General Population and Environmental Exposure: Surface, Groundwater, and Drinking Water

Surface water release estimates were used as inputs for estimating surface water concentrations via an updated modeling approach that applies equations drawn from the Exposure and Fate Assessment Screening Tool (EFAST 2014) and Variable Volume Water Model - Point Source Calculator (VVWM-PSC) but incorporates newer hydrologic flow data from the National Hydrography Dataset (NHD) and prioritizes a calculated facility effluent flow when a modeled NHD flow appears unreasonably low. The updated approach also includes an evaluation of surface water concentrations at intake locations of

Public Water Systems (PWSs) that involves adjusting concentration estimates at the source to an anticipated down-stream dilution effect at the PWS's respective intake location.

In-stream concentrations from air deposition were modeled using the PSC. Distances between sites of air release/deposition and the nearest NHD flowline were estimated to rule out unreasonable stream modeling scenarios. Soil concentrations were used to estimate ingestion. Modeled surface water concentrations were used for dermal and ingestion estimates through various scenarios (*e.g.,* drinking water, dermal via swimming, incidental ingestion via swimming, and fish ingestion).

For the environmental exposure assessment, EPA used modeled surface water concentrations, benthic pore water concentrations and sediment concentrations modeled via VVWM-PSC.

Where available, EPA compared reported environmental monitoring data and reported environmental modeling data with EPA modeled media concentrations. Section 3.3 of the *Risk Evaluation for 1,2-Dichloroethane* summarizes the EPA estimated environmental concentrations (U.S. EPA, 2026n). The *Environmental Exposure Assessment for 1,2-Dichloroethane* includes measured and modeled concentrations of 1,2-dichloroethane in aquatic and terrestrial species (U.S. EPA, 2026i). Furthermore, EPA gathered available information on 1,2-dichloroethane in surface water and groundwater from the WQP database as presented in the *Environmental Media Assessment for 1,2-Dichloroethane* (U.S. EPA, 2026k). Appendices B and C of the *Environmental Media Assessment for 1,2-Dichloroethane* describe the approach taken to retrieve and process the WQP data (U.S. EPA, 2026k). It is anticipated that in the future, the incorporation of state-specific databases for measured drinking water concentrations from PWSs will add to the monitoring data that can be used to verify and compare with modeled drinking water concentrations.

When applying the PSC, certain physical and chemical properties are used as model input variables, which are collected as a part of the chemistry, transport, and fate assessment. The use of SR to verify physical and chemical properties of 1,2-dichloroethane are thus relevant for exposure modeling using the PSC. Aquatic (in-stream water column, benthic pore water, and benthic sediment) concentrations of concern (COC) are used as a part of the water pathway's exposure team assessment using the PSC. Similarly, any verification of aquatic COCs from experimental data obtained through SR that is used by the ecology team to determine these COCs are thus relevant for exposure modeling using the PSC.

6.4.2 General Population and Environmental Exposure: Ambient Air

EPA evaluated general population and environmental exposures based on measured and predicted concentrations of 1,2-dichloroethane in ambient air. Section 3.3.1.1 of the *Risk Evaluation for 1,2-Dichloroethane* summarizes reported measured concentrations for ambient air found in the peer-reviewed literature obtained through systematic review, from the EPA Ambient Monitoring Technology Information Center (AMTIC) archive, and from the EPA estimated ambient air concentrations (U.S. EPA, 2026n). Air release estimates were used as inputs for estimating ambient air concentrations and deposition fluxes via American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) and Human Exposure Model (HEM). Modeled ambient air concentrations were used to estimated inhalation exposure. Modeled deposition fluxes were used to estimate soil concentrations and in-stream concentrations of 1,2-dichloroethane. Where available, EPA compared reported environmental monitoring and modeling data with EPA modeled ambient air concentrations (Section 7.1 of the *Environmental Media Assessment for 1,2-Dichloroethane*) (U.S. EPA, 2026k).

6.4.3 General Population Exposure: Dietary, Biomonitoring and Exposure Reconstruction

Dietary data from the systematic review monitoring literature is summarized in Section 5.1.3.4 of the *Risk Evaluation for 1,2-Dichloroethane* (U.S. EPA, 2026n). EPA estimated dietary exposures to 1,2-dichloroethane via fish ingestion based on estimated chemical concentration in fish and general population and tribal fish ingestion rates as cited in the EPA *Exposure Factors Handbook* (U.S. EPA, 2017). EPA estimated fish concentrations using surface water concentrations modeled using PSC and the bioaccumulation factor that was as a part of the chemistry, transport, and fate assessment. The *Environmental Exposure Assessment for 1,2-Dichloroethane* includes measured concentrations of 1,2-dichloroethane in aquatic species (U.S. EPA, 2026i).

EPA extracted from one human milk monitoring study. In addition to the absence of 1,1-dichloroethane in human milk, 1,2-dichloroethane is not expected to accumulate and be present in human milk.

6.4.4 Consumer Exposure Assessment

EPA conducted a consumer exposure assessment for 1,2-dichloroethane-containing articles as summarized in Section 5.1.2 of the *Risk Evaluation for 1,2-Dichloroethane* (U.S. EPA, 2026n). Through the systematic review of completed assessments and peer-reviewed literature, EPA identified data regarding articles (*e.g.,* ornaments, squishy toys and lamp base) containing 1,2-dichloroethane. Specific data utilized in the assessment included product-specific emission rates and indoor air concentrations from 1,2-dichloroethane-emitting articles.

6.4.5 Other Data Sources

The exposure models relied heavily on the physical chemical and fate properties as input parameters. Sections 5.1 and 5.2 describe how the physical chemical and fate properties were selected. Where applicable, EPA relied on model defaults, and exposure factors and activity patterns available from EPA's *Exposure Factors Handbook* (U.S. EPA, 2017). As mentioned previously, these physical chemical and fate parameters are used as inputs for PSC modeling of surface water concentrations of 1,2-dichloroethane and as inputs for AERMOD and HEM modeling.

6.5 Environmental and Human Health Hazard

Sections 7.4 and 7.5 in the 2021 Draft Systematic Review Protocol explain how information from data sources that undergo systematic review and those that do not are considered for use in risk evaluations under TSCA, specifically, for evaluating environmental and human health hazard, respectively (U.S. EPA, 2021).

The environmental hazard evidence streams, as described in Table 7-8 of the 2021 Draft Systematic Review Protocol, have been updated to increase the level of clarity and consistency of granularity (U.S. EPA, 2021). Table 6-1 reflects the updated environmental hazard evidence streams that parses out the types of mechanistic data evidence streams.

As described in Appendix A of the *Environmental Hazard Assessment for 1,2-Dichloroethane* (U.S. EPA, 2026j), additional information was needed to characterize environmental hazard resulting from exposure to 1,2-dichloroethane. For hazard, analogs were utilized for read-across to 1,2-dichloroethane, described in further detail in Appendix A of the *Environmental Hazard Assessment for 1,2-Dichloroethane* and in Section 6.5.1.

6.5.1 Environmental Hazard

Section 7.1 of the 2021 Draft Systematic Review Protocol describes how environmental hazard integration is organized into different evidence streams. For risk evaluations conducted under TSCA, the environmental hazard evidence streams were updated (Table 6-1) to more clearly reflect how apical and mechanistic hazardous endpoints (as defined by the screening PECO statement) that result from either controlled field/laboratory or uncontrolled exposure field studies are binned to better consider the relevancy of the data for the respective risk evaluation.

Table 6-1. Querying the Evidence to Organize Integration for Environmental Data and Information

Evidence Stream	Questions
Apical endpoints (controlled field/laboratory conditions)	Of the available data, are there endpoints that could have population level effects such as reproduction, growth, and/or mortality?
Mechanistic data **(controlled field/laboratory conditions)**	Is the mechanistic endpoint linked to an apical endpoint? Is it part of an AOP? If not, can you instead use it qualitatively? If a transcriptomic point of departure (tPOD) is available, is it appropriate to use quantitatively?
Apical endpoints (uncontrolled exposure field conditions)	Are there any field studies available showing adverse effects? How does exposure to the chemical of interest affect the community of organisms? Are there any co-occurring adverse environmental conditions other than exposure to the chemical of interest that should be taken into consideration?
Mechanistic endpoints **(uncontrolled exposure field conditions)**	Is the mechanistic endpoint linked to an apical endpoint? Is it part of an AOP? If not, can you instead use it qualitatively? If a transcriptomic point of departure (tPOD) is available, is it appropriate to use quantitatively? Are there any co-occurring adverse environmental conditions other than exposure to the chemical of interest that should be taken into consideration?

As described in the *Environmental Hazard Assessment for 1,2-Dichloroethane* (U.S. EPA, 2026j), streams for environmental hazard included empirical data with apical endpoints for aquatic and terrestrial organisms that were reviewed following the TSCA systematic review process.

EPA reviewed potential environmental health hazards associated with 1,2-dichloroethane (U.S. EPA, 2026j). Studies identified as meeting PECO screening criteria and evaluated for data quality received an overall quality determination of high, medium, low, or uninformative. Only high and medium-quality studies were used for purposes of quantitative hazard and risk characterization (U.S. EPA, 2026j). Due to a lack of wildlife terrestrial mammalian studies, controlled laboratory studies that used mice and rats as human health model organisms were used to assess terrestrial hazards.

1,2-Dichloroethane presented data gaps for sediment-dwelling species. 1,1-Dichloroethane and 1,2-dichloropropane were selected for read-across of 1,2-dichloroethane acute benthic hazard and 1,1,2-trichloroethane was selected for read-across of 1,2-dichloroethane chronic benthic hazard based on structural similarity, physical and chemical similarity, and toxicological similarity. High-rated benthic invertebrate hazard data are available for acute (Smithers, 2024) exposure to 1,1-dichloroethane and 1,2-

dichloropropane. High-rated benthic invertebrate hazard data are available for chronic exposure to 1,1,2-trichloroethane (Smithers, 2023).

Evidence streams for environmental hazard included empirical data with apical endpoints and mechanistic data from controlled laboratory experiments for aquatic and terrestrial organisms. Predictive models represented within the body of evidence included the EPA's Web-based interspecies Correlation Estimation (Web-ICE) application and the Ecological Structure Activity Relationships (ECOSAR) Predictive Model. Modeled data served as evidence streams that fall outside of systematic review but include systematically reviewed methods and were integrated with evidence streams that fall within the TSCA systematic review process.

Using empirical and modeled evidence streams, EPA characterized the environmental hazards of 1,2-dichloroethane to surrogate species representing various receptor groups (U.S. EPA, 2026j), including freshwater and saltwater vertebrates (fish, acute and chronic; amphibian, acute); freshwater and saltwater invertebrates (acute and chronic); freshwater and saltwater algae (acute); a terrestrial plant (tobacco, acute); and terrestrial vertebrates (mammalian [mouse and rat]; avian [chicken]).

Evaluations of the strength of evidence and weight of scientific evidence for environmental hazard was conducted as described within Section 7.4.2 of the 2021 Draft Systematic Review Protocol (U.S. EPA, 2021). For additional details on the application of this methodology, see section 6 of the *Environmental Hazard Assessment for 1,2-Dichloroethane* (U.S. EPA, 2026j).

6.5.2 Human Health Hazard

Section 7.5 of the 2021 draft protocol describes how EPA considers individual evidence streams (human, animal toxicity, and mechanistic/supplemental studies) when integrating evidence. For risk evaluations conducted under TSCA, the human health hazard evidence streams were updated (Table 6-2) to more clearly reflect how apical and mechanistic hazardous endpoints (as defined by the screening PECO statement) that result from either animal toxicology and epidemiology studies are binned to better consider the relevancy of the data for the respective risk evaluation.

Table 6-2. Querying the Evidence to Organize Integration for Human Health Hazard Data and Information

Evidence Stream	Questions
Studies of Exposed Humans Considered for Deriving Toxicity Values	Is there dose-response data and/or endpoints in human studies that can be used as PODs? Is there any qualitative data in human studies that can be used to support PODs used for risk estimates?
In Vivo Mammalian Animal Studies Considered for Deriving Toxicity Values	Is there dose-response information and/or endpoints that could be used as PODs? Are there differences/similarities in toxicity across studies of different exposure durations and routes? Is there concordance across species and studies for observed endpoints?
Mechanistic and *In Vitro* Studies	Is the mechanistic endpoint linked to an apical endpoint? Is it part of an AOP? If not, can you instead use it qualitatively? If a transcriptomic point of departure (tPOD) is available, is it appropriate to use quantitatively?

Evidence Stream	Questions
and Supplemental Information	

6.6 Dermal Absorption

Table 6-3 describes relevant questions to consider when integrating evidence from empirical data, read-across analysis from analog chemicals, and models of dermal absorption.

As a result of a test order, EPA received an in vitro dermal absorption using human skin for 1,1-dichloroethane (Labcorp Early Development, 2024). Rankings assigned by EPA for these studies are described in Section 5.6.

For 1,2-dichloroethane, EPA considered the evaluated studies (see OQDs presented in Section 5.6) as well as the EPA Superfund K_p equation (U.S. EPA, 2004), which is a model for deriving an estimated Kp value based on the (Potts and Guy, 1992) analysis of the Flynn (1990) dermal dataset using physical-chemical properties of molecular weight and log K_{OW} values as inputs when integrating dermal absorption data for 1,2-dichloroethane. EPA's New Chemicals Division has used a qualitative approach to estimate dermal absorption based on the physical-chemical properties of molecular weight, log K_{OW}, solubility, and vapor pressure, which EPA also used when choosing a screening level dermal absorption estimate.

Table 6-3. Querying the Evidence to Organize Integration for Human Health Dermal Absorption

Evidence Stream (Individual or Combined)	Questions
Studies of Exposed Humans for the Target Chemical	Are there human studies that can be used quantitively to determine dermal absorption estimates or qualitatively in a weight of scientific evidence analysis?
In Vivo Mammalian Animal Studies for the Target Chemical	Are there *in vivo* animal data that can be used quantitatively or qualitatively?
In Vitro/Ex Vivo Studies and Supplemental Information for the Target Chemical	Are there *in vitro* dermal absorption data that can be used quantitatively or qualitatively?
Read Across from Chemical Analogs	Are there human, *in vivo,* or *in vitro/ex vivo* dermal absorption data available for analogs of the target chemical that have similar physical-chemical properties?
Models for Kp and Fraction Absorption	Are there models available to estimate the dermal permeability coefficient (Kp) or fraction absorbed?
Combining Evidence	Are there differences/similarities in dermal absorption across studies? Is there concordance within and across *in vivo* and *in vitro* studies as well as within and across species?

Evidence Stream (Individual or Combined)	Questions
	If read-across analysis from an analog chemical is used, is there consistency with any limited data for the target chemical or among the analog chemical studies? If multiple models are used, is there concordance among the models and with any limited empirical data?

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8 APPENDICES

Appendix A ENVIRONMENTAL AND HUMAN HEALTH HAZARD UPDATED LITERATURE SEARCH STRINGS

As noted in Section 3.6, the updated literature search for environmental and human health hazard performed in April 2025 utilized the same search strategy as in the initial literature search in 2019. Additionally, a revision was made to improve an epidemiological information filter that is part of the standard filter set for human health hazard. Then, the results from the search strategy went through an additional round of a series of specific search strategies to identify information to be considered for the evaluation of environmental hazard. Details on the improved filter for epidemiologic quantitative analysis information and the series of specific search strategies applied to identify environmental hazard for the updated literature search performed in April 2025 are listed in Table_Apx A-1.

All together (environmental hazard, epidemiologic, and animal model data relevant to human health hazard), EPA identified a total of 176 additional sources from the updated peer-reviewed literature search for hazard for 1,2-dichloroethane. Out of the 176 references, the improved filter for epidemiologic quantitative analysis and the series of specific search strategies for environmental hazard resulted in the identification of 85 references. All additional sources were screened as described in Section 4.6.

Table_Apx A-1. Targeted Peer Literature Search Strategies for Environmental Hazard for 1,2-Dichloroethane

Targeted Area	Search Strategy
Algae	tiab:("Acetabularia" OR "achlya" OR "Achnanthes" OR "Achnanthidium" OR "Acrosiphonia" OR "Acutodesmus" OR "Adlafia" OR "Aegagropila" OR "Agardhiella" OR "Agmenellum" OR "Ahnfeltia" OR "Alaria" OR "Alariaceae" OR "Alexandrium" OR "Algae" OR "Amphidinium" OR "Amphiprora" OR "Amphora" OR "Amyloodinium" OR "Anabaena" OR "Anabaenopsis" OR "Anacystis" OR "Analipus" OR "Ankistrodesmus" OR "Ankyra" OR "Anomoeneis" OR "Antithamnion" OR "Aphanizomenon" OR "Aphanocapsa" OR "Aphanochaete" OR "aphanomyces" OR "Aphanothece" OR "Apiocystis" OR "Archaeplastida" OR "Arthrospira" OR "Ascophyllum" OR "Astasia" OR "Asterionella" OR "Asterochloris" OR "Attheya" OR "Aulacoseira" OR "Aulosira" OR "Aureococcus" OR "Axodines" OR "Bacillaria" OR "Bacillariophyceae" OR "Bacillariophyta" OR "Bacteriastrum" OR "Batrachospermum" OR "Bellerochea" OR "Biddulphia" OR "Boergesenia" OR "Bolidomonas" OR "Botrydium" OR "Botryococcus" OR "Brachiomonas" OR "Bracteacoccus" OR "Bryopsis" OR "Bumilleria" OR "Bumilleriopsis" OR "Cachonina" OR "Callithamnion" OR "Calothrix" OR "Carteria" OR "Cavinula" OR "Centrales" OR "Cephaleuros" OR "Ceramiaceae" OR "Ceramium" OR "Cerataulina" OR "Ceratium" OR "Ceratocorys" OR "Ceratoneis" OR "Chaetoceros" OR "Chaetomorpha" OR "Chaetophora" OR "Chamaesiphon" OR "Champia" OR "Chara" OR "Characeae" OR "Characiopsis" OR "Characium" OR "Charophyta" OR "Chattonella" OR "Chilomonas" OR "Chlamydocapsa" OR "Chlamydomonas" OR "Chlorarachniophytes" OR "Chlorella" OR "Chloridella" OR "Chlorococcales" OR "Chlorococcum" OR "Chlorogloeopsis" OR "Chlorogonium" OR "Chloroidium" OR "Chlorokybophyceae" OR "Chlorolobion" OR "Chloromonas" OR "Chlorophyceae" OR "Chlorophyta" OR "Chodatella" OR "Chondrus" OR "Chorda" OR "Choricystis" OR "Chromista" OR "Chromochloris" OR "Chromulina" OR "Chromulinaceae" OR "Chroococcus" OR "Chroomonas" OR "Chrysochromulina" OR "Chrysococcus" OR "Chrysophyceae" OR "Chrysophyta" OR "Chrysosporum" OR "Cladophora" OR "Closterium" OR "Coccochloris" OR "Coccolithaceae" OR "Coccolithus" OR "Coccomyxa" OR "Cocconeis" OR "Coccotylus" OR "Cochlodinium" OR "Codium" OR "Codosiga" OR "Coelastrum" OR "Coelosphaerium" OR "Coenochloris" OR "Coleochaete" OR "Conjugatophyceae" OR "Conticribra" OR "Corallina" OR "Coscinodiscus" OR "Cosmarium" OR "Craticula" OR "Crucigenia" OR "Crypthecodinium" OR "Cryptochrysis" OR "Cryptomonas" OR "Cryptophyceae" OR "Cryptophycophyta" OR "Cryptophyta" OR "Cyanidium" OR "Cyanobium" OR "Cyanophyceae" OR "Cyanophycota" OR "Cyathomonas" OR "Cyclotella" OR "Cylindrocapsa" OR "Cylindrospermopsis" OR "Cylindrospermum" OR "Cylindrotheca"

	OR "Cymatopleura" OR "Cymatosira" OR "Cymbella" OR "Cymbellaceae" OR "Cystoseira" OR "Desmarella" OR "Desmarestia" OR "Desmidiaceae" OR "Desmococcus" OR "Desmodesmus" OR "Detonula" OR "Devaleraea" OR "Diatoma" OR "Diatomaceae" OR "Dicrateria" OR "Dictyosphaerium" OR "Dictyota" OR "Didymosphenia" OR "Dinobryon" OR "Dinoflagellata" OR "Dinophyceae" OR "Diploneis" OR "Ditylum" OR "Draparnaldia" OR "Dunaliella" OR "Durvillaea" OR "Ecklonia" OR "Ectocarpus" OR "Edaphochlorella" OR "Eisenia" OR "Elakatothrix" OR "Emiliania" OR "Encyonema" OR "Enteromorpha" OR "Entomoneis" OR "Entosiphon" OR "Eolimna" OR "Epithemia" OR "Euastrum" OR "Eucocconeis" OR "Eudorina" OR "Euglena" OR "Euglenids" OR "Euglenophyceae" OR "Euglenophycota" OR "Eunotia" OR "Eustigmatophyceae" OR "Eutreptiella" OR "Exuviella" OR "Fibrocapsa" OR "Fischerella" OR "Fistulifera" OR "Fragilaria" OR "Franceia" OR "Frustilia" OR "Fucaceae" OR "Fucus" OR "Galaxaura" OR "Galdieria" OR "Gayralia" OR "Geitlerinema" OR "Gelidium" OR "Geminella" OR "Gephyrocapsa" OR "Glaucocystis" OR "Glaucophyta" OR "Glenodinium" OR "Gloeocapsa" OR "Gloeococcus" OR "Gloeocystis" OR "Gloeotaenium" OR "Gloeotrichia" OR "Golenkinia" OR "Gomphonema" OR "Gomphosphaeria" OR "Gonatozygon" OR "Gongrosira" OR "Goniotrichum" OR "Gonium" OR "Gonyaulax" OR "Gracilaria" OR "Gracilariopsis" OR "Grammatophora" OR "Grateloupia" OR "Guinardia" OR "Gymnodinium" OR "Gyrodinium" OR "Gyrosigma" OR "Haematococcus" OR "Halochlorococcum" OR "Hannaea" OR "Hantzschia" OR "Hapalosiphon" OR "Haptophyceae" OR "Haptophyta" OR "Haptophytes" OR "Haslea" OR "Hemiaulus" OR "Hemiselmis" OR "Heterocapsa" OR "heterokonts" OR "Heteromita" OR "Heterosigma" OR "Himantothallus" OR "Hizikia" OR "Hormidium" OR "Hormosira" OR "Hydrianum" OR "Hydrodictyon" OR "Hydrolithon" OR "Hymenomonas" OR "Hypnea" OR "Hypnomonas" OR "Iridaea" OR "Isochrysis" OR "Kappaphycus" OR "Karayevia" OR "Karenia" OR "Katablepharis" OR "Kirchneriella" OR "Klebsormidium" OR "Kobayasiella" OR "Komvophoron" OR "Lagenidiaceae" OR "lagenidium" OR "Laminaria" OR "Laminariales" OR "Leptocylindrus" OR "Leptolyngbya" OR "Lessonia" OR "Lessoniaceae" OR "Levanderina" OR "Limnothrix" OR "Lingulodinium" OR "Lithodesmium" OR "Lyngbya" OR "Macrocystis" OR "Mallomonas" OR "Mastigocladus" OR "Mayamaea" OR "Melosira" OR "Meridion" OR "Merismopedia" OR "Mesostigmatophyceae" OR "Mesotaenium" OR "Micractinium" OR "Micrasterias" OR "Microcoleus" OR "Microcystis" OR "Micromonas" OR "Microspora" OR "Microthamnion" OR "Monera" OR "Monochrysis" OR "Monoraphidium" OR "Monosiga" OR "Monostroma" OR "Mougeotia" OR "Myxosarcina" OR "Nannochloris" OR "Nannochloropsis" OR "Navicula" OR "Neochloris" OR "Neogoniolithon" OR "Neosiphonia" OR "Nephrocytium" OR "Nephroselmis" OR "Netrium" OR "Nitella" OR "Nitellopsis" OR "Nitzschia" OR "Nostoc" OR "Ochromonas" OR "Odontella" OR "Odonthalia" OR "Oedogonium" OR "Oikomonas" OR "Olisthodiscus" OR "Oocystis" OR "oomycetes" OR "oomycota" OR "Oophila" OR "Opephora" OR "Oscillatoria" OR "Ourococcus" OR "Padina" OR "Palmaria" OR "Pandorina" OR "Parachlorella" OR "Paulschulzia" OR "Pavlova" OR "Pectinodesmus" OR "Pediastrum" OR "Pelvetia" OR "Penium" OR "Pennales" OR "Peranema" OR "Peridinium" OR "Peronia" OR "peronospora" OR "Peronosporaceae" OR "Peronosporales" OR "Phacotus" OR "Phacus" OR "Phaeocystis" OR "Phaeodactylum" OR "Phaeophyceae" OR "Phaeophyta" OR "Phormidium" OR "Phycodrys" OR "Phyllospora" OR "phytophthora" OR "Pilayella" OR "Pinnularia" OR "Pithophora" OR "Planktolyngbya" OR "Planktosphaeria" OR "Planktothrix" OR "Planothidium" OR "Platymonas" OR "Plectonema" OR "Pleodorina" OR "Pleurochrysis" OR "Pleurococcus" OR "Pleurosigma" OR "Pleurosira" OR "Plumaria" OR "Polykrikos" OR "Polysiphona" OR "Polysiphonia" OR "Polytoma" OR "Polytomella" OR "Porphyra" OR "Porphyridium" OR "Poteriochromonas" OR "Prasinocladus" OR "Prasinococcus" OR "Prasinophyta" OR "Prasiolaceae" OR "Prorocentrum" OR "Proteomonas" OR "Protococcus" OR "Protoderma" OR "Protosiphon" OR "Prototheca" OR "Prymnesiophyceae" OR "Prymnesiophytes" OR "Prymnesium" OR "Pseudanabaena" OR "Pseudococcomyxa" OR "Pseudoisochrysis" OR "Pseudo-nitzschia" OR "Pterocladiella" OR "Pyramimonadales" OR "Pyramimonas" OR "Pyrocystis" OR "Pyropia" OR "Pyrrophycophyta" OR "Pythiaceae" OR "pythium" OR "Raphidocelis" OR "Raphidophyceae" OR "Reimeria" OR "Rhizoclonium" OR "Rhizosolenia" OR "Rhodomonas" OR "Rhodophyta" OR "Rhodymenia" OR "Rhoicosphenia" OR "Rhopalodia" OR "Rivularia" OR "Saccharina" OR "Saccorhiza" OR "saprolegnia" OR "Saprolegniaceae" OR "Sargassum" OR "Scenedesmus" OR "Scherffelia" OR "Schizogonium" OR "Schizomeris" OR "Schizothrix" OR "Schroederella" OR "Scrippsiella" OR "Scytonema" OR "Scytosiphon" OR "Selenastrum" OR "Sellaphora" OR "Silvetia" OR "Skeletonema" OR "Snowella" OR "Spermothamnion" OR "Sphacelaria" OR "Sphaerellopsis" OR "Sphaerocystis" OR "Sphaeroplea" OR "Spirogyra" OR "Spirulina" OR "Spondylosium" OR "Spongiochloris" OR "Spongomorpha" OR "Sporotetras" OR "Spumella" OR "Spyridia" OR "Staurastrum" OR "Staurodesmus" OR "Stauroneis" OR "Stephanodiscus" OR "Stichococcus" OR "Stigeoclonium" OR "Stokesiella" OR "Storeatula" OR "Stramenopiles" OR "Streptotheca" OR "Surirella" OR "Symbiodinium" OR

	"Synechococcus" OR "Synechocystis" OR "Synedra" OR "Synura" OR "Synurophyceae" OR "Syracosphaera" OR "Tabellaria" OR "Tabellariales" OR "Tabularia" OR "Tetrachlorella" OR "Tetraedron" OR "Tetraselmis" OR "Thalassiosira" OR "Thoracosphaera" OR "Tolypothrix" OR "Trachelomonas" OR "Trebouxia" OR "Trebouxiophyceae" OR "Treubaria" OR "Tribonema" OR "Triceratium" OR "Trochiscia" OR "Tryblionella" OR "Ulnaria" OR "Ulothrix" OR "Ulva" OR "Umbilicosphaera" OR "undaria" OR "Uroglena" OR "Uronema" OR "Urosolenia" OR "Vaucheria" OR "Viridiplantae" OR "Vitreochlamys" OR "Volvox" OR "Volvulina" OR "Westiellopsis" OR "Willea" OR "Wollea" OR "Xanthophyceae" OR "Xanthophyta" OR "Zygnema" OR "Zygnematales" OR "Zygnematophyceae" OR "Zygogonium" OR "arame" OR "bladderwrack" OR "carageen" OR "Cercozoan" OR "Charophycean" OR "Choanoflagellate" OR "Chrysophyte" OR "Coccolithophore" OR "Coccolithophorid" OR "coralline" OR "Cryptomonad" OR "Crysophyte" OR "Cyanobacteria" OR "Diatom*" OR "dinoflagellate" OR "euglenoid" OR "Haptophyte" OR "irish moss" OR "kelp" OR "kombu" OR "macro algae" OR "marine velvet" OR "mermaid's wine glass" OR "microalgae" OR "neptune's necklace" OR "phytoplankton" OR "platymonad" OR "Prasinophyte" OR "sargassum weed" OR "seaweed" OR "stonewort" OR "tangleweed" OR "wakame" OR "wrack" OR "Xanthophyte" OR "Gulf Weed" OR "Rockweed" OR "alga")
Avian	tiab:("Abeillia" OR "Abroscopus" OR "Aburria" OR "Acanthagenys" OR "Acanthidops" OR "Acanthis" OR "Acanthisitta" OR "Acanthiza" OR "Acanthorhynchus" OR "Acanthornis" OR "Accipiter" OR "Accipitridae" OR "Aceros" OR "Achaetops" OR "Acridotheres" OR "Acritillas" OR "Acrobatornis" OR "Acrocephalus" OR "Acropternis" OR "Acryllium" OR "Actenoides" OR "Actinodura" OR "Actitis" OR "Actophilornis" OR "Adelomyia" OR "Aechmophorus" OR "Aechmorhynchus" OR "Aegithalos" OR "Aegithina" OR "Aegolius" OR "Aegotheles" OR "Aegypius" OR "Aenigmatolimnas" OR "Aepypodius" OR "Aerodramus" OR "Aeronautes" OR "Aethia" OR "Aethopyga" OR "Afropavo" OR "Afrotis" OR "Agamia" OR "Agapornis" OR "Agelaioides" OR "Agelaius" OR "Agelastes" OR "Agelasticus" OR "Aglaeactis" OR "Aglaiocercus" OR "Agraphospiza" OR "Agriornis" OR "Agropsar" OR "Ailuroedus" OR "Aimophila" OR "Aix galericulata" OR "Aix sponsa" OR "Akialoa" OR "Alaemon" OR "Alauda" OR "Alca torda" OR "Alcedo" OR "Alcippe" OR "Aleadryas" OR "Alectoris" OR "Alectroenas" OR "Alectrurus" OR "Alectura" OR "Alethe" OR "Alisterus" OR "Alle alle" OR "Allenia" OR "Alophoixus" OR "Alopochelidon" OR "Alopochen" OR "Amadina" OR "Amalocichla" OR "Amandava" OR "Amaurocichla" OR "Amaurolimnas" OR "Amaurornis" OR "Amaurospiza" OR "Amazilia" OR "Amazilis" OR "Amazona" OR "Amazonetta" OR "Amblycercus" OR "Amblyornis" OR "Amblyospiza" OR "Amblyramphus" OR "Ammodramus" OR "Ammomanes" OR "Ammomanopsis" OR "Ammoperdix" OR "Ammospiza" OR "Ampeliceps" OR "Ampelioides" OR "Ampelion" OR "Amphilais" OR "Amphispiza" OR "Amphispizopsis" OR "Amytornis" OR "Anabacerthia" OR "Anabathmis" OR "Anabazenops" OR "Anairetes" OR "Anaplectes" OR "Anarhynchus" OR "Anas americana" OR "Anas aucklandica" OR "Anas bahamensis" OR "Anas bernieri" OR "Anas capensis" OR "Anas castanea" OR "Anas chlorotis" OR "Anas crecca" OR "Anas cyanoptera" OR "Anas eatoni" OR "Anas erythrorhyncha" OR "Anas falcata" OR "Anas flavirostris" OR "Anas formosa" OR "Anas fulvigula" OR "Anas georgica" OR "Anas gibberifrons" OR "Anas gracilis" OR "Anas hottentota" OR "Anas laysanensis" OR "Anas luzonica" OR "Anas melleri" OR "Anas nesiotis" OR "Anas penelope" OR "Anas platalea" OR "Anas poecilorhyncha" OR "Anas puna" OR "Anas querquedula" OR "Anas rhynchotis" OR "Anas sibilatrix" OR "Anas smithii" OR "Anas sparsa" OR "Anas strepera" OR "Anas superciliosa" OR "Anas undulata" OR "Anas versicolor" OR "Anas wyvilliana" OR "Anas acuta" OR "Anas clypeata" OR "Anas discors" OR "Anas platyrhynchos" OR "Anas rubripes" OR "Anastomus" OR "Anatidae" OR "Ancistrops" OR "Andigena" OR "Androdon" OR "Andropadus" OR "Androphobus" OR "Anhima" OR "Anhinga" OR "Anisognathus" OR "Anodorhynchus" OR "Anomalospiza" OR "Anopetia" OR "Anorrhinus" OR "Anous" OR "anser" OR "Anseranas" OR "Anseriformes" OR "Anthipes" OR "Anthobaphes" OR "Anthocephala" OR "Anthochaera" OR "Anthocincla" OR "Anthornis" OR "Anthoscopus" OR "Anthracoceros" OR "Anthracothorax" OR "Anthreptes" OR "Anthropoides" OR "Anthus" OR "Antilophia" OR "Antrostomus" OR "Anumbius" OR "Anurolimnas" OR "Anurophasis" OR "Apalharpactes" OR "Apalis" OR "Apaloderma" OR "Apalopteron" OR "Aphanotriccus" OR "Aphelocephala" OR "Aphelocoma" OR "Aphrastura" OR "Aphriza" OR "Aphrodroma" OR "Aplonis" OR "Aprosmictus" OR "Aptenodytes" OR "Apterygiformes" OR "Apteryx" OR "Apus" OR "Aquila" OR "Ara ambiguus" OR "Ara ararauna" OR "Ara chloropterus" OR "Ara glaucogularis" OR "Ara macao" OR "Ara militaris" OR "Ara rubrogenys" OR "Ara severus" OR "Ara tricolor" OR "Arachnothera" OR "Aramides" OR "Aramidopsis" OR "Aramus" OR "Aratinga" OR "Arborophila" OR "Arcanator" OR "Archboldia" OR "Archilochus" OR "Ardea" OR "Ardeola" OR "Ardeotis" OR "Arenaria interpres" OR "Arenaria melanocephala" OR "Argusianus" OR "Arizelocichla" OR "Arremon" OR "Arremonops" OR "Arses" OR "Artamella" OR "Artamus" OR

