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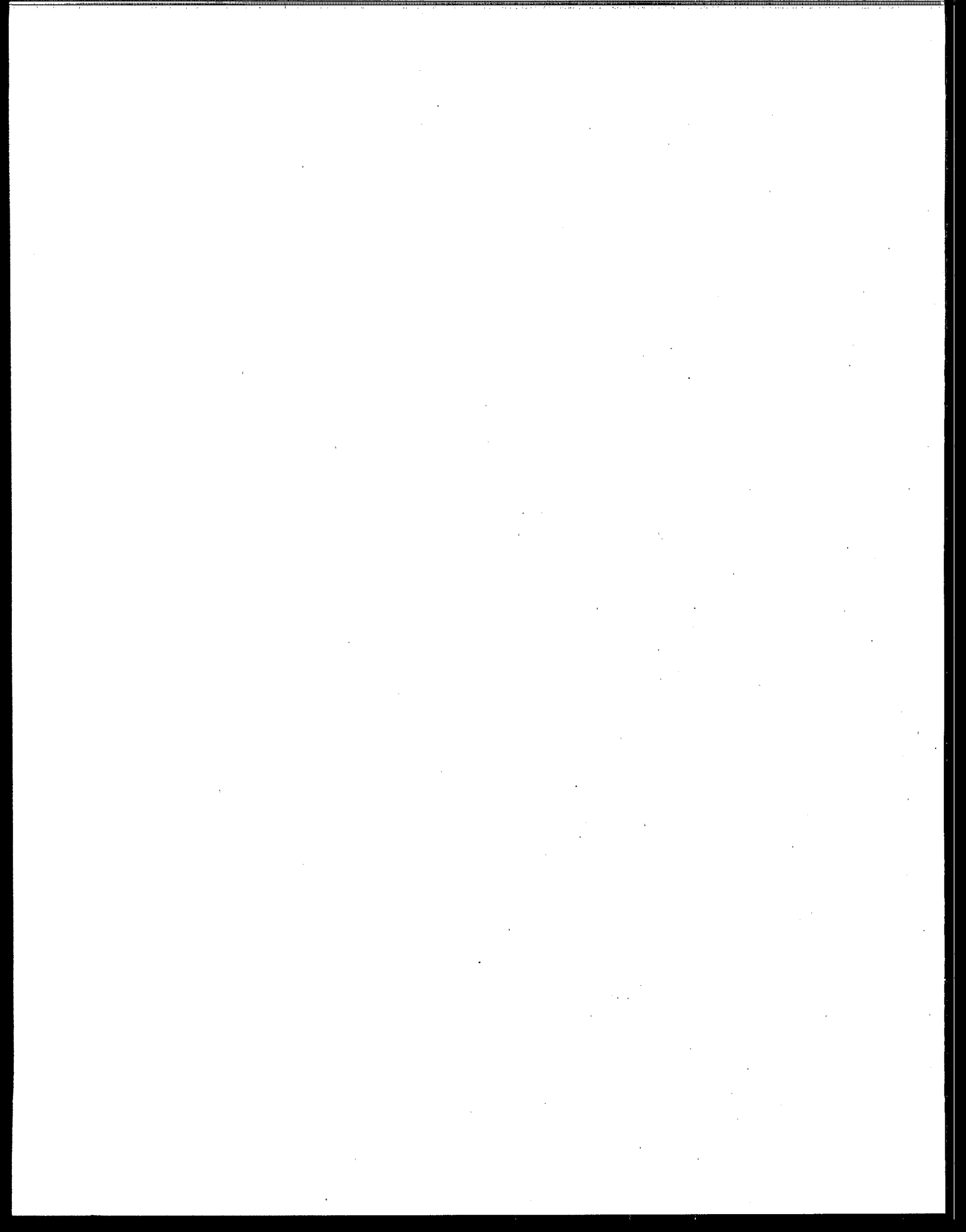
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EPA/620/R-93/013
October 1993

Master Glossary



**Environmental Monitoring and
Assessment Program**



EPA/620/R-93/013
October 1993

Environmental Monitoring and Assessment Program Master Glossary

EMAP Research and Assessment Center
Environmental Monitoring and Assessment Program
Office Of Research And Development
U.S. Environmental Protection Agency
Research Triangle Park, NC 27711



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Abstract

Earlier versions (1990-1992) established two purposes for the Environmental Monitoring and Assessment Program's glossary: it promotes coherent language among the EMAP community and provides access to the program's publications. EMAP personnel have used the original glossary as a guide to keep EMAP terminology consistent in discussions and documents; the users of EMAP's publications have consulted it to derive deeper understanding of particular concepts or processes. This version--now called the *Master Glossary*--also supports access to EMAP documents by supplying authors and seekers of information with words that can be used to search electronic information databases and find which EMAP documents are available and where they are kept.