	"Artemisiospiza" OR "Artisornis" OR "Arundinicola" OR "Asarcornis" OR "Asemospiza" OR "Ashbyia" OR "Asio abyssinicus" OR "Asio capensis" OR "Asio flammeus" OR "Asio madagascariensis" OR "Asio otus" OR "Asio stygius" OR "Aspatha" OR "Asthenes" OR "Astrapia" OR "Atalotriccus" OR "Atelornis" OR "Athene" OR "Atimastillas" OR "Atlantisia" OR "Atlapetes" OR "Atrichornis" OR "Attagis" OR "Atticora" OR "Attila" OR "Augastes" OR "Aulacorhynchus" OR "Auriparus" OR "Automolus" OR "Aves" OR "Aviceda" OR "Avocettula" OR "Aythya" OR "Babax" OR "Baeolophus" OR "Baeopogon" OR "Balaeniceps" OR "Balearica" OR "Bambusicola" OR "Bangsia" OR "Barnardius" OR "Bartramia" OR "Baryphthengus" OR "Basileuterus" OR "Basilinna" OR "Basilornis" OR "Batara" OR "Bathmocercus" OR "Batis" OR "Batrachostomus" OR "Berenicornis" OR "Berlepschia" OR "Bernieria" OR "Bias musicus" OR "Biatas" OR "Biziura" OR "Bleda" OR "Blythipicus" OR "Bocagia" OR "Boissonneaua" OR "Bolbopsittacus" OR "Bolborhynchus" OR "Bolemoreus" OR "Bombycilla" OR "Bonasa" OR "Bostrychia" OR "Botaurus" OR "Brachycope" OR "Brachygalba" OR "Brachypteracias" OR "Brachypteryx" OR "Brachyramphus" OR "Bradornis" OR "Bradypterus" OR "Branta" OR "Brotogeris" OR "Bubalornis" OR "Bubo africanus" OR "Bubo ascalaphus" OR "Bubo bengalensis" OR "Bubo blakistoni" OR "Bubo bubo" OR "Bubo capensis" OR "Bubo cinerascens" OR "Bubo coromandus" OR "Bubo lacteus" OR "Bubo leucostictus" OR "Bubo magellanicus" OR "Bubo nipalensis" OR "Bubo philippensis" OR "Bubo poensis" OR "Bubo scandiacus" OR "Bubo shelleyi" OR "Bubo sumatranus" OR "Bubo virginianus" OR "Bubo vosseleri" OR "Bubulcus" OR "Bucanetes" OR "Buccanodon" OR "Bucco" OR "Bucephala" OR "Buceros" OR "Bucorvus" OR "Buettikoferella" OR "Bugeranus" OR "Bulweria" OR "Burhinus" OR "Busarellus" OR "Butastur" OR "Buteo" OR "Buteogallus" OR "Buthraupis" OR "Butorides" OR "Bycanistes" OR "Cacatua" OR "Cacicus" OR "Cacomantis" OR "Cairina" OR "Calamanthus" OR "Calamonastes" OR "Calamonastides" OR "Calamospiza" OR "Calandrella" OR "Calcarius" OR "Calendulauda" OR "Calicalicus" OR "Calidris" OR "Caliechthrus" OR "Caligavis" OR "Callacanthis" OR "Callaeas" OR "Callipepla" OR "Calliphlox" OR "Callocephalon" OR "Callonetta" OR "Calochaetes" OR "Calocitta" OR "Caloenas" OR "Calonectris" OR "Caloperdix" OR "Caloramphus" OR "Calothorax" OR "Calypte" OR "Calyptocichla" OR "Calyptomena" OR "Calyptophilus" OR "Calyptorhynchus" OR "Calyptura" OR "Camarhynchus" OR "Camaroptera" OR "Campephaga" OR "Campephilus" OR "Campethera" OR "Campicoloides" OR "Campochaera" OR "Camptorhynchus" OR "Camptostoma" OR "Campylopterus" OR "Campylorhamphus" OR "Campylorhynchus" OR "Canirallus" OR "Cantorchilus" OR "Capito" OR "Caprimulgus" OR "Capsiempis" OR "Caracara" OR "Cardellina" OR "Cardinalis" OR "Carduelis" OR "Cariama" OR "Caridonax" OR "Carpococcyx" OR "Carpodacus" OR "Carpodectes" OR "Carpornis" OR "Carpospiza" OR "Carterornis" OR "Caryothraustes" OR "Casiornis" OR "Castanozoster" OR "Casuarius" OR "Casuariiformes" OR "Catamblyrhynchus" OR "Catamenia" OR "Cataponera" OR "Catharopeza" OR "Cathartes" OR "Catharus" OR "Catherpes" OR "Catreus" OR "Cecropis" OR "Celeus" OR "Centrocercus" OR "Centronyx" OR "Centropus" OR "Cephalopterus" OR "Cephalopyrus" OR "Cepphus" OR "Cerasophila" OR "Ceratogymna" OR "Cercibis" OR "Cercococcyx" OR "Cercomacra" OR "Cercotrichas" OR "Cereopsis" OR "Cerorhinca" OR "Certhia" OR "Certhiaxis" OR "Certhidea" OR "Certhilauda" OR "Certhionyx" OR "Ceryle" OR "Cettia" OR "Ceuthmochares" OR "Ceyx argentatus" OR "Ceyx azureus" OR "Ceyx cajeli" OR "Ceyx collectoris" OR "Ceyx cyanopectus" OR "Ceyx dispar" OR "Ceyx erithaca" OR "Ceyx fallax" OR "Ceyx flumenicola" OR "Ceyx gentianus" OR "Ceyx lepidus" OR "Ceyx malaitae" OR "Ceyx margarethae" OR "Ceyx meeki" OR "Ceyx melanurus" OR "Ceyx mulcatus" OR "Ceyx nigromaxilla" OR "Ceyx pusillus" OR "Ceyx sacerdotis" OR "Ceyx solitarius" OR "Ceyx wallacii" OR "Ceyx websteri" OR "Chaetocercus" OR "Chaetops" OR "Chaetoptila" OR "Chaetorhynchus" OR "Chaetornis" OR "Chaetura" OR "Chaimarrornis" OR "Chalcomitra" OR "Chalcoparia" OR "Chalcophaps" OR "Chalcopsitta" OR "Chalcostigma" OR "Chalcothraupis" OR "Chalybura" OR "Chamaea" OR "Chamaepetes" OR "Chamaeza" OR "Charadriiformes" OR "Charadrius" OR "Charitospiza" OR "Charmosyna" OR "Chasiempis" OR "Chauna" OR "Chelictinia" OR "Chelidoptera" OR "Chelidorhynx" OR "Chen carnagica" OR "Chen rossii" OR "Chen caerulescens" OR "Chenonetta" OR "Cheramoeca" OR "Chersomanes" OR "Chersophilus" OR "Chilia" OR "Chionis" OR "Chionomesa" OR "Chiroxiphia" OR "Chlamydera" OR "Chlamydochaera" OR "Chlamydotis" OR "Chleuasicus" OR "Chlidonias" OR "Chloephaga" OR "Chlorestes" OR "Chloridops" OR "Chloris ambigua" OR "Chloris monguilloti" OR "Chloris sinica" OR "Chloris spinoides" OR "Chloris chloris" OR "Chloroceryle" OR "Chlorocharis" OR "Chlorochrysa" OR "Chlorocichla" OR "Chlorodrepanis" OR "Chlorophanes" OR "Chlorophoneus" OR "Chlorophonia" OR "Chloropicus" OR "Chloropsis" OR "Chlorornis" OR "Chlorospingus" OR "Chlorostilbon" OR "Chlorothraupis" OR "Cholornis" OR "Chondestes" OR "Chondrohierax" OR "Chordeiles" OR "Chroicocephalus" OR "Chrysococcyx" OR "Chrysocolaptes" OR "Chrysocorythus" OR "Chrysolampis" OR "Chrysolophus" OR "Chrysomma" OR "Chrysomus" OR "Chrysophlegma" OR "Chrysothlypis" OR "Chrysuronia" OR "Chunga" OR "Cichladusa" OR "Cichlocolaptes" OR "Cichlopsis"

	OR "Cicinnurus" OR "Ciconia" OR "Cinclidium" OR "Cinclocerthia" OR "Cinclodes" OR "Cinclosoma" OR "Cinclus" OR "Cinnycerthia" OR "Cinnyricinclus" OR "Cinnyris" OR "Circaetus" OR "Circus aeruginosus" OR "Circus approximans" OR "Circus assimilis" OR "Circus buffoni" OR "Circus cinereus" OR "Circus cyaneus" OR "Circus macrosceles" OR "Circus macrourus" OR "Circus maillardi" OR "Circus maurus" OR "Circus melanoleucos" OR "Circus pygargus" OR "Circus ranivorus" OR "Circus spilonotus" OR "Circus spilothorax" OR "Ciridops" OR "Cissa" OR "Cissomela" OR "Cissopis" OR "Cisticola" OR "Cisticolidae" OR "Cistothorus" OR "Cittura" OR "Cladorhynchus" OR "Clamator" OR "Clangula" OR "Claravis" OR "Cleptornis" OR "Clibanornis" OR "Climacteris" OR "Clytoceyx" OR "Clytoctantes" OR "Clytolaema" OR "Clytomyias" OR "Clytorhynchus" OR "Clytospiza" OR "Cnemarchus" OR "Cnemathraupis" OR "Cnemophilus" OR "Cnemoscopus" OR "Cnemotriccus" OR "Cnipodectes" OR "Coccopygia" OR "Coccothraustes" OR "Coccyzus" OR "Cochlearius" OR "Cochoa" OR "Coeligena" OR "Coenocorypha" OR "Coereba" OR "Colaptes" OR "Colibri" OR "Colinus" OR "Colius" OR "Collocalia" OR "Colluricincla" OR "Coloeus" OR "Colonia" OR "Colorhamphus" OR "Columba" OR "Columbidae" OR "Columbiformes" OR "Columbina" OR "Compsothraupis" OR "Conioptilon" OR "Conirostrum" OR "Conopias" OR "Conopophaga" OR "Conopophila" OR "Conostoma" OR "Conothraupis" OR "Contopus" OR "Conuropsis" OR "Copsychus" OR "Coracias" OR "Coracina" OR "Coracopsis" OR "Coracornis" OR "Coragyps" OR "Corapipo" OR "Corcorax" OR "Cormobates" OR "Corvidae" OR "Corvinella" OR "Corvus" OR "Corydon" OR "Coryphaspiza" OR "Coryphistera" OR "Coryphospingus" OR "Corythaeola" OR "Corythaixoides" OR "Corythopis" OR "Corythornis" OR "Coscoroba" OR "Cossypha" OR "Cossyphicula" OR "Cotinga" OR "Coturnicops" OR "Coturnix" OR "Coua caerulea" OR "Coua coquereli" OR "Coua cristata" OR "Coua cursor" OR "Coua delalandei" OR "Coua gigas" OR "Coua reynaudii" OR "Coua ruficeps" OR "Coua serriana" OR "Coua verreauxi" OR "Cracticus" OR "Cranioleuca" OR "Crateroscelis" OR "Crax alberti" OR "Crax alector" OR "Crax blumenbachii" OR "Crax daubentoni" OR "Crax fasciolata" OR "Crax globulosa" OR "Crax rubra" OR "Creagrus" OR "Creatophora" OR "Creurgops" OR "Crex crex" OR "Crex egregia" OR "Crinifer" OR "Criniger" OR "Crithagra" OR "Crocias" OR "Crossleyia" OR "Crossoptilon" OR "Crotophaga" OR "Crypsirina" OR "Cryptillas" OR "Cryptophaps" OR "Cryptospiza" OR "Cryptosylvicola" OR "Crypturellus" OR "Cuculus" OR "Culicicapa" OR "Culicivora" OR "Curaeus" OR "Cursorius" OR "Cutia" OR "Cyanerpes" OR "Cyanicterus" OR "Cyanistes" OR "Cyanochen" OR "Cyanocitta" OR "Cyanocompsa" OR "Cyanocorax" OR "Cyanolanius" OR "Cyanolimnas" OR "Cyanoliseus" OR "Cyanoloxia" OR "Cyanolyca" OR "Cyanomitra" OR "Cyanopica" OR "Cyanopsitta" OR "Cyanoptila" OR "Cyanoramphus" OR "Cyclarhis" OR "Cyclopsitta" OR "Cygnus" OR "Cymbilaimus" OR "Cymbirhynchus" OR "Cynanthus" OR "Cyornis" OR "Cyphorhinus" OR "Cypseloides" OR "Cypsiurus" OR "Cypsnagra" OR "Cyrtonyx" OR "Dacelo" OR "Dacnis" OR "Dactylortyx" OR "Daphoenositta" OR "Daption" OR "Daptrius" OR "Dasycrotapha" OR "Dasylophus" OR "Dasyornis" OR "Deconychura" OR "Deleornis" OR "Delichon" OR "Deltarhynchus" OR "Dendragapus" OR "Dendrexetastes" OR "Dendrocincla" OR "Dendrocitta" OR "Dendrocolaptes" OR "Dendrocopos" OR "Dendrocoptes" OR "Dendrocygna" OR "Dendroica" OR "Dendronanthus" OR "Dendropicos" OR "Dendrortyx" OR "Deroptyus" OR "Dicaeum" OR "Dichrozona" OR "Dicrurus" OR "Didunculus" OR "Diglossa" OR "Dinemellia" OR "Dinopium" OR "Dinornithiformes" OR "Diomedea" OR "Diopsittaca" OR "Dioptrornis" OR "Diphyllodes" OR "Discosura" OR "Diuca" OR "Dives atroviolaceus" OR "Dives dives" OR "Dives warszewiczi" OR "Dolichonyx" OR "Doliornis" OR "Donacobius" OR "Donacospiza" OR "Doricha" OR "Doryfera" OR "Drepanis" OR "Drepanoptila" OR "Drepanorhynchus" OR "Drepanornis" OR "Dreptes" OR "Dromaius" OR "Dromaius" OR "Dromas" OR "Dromococcyx" OR "Drymocichla" OR "Drymodes" OR "Drymophila" OR "Drymornis" OR "Dryobates" OR "Dryocopus" OR "Dryolimnas" OR "Dryoscopus" OR "Dryotriorchis" OR "Dubusia" OR "Ducula" OR "Dulus" OR "Dumetella" OR "Dumetia" OR "Dupetor" OR "Dysithamnus" OR "Dysmorodrepanis" OR "Eclectus" OR "Ectopistes" OR "Egretta" OR "Elaenia" OR "Elanoides" OR "Elanus" OR "Elaphrornis" OR "Electron carinatum" OR "Electron platyrhynchum" OR "Eleoscytalopus" OR "Eleothreptus" OR "Elliotomyia" OR "Elminia" OR "Elseyornis" OR "Emarginata" OR "Emberiza" OR "Emberizoides" OR "Embernagra" OR "Emblema" OR "Eminia" OR "Empidonax" OR "Empidonomus" OR "Empidornis" OR "Enicognathus" OR "Enicurus" OR "Enodes" OR "Ensifera" OR "Entomodestes" OR "Entomyzon" OR "Eolophus" OR "Eophona" OR "Eopsaltria" OR "Eos bornea" OR "Eos cyanogenia" OR "Eos histrio" OR "Eos semilarvata" OR "Eos reticulata" OR "Eos squamata" OR "Ephippiorhynchus" OR "Epimachus" OR "Epinecrophylla" OR "Epthianura" OR "Eremalauda" OR "Eremobius" OR "Eremomela" OR "Eremophila" OR "Eremopterix" OR "Eriocnemis" OR "Erithacus" OR "Erpornis" OR "Erythrocercus" OR "Erythrogonys" OR "Erythropygia" OR "Erythrotriorchis" OR "Erythrura" OR "Esacus" OR "Eubucco" OR "Eucometis" OR "Eudocimus" OR "Eudromia" OR "Eudynamys" OR "Eudyptes" OR "Eudyptula" OR "Eugenes fulgens" OR "Eugenes spectabilis" OR "Eugerygone" OR "Eugralla" OR

	"Eulabeornis" OR "Eulacestoma" OR "Eulampis" OR "Eulidia" OR "Eulipoa" OR "Eumomota" OR "Eumyias" OR "Euneornis" OR "Eunymphicus" OR "Euodice" OR "Eupetes" OR "Eupetomena" OR "Euphagus" OR "Eupherusa" OR "Euphonia" OR "Euplectes" OR "Eupodotis" OR "Euptilotis" OR "Eurillas" OR "Eurocephalus" OR "Eurostopodus" OR "Euryceros" OR "Eurylaimus" OR "Eurynorhynchus" OR "Euryptila" OR "Eurypyga" OR "Eurystomus" OR "Euscarthmus" OR "Euschistospiza" OR "Eutoxeres" OR "Eutrichomyias" OR "Eutriorchis" OR "Falcipennis" OR "Falco" OR "Falco sparverius" OR "Falconiformes" OR "Falculea" OR "Falcunculus" OR "Ferminia" OR "Ficedula" OR "Finschia" OR "Florisuga" OR "Fluvicola" OR "Formicarius" OR "Formicivora" OR "Forpus" OR "Foudia" OR "Foulehaio" OR "Francolinus" OR "Fraseria" OR "Fratercula" OR "Frederickena" OR "Fregata" OR "Fregetta" OR "Fregilupus" OR "Fringilla" OR "Fringillidae" OR "Fulica" OR "Fulmarus" OR "Fulvetta" OR "Furnarius" OR "Gactornis" OR "Galbalcyrhynchus" OR "Galbula" OR "Galerida" OR "Gallicolumba" OR "Gallicrex" OR "Galliformes" OR "Gallinago" OR "Gallinula" OR "Gallirallus" OR "Galloperdix" OR "Gallus" OR "Gampsonyx" OR "Gampsorhynchus" OR "Garritornis" OR "Garrodia" OR "Garrulax" OR "Garrulus" OR "Gavia" OR "Gavicalis" OR "Gecinulus" OR "Gelochelidon" OR "Geobiastes" OR "Geococcyx" OR "Geocolaptes" OR "Geoffroyus" OR "Geokichla" OR "Geomalia" OR "Geopelia" OR "Geophaps" OR "Geositta" OR "Geospiza" OR "Geospizopsis" OR "Geothlypis" OR "Geotrygon" OR "Geranoaetus" OR "Geranospiza" OR "Geronticus" OR "Gerygone" OR "Glareola" OR "Glaucidium" OR "Glaucis" OR "Gliciphila" OR "Glossopsitta" OR "Glycichaera" OR "Glycifohia" OR "Glyphorynchus" OR "Gnorimopsar" OR "Goldmania" OR "Gorsachius" OR "Goura" OR "Gracula" OR "Gracupica" OR "Grafisia" OR "Grallaria" OR "Grallaricula" OR "Grallina" OR "Graminicola" OR "Granatellus" OR "Grandala" OR "Grantiella" OR "Graueria" OR "Graydidascalus" OR "Grus americana" OR "Grus antigone" OR "Grus canadensis" OR "Grus grus" OR "Grus japonensis" OR "Grus leucogeranus" OR "Grus monacha" OR "Grus nigricollis" OR "Grus rubicunda" OR "Grus vipio" OR "Guadalcanaria" OR "Guaruba" OR "Gubernatrix" OR "Gubernetes" OR "Guira" OR "Guttera" OR "Gyalophylax" OR "Gygis" OR "Gymnobucco" OR "Gymnocichla" OR "Gymnocrex" OR "Gymnoderus" OR "Gymnogyps" OR "Gymnomystax" OR "Gymnomyza" OR "Gymnophaps" OR "Gymnopithys" OR "Gymnorhina" OR "Gymnorhinus" OR "Gymnoris" OR "Gypaetus" OR "Gypohierax" OR "Gyps africanus" OR "Gyps bengalensis" OR "Gyps coprotheres" OR "Gyps fulvus" OR "Gyps himalayensis" OR "Gyps indicus" OR "Gyps rueppellii" OR "Gyps tenuirostris" OR "Habia" OR "Habroptila" OR "Haematoderus" OR "Haematopus" OR "Haematortyx" OR "Haemorhous" OR "Halcyon" OR "Haliaeetus" OR "Haliastur" OR "Halobaena" OR "Hamirostra" OR "Hapalopsittaca" OR "Hapaloptila" OR "Haplochelidon" OR "Haplophaedia" OR "Haplospiza" OR "Harpactes" OR "Harpagus" OR "Harpia" OR "Harpyhaliaetus" OR "Harpyopsis" OR "Hartertula" OR "Hartlaubius" OR "Hedydipna" OR "Heinrichia" OR "Heleia" OR "Heliactin" OR "Heliangelus" OR "Helicolestes" OR "Heliobletus" OR "Heliodoxa" OR "Heliolais" OR "Heliomaster" OR "Heliopais" OR "Heliornis" OR "Heliothraupis" OR "Heliothryx" OR "Hellmayrea" OR "Helmitheros" OR "Hemicircus" OR "Hemignathus" OR "Hemiphaga" OR "Hemiprocne" OR "Hemipus" OR "Hemithraupis" OR "Hemitriccus" OR "Hemixos" OR "Henicopernis" OR "Henicophaps" OR "Henicorhina" OR "Herpetotheres" OR "Herpsilochmus" OR "Hesperiphona" OR "Heteralocha" OR "Heterocercus" OR "Heteroglaux" OR "Heteromirafra" OR "Heteromunia" OR "Heteromyias" OR "Heteronetta" OR "Heterophasia" OR "Heterospingus" OR "Heteroxenicus" OR "Heteroxolmis" OR "Hieraaetus" OR "Himantopus" OR "Himantornis" OR "Himatione" OR "Hippolais" OR "Hirundapus" OR "Hirundinea" OR "Hirundinidae" OR "Hirundo" OR "Histrionicus" OR "Histurgops" OR "Hodgsonius" OR "Hoploxypterus" OR "Horizocerus" OR "Horizorhinus" OR "Horornis" OR "Houbaropsis" OR "Humblotia" OR "Hydrobates" OR "Hydrochous" OR "Hydrocoloeus" OR "Hydrophasianus" OR "Hydroprogne" OR "Hydropsalis" OR "Hyetornis" OR "Hylexetastes" OR "Hylia" OR "Hyliota" OR "Hylocharis" OR "Hylocichla" OR "Hylocitrea" OR "Hylocryptus" OR "Hyloctistes" OR "Hylomanes" OR "Hylonympha" OR "Hylopezus" OR "Hylophilus" OR "Hylophylax" OR "Hylopsar" OR "Hylorchilus" OR "Hymenolaimus" OR "Hymenops" OR "Hypargos" OR "Hypergerus" OR "Hypnelus" OR "Hypocnemis" OR "Hypocnemoides" OR "Hypocolius" OR "Hypocryptadius" OR "Hypoedaleus" OR "Hypogramma" OR "Hypopyrrhus" OR "Hypositta" OR "Hypothymis" OR "Hypsipetes" OR "Ibidorhyncha" OR "Ibycter" OR "Ichthyaetus" OR "Icteria" OR "Icteridae" OR "Icterus" OR "Icthyophaga" OR "Ictinaetus" OR "Ictinia" OR "Idiopsar" OR "Iduna" OR "Ifrita" OR "Ilicura" OR "Illadopsis" OR "Incana" OR "Incaspiza" OR "Indicator archipelagicus" OR "Indicator conirostris" OR "Indicator exilis" OR "Indicator indicator" OR "Indicator maculatus" OR "Indicator meliphilus" OR "Indicator minor" OR "Indicator pumilio" OR "Indicator variegatus" OR "Indicator willcocksi" OR "Indicator xanthonotus" OR "Inezia" OR "Iodopleura" OR "Iole" OR "Irania" OR "Irediparra" OR "Irena" OR "Iridophanes" OR "Iridosornis" OR "Isleria" OR "Ispidina" OR "Ithaginis" OR "Ixobrychus" OR "Ixonotus" OR "Ixoreus" OR "Ixos malaccensis" OR "Ixos mcclellandii" OR "Ixos

	nicobariensis" OR "Ixos virescens" OR "Ixothraupis" OR "Jabiru" OR "Jabouilleia" OR "Jacamaralcyon" OR "Jacamerops" OR "Jacana" OR "Jubula" OR "Junco" OR "Jynx ruficollis" OR "Jynx torquilla" OR "Kakamega" OR "Kaupifalco" OR "Kenopia" OR "Ketupa" OR "Klais" OR "Kleinothraupis" OR "Knipolegus" OR "Kupeornis" OR "Lacedo" OR "Lafresnaya" OR "Lagonosticta" OR "Lagopus" OR "Lalage" OR "Lampornis" OR "Lamprolaima" OR "Lamprolia" OR "Lampropsar" OR "Lamprospiza" OR "Lamprotornis" OR "Laniarius" OR "Laniisoma" OR "Lanio" OR "Laniocera" OR "Lanioturdus" OR "Lanius" OR "Laridae" OR "Larosterna" OR "Larus" OR "Laterallus" OR "Lathamus" OR "Lathrotriccus" OR "Laticilla" OR "Legatus" OR "Leiopicus" OR "Leiothlypis" OR "Leiothrix" OR "Leipoa" OR "Lemuresthes" OR "Leonardina" OR "Lepidocolaptes" OR "Lepidogrammus" OR "Lepidothrix" OR "Leptasthenura" OR "Leptocoma" OR "Leptodon" OR "Leptopoecile" OR "Leptopogon" OR "Leptopterus" OR "Leptoptilos" OR "Leptosittaca" OR "Leptosomus" OR "Leptotila" OR "Leptotrygon" OR "Lerwa" OR "Lesbia nuna" OR "Lesbia victoriae" OR "Lessonia" OR "Leucippus" OR "Leucocarbo" OR "Leucochloris" OR "Leucolia" OR "Leuconotopicus" OR "Leucopeza" OR "Leucophaeus" OR "Leucopsar" OR "Leucopternis" OR "Leucosarcia" OR "Leucosticte" OR "Lewinia" OR "Lichenostomus" OR "Lichmera" OR "Limicola" OR "Limnodromus" OR "Limnornis" OR "Limnothlypis" OR "Limosa" OR "Linaria" OR "Linurgus" OR "Liocichla" OR "Lioparus" OR "Lioptilus" OR "Liosceles" OR "Lipaugus" OR "Lissotis" OR "Loboparadisea" OR "Lobotos" OR "Lochmias" OR "Locustella" OR "Loddigesia" OR "Lonchura" OR "Lophaetus" OR "Lophoceros" OR "Lophodytes" OR "Lophoictinia" OR "Lopholaimus" OR "Lophonetta" OR "Lophophanes" OR "Lophophorus" OR "Lophorina" OR "Lophornis" OR "Lophospingus" OR "Lophostrix" OR "Lophotibis" OR "Lophotis" OR "Lophotriccus" OR "Lophotriorchis" OR "Lophozosterops" OR "Lophura" OR "Loriculus" OR "Loriotus" OR "Lorius" OR "Loxia" OR "Loxigilla" OR "Loxioides" OR "Loxipasser" OR "Loxops" OR "Lullula" OR "Lurocalis" OR "Luscinia" OR "Lybius" OR "Lycocorax" OR "Lymnocryptes" OR "Lyncornis" OR "Lyrurus" OR "Macgregoria" OR "Machaerirhynchus" OR "Machaeropterus" OR "Macheiramphus" OR "Machetornis" OR "Mackenziaena" OR "Macroagelaius" OR "Macrocephalon" OR "Macronectes" OR "Macronus" OR "Macronyx" OR "Macropsalis" OR "Macropygia" OR "Macrosphenus" OR "Madanga" OR "Magumma" OR "Malacocincla" OR "Malaconotus" OR "Malacopteron" OR "Malacoptila" OR "Malacorhynchus" OR "Malcorus" OR "Malia" OR "Malimbus" OR "Malurus" OR "Manacus" OR "Mandingoa" OR "Manorina" OR "Manucodia" OR "Margarobyas" OR "Margaroperdix" OR "Margarops" OR "Margarornis" OR "Marmaronetta" OR "Mascarenotus" OR "Mascarinus" OR "Masius" OR "Mayrornis" OR "Mearnsia" OR "Mecocerculus" OR "Megabyas" OR "Megaceryle" OR "Megacrex" OR "Megadyptes" OR "Megalurulus" OR "Megalurus" OR "Megapodius" OR "Megarynchus" OR "Megascops" OR "Megastictus" OR "Megatriorchis" OR "Megaxenops" OR "Megazosterops" OR "Meiglyptes" OR "Melaenornis" OR "Melampitta" OR "Melamprosops" OR "Melanerpes" OR "Melanitta" OR "Melanocharis" OR "Melanochlora" OR "Melanocorypha" OR "Melanodera" OR "Melanodryas" OR "Melanopareia" OR "Melanoperdix" OR "Melanoptila" OR "Melanorectes" OR "Melanospiza" OR "Melanotis" OR "Meleagrididae" OR "Meleagris" OR "Meliarchus" OR "Melichneutes" OR "Melidectes" OR "Melidora" OR "Melierax" OR "Melignomon" OR "Melilestes" OR "Melionyx" OR "Meliphacator" OR "Meliphaga" OR "Melipotes" OR "Melithreptus" OR "Melitograis" OR "Mellisuga" OR "Melocichla" OR "Melopsittacus" OR "Melopyrrha" OR "Melospiza" OR "Melozone" OR "Menura" OR "Merganetta" OR "Mergellus" OR "Mergus" OR "Meropogon" OR "Merops" OR "Merulaxis" OR "Mesembrinibis" OR "Mesitornis" OR "Metabolus" OR "Metallura" OR "Metopidius" OR "Metopothrix" OR "Metriopelia" OR "Micrastur" OR "Micrathene" OR "Microbates" OR "Microcarbo" OR "Microcerculus" OR "Microchera" OR "Microdynamis" OR "Microeca" OR "Microgoura" OR "Microhierax" OR "Microligea" OR "Micromacronus" OR "Micromonacha" OR "Micronisus" OR "Microparra" OR "Micropsitta" OR "Micropternus" OR "Microptilotis" OR "Micropygia" OR "Microrhopias" OR "Microspingus" OR "Microstilbon" OR "Milvago" OR "Milvus" OR "Mimus" OR "Minla" OR "Mino anais" OR "Mino dumontii" OR "Mino kreffti" OR "Mionectes" OR "Mirafra" OR "Mitrephanes" OR "Mitrospingus" OR "Mitu mitu" OR "Mitu salvini" OR "Mitu tomentosum" OR "Mitu tuberosum" OR "Mniotilta" OR "Modulatrix" OR "Moho apicalis" OR "Moho bishopi" OR "Moho braccatus" OR "Moho nobilis" OR "Mohoua" OR "Molothrus" OR "Momotus" OR "Monachella" OR "Monarcha" OR "Monasa" OR "Monias" OR "Monticola" OR "Montifringilla" OR "Morococcyx" OR "Morphnus" OR "Morus" OR "Motacilla" OR "Moupinia" OR "Mulleripicus" OR "Muscicapa" OR "Muscicapella" OR "Muscigralla" OR "Muscipipra" OR "Muscisaxicola" OR "Musophaga" OR "Myadestes" OR "Mycerobas" OR "Mycteria" OR "Myiagra" OR "Myiarchus" OR "Myiobius" OR "Myioborus" OR "Myiodynastes" OR "Myiomela" OR "Myiopagis" OR "Myioparus" OR "Myiophobus" OR "Myiopsitta" OR "Myiornis" OR "Myiotheretes" OR "Myiothlypis" OR "Myiotriccus" OR "Myiozetetes" OR "Myophonus" OR "Myornis" OR "Myrmeciza" OR "Myrmecocichla" OR "Myrmia" OR "Myrmoborus" OR "Myrmochanes" OR "Myrmorchilus" OR "Myrmornis" OR "Myrmothera" OR "Myrmotherula" OR "Myrtis" OR

	"Mystacornis" OR "Myza celebensis" OR "Myza sarasinorum" OR "Myzomela" OR "Myzornis" OR "Namibornis" OR "Nandayus" OR "Nannopsittaca" OR "Napothera" OR "Nasica" OR "Neafrapus" OR "Necropsar" OR "Necrosyrtes" OR "Nectarinia" OR "Nemosia" OR "Neochelidon" OR "Neochen" OR "Neochmia" OR "Neocichla" OR "Neocossyphus" OR "Neocrex" OR "Neoctantes" OR "Neodrepanis" OR "Neolalage" OR "Neolestes" OR "Neomixis" OR "Neomorphus" OR "Neopelma" OR "Neophema" OR "Neophron" OR "Neopipo" OR "Neopsephotus" OR "Neopsittacus" OR "Neosuthora" OR "Neothraupis" OR "Neotis" OR "Neoxolmis" OR "Nephelornis" OR "Nesasio" OR "Nesillas" OR "Nesocichla" OR "Nesoclopeus" OR "Nesoctites" OR "Nesoenas" OR "Nesofregetta" OR "Nesophlox" OR "Nesopsar" OR "Nesoptilotis" OR "Nesospingus" OR "Nesospiza" OR "Nesotriccus" OR "Nestor" OR "Netta" OR "Nettapus" OR "Newtonia" OR "Nicator" OR "Nilaus" OR "Niltava" OR "Ninox" OR "Nipponia" OR "Nisaetus" OR "Nomonyx" OR "Nonnula" OR "Northiella" OR "Notharchus" OR "Nothocercus" OR "Nothocrax" OR "Nothoprocta" OR "Nothura" OR "Notiochelidon" OR "Notiomystis" OR "Notopholia" OR "Nucifraga" OR "Numenius" OR "Numida" OR "Nyctanassa" OR "Nyctibius" OR "Nycticorax" OR "Nycticryphes" OR "Nyctidromus" OR "Nyctiphrynus" OR "Nyctipolus" OR "Nyctiprogne" OR "Nyctyornis" OR "Nymphicus" OR "Nystalus" OR "Oceanites" OR "Oceanodroma" OR "Ochthoeca" OR "Ochthornis" OR "Ocreatus" OR "Oculocincta" OR "Ocyalus" OR "Ocyceros" OR "Ocyphaps" OR "Odontophorus" OR "Odontorchilus" OR "Odontospiza" OR "Oedistoma" OR "Oena capensis" OR "Oenanthe" OR "Ognorhynchus" OR "Oncostoma" OR "Onychognathus" OR "Onychoprion" OR "Onychorhynchus" OR "Onychostruthus" OR "Ophrysia" OR "Opisthocomus" OR "Opisthoprora" OR "Oporornis" OR "Orchesticus" OR "Oreocharis" OR "Oreoica" OR "Oreolais" OR "Oreomystis" OR "Oreonympha" OR "Oreophasis" OR "Oreophilais" OR "Oreopholus" OR "Oreophylax" OR "Oreopsittacus" OR "Oreornis" OR "Oreortyx" OR "Oreoscoptes" OR "Oreoscopus" OR "Oreostruthus" OR "Oreothlypis" OR "Oreothraupis" OR "Oreotrochilus" OR "Origma" OR "Oriolia" OR "Oriolus" OR "Oriturus" OR "Ornithion" OR "Ornorectes" OR "Ortalis" OR "Orthogonys" OR "Orthonyx" OR "Orthopsittaca" OR "Orthorhyncus" OR "Orthotomus" OR "Ortygospiza" OR "Ortyxelos" OR "Oscines" OR "Otidiphaps" OR "Otis tarda" OR "Otus alfredi" OR "Otus alius" OR "Otus angelinae" OR "Otus bakkamoena" OR "Otus balli" OR "Otus beccarii" OR "Otus brookii" OR "Otus brucei" OR "Otus capnodes" OR "Otus collari" OR "Otus cyprius" OR "Otus elegans" OR "Otus enganensis" OR "Otus everetti" OR "Otus fuliginosus" OR "Otus gurneyi" OR "Otus hartlaubi" OR "Otus icterorhynchus" OR "Otus insularis" OR "Otus ireneae" OR "Otus jolandae" OR "Otus lempiji" OR "Otus lettia" OR "Otus longicornis" OR "Otus madagascariensis" OR "Otus magicus" OR "Otus manadensis" OR "Otus mantananensis" OR "Otus mayottensis" OR "Otus megalotis" OR "Otus mentawi" OR "Otus mindorensis" OR "Otus mirus" OR "Otus moheliensis" OR "Otus nigrorum" OR "Otus pamelae" OR "Otus pauliani" OR "Otus pembaensis" OR "Otus rufescens" OR "Otus rutilus" OR "Otus sagittatus" OR "Otus scops" OR "Otus semitorques" OR "Otus senegalensis" OR "Otus siaoensis" OR "Otus silvicola" OR "Otus socotranus" OR "Otus spilocephalus" OR "Otus sulaensis" OR "Otus sunia" OR "Otus thilohoffmanni" OR "Otus umbra" OR "Oxylabes" OR "Oxypogon" OR "Oxyruncus" OR "Oxyura" OR "Pachycare" OR "Pachycephala" OR "Pachycephalopsis" OR "Pachycoccyx" OR "Pachyptila" OR "Pachyramphus" OR "Pagodroma" OR "Pagophila" OR "Palmeria" OR "Paludipasser" OR "Pampa" OR "Pampusana" OR "Pandion" OR "Panterpe" OR "Panurus" OR "Panyptila" OR "Papasula" OR "Parabuteo" OR "Paradigalla" OR "Paradisaea" OR "Paradoxornis" OR "Paramythia" OR "Pardalotus" OR "Pardipicus" OR "Pardirallus" OR "Parkerthraustes" OR "Parkesia" OR "Parmoptila" OR "Paroaria" OR "Parophasma" OR "Paroreomyza" OR "Parotia" OR "Parulidae" OR "Parus" OR "Passer ammodendri" OR "Passer castanopterus" OR "Passer cordofanicus" OR "Passer diffusus" OR "Passer domesticus" OR "Passer eminibey" OR "Passer euchlorus" OR "Passer flaveolus" OR "Passer gongonensis" OR "Passer griseus" OR "Passer hemileucus" OR "Passer hispaniolensis" OR "Passer iagoensis" OR "Passer insularis" OR "Passer italiae" OR "Passer luteus" OR "Passer melanurus" OR "Passer moabiticus" OR "Passer montanus" OR "Passer motitensis" OR "Passer pyrrhonotus" OR "Passer rufocinctus" OR "Passer rutilans" OR "Passer shelleyi" OR "Passer simplex" OR "Passer suahelicus" OR "Passer swainsonii" OR "Passerculus" OR "Passerella" OR "Passeriformes" OR "Passerina" OR "Pastor roseus" OR "Patagioenas" OR "Patagona" OR "Pauxi" OR "Pavo cristatus" OR "Pavo muticus" OR "Pedionomus" OR "Pelagodroma" OR "Pelargopsis" OR "Pelecanoides" OR "Pelecanus" OR "Pellorneum" OR "Peltohyas" OR "Peltops" OR "Penelope" OR "Penelopides" OR "Penelopina" OR "Peneoenanthe" OR "Peneothello" OR "Pentholaea" OR "Percnohierax" OR "Percnostola" OR "Perdicula" OR "Perdix" OR "Pericrocotus" OR "Periparus" OR "Periporphyrus" OR "Perisoreus" OR "Perissocephalus" OR "Pernis" OR "Petrochelidon" OR "Petroica" OR "Petronia" OR "Petrophassa" OR "Peucaea" OR "Peucedramus" OR "Pezopetes" OR "Pezophaps" OR "Pezoporus" OR "Phacellodomus" OR "Phaenicophaeus" OR "Phaenicophilus" OR "Phaenostictus" OR "Phaeochroa" OR "Phaeomyias" OR "Phaeoptila" OR "Phaethon" OR "Phaethornis" OR "Phaetusa" OR "Phainopepla" OR "Phainoptila" OR "Phalacrocorax"

	OR "Phalaenoptilus" OR "Phalaropus" OR "Phalcoboenus" OR "Phapitreron" OR "Phaps" OR "Pharomachrus" OR "Phasianidae" OR "Phasianus" OR "Phedina" OR "Phegornis" OR "Phelpsia" OR "Pheucticus" OR "Pheugopedius" OR "Phibalura" OR "Phigys" OR "Philemon" OR "Philentoma" OR "Philepitta" OR "Philesturnus" OR "Philetairus" OR "Philomachus" OR "Philortyx" OR "Philydor" OR "Phimosus" OR "Phlegopsis" OR "Phleocryptes" OR "Phlogophilus" OR "Phodilus" OR "Phoebastria" OR "Phoebetria" OR "Phoenicircus" OR "Phoeniconaias" OR "Phoenicoparrus" OR "Phoenicopterus" OR "Phoeniculus" OR "Phoenicurus" OR "Pholidornis" OR "Phonipara" OR "Phonygammus" OR "Phragmacia" OR "Phrygilus" OR "Phylidonyris" OR "Phyllaemulor" OR "Phyllanthus" OR "Phyllastrephus" OR "Phyllergates" OR "Phyllolais" OR "Phyllomyias" OR "Phylloscartes" OR "Phylloscopus" OR "Phytotoma" OR "Piaya" OR "Pica hudsonia" OR "Pica nuttalli" OR "Pica pica" OR "Picathartes" OR "Picidae" OR "Picoides" OR "Piculus" OR "Picumnus" OR "Picus awokera" OR "Picus canus" OR "Picus chlorolophus" OR "Picus erythropygius" OR "Picus puniceus" OR "Picus rabieri" OR "Picus sharpei" OR "Picus squamatus" OR "Picus vaillantii" OR "Picus viridanus" OR "Picus viridis" OR "Picus vittatus" OR "Picus xanthopygaeus" OR "Piezorina" OR "Pilherodius" OR "Pinarochroa" OR "Pinarocorys" OR "Pinaroloxias" OR "Pinarornis" OR "Pinguinus" OR "Pinicola" OR "Pionites" OR "Pionopsitta" OR "Pionus" OR "Pipilo" OR "Pipra" OR "Pipraeidea" OR "Pipreola" OR "Piprites" OR "Piranga" OR "Pitangus" OR "Pithecophaga" OR "Pithys" OR "Pitohui" OR "Pittasoma" OR "Pityriasis" OR "Platalea" OR "Platycercus" OR "Platylophus" OR "Platyrinchus" OR "Platysmurus" OR "Platyspiza" OR "Platysteira" OR "Plectorhyncha" OR "Plectropterus" OR "Plegadis" OR "Plocepasser" OR "Ploceus" OR "Pluvialis" OR "Pluvianellus" OR "Pluvianus" OR "Pnoepyga" OR "Podargus" OR "Podica" OR "Podiceps" OR "Podilymbus" OR "Podoces" OR "Poecile" OR "Poecilodryas" OR "Poecilostreptus" OR "Poecilotriccus" OR "Poeoptera" OR "Poephila" OR "Pogoniulus" OR "Pogonocichla" OR "Poicephalus" OR "Polemaetus" OR "Polihierax" OR "Poliocephalus" OR "Poliolais" OR "Polioptila" OR "Polioxolmis" OR "Polyboroides" OR "Polyerata" OR "Polyonymus" OR "Polyplectron" OR "Polysticta" OR "Polystictus" OR "Polytelis" OR "Polytmus" OR "Pomarea" OR "Pomatorhinus" OR "Pomatostomus" OR "Pooecetes" OR "Poospiza" OR "Poospizopsis" OR "Porphyrio" OR "Porphyrolaema" OR "Porphyrospiza" OR "Porzana" OR "Premnoplex" OR "Premnornis" OR "Primolius" OR "Prinia" OR "Prioniturus" OR "Prionochilus" OR "Prionodura" OR "Prionops" OR "Priotelus" OR "Probosciger" OR "Procarduelis" OR "Procellaria" OR "Procelsterna" OR "Procnias" OR "Prodotiscus" OR "Progne" OR "Promerops" OR "Prosobonia" OR "Prosopeia" OR "Prosthemadera" OR "Protonotaria" OR "Prunella atrogularis" OR "Prunella collaris" OR "Prunella fagani" OR "Prunella fulvescens" OR "Prunella himalayana" OR "Prunella immaculata" OR "Prunella koslowi" OR "Prunella modularis" OR "Prunella montanella" OR "Prunella ocularis" OR "Prunella rubeculoides" OR "Prunella rubida" OR "Prunella strophiata" OR "Psalidoprocne" OR "Psaltria" OR "Psaltriparus" OR "Psarisomus" OR "Psarocolius" OR "Psephotus" OR "Pseudalaemon" OR "Pseudalethe" OR "Pseudelaenia" OR "Pseudeos" OR "Pseudhirundo" OR "Pseudibis" OR "Pseudoalcippe" OR "Pseudobias" OR "Pseudobulweria" OR "Pseudocalyptomena" OR "Pseudochelidon" OR "Pseudocolaptes" OR "Pseudocolopteryx" OR "Pseudoleistes" OR "Pseudonestor" OR "Pseudonigrita" OR "Pseudopodoces" OR "Pseudorectes" OR "Pseudosaltator" OR "Pseudoscops" OR "Pseudoseisura" OR "Pseudospingus" OR "Pseudotriccus" OR "Psilopogon" OR "Psilopsiagon" OR "Psilorhamphus" OR "Psilorhinus" OR "Psiloscops" OR "Psittacella" OR "Psittaciformes" OR "Psittacines" OR "Psittacula" OR "Psittaculirostris" OR "Psittacus" OR "Psitteuteles" OR "Psittinus" OR "Psittiparus" OR "Psittirostra" OR "Psittrichas" OR "Psophia" OR "Psophocichla" OR "Psophodes" OR "Pteridophora" OR "Pterocles" OR "Pterodroma" OR "Pteroglossus" OR "Pteronetta" OR "Pterophanes" OR "Pteroptochos" OR "Pteruthius" OR "Ptilinopus" OR "Ptilocichla" OR "Ptilogonys" OR "Ptilonorhynchus" OR "Ptilopachus" OR "Ptiloprora" OR "Ptilopsis" OR "Ptiloris" OR "Ptilorrhoa" OR "Ptilostomus" OR "Ptilotula" OR "Ptychoramphus" OR "Ptyonoprogne" OR "Ptyrticus" OR "Pucrasia" OR "Puffinus" OR "Pulsatrix" OR "Purnella" OR "Purpureicephalus" OR "Pycnonotus" OR "Pycnoptilus" OR "Pycnopygius" OR "Pygarrhichas" OR "Pygiptila" OR "Pygoscelis" OR "Pyrenestes" OR "Pyrgilauda" OR "Pyriglena" OR "Pyrocephalus" OR "Pyroderus" OR "Pyrrhocorax" OR "Pyrrholaemus" OR "Pyrrhomyias" OR "Pyrrhoplectes" OR "Pyrrhula" OR "Pyrrhura" OR "Pyrroglaux" OR "Pytilia" OR "Quelea" OR "Querula" OR "Quiscalus" OR "Rallidae" OR "Rallina" OR "Rallus" OR "Ramphastos" OR "Ramphocaenus" OR "Ramphocelus" OR "Ramphocinclus" OR "Ramphocoris" OR "Ramphodon" OR "Ramphomicron" OR "Ramphotrigon" OR "Ramsayornis" OR "Randia" OR "Raphidae" OR "Raphus" OR "Rauenia" OR "Recurvirostra" OR "Regulus" OR "Reinwardtipicus" OR "Reinwardtoena" OR "Remiz" OR "Rhabdornis" OR "Rhabdotorrhinus" OR "Rhagologus" OR "Rhamphocharis" OR "Rhamphomantis" OR "Rhaphidura" OR "Rhegmatorhina" OR "Rheiformes" OR "Rheinardia" OR "Rhinocrypta" OR "Rhinomyias" OR "Rhinoplax" OR "Rhinopomastus" OR "Rhinoptilus" OR "Rhinortha" OR "Rhipidura" OR "Rhizothera" OR "Rhodacanthis" OR "Rhodinocichla" OR "Rhodonessa" OR "Rhodopechys" OR "Rhodopis" OR

	"Rhodospingus" OR "Rhodospiza" OR "Rhodostethia" OR "Rhodothraupis" OR "Rhopias" OR "Rhopocichla" OR "Rhopodytes" OR "Rhopophilus" OR "Rhopornis" OR "Rhopospina" OR "Rhyacornis" OR "Rhynchocyclus" OR "Rhynchophanes" OR "Rhynchopsitta" OR "Rhynchortyx" OR "Rhynchospiza" OR "Rhynchostruthus" OR "Rhynchotus" OR "Rhynochetos" OR "Rhyticeros" OR "Rhytipterna" OR "Riccordia" OR "Ridgwayia" OR "Rigidipenna" OR "Rimator" OR "Riparia" OR "Rissa" OR "Robsonius" OR "Rollandia" OR "Rollulus" OR "Roraimia" OR "Rostratula" OR "Rostrhamus" OR "Rougetius" OR "Rowettia" OR "Rukia" OR "Rupicola" OR "Rupornis" OR "Ruwenzornis" OR "Sagittarius serpentarius" OR "Sakesphorus" OR "Salpinctes" OR "Salpornis" OR "Saltator" OR "Saltatricula" OR "Salvadorina" OR "Sapayoa" OR "Sappho sparganurus" OR "Sarcogyps" OR "Sarcophanops" OR "Sarcops" OR "Sarcoramphus" OR "Sarkidiornis" OR "Saroglossa" OR "Sarothrura" OR "Sasia" OR "Satrapa" OR "Saucerottia" OR "Saurothera" OR "Saxicola" OR "Saxicoloides" OR "Sayornis" OR "Sceloglaux" OR "Scelorchilus" OR "Scenopoeetes" OR "Scepomycter" OR "Schetba" OR "Schiffornis" OR "Schistes" OR "Schistochlamys" OR "Schistocichla" OR "Schistolais" OR "Schizoeaca" OR "Schoenicola" OR "Schoeniophylax" OR "Schoutedenapus" OR "Scissirostrum" OR "Sclateria" OR "Sclerurus" OR "Scolopax" OR "Scopus umbretta" OR "Scotocerca" OR "Scotopelia" OR "Scytalopus" OR "Scythrops" OR "Seicercus" OR "Seiurus" OR "Selasphorus" OR "Selenidera" OR "Seleucidis" OR "Semioptera" OR "Semnornis" OR "Sephanoides" OR "Sericornis" OR "Sericossypha" OR "Sericulus" OR "Serilophus" OR "Serinus" OR "Serpophaga" OR "Setopagis" OR "Setophaga" OR "Setornis" OR "Sheppardia" OR "Sialia" OR "Sicalis" OR "Sigelus" OR "Sinosuthora" OR "Siphonorhis" OR "Sipodotus" OR "Siptornis" OR "Siptornopsis" OR "Sirystes" OR "Sitta" OR "Sittasomus" OR "Smicrornis" OR "Smithornis" OR "Snowornis" OR "Somateria" OR "Spartonoica" OR "Speculanas" OR "Speculipastor" OR "Spelaeornis" OR "Spermophaga" OR "Sphecotheres" OR "Spheniscidae" OR "Sphenisciformes" OR "Spheniscus" OR "Sphenocichla" OR "Sphenoeacus" OR "Sphenopsis" OR "Sphyrapicus" OR "Spilopelia" OR "Spiloptila" OR "Spilornis" OR "Spindalis" OR "Spinus" OR "Spiza" OR "Spizaetus" OR "Spizella" OR "Spizelloides" OR "Spiziapteryx" OR "Spizixos" OR "Spizocorys" OR "Spodiopsar" OR "Sporathraupis" OR "Sporophila" OR "Sporopipes" OR "Stachyridopsis" OR "Stachyris" OR "Stactolaema" OR "Stagonopleura" OR "Starnoenas" OR "Steatornis" OR "Stelgidillas" OR "Stelgidopteryx" OR "Stenostira" OR "Stephanoaetus" OR "Stephanophorus" OR "Stephanoxis" OR "Stercorarius" OR "Sterna" OR "Sternoclyta" OR "Sternula" OR "Sterrhoptilus" OR "Stictonetta" OR "Stigmatura" OR "Stilpnia" OR "Stiltia" OR "Stiphrornis" OR "Stipiturus" OR "Stizorhina" OR "Stomiopera" OR "Strepera" OR "Streptocitta" OR "Streptopelia" OR "Streptoprocne" OR "Stresemannia" OR "Strigiformes" OR "Strigops" OR "Strix" OR "Struthidea" OR "Struthio" OR "Struthioniformes" OR "Sturnella" OR "Sturnia" OR "Sturnornis" OR "Sturnus" OR "Stymphalornis" OR "Sublegatus" OR "Sugomel" OR "Suiriri" OR "Sula dactylatra" OR "Sula granti" OR "Sula leucogaster" OR "Sula nebouxii" OR "Sula sula" OR "Sula variegata" OR "Surnia" OR "Surniculus" OR "Suthora" OR "Swynnertonia" OR "Sylvia" OR "Sylvietta" OR "Sylviorthorhynchus" OR "Sylviparus" OR "Syma megarhyncha" OR "Syma torotoro" OR "Symposiachrus" OR "Synallaxis" OR "Syndactyla" OR "Synthliboramphus" OR "Sypheotides" OR "Syrigma" OR "Syrmaticus" OR "Syrrhaptes" OR "Systellura" OR "Taccocua" OR "Tachornis" OR "Tachuris" OR "Tachybaptus" OR "Tachycineta" OR "Tachyeres" OR "Tachymarptis" OR "Tachyphonus" OR "Tadorna" OR "Taeniopygia" OR "Taeniotriccus" OR "Talaphorus" OR "Talegalla" OR "Tangara" OR "Tanygnathus" OR "Tanysiptera" OR "Taoniscus" OR "Tapera" OR "Taphrolesbia" OR "Taphrospilus" OR "Taraba" OR "Tarsiger" OR "Tauraco" OR "Tchagra" OR "Telacanthura" OR "Teledromas" OR "Telespiza" OR "Telophorus" OR "Temnurus" OR "Tephrodornis" OR "Tephrophilus" OR "Tephrozosterops" OR "Terathopius" OR "Terenotriccus" OR "Terenura" OR "Teretistris" OR "Terpsiphone" OR "Territornis" OR "Tersina" OR "Tesia" OR "Tetrao" OR "Tetraogallus" OR "Tetraophasis" OR "Tetrastes" OR "Tetrax" OR "Thalassarche" OR "Thalasseus" OR "Thalassoica" OR "Thalassornis" OR "Thalurania" OR "Thamnistes" OR "Thamnolaea" OR "Thamnomanes" OR "Thamnophilus" OR "Thamnornis" OR "Thapsinillas" OR "Thaumasius" OR "Thaumastura" OR "Theristicus" OR "Thescelocichla" OR "Thinocorus" OR "Thinornis" OR "Thlypopsis" OR "Thraupis" OR "Threnetes" OR "Threskiornis" OR "Thripadectes" OR "Thripophaga" OR "Thryomanes" OR "Thryophilus" OR "Thryorchilus" OR "Thryothorus" OR "Tiaris" OR "Tichodroma" OR "Tickellia" OR "Tigriornis" OR "Tigrisoma" OR "Tijuca" OR "Tilmatura" OR "Timalia" OR "Timeliopsis" OR "Tinamotis" OR "Tinamus" OR "Tityra" OR "Tmetothylacus" OR "Tockus" OR "Todiramphus" OR "Todirostrum" OR "Todus" OR "Tolmomyias" OR "Topaza" OR "Torgos" OR "Torreornis" OR "Touit" OR "Toxorhamphus" OR "Toxostoma" OR "Trachyphonus" OR "Tragopan" OR "Tregellasia" OR "Treron" OR "Trichastoma" OR "Trichixos" OR "Trichodere" OR "Trichoglossus" OR "Tricholaema" OR "Tricholestes" OR "Trichothraupis" OR "Triclaria" OR "Trigonoceps" OR "Tringa" OR "Trochalopteron" OR "Trochilus" OR "Trochocercus" OR "Troglodytes" OR "Troglodytidae" OR "Troglodytinae" OR "Trugon" OR "Tryngites" OR "Tumbezia" OR "Turacoena"