The original authors and editors of the glossary foresaw that EMAP terminology would evolve as the program continued to develop. As in earlier versions, the audiences--the users of EMAP's documents--always are considered when writers prepare communications and strive for language as uncomplicated and jargon-free as possible.

This *Master Glossary* clarifies terms that describe EMAP's conceptual framework, research, and field work. Undoubtedly, the users of EMAP's documents recognize that a glossary cannot stand alone as well as convey a complete understanding of EMAP's philosophy and the approaches that guide its strategies for ecological monitoring or assessment. The *Master Glossary* aims to assist readers as they investigate other EMAP products and seek EMAP information. It provides a concordance (Appendix A) that can be used by authors to construct an index to another EMAP document; it also lists selected Library of Congress Subject Headings (Appendix B) to assist authors in choosing descriptive key words. Finally, EMAP's *Master Glossary* contains terms from the *Framework for Ecological Risk Assessment* (Risk Assessment Forum) and the entire *Glossary of Quality Assurance Terms* (Appendix C) used by the Quality Assurance Management Staff (QAMS) within the Office of Modeling, Monitoring Systems and Quality Assurance of EPA's Office of Research and Development.

Key words:

Environmental Monitoring and Assessment Program--handbooks, manuals, etc.;
communication of technical information, USEPA-EMAP

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Acknowledgements

This *Master Glossary* began when Penelope Kellar (Kilkelly Environmental Associates) brought together a variety of glossaries developed independently for several EMAP documents, recognizing early the importance of EMAP's language. William Baillargeon (ManTech Environmental Technology, Inc.) who assembled and reconciled the initial glossary, has provided continuing and comprehensive advice for its evolution. Several members of EMAP's original Integration and Assessment Team reviewed the first draft and subsequent drafts, providing additional definitions. These individuals included Dan Vallero (EPA-AREAL), D. Eric Hyatt (EPA-AREAL), Dean Carpenter (ManTech Environmental Technology, Inc.), and Mary Fabrizio (ManTech Environmental Technology, Inc.). Jay Messer (EPA-AREAL), Kent Thornton (FTN Associates), and Dick Novitzki (ManTech Environmental Technology, Inc.), commented on the final form of the initial glossary, the first draft. Valuable comments of a later draft were provided by Dick Novitzki, Doug Norton (EPA-EPIC), Walt Heck (USDA-ARS), George Hess (NCSU), and Steve Peck (NCSU). Carolyn Hunsaker (Oak Ridge National Laboratory), Sue Norton (EPA-OHEA), and Don Rodier (EPA-OTS) reconciled EMAP risk assessment terminology with EPA guidance in ecological risk assessment. The original version of the glossary reflected this reconciliation for terms most integral to EMAP; Bill van der Schalie (EPA-ORD) and Jay Garner (EPA-ECAO) reviewed the original.

In March 1993, the glossary came into revision because EMAP managers realized that many words had been added to, refined, or eliminated from EMAP's vocabulary. They also decided it should be entitled *Master Glossary* because it will be used to customize specific glossaries for each EMAP publication. In the revised *Master Glossary*, terms have been reconciled to current usage by means of contributions from EMAP managers, including technical coordinators and technical directors. In addition, terms have been incorporated from EMAP's Integration and Assessment groups for Design and Statistics, Landscape Characterization, Indicator Development, Assessment and Reporting; from the *Glossary of Quality Assurance Terms* (Quality Assurance Management Staff); and from the *Framework for Ecological Risk Assessment* (Risk Assessment Forum).