	OR "Turdidae" OR "Turdoides" OR "Turdus" OR "Turnagra" OR "Turnix" OR "Turtur" OR "Tylas" OR "Tympanuchus" OR "Tyranneutes" OR "Tyrannidae" OR "Tyrannopsis" OR "Tyrannulus" OR "Tyrannus" OR "Tyto alba" OR "Tyto aurantia" OR "Tyto capensis" OR "Tyto deroepstorffi" OR "Tyto furcata" OR "Tyto glaucops" OR "Tyto inexspectata" OR "Tyto javanica" OR "Tyto longimembris" OR "Tyto manusi" OR "Tyto multipunctata" OR "Tyto nigrobrunnea" OR "Tyto novaehollandiae" OR "Tyto rosenbergii" OR "Tyto sororcula" OR "Tyto soumagnei" OR "Tyto tenebricosa" OR "Upucerthia" OR "Upupa" OR "Uraeginthus" OR "Uranomitra" OR "Uratelornis" OR "Uria lomvia" OR "Uria aalge" OR "Urochroa" OR "Urocissa" OR "Urocolius" OR "Urocynchramus" OR "Urodynamis" OR "Uroglaux" OR "Urolais" OR "Urolestes" OR "Uropelia" OR "Uropsalis" OR "Uropsila" OR "Urorhipis" OR "Urosphena" OR "Urosticte" OR "Urothraupis" OR "Urotriorchis" OR "Vanellus" OR "Vanga" OR "Veles" OR "Veniliornis" OR "Vermivora" OR "Vestiaria" OR "Vidua" OR "Vini australis" OR "Vini kuhlii" OR "Vini peruviana" OR "Vini stepheni" OR "Vini ultramarina" OR "Vireo" OR "Vireolanius" OR "Viridonia" OR "Volatinia" OR "Vosea" OR "Vultur" OR "Wetmorethraupis" OR "Willisornis" OR "Wilsonia" OR "Woodfordia" OR "Xanthocephalus" OR "Xanthomixis" OR "Xanthopsar" OR "Xanthotis" OR "Xema sabini" OR "Xenerpestes" OR "Xenicus" OR "Xenocopsychus" OR "Xenodacnis" OR "Xenoglaux" OR "Xenoligea" OR "Xenoperdix" OR "Xenopipo" OR "Xenopirostris" OR "Xenops" OR "Xenopsaris" OR "Xenornis" OR "Xenospingus" OR "Xenospiza" OR "Xenotriccus" OR "Xenus" OR "Xiphidiopicus" OR "Xiphocolaptes" OR "Xipholena" OR "Xiphorhynchus" OR "Xolmis" OR "Yuhina" OR "Yungipicus" OR "Zanclostomus" OR "Zaratornis" OR "Zavattariornis" OR "Zebrilus" OR "Zeledonia" OR "Zenaida" OR "Zentrygon" OR "Zimmerius" OR "Zonerodius" OR "Zonotrichia" OR "Zoonavena" OR "Zoothera" OR "Zosterops" OR "Zosternornis" OR "accentor" OR "Accipitriformes" OR "albatross" OR "alcid*" OR "antpecker" OR "auklet" OR "avadavat" OR "avocet" OR "bellbird" OR "bittern" OR "blackbird" OR "bluebird" OR "bobwhite" OR "boobies" OR "booby" OR "Bucerotiformes" OR "buderigar" OR "budgie" OR "bufflehead" OR "bulbul" OR "bunting" OR "buphagus" OR "butcherbird" OR "buteos" OR "buzzard" OR "canaries" OR "canary" OR "capercaillie" OR "cassowary" OR "catbird" OR "chaffinch" OR "chickadee" OR "chicken" OR "chukar" OR "cockatiel" OR "cockatoo" OR "cock-of-the-woods" OR "colombes" OR "conure" OR "coot" OR "Coraciiformes" OR "cormorant" OR "couas" OR "coucal" OR "cowbird" OR "crake" OR "crimsonwing" OR "crossbill" OR "crow" OR "cuckoo" OR "currawong" OR "cygnes" OR "dickcissel" OR "Duck" OR "dunlin" OR "dunnock" OR "eagle" OR "egret" OR "eider" OR "epervier*" OR "estrilda" OR "falcon" OR "fantail" OR "finch" OR "firecrest" OR "flamingo" OR "fledgeling" OR "foulques" OR "fowl" OR "frigatebird" OR "fulmar" OR "gadwall" OR "gallinule" OR "gamefowl" OR "gannet" OR "garganey" OR "Geese" OR "goatsucker" OR "gobe-mouches" OR "godwit" OR "goldcrest" OR "goldfinch" OR "Goose" OR "goshawk" OR "grackle" OR "grebe" OR "greenfinch" OR "grosbeak" OR "grouse" OR "guillemot" OR "guineafowl" OR "gull" OR "hawk" OR "heather cock" OR "heron" OR "hoopoes" OR "hornbill" OR "hummingbird" OR "jackdaw" OR "kestrel" OR "killdeer" OR "kingfisher" OR "kinglet" OR "kittiwake" OR "kiwi bird" OR "Koels" OR "landfowl" OR "longspur" OR "lovebird" OR "macaw" OR "magpie" OR "malkohas" OR "mannikin" OR "meadowlark" OR "merganser" OR "moorhen" OR "motmot" OR "mousebird" OR "murre" OR "nesocharis" OR "nigrita" OR "nuthatch" OR "osprey" OR "ostrich" OR "ovenbird" OR "owl" OR "oxpecker" OR "oystercatcher" OR "padda" OR "palaeognathae" OR "parakeet" OR "parrot" OR "partridge" OR "parula" OR "passerine" OR "peafowl" OR "pelican" OR "penguin" OR "petrel" OR "pheasant" OR "piciformes" OR "pigeon" OR "pintail" OR "pitta" OR "Plectrophenax" OR "plover" OR "prairie-chicken" OR "prions" OR "puffin" OR "quail" OR "quailfinch" OR "raptor*" OR "raven" OR "razorbill" OR "rheidae" OR "roadrunner" OR "robin" OR "rook" OR "rosella" OR "rynchops" OR "sanderling" OR "sandgrouse" OR "sandpiper" OR "sapsucker" OR "sauvagine" OR "scaup" OR "screamer" OR "seabird" OR "shearwater" OR "shrike" OR "silverbill" OR "siskin" OR "smew" OR "songbird" OR "sparrow" OR "starling" OR "stork" OR "struthionidae" OR "sulidae" OR "swamphen" OR "swan" OR "tanager" OR "thrasher" OR "tinamiformes" OR "tinamou" OR "tinamous" OR "titmouse" OR "towhee" OR "treecreeper" OR "trogon" OR "turaco" OR "turkey" OR "turnstone" OR "vulture" OR "wader" OR "warbler" OR "waterbird" OR "waterfowl" OR "waxbill" OR "weaverbird" OR "wigeon" OR "woodpecker" OR "wren" OR "wryneck" OR "yellowthroat" OR "seabird" OR (("bird*" OR "avian" OR "passerine*" OR "animal") AND ("bee-eater" OR "crane" OR "dove" OR "emu" OR "flicker" OR "flycatcher" OR "goldeneye" OR "harrier" OR "ibis" OR "jay" OR "kea" OR "lark" OR "loon" OR "munia" OR "myna" OR "mynah*" OR "nandus" OR "oies" OR "rail" OR "ratite" OR "red knot" OR "redpoll" OR "redstart" OR "rhea" OR "ruff" OR "shag" OR "shoveler" OR "silvereye" OR "skua" OR "stilt" OR "swallow" OR "teal" OR "tern" OR "thrush" OR "tit" OR "tui" OR "weaver" OR "cardinal")))
Benthic	tiab:("sediment" OR "benthic" OR "aquatic organism*" OR "nutrient cycl*" OR "ecosystem" OR "ocean floor" OR "sea floor" OR ("decomposition" AND "sediment"))

	tiab:("clam" OR "clams" OR "worm*" OR "snail*" OR "shrimp" OR "phytoplankton" OR "seaweed*" OR "flatfish")
Plants	tiab:("Abelia" OR "Abelmoschus" OR "Abies" OR "Abietinella" OR "Abildgaardia" OR "Abrodictyum" OR "Abronia" OR "Abrus" OR "Abutilon" OR "Acacia" OR "Acaena" OR "Acalypha" OR "Acamptopappus" OR "Acanthocereus" OR "Acanthocoleus" OR "Acanthomintha" OR "Acanthonema" OR "Acanthoscyphus" OR "Acanthospermum" OR "Acanthus" OR "Acaulon" OR "Acca sellowiana" OR "Acer buergerianum" OR "Acer campestre" OR "Acer circinatum" OR "Acer cissifolium" OR "Acer diabolicum" OR "Acer floridanum" OR "Acer ginnala" OR "Acer glabrum" OR "Acer grandidentatum" OR "Acer griseum" OR "Acer japonicum" OR "Acer leucoderme" OR "Acer macrophyllum" OR "Acer negundo" OR "Acer nigrum" OR "Acer opalus" OR "Acer palmatum" OR "Acer pensylvanicum" OR "Acer platanoides" OR "Acer pseudoplatanus" OR "Acer rubrum" OR "Acer saccharinum" OR "Acer saccharum" OR "Acer spicatum" OR "Acer tataricum" OR "Acer X freemanii" OR "Acer X senecaense" OR "Acetabularia" OR "Acharagma" OR "Achillea" OR "Achimenes" OR "Achlaena" OR "Achlys" OR "Achnanthes" OR "Achnanthidium" OR "Achnatherum" OR "Achrophyllum" OR "Achyrachaena" OR "Achyranthes" OR "Achyronychia" OR "Aciachne" OR "Acicarpha" OR "Aciphylla" OR "Acisanthera" OR "Acleisanthes" OR "Acmella" OR "Acmispon" OR "Acnistus" OR "Acoelorraphe" OR "Aconitum" OR "Aconogonon" OR "Acorus" OR "Acostia" OR "Acourtia" OR "Acrachne" OR "Acrobolbus" OR "Acroceras" OR "Acrocomia" OR "Acrolejeunea" OR "Acrolophozia" OR "Acromastigum" OR "Acronychia" OR "Acroporium" OR "Acroptilon" OR "Acroschisma" OR "Acroscyphella" OR "Acrosiphonia" OR "Acrostichum" OR "Actaea" OR "Actinidia" OR "Actiniopteris" OR "Actinocladum" OR "Actinostachys" OR "Acutodesmus" OR "Adansonia" OR "Adelanthus" OR "Adelia" OR "Adenanthera" OR "Adenium" OR "Adenocalymma" OR "Adenocarpus" OR "Adenocaulon" OR "Adenochlaena" OR "Adenophorus" OR "Adenophyllum" OR "Adenostemma" OR "Adenostoma" OR "Adesmia" OR "Adiantopsis" OR "Adiantum" OR "Adlafia" OR "Adlumia" OR "Adolphia" OR "Adonidia" OR "Adonis aestivalis" OR "Adonis annua" OR "Adonis vernalis" OR "Adoxa" OR "Adriana" OR "Aechmea" OR "Aegagropila" OR "Aegiceras" OR "Aegilops" OR "Aeginetia" OR "Aegiphila" OR "Aegle" OR "Aegopodium" OR "Aegopogon" OR "Aeluropus" OR "Aeodes" OR "Aeonium" OR "Aerobryopsis" OR "Aerva" OR "Aeschynanthus" OR "Aeschynomene" OR "Aesculus" OR "Aethionema" OR "Aethusa" OR "Aetoxylon" OR "Aframomum" OR "Afrocarpus" OR "Afroriccardia" OR "Afzelia" OR "Agalinis" OR "Agalmyla" OR "Agapanthus" OR "Agardhiella" OR "Agarista" OR "Agastache" OR "Agathis" OR "Agathosma" OR "Agave" OR "Agdestis" OR "Agenium" OR "Ageratina" OR "Ageratum" OR "Aglaia" OR "Aglaodorum" OR "Aglaonema" OR "Agmenellum" OR "Agnesia" OR "Agnorhiza" OR "Agoseris" OR "Agrimonia" OR "Agropyron" OR "Agrostemma" OR "Agrostis" OR "Agrostopoa" OR "Ahnfeltia" OR "Aidia" OR "Ailanthus" OR "Aiouea" OR "Aiphanes" OR "Aira caryophyllea" OR "Aira cupaniana" OR "Aira elegantissima" OR "Aira praecox" OR "Aitchisoniella" OR "Ajuga" OR "Akebia" OR "Alaria" OR "Albizia" OR "Alcea" OR "Alchemilla" OR "Alchornea" OR "Alchorneopsis" OR "Alectra" OR "Alectryon" OR "Aletes" OR "Aletris" OR "Aleurites" OR "Alexandrium" OR "Alhagi" OR "Aliciella" OR "Alisma" OR "Alkanna" OR "Allagoptera" OR "Allamanda" OR "Allantodia" OR "Allenrolfea" OR "Alliaria" OR "Allionia" OR "Allisonia" OR "Allisoniella" OR "Allium" OR "Allocasuarina" OR "Allocheilos" OR "Allolepis" OR "Allophyllum" OR "Allophylus" OR "Alloplectus" OR "Allorgella" OR "Allosidastrum" OR "Allostigma" OR "Alloteropsis" OR "Allotoonia" OR "Allotropa" OR "Allowissadula" OR "Almutaster" OR "Alnus" OR "Alobiella" OR "Alobiellopsis" OR "Alocasia" OR "Aloe" OR "Aloiampelos" OR "Aloidendron" OR "Aloina" OR "Alopecurus" OR "Alophia" OR "Aloysia" OR "Alphitonia" OR "Alpinia" OR "Alsia" OR "Alsobia" OR "Alstonia" OR "Alstroemeria" OR "Alternanthera" OR "Althaea" OR "Altoparadisium" OR "Alvaradoa" OR "Alvimia" OR "Alysicarpus" OR "Alyssoides" OR "Alyssum" OR "Alyxia" OR "Amalophyllon" OR "Amaranthus" OR "Amaryllis" OR "Amauriopsis" OR "Amazoopsis" OR "Amberboa" OR "Amblyodon" OR "Amblyolepis" OR "Amblyopappus" OR "Amblyopyrum" OR "Amblystegium" OR "Ambrosia" OR "Ambuchanania" OR "Amelanchier" OR "Amelichloa" OR "Amentotaxus" OR "Amianthium" OR "Ammania" OR "Ammannia" OR "Ammi majus" OR "Ammi visnaga" OR "Ammocharis" OR "Ammophila" OR "Ammopiptanthus" OR "Ammoselinum" OR "Amomum" OR "Amoreuxia" OR "Amorpha apiculata" OR "Amorpha californica" OR "Amorpha canescens" OR "Amorpha fruticosa" OR "Amorpha georgiana" OR "Amorpha glabra" OR "Amorpha herbacea" OR "Amorpha laevigata" OR "Amorpha nana" OR "Amorpha nitens" OR "Amorpha ouachitensis" OR "Amorpha paniculata" OR "Amorpha roemeriana" OR "Amorpha schwerinii" OR "Amorpha X notha" OR "Amorphophallus" OR "Ampelaster" OR "Ampelodesmos" OR "Ampelopsis" OR "Amphiachyris" OR "Amphibromus" OR "Amphicarpaea" OR "Amphicarpum" OR "Amphicephalozia" OR "Amphidinium" OR "Amphidium" OR "Amphilophium" OR "Amphipappus" OR "Amphiprora" OR "Amphiroa" OR "Amphiscirpus" OR

	"Amphitecna" OR "Amsinckia" OR "Amsonia" OR "Amyloodinium" OR "Amyris" OR "Amyxa" OR "Anabaena" OR "Anabaenopsis" OR "Anacampseros" OR "Anacamptodon" OR "Anacardium" OR "Anacolia" OR "Anacyclus" OR "Anacystis" OR "Anadenanthera" OR "Anagallis" OR "Analipus" OR "Ananas" OR "Anaphalis" OR "Anaphyllopsis" OR "Anastrepta" OR "Anastrophyllopsis" OR "Anastrophyllum" OR "Anatherostipa" OR "Anaxagorea" OR "Anchusa" OR "Ancistrocarphus" OR "Andira" OR "Andrachne" OR "Andreaea" OR "Andreaeobryum" OR "Andrewsianthus" OR "Andrographis" OR "Andromeda" OR "Andropogon" OR "Androsace" OR "Androstephium" OR "Anechites" OR "Aneilema" OR "Anelsonia" OR "Anemia adiantifolia" OR "Anemia cicutaria" OR "Anemia coriacea" OR "Anemia cuneata" OR "Anemia hirsuta" OR "Anemia hirta" OR "Anemia mexicana" OR "Anemia phyllitidis" OR "Anemia portoricensis" OR "Anemia underwoodiana" OR "Anemia wrightii" OR "Anemone" OR "Anemopaegma" OR "Anemopsis" OR "Anetanthus" OR "Anethum" OR "Anetium" OR "Aneura blasioides" OR "Aneura brasiliensis" OR "Aneura cerebrata" OR "Aneura crateriformis" OR "Aneura crumii" OR "Aneura eachamensis" OR "Aneura erronea" OR "Aneura eskuchei" OR "Aneura gemmifera" OR "Aneura gibbsiana" OR "Aneura glaucescens" OR "Aneura hirsuta" OR "Aneura imbricata" OR "Aneura kaguaensis" OR "Aneura keniae" OR "Aneura latissima" OR "Aneura macrostachya" OR "Aneura marianensis" OR "Aneura maxima" OR "Aneura mirabilis" OR "Aneura novaecaledoniae" OR "Aneura novaguineensis" OR "Aneura pellucida" OR "Aneura pinguis" OR "Aneura polyantha" OR "Aneura punctata" OR "Aneura rodwayi" OR "Aneura rotangicola" OR "Aneura sharpii" OR "Aneura subcanaliculata" OR "Angadenia" OR "Angelica" OR "Angelonia" OR "Angiopteris" OR "Angostura" OR "Aniba" OR "Anigozanthos" OR "Anisacanthus" OR "Aniseia" OR "Anisocarpus" OR "Anisocoma" OR "Anisodontea" OR "Ankistrodesmus" OR "Ankyra" OR "Anna mollifolia" OR "Anna ophiorrhizoides" OR "Anna submontana" OR "Annona" OR "Anoda abutiloides" OR "Anoda acerifolia" OR "Anoda crenatiflora" OR "Anoda cristata" OR "Anoda lanceolata" OR "Anoda pentaschista" OR "Anoda reticulata" OR "Anoda thurberi" OR "Anoectangium" OR "Anoectochilus" OR "Anogeissus" OR "Anomobryum" OR "Anomochloa" OR "Anomodon" OR "Anomodontella" OR "Anomodontopsis" OR "Anomoeneis" OR "Anoplolejeunea" OR "Anredera" OR "Antennaria" OR "Antenoron" OR "Anthaenantia" OR "Anthaenantiopsis" OR "Anthelia" OR "Anthemis" OR "Anthephora" OR "Anthericum" OR "Antheropeas" OR "Anthoceros" OR "Anthoxanthum" OR "Anthriscus" OR "Anthurium" OR "Anthyllis" OR "Anticlea" OR "Antidaphne" OR "Antidesma" OR "Antigonon" OR "Antiphytum" OR "Antirhea" OR "Antirrhinum" OR "Antithamnion" OR "Antitrichia" OR "Antopetitia" OR "Antrophyum" OR "Anubias" OR "Anulocaulis" OR "Aongstroemia" OR "Apacheria" OR "Apeiba" OR "Apera" OR "Aphanamixis" OR "Aphanelytrum" OR "Aphanes" OR "Aphanisma" OR "Aphanizomenon" OR "Aphanocapsa" OR "Aphanochaete" OR "Aphanorrhegma" OR "Aphanostephus" OR "Aphanothece" OR "Aphanotropis" OR "Aphelandra" OR "Aphragmus" OR "Apiastrum" OR "Apiocystis" OR "Apios" OR "Apium" OR "Aplectrum" OR "Aplodon" OR "Apluda" OR "Apochloa" OR "Apoclada" OR "Apocynum" OR "Apodanthera" OR "Aponogeton" OR "Apopellia" OR "Aporothallus" OR "Apotreubia" OR "Appiana" OR "Aptenia" OR "Apteria" OR "Aptychella" OR "Aquilaria" OR "Aquilegia" OR "Aquilonium" OR "Arabidopsis" OR "Arabis" OR "Arachis" OR "Arachniodes" OR "Aralia" OR "Araliaceae" OR "Araucaria" OR "Araujia" OR "Arberella" OR "Arbutus" OR "Arceuthobium" OR "Archeophylla" OR "Archidendron" OR "Archidium" OR "Archilejeunea" OR "Archontophoenix" OR "Arctagrostis" OR "Arctanthemum" OR "Arctium" OR "Arctoa" OR "Arctomecon" OR "Arctophila" OR "Arctopoa" OR "Arctoscyphus" OR "Arctostaphylos" OR "Arctotheca" OR "Arctotis" OR "Arctous" OR "Arcytophyllum" OR "Ardisia" OR "Areca" OR "Arenaria" OR "Arenga" OR "Arethusa" OR "Argemone" OR "Argyranthemum" OR "Argyreia" OR "Argyrochosma" OR "Argyrodendron" OR "Argyrolobium" OR "Argyroxiphium" OR "Argythamnia" OR "Arida" OR "Ariocarpus" OR "Arisaema" OR "Aristaloe" OR "Aristea" OR "Aristida" OR "Aristocapsa" OR "Aristolochia" OR "Aristotelia" OR "Arivela" OR "Armatocereus" OR "Armeria" OR "Armoracia" OR "Arnellia" OR "Arnica" OR "Arnoglossum" OR "Arnoseris" OR "Aronia" OR "Arrabidaea" OR "Arracacia" OR "Arrhenatherum" OR "Arrhenopterum" OR "Arrojadoa" OR "Artabotrys" OR "Artemisia" OR "Arthraxon" OR "Arthrocereus" OR "Arthrocnemum" OR "Arthropodium" OR "Arthropogon" OR "Arthrospira" OR "Arthrostemma" OR "Arthrostylidium" OR "Artocarpus" OR "Arum italicum" OR "Arum maculatum" OR "Arum palaestinum" OR "Aruncus" OR "Arundina" OR "Arundinaria" OR "Arundinella" OR "Arundo" OR "Arundoclaytonia" OR "Arytera" OR "Asanthus" OR "Asarum" OR "Ascarina" OR "Aschisma" OR "Ascidiota" OR "Asclepias" OR "Ascophyllum" OR "Asemeia" OR "Asimina" OR "Aspalathus" OR "Asparagus" OR "Asperugo" OR "Asperula" OR "Asphodelus" OR "Aspicarpa" OR "Aspidotis" OR "Aspilia" OR "Asplenium" OR "Astasia" OR "Astelia" OR "Aster" OR "Asteraceae" OR "Asteranthera" OR "Asterella" OR "Asterionella" OR "Asterochloris" OR "Asteromonas" OR "Astilbe" OR "Astonia" OR "Astraea" OR "Astragalus" OR "Astranthium" OR "Astrantia" OR "Astrebla" OR "Astripomoea" OR "Astrolepis" OR "Astroloba" OR "Astronidium" OR

	"Astrophytum" OR "Asyneuma" OR "Asystasia" OR "Atalantia" OR "Atamisquea" OR "Athalamia" OR "Athroostachys" OR "Athyrium" OR "Athysanus" OR "Atractantha" OR "Atractylocarpus" OR "Atrichoseris" OR "Atrichum" OR "Atriplex" OR "Atropa" OR "Attalea" OR "Attheya" OR "Aubrieta" OR "Aucuba" OR "Auerodendron" OR "Aulacomnium" OR "Aulacopilum" OR "Aulacoseira" OR "Aulonemia" OR "Aulosira" OR "Aureococcus" OR "Aureolaria" OR "Aurinia" OR "Austrocactus" OR "Austrocedrus" OR "Austrocylindropuntia" OR "Austroderia" OR "Austrolophozia" OR "Austroriella" OR "Austrostipa" OR "Austrotaxus" OR "Avena" OR "Avenella" OR "Avenula" OR "Averrhoa" OR "Avicennia" OR "Avonia" OR "Avrainvillea" OR "Axonopus" OR "Axyris" OR "Ayapana" OR "Ayenia" OR "Azadirachta" OR "Azolla" OR "Aztekium" OR "Azukia" OR "Baccaurea" OR "Baccharis" OR "Bacillaria" OR "Bacillariophyceae" OR "Bacillariophyta" OR "Bacopa" OR "Bacteriastrum" OR "Bactris" OR "Badiera" OR "Baeckea" OR "Bahia absinthifolia" OR "Bahia bigelovii" OR "Bahia biternata" OR "Bahia pedata" OR "Bahia schaffneri" OR "Bahiopsis" OR "Baileya" OR "Baillonella" OR "Balanites" OR "Balanophora" OR "Balantiopsis" OR "Baldellia" OR "Balduina" OR "Baldwiniella" OR "Baliospermum" OR "Ballota" OR "Baloghia" OR "Balsamita" OR "Balsamorhiza" OR "Baltimora" OR "Bambusa" OR "Banara" OR "Bangiopsis" OR "Banisteriopsis" OR "Banksia" OR "Baphia" OR "Baptisia" OR "Barbarea" OR "Barbella" OR "Barbellopsis" OR "Barbeya" OR "Barbieria" OR "Barbilophozia" OR "Barbula" OR "Barkleyanthus" OR "Barleria" OR "Barleriola" OR "Barringtonia" OR "Bartlettia" OR "Bartlettina" OR "Bartonia" OR "Bartramia" OR "Bartramiopsis" OR "Bartsia" OR "Basella" OR "Basellaceae" OR "Basiphyllaea" OR "Bassia" OR "Bastardia" OR "Bastardiopsis" OR "Batesimalva" OR "Batis" OR "Batocarpus" OR "Batrachospermum" OR "Bauhinia" OR "Bazzania" OR "Bealia" OR "Beaucarnea" OR "Bebbia" OR "Beccarinda" OR "Beccariophoenix" OR "Beckmannia" OR "Begonia" OR "Begoniaceae" OR "Beilschmiedia" OR "Bejaria" OR "Bellardia" OR "Bellerochea" OR "Bellibarbula" OR "Bellis" OR "Bellonia" OR "Beloglottis" OR "Benincasa" OR "Benitoa" OR "Bensoniella" OR "Berberis" OR "Berchemia" OR "Bergenia" OR "Bergerocactus" OR "Bergia" OR "Berkheya" OR "Berlandiera" OR "Bernardia" OR "Berrya" OR "Berteroa" OR "Bertholletia" OR "Bertya" OR "Berula" OR "Berylsimpsonia" OR "Bescherellia" OR "Besleria" OR "Bestia" OR "Beta lomatogona" OR "Beta nana" OR "Beta patula" OR "Beta procumbens" OR "Beta trigyna" OR "Beta vulgaris" OR "Bethencourtia" OR "Betula" OR "Beyeria" OR "Biantheridion" OR "Biddulphia" OR "Bidens" OR "Bifora" OR "Bigelowia" OR "Bignonia" OR "Bikkia" OR "Billardiera" OR "Billbergia" OR "Billieturnera" OR "Biophytum" OR "Bischofia" OR "Biserrula" OR "Bistorta" OR "Bituminaria" OR "Bixa orellana" OR "Blachia" OR "Blasia" OR "Blasiites" OR "Blechnum" OR "Blechum" OR "Blennosperma" OR "Blepharidachne" OR "Blepharidophyllum" OR "Blepharipappus" OR "Blepharizonia" OR "Blepharolejeunea" OR "Blepharoneuron" OR 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	"Conocarpus" OR "Conocephalum" OR "Conocephalumites" OR "Conoclinium" OR "Conopholis" OR "Conoscyphus" OR "Conospermum" OR "Conostegia" OR "Conostomum" OR "Conostylis" OR "Conradina" OR "Conringia" OR "Consolea" OR "Consolida" OR "Constancea" OR "Constantinea" OR "Conticribra" OR "Convallaria" OR "Convolvulaceae" OR "Convolvulus" OR "Conyza" OR "Copaifera" OR "Copernicia" OR "Copiapoa" OR "Coprosma" OR "Coptis" OR "Corallina" OR "Corallocarpus" OR "Corallodiscus" OR "Corallorhiza" OR "Corchorus" OR "Cordia" OR "Cordylanthus" OR "Cordyline" OR "Corema" OR "Coreocarpus" OR "Coreopsis" OR "Corethrogyne" OR "Coriandrum" OR "Coriophyllum" OR "Corispermum" OR "Cornus" OR "Cornutia" OR "Coronanthera" OR "Coronilla" OR "Coronopus" OR "Correa" OR "Corrigiola" OR "Corryocactus" OR "Corsinia" OR "Cortaderia" OR "Corydalis" OR "Corylopsis" OR "Corylus" OR "Corymbia" OR "Corymborkis" OR "Corynella" OR "Corynephorus" OR "Corynocarpus" OR "Corynoplastis" OR "Corynopuntia" OR "Coryphantha" OR 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"Crypsis" OR "Cryptantha" OR "Crypthecodinium" OR "Cryptocarya" OR "Cryptochloa" OR "Cryptochrysis" OR "Cryptocolea" OR "Cryptocoleopsis" OR "Cryptocoryne" OR "Cryptogramma" OR "Cryptolophocolea" OR "Cryptomeria" OR "Cryptomitrium" OR "Cryptomonas" OR "Cryptonemia" OR "Cryptophyceae" OR "Cryptophycophyta" OR "Cryptophyta" OR "Cryptoplagiochila" OR "Cryptostegia" OR "Cryptotaenia" OR "Ctenidium" OR "Ctenitis" OR "Ctenium" OR "Ctenolepis" OR "Cubitanthus" OR "Cucumis" OR "Cucurbita" OR "Cucurbitaceae" OR "Culcita" OR "Cullen" OR "Cumagloia" OR "Cuminum" OR "Cumulopuntia" OR "Cuniculotinus" OR "Cunila" OR "Cunninghamia" OR "Cupania" OR "Cupaniopsis" OR "Cuphea" OR "Cupressus" OR "Cuprocyparis" OR "Curculigo" OR "Curcuma" OR "Curio" OR "Cuscuta" OR "Cusickiella" OR "Cuspidatula" OR "Cutandia" OR "Cyamopsis" OR "Cyanea" OR "Cyanidium" OR "Cyanobium" OR "Cyanophyceae" OR "Cyanophycota" OR "Cyanotis" OR "Cyanthillium" OR "Cyathea" OR "Cyathodium" OR "Cyathomonas" OR "Cyathophorum" OR 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"Cyrtomium" OR "Cyrtomnium" OR "Cyrtopodendron" OR "Cyrtopodium" OR "Cyrtopus" OR "Cyrtosperma" OR "Cystoclonium" OR "Cystodium" OR "Cystopteris" OR "Cystoseira" OR "Cytisophyllum" OR "Cytisus" OR "Dacrycarpus" OR "Dacrydium" OR "Dacryodes" OR "Dacryophyllum" OR "Dactylis" OR "Dactyloctenium" OR "Dactylophorella" OR "Dactylorhiza" OR "Dahlia" OR "Dalbergaria" OR "Dalbergia" OR "Dalea" OR "Dalechampia" OR "Dalibarda" OR "Daltonia" OR "Damasonium" OR "Damnacanthus" OR "Dampiera" OR "Danaea" OR "Daniellia" OR "Danthonia" OR "Daphne" OR "Daphnopsis" OR "Darlingtonia" OR "Darmera" OR "Dasiphora" OR "Dasistoma" OR "Dasylirion" OR "Dasynotus" OR "Dasyochloa" OR "Dasypyrum" OR "Datisca" OR "Datura" OR "Daucosma" OR "Daucus" OR "Davallia" OR "Dawsonia" OR "Dawsoniocolax" OR "Decalepis" OR "Decaspermum" OR "Deceptifrons" OR "Decodon" OR "Decumaria" OR "Dedeckera" OR "Deeringia" OR "Deeringothamnus" OR "Deinandra" OR "Deinostigma" OR "Deiregyne" OR "Delairea" OR "Delavayella" OR "Delissea" OR "Delonix" OR "Delosperma" OR "Delphinium" OR "Dendranthema" OR "Dendroalsia" OR "Dendrobium" OR "Dendrocalamus" OR "Dendrocereus" OR "Dendroceros" OR "Dendrocnide" OR "Dendrolembidium" OR "Dendrolobium" OR "Dendromastigophora" OR "Dendromecon" OR "Dendropanax" OR "Dendropemon" OR

	"Dendrophorbium" OR "Dendrophthora" OR "Dendrophylax" OR "Dendropogonella" OR "Denmoza" OR "Dennstaedtia" OR "Denotarisia" OR "Dentella" OR "Depanthus" OR "Deparia" OR "Dermatophyllum" OR "Dermonema" OR "Derris" OR "Deschampsia" OR "Descurainia" OR "Desfontainia" OR "Desmanthus" OR "Desmarella" OR "Desmarestia" OR "Desmazeria" OR "Desmidiaceae" OR "Desmidium" OR "Desmococcus" OR "Desmodesmus" OR "Desmodium" OR "Detonula" OR "Deutzia" OR "Devaleraea" OR "Dialium" OR "Diamorpha" OR "Diandrolyra" OR "Dianella" OR "Dianthus" OR "Diapensia" OR "Diaperia" OR "Diarrhena" OR "Diastema" OR "Diatoma" OR "Diatomaceae" OR "Dibrachiella" OR "Dicentra" OR "Dicerandra" OR "Dichaea" OR "Dichaetophora" OR "Dichanthelium" OR "Dichanthium" OR "Dichelachne" OR "Dichelostemma" OR "Dichelyma" OR "Dichodontium" OR "Dichondra" OR "Dichromanthus" OR "Dichrostachys" OR "Dicksonia" OR "Dicliptera" OR "Dicnemon" OR "Dicoria" OR "Dicranella" OR "Dicranocarpus" OR "Dicranochaete" OR "Dicranodontium" OR "Dicranolejeunea" OR "Dicranoloma" OR "Dicranopteris" OR "Dicranostegia" OR "Dicranoweisia" OR "Dicranum" OR "Dicrateria" OR "Dictamnus" OR "Dictyosphaerium" OR "Dictyota" OR "Didiplis" OR "Didissandra" OR "Didymocarpus" OR "Didymochlaena" OR "Didymodon" OR "Didymoglossum" OR "Didymoplexis" OR "Didymosphenia" OR "Didymostigma" OR "Dieffenbachia" OR "Diegodendron" OR "Dielsiochloa" OR "Diervilla" OR "Dieteria" OR "Diettertia" OR "Digera" OR "Digitalis" OR "Digitaria" OR "Dillenia" OR "Dillwynia" OR "Dilomilis" OR "Dimeresia" OR "Dimeria" OR "Dimocarpus" OR "Dimorphocarpa" OR "Dimorphotheca" OR "Dinckleria" OR "Dinebra" OR "Dinobryon" OR "Dinochloa" OR "Dinophyceae" OR "Dioclea" OR "Diodella" OR "Diodia" OR "Dionaea" OR "Dioon" OR "Dioscorea" OR "Dioscoreophyllum" OR "Diospyros" OR "Dipentodon" OR "Diphylleia" OR "Diphysa" OR "Diphyscium" OR "Diplacrum" OR "Diplacus" OR "Diplasiolejeunea" OR "Diplazium" OR "Diploblechnum" OR "Diplocolea" OR "Diploknema" OR "Diploneis" OR "Diplophyllum" OR "Diplopterygium" OR "Diplotaxis" OR "Dipogon" OR "Dipsacus" OR "Dipteryx" OR "Dirca" OR "Discelium" OR "Dischidia" OR "Discites" OR "Discocactus" OR "Discocalyx" OR "Disocactus" OR "Disphyma" OR "Disporum" OR "Dissanthelium" OR "Dissochondrus" OR "Dissotis" OR "Distichium" OR "Distichlis" OR "Distichophyllum" OR "Distictella" OR "Distictis" OR "Ditaxis" OR "Dithyrea" OR "Ditrichum" OR "Ditrysinia" OR "Ditta" OR "Dittrichia" OR "Ditylum" OR "Diuris" OR "Dixoniella" OR "Dodecahema" OR "Dodonaea" OR "Doellingeria" OR "Dolichandra" OR "Dolichandrone" OR "Dolichopentas" OR "Dolichos" OR "Doliocarpus" OR "Dombeya" OR "Domingoa" OR "Donax" OR "Donnellia" OR "Donrichardsia" OR "Doodia" OR "Dopatrium" OR "Dorema" OR "Doronicum" OR "Dorstenia" OR "Dorycnium" OR "Doryopteris" OR "Douinia" OR "Dovyalis" OR "Downingia" OR "Doyerea" OR "Draba" OR "Dracaena" OR "Dracocephalum" OR "Dracontioides" OR "Dracontium" OR "Dracontomelon" OR "Dracunculus" OR "Draparnaldia" OR "Draperia" OR "Drepanium" OR "Drepanocladus" OR "Drepanolejeunea" OR "Drepanostachyum" OR "Drimia" OR "Drimys" OR "Drosanthemum" OR "Drosera" OR "Drucella" OR "Drummondia" OR "Dryas" OR "Drymaria" OR "Drymocallis" OR "Drymonia" OR "Dryobalanops" OR "Dryopetalon" OR "Dryopteris" OR "Drypetes" OR "Dubautia" OR "Duboisia" OR "Duchesnea" OR "Dudleya" OR "Duguetia" OR "Dulichium" OR "Dumontia" OR "Dumortiera" OR "Dunaliella" OR "Dupontia" OR "Duranta" OR "Durio" OR "Durvillaea" OR "Dussia" OR "Dyckia" OR "Dyera" OR "Dypsis" OR "Dyschoriste" OR "Dysodiopsis" OR "Dysoxylum" OR "Dysphania" OR "Dyssodia" OR "Eastwoodia" OR "Eatonella" OR "Ebenopsis" OR "Ebenus" OR "Ecballium" OR "Eccremidium" OR "Echeandia" OR "Echeveria" OR "Echinacea" OR "Echinocactus" OR "Echinocereus" OR "Echinochloa" OR "Echinocystis" OR "Echinodium" OR "Echinodorus" OR "Echinolaena" OR "Echinolejeunea" OR "Echinopepon" OR "Echinophyllum" OR "Echinops" OR "Echinopsis" OR "Echites" OR "Echium" OR "Ecklonia" OR "Eclipta" OR "Ectocarpus" OR "Ectropothecium" OR "Edaphochlorella" OR "Edgeworthia" OR "Edithcolea" OR "Egeria" OR "Egletes" OR "Ehretia" OR "Ehrharta" OR "Eichhornia" OR "Eisenia" OR "Ekmanochloa" OR "Elaeagnus" OR "Elaeis" OR "Elaeocarpus" OR "Elaeodendron" OR "Elakatothrix" OR "Elaphoglossum" OR "Elatine" OR "Elatostema" OR "Eleocharis" OR "Elephantopus" OR "Elettaria" OR "Eleusine" OR "Eleutheranthera" OR "Eleutherine" OR "Eleutherococcus" OR "Elionurus" OR "Elleanthus" OR "Elliottia" OR "Ellisia" OR "Elmera" OR "Elodea" OR "Elodium" OR "Elsholtzia" OR "Eltroplectris" OR "Elymandra" OR "Elymus" OR "Elytraria" OR "Elytrostachys" OR "Emarhendia" OR "Embelia" OR "Embothrium" OR "Emex" OR "Emilia" OR "Emmenanthe" OR "Emorya" OR "Empetrum" OR "Encalypta" OR "Encelia" OR "Enceliopsis" OR "Encephalartos" OR "Enchylaena" OR "Encyclia" OR "Encyonema" OR "Endiandra" OR "Endogemma" OR "Enemion" OR "Engelmannia" OR "Enhalus" OR "Enicostema" OR "Enigmella" OR "Enkianthus" OR "Enneapogon" OR "Ensete" OR "Entada" OR "Entandrophragma" OR "Entelea" OR "Enterolobium" OR "Enteromorpha" OR "Enteropogon" OR "Enterosora" OR "Entocladia" OR "Entodon" OR "Entodontopsis" OR "Entolasia" OR "Entomoneis" OR "Entosiphon" OR "Entosthodon" OR "Entwisleia" OR "Enydra" OR "Eocalypogeia" OR "Eolimna" OR "Eotrichocolea" OR "Epaltes" OR "Ephedra" OR "Ephemeropsis" OR "Ephemerum" OR "Epidendrum"

	OR "Epifagus" OR "Epigaea" OR "Epilobium" OR "Epimedium" OR "Epipactis" OR "Epiphyllum" OR "Epipremnum" OR "Epipterygium" OR "Episcia" OR "Epithelantha" OR "Epithema" OR "Epithemia" OR "Epixiphium" OR "Equisetum" OR "Eragrostis" OR "Eranthemum" OR "Eranthis" OR "Erato" OR "Erechtites" OR "Eremalche" OR "Eremitis" OR "Eremocaulon" OR "Eremochloa" OR "Eremocitrus" OR "Eremocrinum" OR "Eremogone" OR "Eremonotus" OR "Eremophila" OR "Eremopyrum" OR "Eremospatha" OR "Eremothera" OR "Erianthecium" OR "Eriastrum" OR "Erica" OR "Ericaceae" OR "Ericameria" OR "Erigenia" OR "Erigeron" OR "Erinus" OR "Eriobotrya" OR "Eriocaulon" OR "Eriochloa" OR "Eriochrysis" OR "Eriodictyon" OR "Eriogonum" OR "Erioneuron" OR "Eriophorum" OR "Eriophyllum" OR "Eriosema" OR "Eriosorus" OR "Eriosyce" OR "Erithalis" OR "Eritrichium" OR "Erlangea" OR "Ernodea" OR "Erodium" OR "Erpodium" OR "Errazurizia" OR "Eruca" OR "Erucastrum" OR "Eryngium" OR "Erysimum" OR "Erythrina" OR "Erythrocladia" OR "Erythrodermis" OR "Erythrodes" OR "Erythronium" OR "Erythrophleum" OR "Erythrostemon" OR "Erythrotrichia" OR "Erythroxylum" OR "Escallonia" OR "Eschscholzia" OR "Eschweilera" OR "Escobaria" OR "Escontria" OR "Esenbeckia" OR "Espeletia" OR "Espostoa" OR "Espostoopsis" OR "Etlingera" OR "Euastrum" OR "Eubotrys" OR "Eubrachion" OR "Eucalyptus" OR "Eucephalus" OR "Eucharis" OR "Euchiton" OR "Eucladium" OR "Euclasta" OR "Euclidium" OR "Eucnide" OR "Eucocconeis" OR "Eucodonia" OR "Eucomis" OR "Eucommia" OR "Eucryphia" OR "Eucrypta" OR "Eudorina" OR "Eugeissona" OR "Eugenia" OR "Euglena" OR "Euglenophyceae" OR "Euglenophycota" OR "Eulalia" OR "Eulaliopsis" OR "Eulobus" OR "Eulophia" OR "Eulychnia" OR "Eunotia" OR "Euonymus" OR "Eupatoriadelphus" OR "Eupatorium" OR "Euphorbia" OR "Euphrasia" OR "Euphrosyne" OR "Euploca" OR "Eupodium" OR "Eurhynchiastrum" OR "Eurhynchium" OR "Eurya" OR "Euryale" OR "Eurybia" OR "Euryops" OR "Eurystyles" OR "Eurytaenia" OR "Eusideroxylon" OR "Eustachys" OR "Eustichia" OR "Eustoma" OR "Euterpe" OR "Euthamia" OR "Eutrema" OR "Eutreptiella" OR "Eutrochium" OR "Evansianthus" OR "Evolvulus" OR "Exacum" OR "Excoecaria" OR "Exocarpos" OR "Exochorda" OR "Exomis" OR "Exormotheca" OR "Exostema" OR "Exothea" OR "Extriplex" OR "Exuviella" OR "Eysenhardtia" OR "Fabaceae" OR "Fabales" OR "Fabiana" OR "Fabronia" OR "Facelis" OR "Facheiroa" OR "Fadyenia" OR "Fagales" OR "Fagonia" OR "Fagopyrum" OR "Fagraea" OR "Fagus" OR "Faidherbia" OR "Falcaria" OR "Falcataria" OR "Fallopia" OR "Fallugia" OR "Faradaya" OR "Faramea" OR "Fargesia" OR "Fatoua" OR "Fatsia" OR "Felicia" OR "Fendlera" OR "Fendlerella" OR "Fernaldia" OR "Ferocactus" OR "Ferula" OR "Festuca" OR "Fevillea" OR "Fibraurea" OR "Fibrocapsa" OR "Ficinia" OR "Ficus" OR "Fieldia" OR "Filago" OR "Filgueirasia" OR "Filicium" OR "Filifolium" OR "Filipendula" OR "Fimbristylis" OR "Fingerhuthia" OR "Fioria" OR "Firmiana" OR "Fischerella" OR "Fissidens" OR "Fistulifera" OR "Fitchia" OR "Fitzroya" OR "Flacourtia" OR "Flagellaria" OR "Flaveria" OR "Fleischmannia" OR "Flemingia" OR "Flindersia" OR "Floerkea" OR "Florestina" OR "Floribundaria" OR "Flourensia" OR "Flueggea" OR "Flyriella" OR "Foeniculum" OR "Folioceros" OR "Fontanesia" OR "Fontinalis" OR "Forchhammeria" OR "Forestiera" OR "Forsstroemia" OR "Forsteronia" OR "Forsythia" OR "Fortunella" OR "Fossombronia" OR "Fothergilla" OR "Fouquieria" OR "Fragaria" OR "Fragilaria" OR "Frailea" OR "Franceia" OR "Franciella" OR "Frangula" OR "Frankenia" OR "Franklinia" OR "Frasera" OR "Fraxinus" OR "Freesia" OR "Fremontodendron" OR "Freycinetia" OR "Friesodielsia" OR "Frisvollia" OR "Fritillaria" OR "Froelichia" OR "Froesiochloa" OR "Frullania" OR "Frullanoides" OR "Frustilia" OR "Fryxellia" OR "Fuchsia" OR "Fucoides" OR "Fucus" OR "Fuirena" OR "Fulfordianthus" OR "Fumaria" OR "Funaria" OR "Funastrum" OR "Funtumia" OR "Furcraea" OR "Fuscocephaloziopsis" OR "Gackstroemia" OR "Gaga" OR "Gagea" OR "Gahnia" OR "Gaillardia" OR "Galactia" OR "Galanthus" OR "Galatella" OR "Galax" OR "Galaxaura" OR "Galdieria" OR "Galeandra" OR "Galearis" OR "Galega" OR "Galenia" OR "Galeobdolon" OR "Galeopsis" OR "Galinsoga" OR "Galipea" OR "Galium" OR "Galphimia" OR "Galvezia" OR "Gambelia" OR "Gamochaeta" OR "Garberia" OR "Garcia" OR "Garcinia" OR "Gardenia" OR "Garnotia" OR "Garovaglia" OR "Garrya" OR "Gasteranthus" OR "Gasteria" OR "Gastridium" OR "Gaudinia" OR "Gaultheria" OR "Gaura" OR "Gaussia" OR "Gaylussacia" OR "Gayophytum" OR "Gayralia" OR "Gazania" OR "Geitlerinema" OR "Gelasine" OR "Geleznowia" OR "Gelidium" OR "Gelsemium" OR "Geminella" OR "Gemmabryum" OR "Genicularia" OR "Geniostoma" OR "Genipa" OR "Genista" OR "Genistidium" OR "Gentiana" OR "Gentianella" OR "Gentianopsis" OR "Geocalyx" OR "Geocarpon" OR "Geocaulon" OR "Geochloa" OR "Geodorum" OR "Geoffroea" OR "Geohintonia" OR "Geophila" OR "Geothallus" OR "Gephyrocapsa" OR "Geraea" OR "Geranium" OR "Gerbera" OR "Gerhildiella" OR "Gerrardina" OR "Gerritea" OR "Gesneria" OR "Gessella" OR 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	"Gloeococcus" OR "Gloeocystis" OR "Gloeotaenium" OR "Gloeotrichia" OR "Gloriosa" OR "Glossadelphus" OR "Glossogyne" OR "Glossoloma" OR "Glossopetalon" OR "Glossostigma" OR "Glottidium" OR "Gloxinella" OR "Gloxinia" OR "Gloxiniopsis" OR "Gluta" OR "Glyceria" OR "Glycine clandestina" OR "Glycine falcata" OR "Glycine max" OR "Glycine tabacina" OR "Glycine tomentella" OR "Glycosmis" OR "Glycyrrhiza" OR "Glyptopleura" OR "Gmelina" OR "Gnaphalium" OR "Gnetum" OR "Gochnatia" OR "Goebeliella" OR "Goebelobryum" OR "Goetzea" OR "Goldbachia" OR "Golenkinia" OR "Gollania" OR "Gomontia" OR "Gomphocarpus" OR "Gomphonema" OR "Gomphosphaeria" OR "Gomphrena" OR "Gonatozygon" OR "Gongrosira" OR "Gongylanthus" OR "Gonialoe" OR "Goniotrichopsis" OR "Goniotrichum" OR "Gonium" OR "Gonocalyx" OR "Gonocarpus" OR "Gonolobus" OR "Gonyaulax" OR "Gonystylus" OR "Gonzalagunia" OR "Goodmania" OR "Goodyera" OR "Gordonia" OR "Gossypianthus" OR "Gossypium" OR "Gottschelia" OR "Gouania" OR "Gouinia" OR "Govenia" OR "Goyazia" OR "Gracilaria" OR "Gracilariopsis" OR "Gradsteinianthus" OR "Graffenrieda" OR "Grammatophora" OR "Grammitis" OR "Graphephorum" OR "Graptopetalum" OR "Graptophyllum" OR "Grateloupia" OR "Gratiola" OR "Grayia" OR "Greenella" OR "Greeneothallus" OR "Grevea" OR "Grevillea" OR "Grewia" OR "Greyia" OR "Grimmia" OR "Grindelia" OR "Groenlandia" OR "Grollea" OR "Groutiella" OR "Grusonia" OR "Guadua" OR "Guaiacum" OR "Guapira" OR "Guardiola" OR "Guarea" OR "Guatteria" OR "Guazuma" OR "Guettarda" OR "Guibourtia" OR "Guilandina" OR "Guilleminea" OR "Guinardia" OR "Guizotia" OR "Gundelia" OR "Gundlachia" OR "Gunnera" OR "Gutierrezia" OR "Guzmania" OR "Gyminda" OR "Gymnachne" OR "Gymnadenia" OR "Gymnadeniopsis" OR "Gymnanthes" OR "Gymnema" OR "Gymnocalycium" OR "Gymnocarpium" OR "Gymnocarpos" OR "Gymnocladus" OR "Gymnocolea" OR "Gymnocoleopsis" OR "Gymnodinium" OR "Gymnomitrion" OR "Gymnopogon" OR "Gymnosiphon" OR "Gymnosperma" OR "Gymnosteris" OR "Gymnostomiella" OR "Gymnostomum" OR "Gynandropsis" OR "Gynerium" OR "Gynotroches" OR "Gynura" OR "Gypsophila" OR "Gyrinops" OR "Gyrocheilos" OR "Gyrodinium" OR "Gyrogyne" OR "Gyrosigma" OR "Gyrothyra" OR "Gyroweisia" OR "Haageocereus" OR "Habenaria" OR "Haberlea" OR "Habranthus" OR "Hackelia" OR "Haematococcus" OR "Haematoxylum" OR "Haenianthus" OR "Haesselia" OR "Hageniella" OR "Hainardia" OR "Hakea" OR "Hakonechloa" OR "Halenia" OR "Halesia" OR "Halimeda" OR "Halimione" OR "Halimium" OR "Halimodendron" OR "Halimolobos" OR "Halochlorococcum" OR "Halocnemum" OR "Halodule" OR "Halogeton" OR "Halophila" OR "Haloragis" OR "Haloxylon" OR "Halymenia" OR "Hamamelis" OR "Hamatocaulis" OR "Hamatostrepta" OR "Hamelia" OR "Hancornia" OR "Handroanthus" OR "Hanguana" OR "Hannaea" OR "Hantzschia" OR "Hapalorchis" OR "Hapalosiphon" OR "Haplocarpha" OR "Haplocladium" OR "Haplodontium" OR "Haploesthes" OR "Haplohymenium" OR "Haplolejeunea" OR "Haplomitrium" OR "Haplopappus" OR "Haplophyton" OR "Haplostachys" OR "Haptophyta" OR "Harbouria" OR "Hardenbergia" OR "Harmonia" OR "Harpagonella" OR "Harpagophytum" OR "Harpalejeunea" OR "Harpanthus" OR "Harperocallis" OR "Harpullia" OR "Harrimanella" OR "Harrisia" OR "Hartwrightia" OR "Harveyella" OR "Haslea" OR "Hasteola" OR "Hastingsia" OR "Hatiora" OR "Hattoria" OR "Hattorianthus" OR "Hattoriolejeunea" OR "Havardia" OR "Haworthia" OR "Haworthiopsis" OR "Hazardia" OR "Hebe" OR "Hebeclinium" OR "Hebestigma" OR "Hecastocleis" OR "Hechtia" OR "Hecistopteris" OR "Hedeoma" OR "Hedera" OR "Hedosyne" OR "Hedwigia" OR "Hedwigidium" OR "Hedychium" OR "Hedyosmum" OR "Hedyotis" OR "Hedypnois" OR "Hedysarum" OR "Heimia" OR "Heisteria" OR "Helenium" OR "Heliamphora" OR "Helianthella" OR "Helianthemum" OR "Helianthus" OR "Helichrysum" OR "Helicodictyon" OR "Heliconia" OR "Helicophyllum" OR "Helicteres" OR "Helictotrichon" OR "Helietta" OR "Heliocarpus" OR "Heliomeris" OR "Heliopsis" OR "Heliotropium" OR "Helleborus" OR "Helleriella" OR "Helminthocladia" OR "Helminthora" OR "Helminthostachys" OR "Helminthotheca" OR "Helonias" OR "Helosis" OR "Hemarthria" OR "Hemerocallis" OR "Hemiaulus" OR "Hemiboea" OR "Hemiboeopsis" OR "Hemichaena" OR "Hemidictyum" OR "Hemigraphis" OR "Hemionitis" OR "Hemiscola" OR "Hemiselmis" OR "Hemitomes" OR "Hemizonella" OR "Hemizonia" OR "Henckelia" OR "Henicodium" OR "Hennediella" OR "Henriettea" OR "Henrya" OR "Hepaticites" OR "Hepatostolonophora" OR "Heppiella" OR "Heracleum" OR "Herbertia" OR "Herbertus" OR "Herissantia" OR "Heritiera" OR "Hermannia" OR "Hermbstaedtia" OR "Hernandia" OR "Herniaria" OR "Herpetineuron" OR "Herrickia" OR "Hertia" OR "Herzogianthus" OR "Herzogiaria" OR "Herzogiella" OR "Herzogobryum" OR "Hesperaloe" OR "Hesperevax" OR "Hesperidanthus" OR "Hesperis" OR "Hesperocallis" OR "Hesperochiron" OR "Hesperocnide" OR "Hesperodoria" OR "Hesperolinon" OR "Hesperomannia" OR "Hesperomecon" OR "Hesperostipa" OR "Hesperoyucca" OR "Heteranthemis" OR "Heteranthera" OR "Heterocapsa" OR "Heterocentron" OR "Heterocladiella" OR "Heterocladium" OR "Heterocodon" OR "Heterogemma" OR "Heterogonium" OR "Heteromeles" OR "Heteromita" OR "Heteropappus" OR "Heterophyllium" OR "Heteropogon" OR "Heteropterys" OR "Heterosavia" OR "Heteroscyphus" OR "Heterosigma" OR "Heterospathe" OR "Heterosperma" OR "Heterotheca" OR

	"Heterotis" OR "Heterozostera" OR "Heuchera" OR "Hevea" OR "Hexalectris" OR "Hexastylis" OR "Hexatheca" OR "Hibiscadelphus" OR "Hibiscus" OR "Hieracium" OR "Hieronyma" OR "Hilaria" OR "Hillebrandia" OR "Hillia" OR "Hilpertia" OR "Himalayacalamus" OR "Himantothallus" OR "Hippeastrum" OR "Hippobroma" OR "Hippocratea" OR "Hippocrepis" OR "Hippomane" OR "Hippophae" OR "Hippuris" OR "Hiptage" OR "Hiraea" OR "Hirschfeldia" OR "Hirtella" OR "Histiopteris" OR "Hitchenia" OR "Hizikia" OR "Hodgsonia" OR "Hoffmannseggia" OR "Hofmeisteria" OR "Hohenbergia" OR "Hoheria" OR "Hoita" OR "Holacantha" OR "Holarrhena" OR "Holcus" OR "Hollisteria" OR "Holmbergia" OR "Holmgrenanthe" OR "Holmsella" OR "Holmskioldia" OR "Holocarpha" OR "Holodiscus" OR "Holographis" OR "Holomitrium" OR "Holostemma" OR "Holosteum" OR "Holozonia" OR "Homalanthus" OR "Homalia" OR "Homaliadelphus" OR "Homaliodendron" OR "Homalium" OR "Homalocladium" OR "Homalomena" OR "Homalotheciella" OR "Homalothecium" OR "Homeria" OR "Homolepis" OR "Homomallium" OR "Homonoia" OR "Homozeugos" OR "Honckenya" OR "Hoodia" OR "Hookeria" OR "Hookeriopsis" OR "Hopea" OR "Hopia" OR "Hordeum" OR "Horkelia" OR "Horkeliella" OR "Hormidiospora" OR "Hormidium" OR "Hormosira" OR "Hornungia" OR "Horsfieldia" OR "Horsfordia" OR "Hosackia" OR "Hosta" OR "Hottonia" OR "Houstonia" OR "Houttuynia" OR "Hovanella" OR "Hovenia" OR "Howea" OR "Howellia" OR "Howelliella" OR "Hoya" OR "Hudsonia" OR "Huertea" OR "Hulsea" OR "Hulteniella" OR "Humbertacalia" OR "Humulus" OR "Hunnemannia" OR "Hunzikeria" OR "Huperzia" OR "Hura" OR "Hyacinthoides" OR "Hyacinthus" OR "Hyalolepidozia" OR "Hybanthus" OR "Hydnocarpus" OR "Hydnophytum" OR "Hydrangea" OR "Hydrastis" OR "Hydrianum" OR "Hydrilla" OR "Hydrocharis" OR "Hydrocleys" OR "Hydrocotyle" OR "Hydrodictyon" OR "Hydrogonium" OR "Hydrolea" OR "Hydrolithon" OR "Hydrophylax" OR "Hydrophyllum" OR "Hydropogon" OR "Hydropogonella" OR "Hydropuntia" OR "Hydrostemma" OR "Hygroamblystegium" OR "Hygrobiella" OR "Hygrohypnum" OR "Hygrolembidium" OR "Hygrophila" OR "Hygroryza" OR "Hylocereus" OR "Hylocomiastrum" OR "Hylocomium" OR "Hylotelephium" OR "Hymenachne" OR "Hymenaea" OR "Hymenocallis" OR "Hymenocarpos" OR "Hymenoclea" OR "Hymenocyclus" OR "Hymenoloma" OR "Hymenomonas" OR "Hymenopappus" OR "Hymenophyllum" OR "Hymenophyton" OR "Hymenosporum" OR "Hymenostylium" OR "Hymenothrix" OR "Hymenoxys" OR "Hyophila" OR "Hyophiladelphus" OR "Hyoscyamus" OR "Hyparrhenia" OR "Hypecoum" OR "Hypelate" OR "Hyperbaena" OR "Hypericum" OR "Hyperthelia" OR "Hyphaene" OR "Hypnea" OR "Hypnodendron" OR "Hypnodontopsis" OR "Hypnomonas" OR "Hypnum" OR "Hypocalymma" OR "Hypochaeris" OR "Hypocyrta" OR "Hypoderris" OR "Hypoestes" OR "Hypolepis" OR "Hypolytrum" OR "Hypopitys" OR "Hypopterygium" OR "Hypoxis" OR "Hyptis" OR "Hyssopus" OR "Iberis" OR "Ibervillea" OR "Ibicella" OR "Icacina" OR "Ichnanthus" OR "Idahoa" OR "Ilex" OR "Iliamna" OR "Illecebrum" OR "Illicium" OR "Imbribryum" OR "Impatiens" OR "Imperata" OR "Incarvillea" OR "Indigofera" OR "Indocalamus" OR "Indusiella" OR "Inga" OR "Inocarpus" OR "Intsia" OR "Inula" OR "Iochroma" OR "Iodanthus" OR "Ionactis" OR "Ionopsidium" OR "Ionopsis" OR "Ipheion" OR "Ipomoea" OR "Ipomopsis" OR "Iresine" OR "Iridaea" OR "Iris aphylla" OR "Iris bismarckiana" OR "Iris bracteata" OR "Iris brevicaulis" OR "Iris chrysophylla" OR "Iris cristata" OR "Iris delavayi" OR "Iris dichotoma" OR "Iris domestica" OR "Iris douglasiana" OR "Iris ensata" OR "Iris fernaldii" OR "Iris foetidissima" OR "Iris fulva" OR "Iris germanica" OR "Iris giganticaerulea" OR "Iris hartwegii" OR "Iris hexagona" OR "Iris hoogiana" OR "Iris hookeri" OR "Iris innominata" OR "Iris lacustris" OR "Iris laevigata" OR "Iris longipetala" OR "Iris lutescens" OR "Iris macrosiphon" OR "Iris missouriensis" OR "Iris munzii" OR "Iris orientalis" OR "Iris pallida" OR "Iris prismatica" OR "Iris pseudacorus" OR "Iris pumila" OR "Iris purdyi" OR "Iris sanguinea" OR "Iris savannarum" OR "Iris setosa" OR "Iris sibirica" OR "Iris spuria" OR "Iris tectorum" OR "Iris tenax" OR "Iris tenuis" OR "Iris tenuissima" OR "Iris tingitana" OR "Iris tridentata" OR "Iris variegata" OR "Iris verna" OR "Iris versicolor" OR "Iris virginica" OR "Iris X fulvala" OR "Iris X nelsonii" OR "Iris X robusta" OR "Iris X sancti-cyri" OR "Iris X thompsonii" OR "Iris X vinicolor" OR "Iris xiphium" OR "Isachne" OR "Isatis" OR "Ischaemum" OR "Iseilema" OR "Ismelia" OR "Isocarpha" OR "Isochilus" OR "Isochrysis" OR "Isocoma" OR "Isodendrion" OR "Isoetes" OR "Isolembidium" OR "Isolepis" OR "Isopaches" OR "Isophyllaria" OR "Isopogon" OR "Isopterygiopsis" OR "Isopterygium" OR "Isotachis" OR "Isothecium" OR "Isotria" OR "Itea" OR "Iva" OR "Ivesia" OR "Iwatsukiella" OR "Ixeris" OR "Ixia" OR "Ixophorus" OR "Ixora" OR "Izziella" OR "Jaborosa" OR "Jacaranda" OR "Jackiella" OR "Jacobaea" OR "Jacquemontia" OR "Jacquinia" OR "Jacquiniella" OR "Jaegerina" OR "Jaffueliobryum" OR "Jaganovia" OR "Jaltomata" OR "Jamesia" OR "Jamesianthus" OR "Jancaea" OR "Janusia" OR "Jarava" OR "Jarilla" OR "Jasarum" OR "Jasione" OR "Jasminocereus" OR "Jasminum" OR "Jateorhiza" OR "Jatropha" OR "Jaumea" OR "Jefea" OR "Jeffersonia" OR "Jensenia" OR "Jensia" OR "Jepsonia" OR "Jerdonia" OR "Jochenia" OR "Johanneshowellia" OR "Joinvillea" OR "Jouvea" OR "Jovibarba" OR "Jubaea" OR "Jubula" OR "Juglans" OR "Juncaceae" OR "Juncus" OR "Jungermannia" OR

	"Jungermanniopsis" OR "Jungermannites" OR "Juniperus" OR "Justicia" OR "Kadua" OR "Kaempferia" OR "Kaisupeea" OR "Kalanchoe" OR "Kalimeris" OR "Kaliphora" OR "Kallstroemia" OR "Kalmia" OR "Kalmiopsis" OR "Kalopanax" OR "Kanaloa" OR "Kandelia" OR "Kaolakia" OR "Kappaphycus" OR "Karayevia" OR "Karenia" OR "Karima" OR "Karwinskia" OR "Katablepharis" OR "Keckiella" OR "Kelloggia" OR "Kelseya" OR "Kengia" OR "Kennedia" OR "Kerria" OR "Keteleeria" OR "Keysseria" OR "Khaya" OR "Kiaeria" OR "Kickxia" OR "Kigelia" OR "Kindbergia" OR "Kirchneriella" OR "Klebsormidium" OR "Kleinhovia" OR "Kleinia" OR "Knautia" OR "Kneuckeria" OR "Kniphofia" OR "Koanophyllon" OR "Kobayasiella" OR "Kobresia" OR "Kochia" OR "Koeberlinia" OR "Koeleria" OR "Koellensteinia" OR "Koelreuteria" OR "Koenigia" OR "Kohleria" OR "Kokia" OR "Kolkwitzia" OR "Komvophoron" OR "Koponeniella" OR "Kopsia" OR "Kopsiopsis" OR "Korthalsella" OR "Kosteletzkya" OR "Krameria" OR "Krapovickasia" OR "Krascheninnikovia" OR "Krempogonium" OR "Krigia" OR "Krugiodendron" OR "Kumara" OR "Kummerowia" OR "Kunzea" OR "Kurzia" OR "Kyhosia" OR "Kyliniella" OR "Kyllinga" OR "Kymatocalyx" OR "Kymatolejeunea" OR "Lablab" OR "Labordia" OR "Laburnum" OR "Lachenalia" OR "Lachnagrostis" OR "Lachnanthes" OR "Lachnocaulon" OR "Lactuca" OR "Laelia" OR "Laennecia" OR "Laetia" OR "Lagarosiphon" OR "Lagarostrobos" OR "Lagascea" OR "Lagenandra" OR "Lagenaria" OR "Lagenocarpus" OR "Lagerstroemia" OR "Lagetta" OR "Lagophylla" OR "Lagotis" OR "Lagunaria" OR "Laguncularia" OR "Lagurus" OR "Lallemantia" OR "Lamarckia" OR "Lamellocolea" OR "Laminaria" OR "Lamium" OR "Lampadaria" OR "Lampranthus" OR "Landolphia" OR "Landoltia" OR "Langloisia" OR "Lansium" OR "Lantana" OR "Laplacea" OR "Laportea" OR "Lappula" OR "Lapsana" OR "Lapsanastrum" OR "Larix" OR "Larrea" OR "Larryleachia" OR "Lasia" OR "Lasiacis" OR "Lasianthaea" OR "Lasianthus" OR "Lasiocereus" OR "Lasiocroton" OR "Lasiospermum" OR "Lastarriaea" OR "Lasthenia" OR "Lastreopsis" OR "Lathrocasis" OR "Lathyrus" OR "Laticaulina" OR "Launaea" OR "Laurus" OR "Lavandula" OR "Lavatera" OR "Lavoisiera" OR "Lavrania" OR "Lawsonia" OR "Layia" OR "Leandra" OR "Leavenworthia" OR "Lebeckia" OR "Lechea" OR "Lecythis" OR "Ledum" OR "Leersia" OR "Legenere" OR "Legousia" OR "Leibnitzia" OR "Leidesia" OR "Leiolejeunea" OR "Leiomitra" OR "Leiosporoceros" OR "Leitneria" OR "Lejeunea" OR "Lellingeria" OR "Lembidium" OR "Lembocarpus" OR "Lembophyllum" OR "Lemna" OR "Lemnaceae" OR "Lemurophoenix" OR "Lenophyllum" OR "Lens culinaris" OR "Leocereus" OR "Leochilus" OR "Leonotis" OR "Leontodon" OR "Leonurus" OR "Leopoldinia" OR "Lepanthes" OR "Lepanthopsis" OR "Lepechinia" OR "Lepicolea" OR "Lepidagathis" OR "Lepidaploa" OR "Lepidium" OR "Lepidogyna" OR "Lepidolaena" OR "Lepidolejeunea" OR "Lepidopilum" OR "Lepidospartum" OR "Lepidozamia" OR "Lepidozia" OR "Lepinia" OR "Lepironia" OR "Lepismium" OR "Lepisorus" OR "Leptarrhena" OR "Leptecophylla" OR "Leptoboea" OR "Leptobryum" OR "Leptocereus" OR "Leptochloa" OR "Leptocladia" OR "Leptocylindrus" OR "Leptodactylon" OR "Leptodictyum" OR "Leptodon" OR "Leptodontium" OR "Leptoglossis" OR "Leptohymenium" OR "Leptolejeunea" OR "Leptolyngbya" OR "Leptophyllochloa" OR "Leptophyllopsis" OR "Leptopterigynandrum" OR "Leptopus" OR "Leptoscyphopsis" OR "Leptoscyphus" OR "Leptosiphon" OR "Leptospermum" OR "Leptostomopsis" OR "Leptostomum" OR "Leptotheca" OR "Leptothrium" OR "Lepturidium" OR "Lepturus" OR "Lepuropetalon" OR "Lepyrodiclis" OR "Lepyrodon" OR "Lescuraea" OR "Leskea" OR "Leskeella" OR "Lespedeza" OR "Lessertia" OR "Lessingia" OR "Lessonia" OR "Lethocolea" OR "Leucadendron" OR "Leucaena" OR "Leucanthemella" OR "Leucanthemopsis" OR "Leucanthemum" OR "Leucas" OR "Leuchtenbergia" OR "Leuciva" OR "Leucobryum" OR "Leucocrinum" OR "Leucocroton" OR "Leucodon" OR "Leucojum" OR "Leucolepis" OR "Leucoloma" OR "Leucophanes" OR "Leucophyllum" OR "Leucophysalis" OR "Leucopoa" OR "Leucospermum" OR "Leucospora" OR "Leucothoe" OR "Levanderina" OR "Levisticum" OR "Lewinskya" OR "Lewisia" OR "Leycesteria" OR "Leymus" OR "Liagora" OR "Liatris" OR "Libertia" OR "Libidibia" OR "Licania" OR "Licaria" OR "Ligularia" OR "Ligusticum" OR "Ligustrum" OR "Lilaea" OR "Lilaeopsis" OR "Liliales" OR "Liliopsida" OR "Lilium" OR "Limbella" OR "Limnanthes" OR "Limnobium" OR "Limnocharis" OR "Limnodea" OR "Limnophila" OR "Limnophyton" OR "Limnosciadium" OR "Limnothrix" OR "Limonia" OR "Limonium" OR "Limosella" OR "Linanthus" OR "Linaria" OR "Lindbergia" OR "Lindelofia" OR "Lindera" OR "Lindernia" OR "Lindheimera" OR "Lindigianthus" OR "Lindsaea" OR "Lingulodinium" OR "Linnaea" OR "Linospadix" OR "Linum" OR "Liochlaena" OR "Liparis" OR "Lipocarpha" OR "Lipochaeta" OR "Lippia" OR "Liquidambar" OR "Liriodendron" OR "Liriope" OR "Lisianthius" OR "Litchi" OR "Lithachne" OR "Lithocarpus" OR "Lithodesmium" OR "Lithophila" OR "Lithophragma" OR "Lithospermum" OR "Lithrea" OR "Litostigma" OR "Litsea" OR "Littorella" OR "Livistona" OR "Lloydia" OR "Lobanilia" OR "Lobatiriccardia" OR "Lobelia" OR "Lobularia" OR "Lodoicea" OR "Loeflingia" OR "Loeselia" OR "Loeseliastrum" OR "Loeskeobryum" OR "Loeskypnum" OR "Logfia" OR "Lolium" OR "Lomagramma" OR "Lomariopsis" OR "Lomatium" OR "Lomatogonium" OR "Lomelosia" OR "Lonchitis" OR "Lonchocarpus" OR "Lonicera" OR "Lopezia" OR "Lophiola" OR

	"Lophocolea" OR "Lopholejeunea" OR "Lophonardia" OR "Lophophora" OR "Lophopyxis" OR "Lophosoria" OR "Lophospermum" OR "Lophostemon" OR "Lophozia" OR "Lophoziopsis" OR "Lopidium" OR "Lorandersonia" OR "Loranthus" OR "Lorentziella" OR "Lotononis" OR "Lotus" OR "Loudetia" OR "Loudetiopsis" OR "Loxonia" OR "Loxostigma" OR "Luculia" OR "Lucya" OR "Ludwigia" OR "Luehea" OR "Luetkea" OR "Luffa" OR "Luina" OR "Luisierella" OR "Luma" OR "Lumnitzera" OR "Lunania" OR "Lunaria" OR "Lunularia" OR "Lupinus" OR "Luronium" OR "Luteolejeunea" OR "Luziola" OR "Luzula" OR "Lycaste" OR "Lychnis" OR "Lycianthes" OR "Lycium" OR "Lycopersicon" OR "Lycopodiella" OR "Lycopodium" OR "Lycopus" OR "Lycoris" OR "Lycurus" OR "Lyellia" OR "Lygeum" OR "Lygodesmia" OR "Lygodium" OR "Lyngbya" OR "Lyonia" OR "Lyonothamnus" OR "Lyrocarpa" OR "Lysichiton" OR "Lysiloma" OR "Lysimachia" OR "Lysionotus" OR "Lythrum" OR "Maackia" OR "Mabrya" OR "Macadamia" OR "Macairea" OR "Macaranga" OR "Macbridea" OR "Macfadyena" OR "Machaeranthera" OR "Machaerina" OR "Machaerium" OR "Machaonia" OR "Macleaya" OR "Maclura" OR "Maclurolyra" OR "Macradenia" OR "Macranthera" OR "Macrochloa" OR "Macrocolura" OR "Macrocoma" OR "Macrocystis" OR "Macrodiplophyllum" OR "Macromitrium" OR "Macropidia" OR "Macroptilium" OR "Macroscepis" OR "Macrothamnium" OR "Macrothelypteris" OR "Macrotyloma" OR "Macrozamia" OR "Madhuca" OR "Madia" OR "Maerua" OR "Maesa" OR "Maesopsis" OR "Magnolia" OR "Magnoliophyta" OR "Magnoliopsida" OR "Maianthemum" OR "Maihuenia" OR "Maihueniopsis" OR "Maireana" OR "Makinoa" OR "Malachra" OR "Malacomeles" OR "Malacothamnus" OR "Malacothrix" OR "Malaxis" OR "Malcolmia" OR "Malephora" OR "Malleochloris" OR "Mallomonas" OR "Mallotus" OR "Malosma" OR "Malperia" OR "Malpighia" OR "Malus" OR "Malva" OR "Malvastrum" OR "Malvaviscus" OR "Malvella" OR "Mammea" OR "Mammillaria" OR "Mancoa" OR "Mandevilla" OR "Mandirola" OR "Mandragora" OR "Manfreda" OR "Mangifera" OR "Manihot" OR "Manilkara" OR "Mannia" OR "Mansoa" OR "Mantisalca" OR "Maoutia" OR "Mapania" OR "Mappia" OR "Marah" OR "Maranta" OR "Marantochloa" OR "Marattia" OR "Marcgravia" OR "Marchantia" OR "Marchantiolites" OR "Marchantites" OR "Marchesinia" OR "Margaritaria" OR "Margaritopsis" OR "Marila" OR "Marina calycosa" OR "Marina diffusa" OR "Marina orcuttii" OR "Marina parryi" OR "Mariosousa" OR "Markhamia" OR "Marlierea" OR "Marojejya" OR "Marrubium" OR "Marsdenia" OR "Marshallia" OR "Marsilea" OR "Marsupella" OR "Marsypianthes" OR "Martinella" OR "Martynia" OR "Masdevallia" OR "Mastigocladus" OR "Mastigolejeunea" OR "Mastigopelma" OR "Mastigophora" OR "Matayba" OR "Matelea" OR "Matricaria" OR "Matteuccia" OR "Matthiola" OR "Matucana" OR "Maundia" OR "Maurandella" OR "Maurandya" OR "Mauranthemum" OR "Mauritia" OR "Maxillaria" OR "Maxonia" OR "Mayaca" OR "Mayamaea" OR "Maytenus" OR "Mazus" OR "Mecardonia" OR "Meconella" OR "Meconopsis" OR "Mecranium" OR "Medeola" OR "Medicago" OR "Medinilla" OR "Meehania" OR "Meesia" OR "Megaceros" OR "Megalachne" OR "Megalastrum" OR "Megalembidium" OR "Megalodonta" OR "Megaskepasma" OR "Megathyrsus" OR "Meinungeria" OR "Meiogyne" OR "Meiothecium" OR "Meiotrichum" OR "Melaleuca" OR "Melampodium" OR "Melampyrum" OR "Melanolepis" OR "Melanthera" OR "Melanthium" OR "Melastoma" OR "Melia" OR "Melianthus" OR "Melica" OR "Melicoccus" OR "Melicope" OR "Melicytus" OR "Melilotus" OR "Melinis" OR "Meliosma" OR "Melissa" OR "Melocactus" OR "Melocanna" OR "Melochia" OR "Melolobium" OR "Melothria" OR "Melpomene" OR "Menispermum" OR "Menodora" OR "Mentha" OR "Mentzelia" OR "Menyanthes" OR "Menziesia" OR "Mercurialis" OR "Meristiella" OR "Merostachys" OR "Merremia" OR "Merrilliodendron" OR "Mertensia" OR "Merwilla" OR "Merxmuellera" OR "Meryta" OR "Mesadenus" OR "Mesembryanthemum" OR "Mesoptychia" OR "Mesosetum" OR "Mesotus" OR "Metacalypogeia" OR "Metalejeunea" OR "Metalepis" OR "Metapetrocosmea" OR "Metaplexis" OR "Metasequoia" OR "Metastelma" OR "Metcalfia" OR "Meteoriopsis" OR "Meteorium" OR "Metopium" OR "Metrosideros" OR "Metroxylon" OR "Metzgeria" OR "Metzgeriites" OR "Metzgeriothallus" OR "Meximalva" OR "Mezonevron" OR "Mibora" OR "Miconia" OR "Micrandra" OR "Micranthemum" OR "Micranthes" OR "Micranthocereus" OR "Microbryum" OR "Microchilus" OR "Microchloa" OR "Microcitrus" OR "Microcycas" OR "Microdictyon" OR "Microgramma" OR "Microhypnum" OR "Microlejeunea" OR "Microlepia" OR "Micromeria" OR "Micromitrium" OR "Micromonolepis" OR "Micropholis" OR "Micropsis" OR "Micropterygium" OR "Micropus" OR "Microseris" OR "Microsorum" OR "Microstachys" OR "Microstegium" OR "Microsteris" OR "Microtea" OR "Microthamnion" OR "Microtheciella" OR "Microthlaspi" OR "Microtis" OR "Mielichhoferia" OR "Mikania" OR "Mila" OR "Milicia" OR "Milium" OR "Milla" OR "Millettia" OR "Miltonia" OR "Miltoniopsis" OR "Mimosa" OR "Mimulus" OR "Mimusops" OR "Minuartia" OR "Miqueliopuntia" OR "Mirabilis" OR "Miscanthus" OR "Misodendrum" OR "Misopates" OR "Mitchella" OR "Mitella" OR "Mitracarpus" OR "Mitraria" OR "Mitreola" OR "Mittenia" OR "Mizutania" OR "Mnesithea" OR "Mniobryoides" OR "Mniochloa" OR "Mnioloma" OR "Mniomalia" OR "Mnium" OR "Modiola" OR "Moehringia" OR "Moenchia" OR

	"Moerckia" OR "Mohavea" OR "Molendoa" OR "Molineria" OR "Molineriella" OR "Molinia" OR "Mollinedia" OR "Mollugo" OR "Moluccella" OR "Momordica" OR "Monarda" OR "Monardella" OR "Moneses" OR "Monnina" OR "Monocarpus" OR "Monochoria" OR "Monoclea" OR "Monodactylopsis" OR "Monodora" OR "Monolepis" OR "Monolopia" OR "Monophyllaea" OR "Monoptilon" OR "Monopyle" OR "Monosolenium" OR "Monostroma" OR "Monotaxis" OR "Monotropa" OR "Monotropsis" OR "Monstera" OR "Montanoa" OR "Montia" OR "Montinia" OR "Montrichardia" OR "Moorochloa" OR "Moraea" OR "Morella" OR "Morelotia" OR "Moricandia" OR "Morinda" OR "Moringa" OR "Morisonia" OR "Mormolyca" OR "Morrenia" OR "Mortonia" OR "Morus" OR "Mosiera" OR "Mosla" OR "Mouriri" OR "Moussonia" OR "Mstikhinia" OR "Mucronea" OR "Mucuna" OR "Muehlenbeckia" OR "Muelleriella" OR "Muhlenbergia" OR "Muilla" OR "Mulgedium" OR "Mundulea" OR "Munroa" OR "Muntingia" OR "Munzothamnus" OR "Muraltia" OR "Murdannia" OR "Murraya" OR "Musa" OR "Muscari" OR "Musineon" OR "Mussaenda" OR "Myagrum" OR "Mycelis" OR "Mylia" OR "Myoporum" OR "Myosotidium" OR "Myosotis" OR "Myosoton" OR "Myosurus" OR "Myrcia" OR "Myrcianthes" OR "Myrciaria" OR "Myrica" OR "Myrinia" OR "Myriocladus" OR "Myriocoleopsis" OR "Myriophyllum" OR "Myriopus" OR "Myristica" OR "Myrosma" OR "Myrospermum" OR "Myroxylon" OR "Myrrhis" OR "Myrsine" OR "Myrtella" OR "Myrtillocactus" OR "Myrtus" OR "Mytilopsis" OR "Myurella" OR "Myuroclada" OR "Naiadita" OR "Najas" OR "Nama" OR "Nandina" OR "Nanobryum" OR "Nanomarsupella" OR "Napaea" OR "Napeanthus" OR "Narcissus" OR "Nardia" OR "Nardus" OR "Narthecium" OR "Nashia" OR "Nassella" OR "Nasturtium" OR "Nautilocalyx" OR "Navarretia" OR "Neanotis" OR "Nechamandra" OR "Neckera" OR "Neckeropsis" OR "Nectandra" OR "Nectouxia" OR "Neea" OR "Neesiochloa" OR "Neesioscyphus" OR "Neevea" OR "Negria" OR "Neillia" OR "Nelsonia" OR "Nelumbo" OR "Nemacaulis" OR "Nemacladus" OR "Nemalion" OR "Nemastylis" OR "Nematanthus" OR "Nemesia" OR "Nemophila" OR "Neobouteloua" OR "Neoboutonia" OR "Neobuxbaumia" OR "Neogaerrhinum" OR "Neogrollea" OR "Neoguillauminia" OR "Neohattoria" OR "Neohodgsonia" OR "Neoholmgrenia" OR "Neolamarckia" OR "Neolepidozia" OR "Neolindbergia" OR "Neolloydia" OR "Neomacounia" OR "Neomarica" OR "Neomortonia" OR "Neonauclea" OR "Neonesomia" OR "Neonotonia" OR "Neoorthocaulis" OR "Neopanax" OR "Neoparrya" OR "Neoraimondia" OR "Neoregelia" OR "Neorhodella" OR "Neorudolphia" OR "Neoshirakia" OR "Neostapfia" OR "Neotorularia" OR "Neotrichocolea" OR "Neottia" OR "Neowerdermannia" OR "Nepenthes" OR "Nepeta" OR "Nephelium" OR "Nephelolejeunea" OR "Nephrolepis" OR "Nephrophyllidium" OR "Nepsera" OR "Neptunia" OR "Neraudia" OR "Nerine" OR "Nerisyrenia" OR "Nerium" OR "Nertera" OR "Nervilia" OR "Nesaea" OR "Neslia" OR "Nesogenes" OR "Nesoluma" OR "Nestegis" OR "Nestotus" OR "Nestronia" OR "Neuburgia" OR "Neurodium" OR "Neurolaena" OR "Neurolejeunea" OR "Nevada holmgrenii" OR "Neviusia" OR "Neyraudia" OR "Nicandra" OR "Nicolletia" OR "Nicoraepoa" OR "Nicotiana" OR "Nidema" OR "Nierembergia" OR "Nigella" OR "Niphaea" OR "Niphidium" OR "Niphotrichum" OR "Nipponanthemum" OR "Nipponolejeunea" OR "Nissolia" OR "Nitrophila" OR "Noccaea" OR "Nodonema" OR "Nogopterium" OR "Nolina" OR "Nomaphila" OR "Nomopyle" OR "Nonea" OR "Nopalea" OR "Noronhia" OR "Noteroclada" OR "Nothocalais" OR "Nothoceros" OR "Nothocestrum" OR "Nothochelone" OR "Nothofagus" OR "Nothogymnomitrion" OR "Notholaena" OR "Nothoperanema" OR "Nothoscordum" OR "Nothostrepta" OR "Notochloe" OR "Notohypnum" OR "Notopleura" OR "Notoscyphus" OR "Notothylas" OR "Nototrichium" OR "Nowellia" OR "Nuphar" OR "Nuttallanthus" OR "Nyctaginia" OR "Nyholmiella" OR "Nymphaea" OR "Nymphoides" OR "Nypa" OR "Nyssa" OR "Oberna" OR "Obolaria" OR "Obregonia" OR "Obtusifolium" OR "Ocalia" OR "Ocellochloa" OR "Ochlandra" OR "Ochna" OR "Ochrobryum" OR "Ochroma" OR "Ochrosia" OR "Ocimum" OR "Oclemena" OR "Ocotea" OR "Octoblepharum" OR "Odontites" OR "Odontolejeunea" OR "Odontonema" OR "Odontoschisma" OR "Odontoseries" OR "Odontosoria" OR "Odontostomum" OR "Oeceoclades" OR "Oedipodiella" OR "Oedipodium" OR "Oemleria" OR "Oenanthe" OR "Oenothera" OR "Oerstedina" OR "Okenia" OR "Oldenlandia" OR "Oldenlandiopsis" OR "Olea" OR "Oleandra" OR "Olearia" OR "Oleolophozia" OR "Olfersia" OR "Oligomeris" OR "Oligoneuron" OR "Oligotrichum" OR "Olmeca" OR "Olneya" OR "Olsynium" OR "Olyra" OR "Omalotheca" OR "Omphalodes" OR "Oncidium" OR "Oncoba" OR "Oncophorus" OR "Oncosiphon" OR "Ongokea" OR "Onobrychis" OR "Onoclea" OR "Ononis" OR "Onopordum" OR "Onosma" OR "Onosmodium" OR "Oonopsis" OR "Operculina" OR "Ophiochloa" OR "Ophioglossum" OR "Ophiopogon" OR "Ophiuros" OR "Ophrys" OR "Oplismenopsis" OR "Oplismenus" OR "Oplonia" OR "Oplopanax" OR "Opuntia" OR "Orbea" OR "Orbexilum" OR "Orchadocarpa" OR "Orchis" OR "Orcuttia" OR "Oreas" OR "Oreobambos" OR "Oreobolus" OR "Oreocereus" OR "Oreocharis" OR "Oreochrysum" OR "Oreogrammitis" OR "Oreomunnea" OR "Oreonana" OR 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	"Orogenia" OR "Orontium" OR "Orothamnus" OR "Oroya" OR "Ortachne" OR "Ortegocactus" OR "Orthilia" OR "Orthocarpus" OR "Orthocaulis" OR "Orthoclada" OR "Orthodontium" OR "Orthorrhynchium" OR "Orthosia" OR "Orthosiphon" OR "Orthothecium" OR "Orthotrichum" OR "Orychophragmus" OR "Oryctes" OR "Oryza" OR "Oryzopsis" OR "Oscularia" OR "Osmadenia" OR "Osmanthus" OR "Osmorhiza" OR "Osmoxylon" OR "Osmunda" OR "Osmundastrum" OR "Ossaea" OR "Osteomeles" OR "Osteospermum" OR "Ostreobium" OR "Ostrya" OR "Otachyrium" OR "Otatea" OR "Otholobium" OR "Otigoniolejeunea" OR "Otolejeunea" OR "Otoscyphus" OR "Ottelia" OR "Ottochloa" OR "Ottoschulzia" OR "Ouratea" OR "Oxalis" OR "Oxandra" OR "Oxycaryum" OR "Oxydendrum" OR "Oxylobium" OR "Oxymitra" OR "Oxypetalum" OR "Oxypolis" OR "Oxyrhynchus" OR "Oxyria" OR "Oxyrrhynchium" OR "Oxyspora" OR "Oxystegus" OR "Oxystylis" OR "Oxytenanthera" OR "Oxytenia" OR "Oxytheca" OR "Oxytropis" OR "Ozothamnus" OR "Pachira" OR "Pachycereus" OR "Pachyglossa" OR 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bumeliifolia" OR "Peranema" OR "Peraphyllum" OR "Perdusenia" OR "Pereilema" OR "Pereskia" OR "Pereskiopsis" OR "Perezia" OR "Pergularia" OR "Periandra" OR "Pericallis" OR "Pericome" OR "Pericopsis" OR "Perideridia" OR "Perilla" OR "Periploca" OR "Peritoma" OR "Perityle" OR "Perovskia" OR "Perrottetia" OR "Persea" OR "Persicaria" OR "Petalonyx" OR "Petalophyllum" OR "Petasites" OR "Petenaea" OR "Peteria" OR "Petitia" OR "Petiveria" OR "Petradoria" OR "Petrea" OR "Petrocodon" OR "Petrocosmea" OR "Petrophytum" OR "Petrorhagia" OR "Petroselinum" OR "Petunia" OR "Peucedanum" OR "Peucephyllum" OR "Peumus" OR "Peyritschia" OR "Peyssonnelia" OR "Pfaffia" OR "Pfeiffera" OR "Phacelia" OR "Phaeoceros" OR "Phaeolejeunea" OR "Phaeomegaceros" OR "Phaius" OR "Phalacroseris" OR "Phalaenopsis" OR "Phalaris" OR "Phanerophlebia" OR "Phanopyrum" OR "Pharus" OR "Phaseolus" OR "Phaulothamnus" OR "Phedimus" OR "Phegopteris" OR "Pheidonocarpa" OR "Phelipanche" OR "Phellodendron" OR "Phemeranthus" OR "Phenax" OR "Pherotrichis" OR "Phialanthus" OR "Philadelphus" OR "Philenoptera" OR "Philodendron" OR "Philonotis" OR "Philoxerus" OR "Philydrum" OR "Phinaea" OR "Phippsia" OR "Phlebodium" OR "Phlebotaenia" OR "Phleum" OR "Phlojodicarpus" OR "Phlomis" OR "Phlox" OR "Phoebanthus" OR "Phoebe" OR "Phoenicaulis" OR "Phoenix" OR "Pholisma" OR "Pholistoma" OR "Phoradendron" OR "Phormium" OR "Photinia" OR "Phragmites" OR "Phragmonema" OR "Phryma" OR "Phycolepidozia" OR "Phygelius" OR "Phyla canescens" OR "Phyla cuneifolia" OR "Phyla dulcis" OR "Phyla fruticosa" OR "Phyla lanceolata" OR "Phyla nodiflora" OR "Phyla steochadifolia" OR "Phyla X intermedia" OR "Phyllanthopsis" OR "Phyllanthus" OR "Phyllobium" OR "Phylloboea" OR "Phyllocladus" OR "Phyllodoce" OR "Phyllodon" OR "Phyllodrepanium" OR "Phyllogonium" OR "Phyllospadix" OR "Phyllostachys" OR "Phyllostegia" OR "Phyllothallia" OR "Phymaspermum" OR "Phymatoceros" OR "Phymatosorus" OR "Phymosia" OR "Physalis" OR "Physaria" OR "Physcomitrella" OR 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	"Pilularia" OR "Pimelea" OR "Pimenta" OR "Pimpinella" OR "Pinaceae" OR "Pinales" OR "Pinanga" OR "Pinaropappus" OR "Pinckneya" OR "Pinellia" OR "Pinguicula" OR "Pinochia" OR "Pinopsida" OR "Pinus" OR "Pinzona" OR "Piper" OR "Piperaceae" OR "Piptatherum" OR "Piptocarpha" OR "Piptochaetium" OR "Piptocoma" OR "Pipturus" OR "Pireella" OR "Piresia" OR "Piresiella" OR "Piriqueta" OR "Pisanoa" OR "Piscidia" OR "Pisonia" OR "Pistacia" OR "Pistia" OR "Pisum" OR "Pitcairnia" OR "Pithecellobium" OR "Pithecoctenium" OR "Pittosporum" OR "Pityopsis" OR "Pityopus" OR "Pityrogramma" OR "Plagiantha" OR "Plagianthus" OR "Plagiobothrys" OR "Plagiobryoides" OR "Plagiobryum" OR "Plagiochasma" OR "Plagiochila" OR "Plagiochilidium" OR "Plagiochilion" OR "Plagiomnium" OR "Plagiopus" OR "Plagiothecium" OR "Planera" OR "Planodes" OR "Plantae" OR "Plantago" OR "Platanthera" OR "Platanus" OR "Plateilema" OR "Platonia" OR "Platycarya" OR "Platycaulis" OR "Platycerium" OR "Platycladus" OR "Platycodon" OR 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"Poa atropurpurea" OR "Poa autumnalis" OR "Poa ayacuchensis" OR "Poa bajaensis" OR "Poa bergii" OR "Poa bigelovii" OR "Poa bolanderi" OR "Poa bonariensis" OR "Poa boxiana" OR "Poa bradei" OR "Poa brevis" OR "Poa bulbosa" OR "Poa cabreriana" OR "Poa calchaquiensis" OR "Poa candamoana" OR "Poa carazensis" OR "Poa chaixii" OR "Poa chamaeclinos" OR "Poa chambersii" OR "Poa chapmaniana" OR "Poa chirripoensis" OR "Poa compressa" OR "Poa confinis" OR "Poa cucullata" OR "Poa cumingii" OR "Poa curtifolia" OR "Poa cusickii" OR "Poa cuspidata" OR "Poa darwiniana" OR "Poa denticulata" OR "Poa dentigluma" OR "Poa denudata" OR "Poa diaboli" OR "Poa diaphora" OR "Poa dissanthelioides" OR "Poa dolichophylla" OR "Poa douglasii" OR "Poa durifolia" OR "Poa fendleriana" OR "Poa ferreyrae" OR "Poa fibrifera" OR "Poa flabellata" OR "Poa gayana" OR "Poa gilgiana" OR "Poa glaberrima" OR "Poa glauca" OR "Poa grisebachii" OR "Poa gymnantha" OR "Poa hachadoensis" OR "Poa hartzii" OR "Poa hieronymii" OR "Poa holciformis" OR "Poa horridula" OR "Poa howellii" OR "Poa huancavelicae" OR "Poa hubbardiana" OR "Poa huecu" OR "Poa humillima" OR "Poa infirma" OR "Poa interior" OR "Poa iridifolia" OR "Poa keckii" OR "Poa kelloggii" OR "Poa kurtzii" OR "Poa laetevirens" OR "Poa lanigera" OR "Poa lanuginosa" OR "Poa laxa" OR "Poa laxiflora" OR "Poa leibergii" OR "Poa leioclada" OR "Poa lepidula" OR "Poa leptocoma" OR "Poa lettermanii" OR "Poa ligularis" OR "Poa lilloi" OR "Poa macrantha" OR "Poa macrocalyx" OR "Poa mannii" OR "Poa marcida" OR "Poa marshallii" OR "Poa matris-occidentalis" OR "Poa megalantha" OR "Poa mendocina" OR "Poa mucuchachensis" OR "Poa mulalensis" OR "Poa mulleri" OR "Poa myriantha" OR "Poa napensis" OR "Poa nemoralis" OR "Poa nervosa" OR "Poa nubensis" OR "Poa obvallata" OR "Poa occidentalis" OR "Poa orizabensis" OR "Poa orthophylla" OR "Poa oscariana" OR "Poa paludigena" OR "Poa palustris" OR "Poa paposana" OR "Poa paramoensis" OR "Poa parviceps" OR "Poa pauciflora" OR "Poa paucispicula" OR "Poa pearsonii" OR "Poa pedersenii" OR "Poa perligulata" OR "Poa persica" OR "Poa petrosa" OR "Poa pilcomayensis" OR "Poa pilgeri" OR "Poa piperi" OR "Poa planifolia" OR "Poa plicata" OR "Poa porsildii" OR "Poa pratensis" OR "Poa pringlei" OR "Poa pseudoabbreviata" OR "Poa ragonesei" OR "Poa reflexa" OR "Poa reitzii" OR "Poa resinulosa" OR "Poa rhizomata" OR "Poa ruprechtii" OR "Poa saltuensis" OR "Poa sandvicensis" OR "Poa scaberula" OR "Poa scabrivaginata" OR "Poa schizantha" OR "Poa secunda" OR "Poa seleri" OR "Poa sellowii" OR "Poa sharpii" OR "Poa sierrae" OR "Poa siphonoglossa" OR "Poa soderstromii" OR "Poa spiciformis" OR "Poa spicigera" OR "Poa stebbinsii" OR "Poa stenantha" OR "Poa stepparia" OR "Poa strictiramea" OR "Poa stuckertii" OR "Poa sublanata" OR "Poa subspicata" OR "Poa suksdorfii" OR "Poa superata" OR "Poa supina" OR "Poa sylvestris" OR "Poa tacanae" OR "Poa talamancae" OR "Poa tenerrima" OR "Poa tovarii" OR "Poa trachyantha" OR "Poa trachyphylla" OR "Poa tracyi" OR "Poa trivialis" OR "Poa tucumana" OR "Poa umbrosa" OR "Poa unilateralis" OR "Poa unispiculata" OR "Poa uruguayensis" OR "Poa venosa" OR "Poa wheeleri" OR "Poa wolfii" OR "Poa X gaspensis" OR "Poa X limosa" OR "Poa X multnomae" OR "Poa X nematophylla" OR "Poa yaganica" OR "Poaceae" OR "Podagrostis" OR "Podistera" OR "Podocarpus" OR "Podocoma" OR "Podolepis" OR "Podomitrium" OR "Podophorus" OR "Podophyllum" OR "Podostemum" OR "Podranea" OR "Poeltia" OR "Pogogyne" OR "Pogonarthria" OR "Pogonatherum" OR "Pogonatum" OR "Pogonia" OR "Pogostemon" OR "Pohlia" OR "Pohlidium" OR "Poidium" OR

	"Poincianella" OR "Poitea" OR "Polanisia" OR "Polaskia" OR "Polemonium" OR "Polianthes" OR "Poliomintha" OR "Pollichia" OR "Polyalthia" OR "Polyblepharides" OR "Polybotrya" OR "Polycarpaea" OR "Polycarpon" OR "Polycnemum" OR "Polyctenium" OR "Polygala" OR "Polygonatum" OR "Polygonella" OR "Polygonum" OR "Polymnia" OR "Polyphlebium" OR "Polypodiales" OR "Polypodiophyta" OR "Polypodium" OR "Polypogon" OR "Polypremum" OR "Polyscias" OR "Polystachya" OR "Polystemma" OR "Polystichum" OR "Polytaenia" OR "Polytrias" OR "Polytrichastrum" OR "Polytrichum" OR "Pomaria" OR "Poncirus" OR "Pontederia" OR "Ponthieva" OR "Populus" OR "Porana" OR "Poranopsis" OR "Porella" OR "Porophyllum" OR "Porotrichum" OR "Porphyropsis" OR "Porterella" OR "Portulaca" OR "Portulacaria" OR "Posidonia" OR "Posoqueria" OR "Potamogeton" OR "Potamogetonaceae" OR "Potentilla" OR "Poteridium" OR "Pouteria" OR "Pouzolzia" OR "Praecereus" OR "Prasanthus" OR "Prasinocladus" OR "Prehepaticites" OR "Premna" OR "Prenanthella" OR "Prenanthes" OR "Prepusa" OR "Prescottia" OR "Prestoea" OR "Prestonia" OR "Primula" OR "Primulina" OR "Prinsepia" OR "Prionitis" OR "Prionodon" OR "Prionolejeunea" OR "Pristimera" OR "Pritchardia" OR "Priva" OR "Proatriplex" OR "Proboscidea" OR "Prockia" OR "Procris" OR "Proiphys" OR "Prosartes" OR "Proserpinaca" OR "Prosopis" OR "Prosthechea" OR "Protea" OR "Protocephalozia" OR "Protofrullania" OR "Protolophozia" OR "Protosyzygiella" OR "Proustia" OR "Prunella" OR "Prunus" OR "Psacalium" OR "Psathyrostachys" OR "Psathyrotes" OR "Psathyrotopsis" OR "Pseudabutilon" OR "Pseudanamomis" OR "Pseudanomodon" OR "Pseudarthria" OR "Pseudechinolaena" OR "Pseudelephantopus" OR "Pseudephemerum" OR "Pseuderanthemum" OR "Pseudoacanthocereus" OR "Pseudobahia" OR "Pseudobombax" OR "Pseudobraunia" OR "Pseudobryum" OR "Pseudocalliergon" OR "Pseudocampylium" OR "Pseudocephalozia" OR "Pseudocephaloziella" OR "Pseudochirita" OR "Pseudoclappia" OR "Pseudocrossidium" OR "Pseudocryphaea" OR "Pseudocymopterus" OR "Pseudoditrichum" OR "Pseudofumaria" OR "Pseudognaphalium" OR "Pseudogynoxys" OR "Pseudohygrohypnum" OR "Pseudoisotachis" OR "Pseudolarix" OR "Pseudolepicolea" OR "Pseudoleskea" OR "Pseudoleskeella" OR "Pseudolmedia" OR "Pseudolophocolea" OR "Pseudolysimachion" OR "Pseudomarsupidium" OR "Pseudopanax" OR "Pseudopentameris" OR "Pseudophegopteris" OR "Pseudophoenix" OR "Pseudoraphis" OR "Pseudorchis" OR "Pseudorhipsalis" OR "Pseudoroegneria" OR "Pseudorontium" OR "Pseudosasa" OR "Pseudosclerochloa" OR "Pseudoscleropodium" OR "Pseudostellaria" OR "Pseudostereodon" OR "Pseudosymblepharis" OR "Pseudotaxiphyllum" OR "Pseudotaxus" OR "Pseudotrillium" OR "Pseudotritomaria" OR "Pseudotsuga" OR "Pseudulvella" OR "Psidium" OR "Psiguria" OR "Psilactis" OR "Psilocarphus" OR "Psilocaulon" OR "Psilochilus" OR "Psiloclada" OR "Psilopilum" OR "Psilostrophe" OR "Psilotrichum" OR "Psilotum" OR "Psophocarpus" OR "Psoralea" OR "Psoralidium" OR "Psorothamnus" OR "Psychilis" OR "Psychopsis" OR "Psychotria" OR "Psydrax" OR "Ptelea" OR "Pteralyxia" OR "Pteridium" OR "Pteridoblechnum" OR "Pterigynandrum" OR "Pteris" OR "Pterobryon" OR "Pterocactus" OR "Pterocarpus" OR "Pterocarya" OR "Pterocaulon" OR "Pteroglossaspis" OR "Pterogyne" OR "Pterolepis" OR "Pteropsiella" OR "Pterosperma" OR "Pterospora" OR "Pterostegia" OR "Pterostylis" OR "Pterostyrax" OR "Pterygoneurum" OR "Pterygota" OR "Pteryxia" OR "Ptilagrostis" OR "Ptilidium" OR "Ptilimnium" OR "Ptilium" OR "Ptisana" OR "Ptychanthus" OR "Ptychomitrium" OR "Ptychomnion" OR "Ptychosperma" OR "Ptychostomum" OR "Ptychotis" OR "Puccinellia" OR "Pueraria" OR "Pulicaria" OR "Pulmonaria" OR "Pulvigera" OR "Punica" OR "Purshia" OR "Pycnantha" OR "Pycnanthemum" OR "Pycnolejeunea" OR "Pycreus" OR "Pygmaeocereus" OR "Pylaisia" OR "Pylaisiadelpha" OR "Pyracantha" OR "Pyramidula" OR "Pyramimonas" OR "Pyrola" OR "Pyrostegia" OR "Pyrrhobryum" OR "Pyrrhopappus" OR "Pyrrocoma" OR "Pyrrosia" OR "Pyrularia" OR "Pyrus" OR "Pyxidanthera" OR "Quadrella" OR "Quararibea" OR "Quassia" OR "Quercus" OR "Quiabentia" OR "Quillaja" OR "Quincula" OR "Quisqualis" OR "Racomitrium" OR "Racopilum" OR "Raddia" OR "Raddiella" OR "Radiofilum" OR "Radiola" OR "Radula" OR "Radulina" OR "Rafinesquia" OR "Raillardella" OR "Rainiera" OR "Rajania" OR "Ramonda" OR "Ranalisma" OR "Randia" OR "Ranunculus" OR "Raphanus" OR "Raphia" OR "Raphiocarpus" OR "Rapistrum" OR "Ratibida" OR "Rauhocereus" OR "Rauiella" OR "Rauvolfia" OR "Ravenala" OR "Ravenea" OR "Ravenia" OR "Rayjacksonia" OR "Reboulia" OR "Rebouliothallus" OR "Rebutia" OR "Rectolejeunea" OR "Redfieldia" OR "Regmatodon" OR "Regnellidium" OR "Rehia" OR "Reichardia" OR "Reimarochloa" OR "Reinerantha" OR "Reitzia" OR "Relchela" OR "Reldia" OR "Remirea" OR "Remya" OR "Remyella" OR "Renanthera" OR "Renealmia" OR "Renvoizea" OR "Reseda" OR "Resia" OR "Restrepiella" OR "Retama" OR "Reticulobotrys" OR "Reutealis" OR "Reynaudia" OR "Reynosia" OR "Rhabdadenia" OR "Rhabdonia" OR "Rhabdothamnopsis" OR "Rhabdothamnus" OR "Rhabdoweisia" OR "Rhachithecium" OR "Rhagadiolus" OR "Rhamnus" OR "Rhaphidostichum" OR "Rhaphiolepis" OR "Rhapidophyllum" OR "Rhapis" OR "Rhaponticum" OR "Rheochloa" OR "Rheum" OR "Rhexia" OR "Rhexophyllum" OR "Rhinanthus" OR "Rhinotropis" OR "Rhipidocladum" OR "Rhipocephalus" OR "Rhipsalis" OR "Rhizogonium" OR "Rhizomnium" OR

	"Rhizophora" OR "Rhodanthe" OR "Rhodella" OR "Rhodiola" OR "Rhodobryum" OR "Rhodochaete" OR "Rhodochytrium" OR "Rhododendron" OR "Rhododon" OR "Rhodomyrtus" OR "Rhodophyllis" OR "Rhodophysema" OR "Rhodospora" OR "Rhodotypos" OR "Rhoiptelea" OR "Rhombolytrum" OR "Rhoogeton" OR "Rhus" OR "Rhynchoglossum" OR "Rhynchoryza" OR "Rhynchosia" OR "Rhynchosida" OR "Rhynchospora" OR "Rhynchostegium" OR "Rhynchotechum" OR "Rhytachne" OR "Rhytidiadelphus" OR "Rhytidiopsis" OR "Rhytidium" OR "Rhytidophyllum" OR "Ribes" OR "Riccardia" OR "Riccardiopsis" OR "Riccardiothallus" OR "Riccia" OR "Ricciellopsis" OR "Ricciocarpos" OR "Ricciopsis" OR "Richardia" OR "Ricinocarpos" OR "Ricinodendron" OR "Ricinus" OR "Ridleyandra" OR "Riella" OR "Rigiopappus" OR "Rigodium" OR "Riocreuxia" OR "Rivina" OR "Rivulariella" OR "Roaldia" OR "Robinia" OR "Rochefortia" OR "Rodgersia" OR "Roellobryon" OR "Roemeria" OR "Rolandra" OR "Roldana" OR "Romanzoffia" OR "Romneya" OR "Romulea" OR "Rondeletia" OR "Rorippa" OR "Rosa" OR "Rosaceae" OR "Rosenbergiodendron" OR "Roseodendron" OR "Rosmarinus" OR "Rostraria" OR "Rosulabryum" OR "Rotala" OR "Rottboellia" OR "Rourea" OR "Rousselia" OR "Roystonea" OR "Rubia" OR "Rubus" OR "Rudbeckia" OR "Ruellia" OR "Rufodorsia" OR "Rufusia" OR "Rugelia" OR "Ruizanthus" OR "Rumex" OR "Rumohra" OR "Rupertia" OR "Rupichloa" OR "Ruppia" OR "Russelia" OR "Ruta" OR "Rutaceae" OR "Rutenbergia" OR "Rytidosperma" OR "Saba senegalensis" OR "Sabal" OR "Sabatia" OR "Sabicea" OR "Saccharum" OR "Sacciolepis" OR "Saccobasis" OR "Saccogyna" OR "Saccogynidium" OR "Saccoloma" OR "Sachsia" OR "Sacoila" OR "Sadleria" OR "Saelania" OR "Sageretia" OR "Sagina" OR "Sagittaria" OR "Sagraea" OR "Saintpaulia" OR "Sairocarpus" OR "Salacca" OR "Salacia" OR "Salazaria" OR "Salicornia" OR "Salix" OR "Salmea" OR "Salomonia" OR "Salpichlaena" OR "Salpichroa" OR "Salpiglossis" OR "Salsola" OR "Saltugilia" OR "Salvia" OR "Salvinia" OR "Samadera" OR "Samaipaticereus" OR "Samanea" OR "Sambucus" OR "Samolus" OR "Samyda" OR "Sanango" OR "Sanchezia" OR "Sandbergia" OR "Sandeothallus" OR "Sandoricum" OR "Sanguinaria" OR "Sanguisorba" OR "Sanicula" OR "Sanionia" OR "Sansevieria" OR "Santalum" OR "Santolina" OR "Sanvitalia" OR "Sapindus" OR "Sapium" OR "Saponaria" OR "Saracha" OR "Sarcobatus" OR "Sarcocornia" OR "Sarcodes" OR "Sarcopygme" OR "Saritaea" OR "Sarmentypnum" OR "Sarmienta" OR "Sarracenia" OR "Sartwellia" OR "Sasa palmata" OR "Sasa senanensis" OR "Sasa veitchii" OR "Sasaella" OR "Sassafras" OR "Satranala" OR "Satureja" OR "Saugetia" OR "Sauropus" OR "Saururus" OR "Saussurea" OR "Sauteria" OR "Sauvagesia" OR "Savia" OR "Saxegothaea" OR "Saxifraga" OR "Saxifragopsis" OR "Scabiosa" OR "Scabrethia" OR "Scadoxus" OR "Scaevola" OR "Scandix" OR "Scapania" OR "Scaphyglottis" OR "Schaefferia" OR "Schaffnerella" OR "Schedonnardus" OR "Schedonorus" OR "Schefflera" OR "Schenkia" OR "Scheuchzeria" OR "Schiedea" OR "Schiedeella" OR "Schiffneria" OR "Schiffneriolejeunea" OR "Schima" OR "Schinopsis" OR "Schinus" OR "Schinziophyton" OR "Schisandra" OR "Schismus" OR "Schistidium" OR "Schistochila" OR "Schistochilopsis" OR "Schistomitrium" OR "Schistophragma" OR "Schistostega" OR "Schivereckia" OR "Schizachne" OR "Schizachyrium" OR "Schizaea" OR "Schizanthus" OR "Schizoboea" OR "Schizolepidella" OR "Schizolobium" OR "Schizomeris" OR "Schizophragma" OR "Schizophyllopsis" OR "Schizostachyum" OR "Schizymenium" OR "Schkuhria" OR "Schlegelia" OR "Schleichera" OR "Schleinitzia" OR "Schljakovia" OR "Schljakovianthus" OR "Schlotheimia" OR "Schlumbergera" OR "Schoenobryum" OR "Schoenocaulon" OR "Schoenolirion" OR "Schoenoplectus" OR "Schoenus" OR "Schoepfia" OR "Schottera" OR "Schradera" OR "Schultesia" OR "Schusterolejeunea" OR "Schwalbea" OR "Schwetschkeopsis" OR "Sciadophytopsis" OR "Sciaphila" OR "Scilla" OR "Scirpodendron" OR "Scirpoides" OR "Scirpus" OR "Sciuro-hypnum" OR "Scleranthus" OR "Scleria" OR "Sclerocactus" OR "Sclerocarpus" OR "Sclerocarya" OR "Sclerochloa" OR "Sclerolepis" OR "Sclerolinon" OR "Scleropodium" OR "Scleropogon" OR "Scoliopus" OR "Scolochloa" OR "Scolosanthus" OR "Scolymus" OR "Scoparia" OR "Scopelophila" OR "Scopolia" OR "Scopulophila" OR "Scorpidium" OR "Scorpiurus" OR "Scorzonera" OR "Scotinosphaera" OR "Scouleria" OR "Scribneria" OR "Scrophularia" OR "Scutachne" OR "Scutellaria" OR "Scybalium" OR "Scyphiphora" OR "Searsia" OR "Sebastiania" OR "Sebdenia" OR "Secale" OR "Sechium" OR "Securidaca" OR "Securigera" OR "Securinega" OR "Sedella" OR "Sedum" OR "Seemannia" OR "Sehima" OR "Selaginella" OR "Selenia" OR "Selenicereus" OR "Seligeria" OR "Selinum" OR "Sematophyllum" OR "Semecarpus" OR "Semiarundinaria" OR "Sempervivum" OR "Senecio" OR "Senegalia" OR "Senna" OR "Senyumia" OR "Sepikaea" OR "Seppeltia" OR "Sequoia" OR "Sequoiadendron" OR "Serenoa" OR "Serianthes" OR "Sericocarpus" OR "Serissa" OR "Serjania" OR "Serpocaulon" OR "Serratula" OR "Sesamum" OR "Sesbania" OR "Seseli" OR "Sesleria" OR "Sesuvium" OR "Setaria" OR "Setariopsis" OR "Seutera" OR "Severinia" OR "Sewardiella" OR "Seymeria" OR "Shepherdia" OR "Sherardia" OR "Shibataea" OR "Shinnersia" OR "Shinnersoseris" OR "Shirakiopsis" OR "Shorea" OR "Shortia" OR "Shoshonea" OR "Sibara" OR "Sibaropsis" OR "Sibbaldia" OR "Sibbaldiopsis" OR "Sicana" OR "Sicyos" OR "Sicyosperma" OR "Sida"

	OR "Sidalcea" OR "Sidastrum" OR "Sideritis" OR "Sideroxylon" OR "Sidotheca" OR "Sieversia" OR "Sigesbeckia" OR "Silene" OR "Silphium" OR "Silybum" OR "Simarouba" OR "Simmondsia" OR "Simsia" OR "Sinapis" OR "Sinarundinaria" OR "Sinningia" OR "Sinobambusa" OR "Sinolejeunea" OR "Sinosenecio" OR "Siphoneugena" OR "Siphonoglossa" OR "Siphonolejeunea" OR "Sisymbrium" OR "Sisyrinchium" OR "Sium" OR "Sloanea" OR "Smallanthus" OR "Smelowskia" OR "Smilax" OR "Smithiantha" OR "Smithora" OR "Smyrnium" OR "Smythea" OR "Sobralia" OR "Sohnsia" OR "Solandra" OR "Solanum" OR "Soleirolia" OR "Solenophora" OR "Solenostoma" OR "Solidago" OR "Soliva" OR "Solmsiella" OR "Solms-laubachia" OR "Sonchus" OR "Sonneratia" OR "Sophora" OR "Sopubia" OR "Sorapilla" OR "Sorbaria" OR "Sorbus" OR "Sorghastrum" OR "Sorghum" OR "Sotoa" OR "Southbya" OR "Sowerbaea" OR "Sparaxis" OR "Sparganium" OR "Sparganophorus" OR "Spartina" OR "Spartium" OR "Spathiphyllum" OR "Spathodea" OR "Spathoglottis" OR "Spelaeanthus" OR 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"Stegnosperma" OR "Stegonia" OR "Steinchisma" OR "Steirachne" OR "Stelechocarpus" OR "Stelis" OR "Stellaria" OR "Stemodia" OR "Stemonurus" OR "Stenandrium" OR "Stenanthium" OR "Stenaria" OR "Stenocactus" OR "Stenocarpus" OR "Stenocereus" OR "Stenochlaena" OR "Stenogonum" OR "Stenogyne" OR "Stenomesson" OR "Stenorrhynchos" OR "Stenostomum" OR "Stenotaphrum" OR "Stenotus" OR "Stephaniella" OR "Stephaniellidium" OR "Stephanocereus" OR "Stephanomeria" OR "Stephanoptera" OR "Stephostachys" OR "Sterculia" OR "Stereodon" OR "Stereophyllum" OR "Sternbergia" OR "Stetsonia" OR "Stevia" OR "Stewartia" OR "Steyermarkochloa" OR "Sticherus" OR "Stichococcus" OR "Stictocardia" OR "Stictolejeunea" OR "Stigmaphyllon" OR "Stillingia" OR "Stipa" OR "Stipulicida" OR "Stokesia" OR "Stolonivector" OR "Straminergon" OR "Stranvaesia" OR "Stratiotes" OR "Streblotrichum" OR "Streblus" OR "Strelitzia" OR "Streptanthella" OR "Streptanthus" OR "Streptocarpus" OR "Streptochaeta" OR "Streptogyna" OR "Streptopogon" OR "Streptopus" OR "Streptosolen" OR "Streptostachys" OR "Striatothallus" OR "Striga" OR "Strigosella" OR "Strobilanthes" OR "Strombocactus" OR "Strongylodon" OR "Strophanthus" OR "Strophocactus" OR "Strophostyles" OR "Struchium" OR "Strumpfia" OR "Strychnos" OR "Stryphnodendron" OR "Stuckenia" OR "Stutzia" OR "Stylisma" OR "Stylocline" OR "Stylogyne" OR "Stylonema" OR "Stylophorum" OR "Stylosanthes" OR "Stylosphaeridium" OR "Styphelia" OR "Styphnolobium" OR "Styrax" OR "Suaeda" OR "Subularia" OR "Succisa" OR "Succisella" OR "Suckleya" OR "Sucrea" OR "Sudamerlycaste" OR "Suksdorfia" OR "Sullivantia" OR "Sumbaviopsis" OR "Suriana" OR "Swainsona" OR "Swallenia" OR "Swertia" OR "Swietenia" OR "Syagrus" OR "Symbiezidium" OR "Symblepharis" OR "Symphoricarpos" OR "Symphyodon" OR "Symphyogyna" OR "Symphyogynopsis" OR "Symphyotrichum" OR "Symphysia" OR "Symphytum" OR "Symplocarpus" OR "Symplocos" OR "Synandra" OR "Syncarpia" OR "Synedrella" OR "Synedrellopsis" OR "Synelcosciadium" OR "Syngonanthus" OR "Syngonium" OR "Synsepalum" OR "Synthlipsis" OR "Synthyris" OR "Syntrichia" OR "Syntrichopappus" OR "Syringa" OR "Syringodium" OR "Syrrhopodon" OR "Systenotheca" OR "Syzygiella" OR "Syzygium" OR "Tabebuia" OR "Tabernaemontana" OR "Tacca" OR "Tachigali" OR "Tacinga" OR "Taeniatherum" OR "Taenidia" OR "Tagetes" OR "Takakia" OR "Talauma" OR "Talinopsis" OR "Talinum" OR "Taliparititi" OR "Talisia" OR "Tamarindus" OR "Tamarix" OR "Tamaulipa" OR "Tamonea" OR "Tanacetum" OR "Tannodia" OR "Tapiscia" OR "Tara" OR "Taralea" OR "Taraxacum" OR "Taraxia" OR "Tarenaya" OR "Tarenna" OR "Targionia" OR "Tatianyx" OR "Tauschia" OR "Taxilejeunea" OR "Taxiphyllum" OR "Taxithelium" OR "Taxodium" OR "Taxus" OR "Tayloria" OR "Tecoma" OR "Tecomanthe" OR "Tectaria" OR "Tectona" OR "Teesdalia" OR "Telanthophora" OR "Telaranea" OR "Telesonix" OR "Telfairia" OR "Teliostachya" OR "Tellamia" OR "Tellima" OR "Telosma" OR "Temnoma" OR "Tenaxia" OR "Tephrocactus" OR "Tephroseris" OR "Tephrosia" OR "Teramnus" OR "Terminalia" OR "Ternstroemia" OR "Tetracera" OR "Tetrachne" OR "Tetraclea" OR "Tetraclinis" OR "Tetracoccus" OR "Tetracymbaliella" OR "Tetradium" OR "Tetradymia" OR "Tetragastris" OR "Tetragonia" OR "Tetragonotheca" OR "Tetralophozia" OR "Tetramerium" OR "Tetramicra" OR "Tetramolopium" OR "Tetraneuris" OR "Tetrapanax" OR "Tetraphidopsis" OR "Tetraphis" OR "Tetraphyllum" OR

	"Tetraplodon" OR "Tetrapteron" OR "Tetrapterys" OR "Tetraselmis" OR "Tetrastigma" OR "Tetrazygia" OR "Tetrodontium" OR "Teucrium" OR "Thalassia" OR "Thalassodendron" OR "Thalia" OR "Thalictrum" OR "Thallites" OR "Thamniochaete" OR "Thamniopsis" OR "Thamnobryum" OR "Thamnocalamus" OR "Thamnosma" OR "Thaspium" OR "Thaumatococcus" OR "Thelesperma" OR "Thelia" OR "Thelocactus" OR "Thelypodiopsis" OR "Thelypodium" OR "Thelypteris" OR "Themeda" OR "Theobroma" OR "Thermopsis" OR "Therorhodion" OR "Thesium" OR "Thespesia" OR "Thevetia" OR "Thiersianthus" OR "Thinopyrum" OR "Thismia" OR "Thladiantha" OR "Thlaspi" OR "Thouinia" OR "Thrasyopsis" OR "Thrinax" OR "Thuarea" OR "Thuidium" OR "Thuja" OR "Thunbergia" OR "Thurovia" OR "Thymelaea" OR "Thymophylla" OR "Thymus kosteletzkyanus" OR "Thymus praecox" OR "Thymus pulegiodes" OR "Thymus vulgaris" OR "Thyrsanthella" OR "Thyrsopteris" OR "Thysananthus" OR "Thysanocarpus" OR "Thysanolaena" OR "Thysanotus" OR "Tiarella" OR "Tibouchina" OR "Ticanto" OR "Ticodendron" OR "Tidestromia" OR "Tigridia" OR "Tilia" OR "Tilingia" OR "Tillandsia" OR "Timmia" OR "Timmiella" OR "Timonius" OR "Tinantia" OR "Tipuana" OR "Tipularia" OR "Tiquilia" OR "Titanotrichum" OR "Tithonia" OR "Tofieldia" OR "Toiyabea" OR "Tolmiea" OR "Tolpis" OR "Tolumnia" OR "Tomentypnum" OR "Tonella" OR "Tonestus" OR "Toona" OR "Tordylium" OR "Torenia" OR "Torilis" OR "Torralbasia" OR "Torrentaria" OR "Torreya" OR "Torreyochloa" OR "Tortella" OR "Tortilicaulis" OR "Tortula" OR "Touchardia" OR "Tournefortia" OR "Tovarochloa" OR "Townsendia" OR "Toxicodendron" OR "Toxicoscordion" OR "Trabacellula" OR "Trachelospermum" OR "Tracheophyta" OR "Trachycarpus" OR "Trachycystis" OR "Trachyloma" OR "Trachypodopsis" OR "Trachypogon" OR "Trachypus" OR "Trachyspermum" OR "Trachystigma" OR "Trachyxiphium" OR "Tracyina" OR "Tradescantia" OR "Tragia" OR "Tragopogon" OR "Tragus" OR "Transberingia" OR "Trapa" OR "Trautvetteria" OR "Trebouxia" OR "Treculia" OR "Trema" OR "Trematodon" OR "Trematolobelia" OR "Trembleya" OR "Trepocarpus" OR "Treubia" OR "Treubiites" OR "Triadenum" OR "Triadica" OR "Triandrophyllum" OR "Triantha" OR "Trianthema" OR "Tribolium" OR "Tribulus" OR "Tricardia" OR "Trichilia" OR "Trichloris" OR "Trichocentrum" OR "Trichocolea" OR "Trichocoleopsis" OR "Trichocoronis" OR "Trichodon" OR "Trichogloea" OR "Trichogloeopsis" OR "Tricholepidozia" OR "Trichomanes" OR "Trichoneura" OR "Trichophorum" OR "Trichoptilium" OR "Trichosalpinx" OR "Trichosanthes" OR "Trichospermum" OR "Trichostema" OR "Trichostigma" OR "Trichostomum" OR "Trichotemnoma" OR "Tricyrtis" OR "Tridax" OR "Tridens" OR "Trientalis" OR "Trifolium" OR "Triglochin" OR "Trigonella" OR "Trigonostemon" OR "Trigonotis" OR "Trillium" OR "Trilophozia" OR "Trimezia" OR "Triniochloa" OR "Triniteurybia" OR "Triodanis" OR "Triosteum" OR "Triphasia" OR "Triphora" OR "Triphysaria" OR "Tripidium" OR "Triplaris" OR "Triplasis" OR "Tripleurospermum" OR "Triplophyllum" OR "Tripodion" OR "Tripogandra" OR "Tripogon" OR "Tripolium" OR "Tripsacum" OR "Tripterocalyx" OR "Tripterocladium" OR "Triquetrella" OR "Triraphis" OR "Triscenia" OR "Trisepalum" OR "Trisetum" OR "Tristachya" OR "Tristagma" OR "Tristaniopsis" OR "Tristellateia" OR "Tristiropsis" OR "Triteleia" OR "Triteleiopsis" OR "Triticum" OR "Tritomaria" OR "Triumfetta" OR "Trixis" OR "Trochophyllohypnum" OR "Trollius" OR "Tropaeolum" OR "Trophis" OR "Tropidia" OR "Tropidocarpum" OR "Tsuga" OR "Tuberaria" OR "Tuctoria" OR "Tuerckheimia" OR "Tulbaghia" OR "Tulipa" OR "Tulista" OR "Tumamoca" OR "Tunilla" OR "Turbina" OR "Turbinicarpus" OR "Turgenia" OR "Turnera" OR "Turpinia" OR "Turricula" OR "Turritis" OR "Tussilago" OR "Tuyamaella" OR "Tuzibeanthus" OR "Tylophora" OR "Tylopsacas" OR "Tylosema" OR "Tynanthus" OR "Typha" OR "Typhonium" OR "Udotea" OR "Uebelmannia" OR "Ugni" OR "Ulex" OR "Ullucus" OR "Ulmus" OR "Ulota" OR "Ulvaria" OR "Umbellularia" OR "Uncaria" OR "Uncinia" OR "Ungnadia" OR "Uniola" OR "Urena" OR "Urera" OR "Urochloa" OR "Uronema" OR "Uropappus" OR "Urospermum" OR "Urospora" OR "Urtica" OR "Urvillea" OR "Utricularia" OR "Uvularia" OR "Vaccaria" OR "Vaccinium" OR "Vachellia" OR "Vahlodea" OR "Valantia" OR "Valeriana" OR "Valerianella" OR "Valiha" OR "Vallesia" OR "Vallisneria" OR "Vanaea" OR "Vancouveria" OR "Vanda" OR "Vandenboschia" OR "Vandiemenia" OR "Vangueria" OR "Vanhouttea" OR "Vanilla" OR "Vantanea" OR "Varilla" OR "Varronia" OR "Vasconcellea" OR "Vaseyochloa" OR "Vateria" OR "Vatica" OR "Vaupesia" OR "Vauquelinia" OR "Velascoa" OR "Velezia" OR "Venegasia" OR "Venidium" OR "Ventenata" OR "Venturiella" OR "Veratrum" OR "Verbascum" OR "Verbena" OR "Verbesina" OR "Verdoornia" OR "Verdoornianthus" OR "Vernicia" OR "Vernonia" OR "Veronica" OR "Veronicastrum" OR "Verticordia" OR "Vesicarpa" OR "Vesicularia" OR "Vetaforma" OR "Viburnum" OR "Vicia" OR "Victoria amazonica" OR "Victoria cruziana" OR "Vigna" OR "Viguiera" OR "Villadia" OR "Vinca" OR "Vincetoxicum" OR "Viola" OR "Virgilia" OR "Viridivellus" OR "Virola" OR "Viscum" OR "Vismia" OR "Vitalianthus" OR "Vitellaria" OR "Vitex" OR "Vitis" OR "Vittaria" OR "Voanioala" OR "Voitia" OR "Volkameria" OR "Volutaria" OR "Vossia" OR "Voyria" OR "Vriesea" OR "Vulpia" OR "Wachendorfia" OR "Wahlenbergia" OR "Waldsteinia" OR "Wallenia" OR "Waltheria" OR "Walwhalleya" OR "Wardia" OR "Warea" OR "Warnockia" OR "Warnstorfia" OR "Washingtonia" OR

	"Watsonia" OR "Weberbauerocereus" OR "Weberocereus" OR "Websteria" OR "Wedelia" OR "Weeksia" OR "Weigela" OR "Weinmannia" OR "Weissia" OR "Welwitschia" OR "Wentsaiboea" OR "Westringia" OR "Wettsteinia" OR "Whipplea" OR "Whytockia" OR "Wiborgia" OR "Wiesnerella" OR "Wiesneria" OR "Wigandia" OR "Wijkia" OR "Wikstroemia" OR "Wildia" OR "Wilhelmsia" OR "Wilkesia" OR "Willkommia" OR "Wislizenia" OR "Wissadula" OR "Wisteria" OR "Withania" OR "Wittmackanthus" OR "Wolffia" OR "Wolffiella" OR "Wollastonia" OR "Woodsia" OR "Woodwardia" OR "Wullschlaegelia" OR "Wurdemannia" OR "Wyethia" OR "X Achnella" OR "X Aegilotriticum" OR "X Agrohordeum" OR "X Agropogon" OR "X Amelasorbus" OR "X Arctodupontia" OR "X Argyrautia" OR "X Calammophila" OR "X Citroncirus" OR "X Cleistocana" OR "X Cuprocyparis" OR "X Dryostichum" OR "X Duarctopoa" OR "X Dupoa" OR "X Elyhordeum" OR "X Elyleymus" OR "X Espostocactus" OR "X Haagespostoa" OR "X Leydeum" OR "X Lindsaeosoria" OR "X Mahoberberis" OR "X Myrtgerocactus" OR "X Pacherocactus" OR "X Pascoleymus" OR "X Pseudelymus" OR "X Pucciphippsia" OR "X Schedolium" OR "X Sorbaronia" OR "X Stiporyzopsis" OR "X Triticosecale" OR "Xanthisma" OR "Xanthium" OR "Xanthocephalum" OR "Xanthoceras" OR "Xanthorhiza" OR "Xanthosoma" OR "Xenocephalozia" OR "Xenochila" OR "Xenostegia" OR "Xenothallus" OR "Xerochrysum" OR "Xerophyllum" OR "Ximenia" OR "Xiphidium" OR "Xylobium" OR "Xylocarpus" OR "Xylococcus" OR "Xylolejeunea" OR "Xylopia" OR "Xylorhiza" OR "Xylosma" OR "Xylothamia" OR "Xyris" OR "Yabea" OR "Yavia" OR "Yeatesia" OR "Yermo" OR "Youngia" OR "Yucca" OR "Yungasocereus" OR "Zaluzania" OR "Zamia" OR "Zamioculcas" OR "Zannichellia" OR "Zantedeschia" OR "Zantenia" OR "Zanthoxylum" OR "Zapoteca" OR "Zea diploperennis" OR "Zea luxurians" OR "Zea mays" OR "Zea nicaraguensis" OR "Zea perennis" OR "Zehneria" OR "Zelkova" OR "Zelometeorium" OR "Zeltnera" OR "Zenobia" OR "Zephyranthes" OR "Zeugites" OR "Zeuxine" OR "Zexmenia" OR "Zigadenus" OR "Zingiber" OR "Zinnia" OR "Zizania" OR "Zizaniopsis" OR "Zizia" OR "Ziziphus" OR "Zoopsidella" OR "Zoopsis" OR "Zornia" OR "Zostera" OR "Zoysia" OR "Zuloagaea" OR "Zygodon" OR "Zygophlebia" OR "Zygophyllum" OR "Aaron's Beard" OR "Achira" OR "Adderstongue" OR "adzuki" OR "Agarita" OR "agricultural produce" OR "air plant" OR "akar pampan" OR "Alder" OR "Alfalfa" OR "alligator-flag" OR "Alligator-Weed" OR "Almond" OR "aluminium plant" OR "American Bittersweet" OR "American Elder" OR "American Frog's-Bit" OR "Angel's Trumpet" OR "Angiosperm*" OR "Annual Weed*" OR "Aparajita" OR "Apple" OR "Apricot" OR "Aquatic plant*" OR "Arame" OR "Arborvitae" OR "Arrocillo" OR "Arrowgrass" OR "arrowhead" OR "Arrowleaf" OR "Artichoke" OR "Arugula" OR "Ascomycetes" OR "Ash tree" OR "Ashoka" OR "Aspen" OR "Aubergine" OR "Avocado" OR "Azalea" OR "Baangrass" OR "Baby's breath" OR "Babysbreath" OR "Bachelor's-Button" OR "Bagflower" OR "Bagpod" OR "Bahiagrass" OR "Baldcypress" OR "Balsam" OR "Balsampear" OR "balsamroot" OR "Bambara" OR "Bamboo" OR "Banana" OR "bao li" OR "Barbel" OR "barberry" OR "Barilla" OR "bark" OR "Barley" OR "Barnyardgrass" OR "Barrelclover" OR "Basil" OR "Basket-Of-Gold" OR "Basswood" OR "Bayhops" OR "Beachgrass" OR "bean" OR "Beardgrass" OR "Beautyberry" OR "Bedstraw" OR "Beebalm" OR "Beeblossom" OR "beech" OR "Beet" OR "Beggarticks" OR "Beggarweed" OR "Bellflower" OR "Bellvine" OR "Bentgrass" OR "Bergamot" OR "bermudagrass" OR "berries" OR "berry" OR "Berseem" OR "Betony" OR "Bindweed" OR "birch" OR "Birdsfoot" OR "Bird's-foot" OR "Biscuitroot" OR "Bittercress" OR "Bittervine" OR "Bitterweed" OR "Black Cutch" OR "Black Gram" OR "Black gum" OR "Blackberr*" OR "Blackbutt" OR "Black-Eyed pea" OR "Blackeyed susan" OR "Blackgrass" OR "Blackleg" OR "Blackseed" OR "Bladder wrack" OR "Bladderwort" OR "Blanketflower" OR "Bloodwood" OR "Bluebells" OR "blueberr*" OR "bluegrass" OR "Bluestem" OR "Blueweed" OR "Bluewings" OR "Bluntleaf" OR "Boatlily" OR "Bog-Rush" OR "Boneseed" OR "Boobialla" OR "Bouncing-Bet" OR "Boxelder" OR "Boxwood" OR "Bracken" OR "Brackenfern" OR "Bramble" OR "Brambles" OR "Bredinho-De-Linden" OR "Briar" OR "Bridal-Wreaths" OR "Bright-Eyes" OR "Bristlegrass" OR "bristlemallow" OR "Broadleaf" OR "Broccoli" OR "Brome" OR "Bromegrass" OR "Bromeliad" OR "Brookweed" OR "Broomcorn" OR "Broomrape" OR "Broomsedge" OR "Brownseed" OR "Brussels sprout*" OR "Bryophyte" OR "Buck-bean" OR "Buckbrush" OR "Buckthorn" OR "Buckwheat" OR "Buffaloberry" OR "Buffalograss" OR "Buffelgrass" OR "Bugleweed" OR "bugloss" OR "Bugseed" OR "Bullwort" OR "Bulrush" OR "Bunchberry" OR "Bundleflower" OR "Burclover" OR "Burdock" OR "Burgrass" OR "Burnweed" OR "Burreed" OR "Bur-Reed" OR "burrhead" OR "Burrograss" OR "bush" OR "bushes" OR "Bushkiller" OR "Busy Lizzy" OR "Butter print" OR "buttercup" OR "Butterfly bush" OR "Butterfly-Pea" OR "Butterflyweed" OR "Butterweed" OR "Buttonbush" OR "Cabbage" OR "Cacao" OR "cactus" OR "Calla lilly" OR "Calopo" OR "canarygrass" OR "Candyleaf" OR "Capejewels" OR "Capeweed" OR "Caraway" OR "Cardoon" OR "Carnation" OR "carnivorous plant*" OR "Carpetgrass" OR "Carpetweed" OR "Carrot" OR "Cashew" OR "Castorbean" OR "Catchfly" OR "Catchweed" OR "Catjang" OR "Catmint" OR "Catnip" OR "Cattail" OR "Cauliflower" OR "Cayenne" OR "cedar" OR "Celery" OR "Cenizo" OR "Centaury" OR "Chamomile"

	OR "Chard" OR "Charlock" OR "Charophycean" OR "Chastetree" OR "Cheeseweed" OR "Cheesewood" OR "Cherry" OR "Chervil" OR "Chessgrass" OR "Chestnut" OR "Chestnutleaf" OR "chick pea" OR "Chickpea" OR "Chickweed" OR "Chicory" OR "Chinquapin" OR "Chive" OR "Chives" OR "Chocolateweed" OR "Chokeberry" OR "Chokecherry" OR "Christplant" OR "Chrysophyte" OR "Cinnamon" OR "Cinquefoil" OR "Citrange" OR "Citrus fruit" OR "Clementine" OR "Climbingfig" OR "Cloudberry" OR "Clover" OR "Clusterbean" OR "Clustertree" OR "Clustervine" OR "Coccolithid" OR "Coccolithophore" OR "Coccolithophorid" OR "Cocklebur" OR "cockspur" OR "Coconut" OR "Cocoyam" OR "Coco-Yam" OR "Coffeetree" OR "Colewort" OR "Colicwood" OR "Columbine" OR "Comfrey" OR "Conebush" OR "Coneflower" OR "Conifer" OR "Coon-Tail" OR "Copperpod" OR "Coral-pea" OR "Cordgrass" OR "Coriander" OR ("Corn" AND NOT ("corn oil")) OR "Cotton" OR "Cottonwood" OR "Cowitch" OR "Cowlily" OR "Cowparsnip" OR "Cowpea" OR "Cowslip" OR "Coyotethistle" OR "Crabapple" OR "Crabgrass" OR "Cranberr*" OR "Craneflower" OR "crane's-bill" OR "Crapemyrtle" OR "Creosote-Bush" OR "Crepe mrytle" OR "Cress" OR "Crossleaf" OR "Crowberry" OR "Crownbeard" OR "Crowngrass" OR "Crownleaf" OR "Crownvetch" OR "Cucumber" OR "Cudweed" OR "cultivated plant*" OR "Cumin" OR "Cupgrass" OR "curley dock" OR "Curlycup" OR "Currant" OR "Curveseed" OR "Cutgrass" OR "cypress" OR "Cypressvine" OR "Daffodil" OR "Dahoon" OR "daisy" OR "daisybush" OR "Daisy-bush" OR "Dallisgrass" OR "dandelion" OR "dayflower" OR "Deadnettle" OR "deathcamas" OR "Deerberry" OR "Deerbrush" OR "Deertongue" OR "Deervetch" OR "Deflexed" OR "Deodar" OR "Dewflower" OR "Dicot" OR "Dill" OR "Dodder" OR "Dogbane" OR "Dogfennel" OR "Doghobble" OR "Dogstail" OR "Dogstooth" OR "Dog-violet" OR "Dogwood" OR "Douglas-fir" OR "Doveweed" OR "Dropseed" OR "Ducksalad" OR "duckweed" OR "Earlyleaf" OR "edible plant*" OR "Eelgrass" OR "Einkorn" OR "Elderberry" OR "Elecampane" OR "Elm" OR "Eltrot" OR "Emblic" OR "Endive" OR "Esparto" OR "Estafiata" OR "Faba bean" OR "Fanflower" OR "fanwort" OR "Fennel" OR "fenugreek" OR "fern" OR "fescue" OR "Feverfew" OR "Fiddleneck" OR "Fig" OR "Figwort" OR "Fiku" OR "filbert" OR "Fimbry" OR "fingergrass" OR "Fir" OR "Fireplant" OR "Firethorn" OR "Fireweed" OR "Firewood" OR "flatsedge" OR "Flax" OR "flaxlily" OR "fleabane" OR "Flea-Bane" OR "Flixweed" OR "Floating-Heart" OR "flora" OR "flowering plant*" OR "Fountaingrass" OR "Foxglove" OR "Foxtail" OR "fruit*" OR "Furze" OR "Gamagrass" OR "Gambel" OR "Ganhuangcao" OR "Garlic" OR "Gentian" OR "Gherkin" OR "Gillyflower" OR "Ginger" OR "Gingermint" OR "Ginseng" OR "Girasole" OR "Glaucus" OR "Globemallow" OR "Glorybower" OR "goatgrass" OR "Goldenpoppy" OR "Goldenrod" OR "Goldentop" OR "Goldenweed" OR "Goldfields" OR "Goosefoot" OR "Goosegrass" OR "Gourd" OR "Gramalote-Blaco" OR "Granadilla" OR "Granadillo" OR "Grape" OR "Grapefruit" OR "grass" OR "Gray-Box" OR "Greasewood" OR "green plant*" OR "greenbrier" OR "Greenshield" OR "Greenweed" OR "Gromwell" OR "groundcherry" OR "Ground-Cherry" OR "Groundplum" OR "Groundsel" OR "Grumichama" OR "Guava" OR "Guavas" OR "Guayule" OR "Guineagrass" OR "Guiraro" OR "Gumweed" OR "Gympie" OR "Gypsyweed" OR "Hackberry" OR "Hackmatack" OR "Hairgrass" OR "Halophilic Plant*" OR "Halophyte*" OR "Halophytic Plant*" OR "Hamsal" OR "Haptophyte" OR "Harebell" OR "Hare's-ear-mustard" OR "Hawksbeard" OR "Hawthorn" OR "Hawthorne" OR "Hawthorns" OR "Hazel" OR "Hedge-mustard" OR "Hedgenettle" OR "Hedgeparsley" OR "Heliotrope" OR "Hellebore" OR "Hellroot" OR "Hemlock" OR "Hemp" OR "Hempnettle" OR "Hempweed" OR "Henbane" OR "Henbit" OR "Hickory" OR "Highbush" OR "Hijiki" OR "Holly" OR "Hollyfern" OR "Hollyhock" OR "Honeydew" OR "Honeysuckle" OR "Honeyvine" OR "Hophornbeam" OR "Hornbeam" OR "Hornwort" OR "Horsebrush" OR "Horsebush" OR "Horsegram" OR "Horsenettle" OR "Horse-nettle" OR "Horseradish" OR "Horsetail" OR "Horseweed" OR "Huckleberry" OR "hyacinth" OR "Hyphomycete" OR "hyssop" OR "Inberry" OR "Inchplant" OR "Indiangrass" OR "Indianwheat" OR "Inkberry" OR "insectivorous plant*" OR "Invasive Weed*" OR "Ipecacuanha" OR "ironweed" OR "Ironwort" OR "Ivy" OR "Jackfruit" OR "jasmine" OR "jessamine" OR "Jewelweed" OR "Jicama" OR "Jimmyweed" OR "Jimsonweed" OR "Joepyeweed" OR "Jointvetch" OR "Jojoba" OR "Jujube" OR "Jumpseed" OR "Junegrass" OR "Junglerice" OR "juniper" OR "Jute" OR "Kadzu" OR "Kale" OR "Kantsakantsa" OR "Karum-Tree" OR "Kelp" OR "Kidneyvetch" OR "Kikuyu" OR "kiwi" OR "Kiwifruit" OR "Kleingrass" OR "Knapweed" OR "Knotgrass" OR "Knotweed" OR "Kudsu" OR "Kudzu" OR "Kumquat" OR "ladyfern" OR "Lagoonweed" OR "Lancepod" OR "Larch" OR "Larkspur" OR "laurel" OR "Laurisiagrass" OR "Laurustinus" OR "Lavender" OR "Lawngrass" OR "Leadplant" OR "Leadtree" OR "leaf" OR "leafy plant*" OR "Leatherleaf" OR "leaves" OR "Lebbek" OR "Leechee" OR "Leek" OR "legume" OR "lemon" OR "Lemongrass" OR "Lenspod" OR "Lenten-rose" OR "Lentil" OR "Leporinum" OR "Lettuce" OR "Lichen" OR "Lilac" OR "lilies" OR "Lillies" OR "Lilly" OR "lily" OR "Lilyturf" OR "Lima bean" OR "lime" OR "Lingonberry" OR "Lingzhi" OR "Lipsticktree" OR "Liverseed" OR "Liverwort" OR "Loblolly" OR "Locoweed" OR "Longan" OR "Loostrife" OR "Loquat" OR "Lotebush" OR "Lousewort" OR "Lovage" OR "Lovegrass" OR "Lupine" OR "Macrophyte" OR

	"Madeiravine" OR "Madrone" OR "Madwort" OR "Mahwa" OR "Maidencane" OR "Mallee" OR "Mallow" OR "Mandarin Orange" OR "Mangabeira" OR "Mango" OR "mangrove" OR "Mannagrass" OR "Manzanita" OR "Maple" OR "Marigold" OR "Marijuana" OR "Marine velvet" OR "Marjoram" OR "Marlberry" OR "Marshcress" OR "Marshlocks" OR "Marshmallow" OR "marshweed" OR "Marshwort" OR "Matgrass" OR "Matroot" OR "Mayflower" OR "Maypop" OR "Mayweed" OR "Meadow" OR "Meadow-Rue" OR "Meadowsweet" OR "Medicinal Plant*" OR "Melon" OR "Mildew" OR "milfoil" OR "Milkthistle" OR "milkvetch" OR "Milk-Vetch" OR "Milkweed" OR "Millet" OR "mimosa tree" OR "Mint" OR "Moleplant" OR "Moneywort" OR "Monkeyflower" OR "Montbretia" OR "Morningglory" OR "Morning-Glory" OR "Mosquitofern" OR "Mossrose" OR "Motherwort" OR "Mountain-Ash" OR "Mudar" OR "Mud-Plantain" OR "Muhly" OR "Mulberry" OR "Mullein" OR "Mung bean" OR "Mungbean" OR "Muscadine" OR "Mustard" OR "Myrtle" OR "Navua" OR "Nectarine" OR "Needlegrass" OR "Needleleaf" OR "Neem" OR "Nephthytis" OR "Neptune's necklace" OR "Nettle" OR "Nettleleaf" OR "Netvein" OR "Nightshade" OR "Ninebark" OR "Nipplewort" OR "Nippon" OR "Nodeweed" OR "Noxious Weed*" OR "Nutrush" OR "Nutsedge" OR "Nymph" OR "Oat*" OR "Okra" OR "Oleander" OR "Oleanderleaf" OR "Olive" OR "Oneflower" OR "onion" OR "Onionweed" OR "Orach" OR "Orchardgrass" OR "orchid" OR "oregano" OR "Orpine" OR "Owl-clover" OR "Oxtongue" OR "Paeony" OR "Pak-Choi" OR "Palmetto" OR "Panicgrass" OR "pansy" OR "Papaya" OR "Parakeetflower" OR "Parasitic Weed*" OR "parsley" OR "Parsnip" OR "passionflower" OR "pea" OR "Peach" OR ("Peanut" AND NOT ("peanut oil")) OR "Pear" OR "Pearlwort" OR "Peatree" OR "Peavine" OR "Pecan" OR "Pennycress" OR "pennywort" OR "Peony" OR "pepper" OR "Peppergrass" OR "Peppermint" OR "Peppertree" OR "Pepperweed" OR "pepperwort" OR "Perennial Weed*" OR "Periwinkle" OR "Persimmon" OR "Pharmaceutical Plant*" OR "Phureja" OR "Pickerel" OR "Pickerelweed" OR "Pigeonpea" OR "Pigweed" OR "Pillwort" OR "Pimpernel" OR "Pincushionplant" OR "Pine" OR "Pineapple" OR "Pinkfairies" OR "Pipewort" OR "Pistachio" OR "Pitcherplant" OR "plaintain" OR "plant weed*" OR "Plantain" OR "Plum" OR "Plumegrass" OR "Poinsettia" OR "poison ivy" OR "poison oak" OR "poisonous plant*" OR "poisonpie" OR "Pokeweed" OR "Pomegranate" OR "Pondlily" OR "Pond-Lily" OR "pondweed" OR "poplar" OR "Poppy" OR "potato" OR "Prayerplant" OR "Pricklypear" OR "Pricklypoppy" OR "primrose" OR "Prince's-Plume" OR "Privet" OR "pterophyta" OR "Pumpkin" OR "Purslane" OR "Pussytoes" OR "Pygmyweed" OR "Pyrethrum" OR "Quackgrass" OR "Quillwort" OR "Quinoa" OR "Rabbitbells" OR "Rabbitbrush" OR "Radish" OR "Ragweed" OR "Ragwort" OR "Ramtilla" OR "Rapeseed" OR "Rasna" OR "Raspberr*" OR "Raspwort" OR "Redclaw" OR "redgum" OR "redroot" OR "Redshank" OR "Redstem" OR "Redtop" OR "Redwood" OR "Reed" OR "Reedgrass" OR "Rescuegrass" OR "Rhodesgrass" OR "Rhodora" OR "rhubarb" OR "Ribbonweed" OR "Ribbonwood" OR "rice" OR "Ricegrass" OR "riverhemp" OR "rockcress" OR "Rockpurslane" OR "Roseapple" OR "Rosebay" OR "Rosemallow" OR "rosemary" OR "Rosewood" OR "rubberplant" OR "rubbervine" OR "Rye" OR "Ryegrass" OR "Sabaigrass" OR "Safflower" OR "Saffron" OR "Sagebrush" OR "Sagebush" OR "Sagewort" OR "Sago" OR "Sainfoin" OR "Salal" OR "Salmonberry" OR "Salsify" OR "Saltbush" OR "Saltcedar" OR "Saltgrass" OR "samphire" OR "Sandbur" OR "Sandcherry" OR "Sandmat" OR "Sandspurry" OR "Sandwort" OR "Sapodilla" OR "Sarsaparilla" OR "Savin" OR "Sawgrass" OR "Saw-Grass" OR "Saxifrage" OR "Scorpion-weed" OR "Scouringrush" OR "Scurfpea" OR "Seablite" OR "seagrass" OR "Sealavender" OR "Seaweed" OR "Sedge" OR "Serradella" OR "Serviceberry" OR "Sesame" OR "Shattercane" OR "Sheepburr" OR "Shellflower" OR "Sheoak" OR "Shrub" OR "Shyleaf" OR "Sicklekeel" OR "Sicklepod" OR "Signalgrass" OR "Silkleaf" OR "Silkybent" OR "Silvergrass" OR "Silverweed" OR "Skeletonweed" OR "Skullcap" OR "Sleepy-Daisy" OR "Sloughgrass" OR "Smartweed" OR "Snakegourd" OR "Snakeroot" OR "Snakeweed" OR "Snapdragon" OR "sneezeweed" OR "Snoutbean" OR "Snowberry" OR "Snowbush" OR "Snowflower" OR "Soapwort" OR "Softstem" OR "Sorrel" OR "Sourgrass" OR "Sourwood" OR "soy bean" OR "soybean" OR "Sparkleberry" OR "Speargrass" OR "Spear-grass" OR "Spearmint" OR "Spearwood" OR "Speedwell" OR "Spiderflower" OR "Spiderwort" OR "Spikegrass" OR "Spikerush" OR "Spikesedge" OR "spinach" OR "Spindle-Tree" OR "Spirea" OR "Spleenwort" OR "Spongeplant" OR "Sprangletop" OR "Springtape" OR "Spruce" OR "Spurge" OR "Spurrey" OR "Spurweed" OR "Squash" OR "Squashberry" OR "Squill" OR "St. Johnswort" OR "Staggerbush" OR "Starbur" OR "Starflower" OR "Starfruit" OR "Starlily" OR "starwort" OR "Stiltgrass" OR "Stinkingtoe" OR "Stockbean" OR "Stonecrop" OR "Stonewart" OR "Stonewort" OR "Strawberr*" OR "strawflower" OR "Sudangrass" OR "Sugarcane" OR "Sumac" OR "Sumpweed" OR "Sundew" OR "Sunflower" OR "Swainsonpea" OR "Swampweed" OR "Sweetbay" OR "Sweetclover" OR "Sweet-Clover" OR "Sweetflag" OR "Sweetgum" OR "Sweet-Pea" OR "Sweetwilliam" OR "Sweet-William" OR "Swinecress" OR "Switchgrass" OR "Swordfern" OR "Swordplant" OR "Sycamore" OR "Talquezal" OR "tamarind" OR "Tangleweed" OR "Tansy" OR "Tansymustard" OR "Tantan" OR "Tapegrass" OR "Tapioca" OR "Tarbush" OR "Tartary" OR "Tarweed" OR "Tasselfern" OR

	"Tasselflower" OR "teak" OR "Teasel" OR "Teatree" OR "Teosinte" OR "Tesajo" OR "Thimbleweed" OR "thistle" OR "Thornapple" OR "Thoroughwort" OR "threeawn" OR "Thyme" OR "Tickseed" OR "Ticktrefoil" OR "Tick-trefoil" OR "Tidalmarsh" OR "Tiger lily" OR "tiger's claw" OR "toadflax" OR "tobacco" OR "Tomato" OR "Tonguefern" OR "Toothcup" OR "Toria" OR "Touchmenot" OR "Touch-Me-Not" OR "Towelgourd" OR "toxic plant*" OR "Trefoil" OR "Trumpet-Creeper" OR "Tuberose" OR "Tulip" OR "Tumbo" OR "Tungoil" OR "Tupelo" OR "Turbinella" OR "Turmeric" OR "Turnip" OR "Turtle-Grass" OR "Turtleweed" OR "Tussock" OR "Tussockgrass" OR "Tussock-Grass" OR "Tussock-Sedge" OR "Tutsan" OR "Twinflower" OR "Umbrella-Tree" OR "Valerian" OR ("vegetable*" AND NOT ("vegetable oil*")) OR "Velvetgrass" OR "Velvetleaf" OR "Venus fly trap" OR "Vernal" OR "vervain" OR "Vetch" OR "Vetivergrass" OR "Vilevine" OR "Vine" OR "Wallaby-Grass" OR "Wallflower" OR "Walnut" OR "Waterchestnut" OR "Waterclover" OR "Watercress" OR "Waterfern" OR "Waterhemp" OR "Water-Hyacinth" OR "Waterlilly" OR "Waterlily" OR "watermarigold" OR "watermeal" OR "Water-Meal" OR "Watermelon" OR "Watermilfoil" OR "Water-Milfoil" OR "Waternymph" OR "Waterparsnip" OR "Waterprimrose" OR "Water-Primrose" OR "Waterweed" OR "Wattle" OR "Waxgourd" OR "Wax-Plant" OR "Waxweed" OR "Wheat" OR "Wheatgrass" OR "Whetzel" OR "Whitebeam" OR "Whitebrush" OR "Whitebuttons" OR "Whitetop" OR "Whiteweed" OR "Whortleberry" OR "Widgeon-Grass" OR "Widow's-Thrill" OR "Wildrice" OR "wildrye" OR "Willow" OR "Willowherb" OR "Wintercress" OR "Wintergrass" OR "Witchweed" OR "Withe-rod" OR "wolfberry" OR "Woodfern" OR "Woodoats" OR "Woodrose" OR "Woodrush" OR "Woodsorrel" OR "Woolgrass" OR "Wormwood" OR "Wrack" OR "Yam" OR "Yampah" OR "Yankeeweed" OR "Yarrow" OR "Yellowcress" OR "Yellowflower" OR "Yellow-Rattle" OR "Yew")
Epidemiologic Quantitative Analysis	tiab:(("human health" OR "dose response" OR "human studies" OR "human study" OR "human data" OR "human development" OR ("human" AND ("person" OR "people" OR "pediatric*" OR "paediatric*" OR "baby" OR "babies" OR "toddler*" OR "child*" OR "youngster*" OR "teen" OR "teens" OR "teenager*" OR (("in utero" OR "prenat*" OR "perinat*" OR "neonat*" OR "postnat*") AND NOT ("mice" OR "mouse" OR "rat" OR "rats")) OR "preschool*" OR "pre-school*" OR "kindergarten*" OR "schoolchild*" OR "student*" OR "elder*" OR "senior citizen*" OR "seniors" OR "retiree*" OR "septuagenarian*" OR "octagenarian*" OR "sexagenarian*" OR "nonagenarian*" OR "centenarian*" OR "father*" OR "mother*" OR "sibling*" OR "brother*" OR "sister*" OR "twin" OR "twins" OR "grandparent*" OR "grandfather*" OR "grandmother*" OR "grandchild*" OR "granddaughter*" OR "grandson*" OR "caregiver*" OR "care giver*" OR "men" OR "women" OR "man" OR "boy" OR "boys" OR "boyhood" OR "woman" OR "girl" OR "girls" OR "girlhood" OR "population groups" OR "vulnerable populations" OR "african american*" OR "asian american*" OR "hispanic*" OR "latina*" OR "latino*" OR "mexican american*" OR "underserved" OR "disadvantaged" OR "epidemiologic studies" OR "double-blind method" OR "single-blind method" OR "epidemiology" OR "case control*" OR "case-control*" OR "cohort" OR "cross sectional" OR "cross-sectional" OR "follow-up study" OR "longitudinal study" OR "prospective study" OR "retrospective study" OR "case reports" OR "clinical trial" OR "observational study" OR "randomized control trial" OR "twin study" OR "clinical trial*" OR "randomized control trial*" OR "research subjects" OR "human experimentation" OR "Patient Participation" OR "human subject*" OR "research subject*" OR "patient*" OR "inpatient*" OR "outpatient*" OR "participant*" OR "volunteer*" OR "occupational groups" OR "professional" OR "staff" OR "technician*" OR "worker*" OR "educator*" OR "instructor*" OR "teacher*" OR "clinician*" OR "doctor*" OR "physician*" OR "pharmacist*" OR "nurs*" OR "residents" OR "veterinarian*" OR "human experimentation"))) AND ("meta-analysis" OR "Systematic review" OR "prevalence ratio*" OR "hazard ratio*" OR "odds ratio*" OR "risk ratio*" OR "relative risk*" OR "covariate*" OR "adjust*" OR "control* for" OR "associat*" OR "confound*" OR "CI" OR "confidence interval*" OR "credible interval" OR "regression*" OR "explanatory variable*" OR "dose-response" OR "nonsignificant" OR "RR" OR "RRs" OR "SMR" OR "SMRs" OR "rate ratio*" OR "significan*" OR tiab_punct:"P <" OR tiab_punct:"p <" OR tiab_punct:"P <=" OR tiab_punct:"p <=" OR tiab_punct:"P >*" OR tiab_punct:"p >*" OR tiab_punct:"p=*" OR tiab_punct:"P =" OR tiab_punct:"p =" OR tiab_punct:"p>*" OR tiab_punct:"p<*"))
Total Results for Discipline	85 references