Notes from contributors now follow definitions to inform readers of changes in usage, synonyms, or preferred terms (See:) and related terms (See related:). Writers of EMAP documents suggested that words appear in **boldface type** to show they are defined elsewhere in the *Master Glossary*; EMAP managers also suggested that acronyms and abbreviations specific to EMAP appear within the *Master Glossary*, and that EMAP use the guides to acronyms and abbreviations already published in EPA's *Terms of Environment* (1992, 1993) and in the *Glossary of Quality Assurance Terms* (QAMS 1993).

New to this 1993 revision is an appendix (B) that lists controlled vocabulary terms from the Library of Congress Subject Headings (LCSH) to supplement terminology as authors select title words and key words. Lynn El-Hoshy, Senior Cataloging Policy Specialist (Catalog Policy and Support Office, Library of Congress) provided information on new subject headings for environmental sciences as well as insight on how EMAP documents might take advantage of LCSH as key words. EMAP authors who use scientific terms or EMAP terms in their titles and abstracts and who use LCSH as key words enable seekers of EMAP information to more easily find it.

The editor thanks those who contributed to this version of the *Master Glossary*: Daniel H. McKenzie and Harold V. Kibby, Acting Deputy Directors of EMAP (ERL-Corvallis); Linda Looney, Management Services Assistant (ERL-Corvallis); John F. Paul, Associate Director of EMAP-Near Coastal; Technical Coordinators Anthony Olsen (Design and Statistics, ERL-Corvallis), Craig Barber (Indicator Development, ERL-Athens), Denise Shaw (Landscape Characterization, EMAP-Center), D. Eric Hyatt (Assessment and Reporting-EMAP Center), and Linda Kirkland (Quality Assurance, HQ); Lee Alter (Assessment and Reporting-EMAP Center), Kent Thornton (FTN Associates, Little Rock, AR); Fred Haeberer (Quality Assurance Management Staff); Jack Gentile (Scientific Coordinator, Risk Assessment Forum, ERL-Narragansett) and the remaining technical directors of EMAP resource groups and technical coordinators of EMAP integration and assessment groups who also reviewed the manuscript.

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Preface

Purpose

Earlier versions (1990-1992) established two purposes for EMAP's *Master Glossary*: it promotes coherent language among the EMAP community and provides access to the program's publications. EMAP personnel have used it to keep EMAP terminology consistent in discussions and documents; the users of EMAP's publications have consulted it to derive a deeper understanding of EMAP's conceptual framework, activities, and processes. Undoubtedly, the users of EMAP's reports recognize that a glossary cannot stand alone and adequately convey a detailed understanding of the program's philosophy and strategies for ecological monitoring or assessment. The glossary aims to assist users as they consult other EMAP products.

When EMAP's authors prepare communications, it is important for them to consider audiences--the various users of EMAP's information--and strive for language as simple and jargon-free as possible. As the first contributors to the glossary foresaw, EMAP terminology continues to evolve as the program develops.

Assumptions and Usage

Each contributor and editor has maintained one principal assumption in developing the glossary: it must be useful. Together with its concordance (Appendix A), this *Master Glossary* can serve as a reference or as files from which EMAP authors can construct publication-specific glossaries. With this in mind, the content of the EMAP *Master Glossary* has been guided by several criteria:

1. It includes terms broadly applicable and relevant to the program as a whole or terms with EMAP usage that is different or more restricted than common definitions. Terms specific to individual resource or cross-cutting groups have been included only to properly support documentation for those groups.
2. It includes basic scientific terminology like *ecosystem* and *variance* as well as more complex scientific expressions related to EMAP science, such as terminology about design, statistics, and *indicators*.
3. It avoids legitimizing slang terms as official EMAP language. Perhaps the only exception to this criterion is 40-hex, already a firmly ingrained bit of jargon.
4. It avoids, when possible, terms that are concatenations (chains) of other defined words. For example, if both *ecology* and *indicators* are defined, it is unnecessary to define *ecological indicators*. On the other hand, *landscape ecology* has a meaning that is broader than a the sum of its separate terms.
5. It explains or describes terms in EMAP's context by providing connections to other EMAP terms, for example, to synonyms or preferred terms (See:) or to related words (See related:).

For certain expressions in this *Master Glossary*, particularly those relating to *ecological risk assessment*, EPA continues to adjust definitions, with the most recent published in *Terms of Environment* (1992, 1993). The Agency's environmental results agenda has called for coordination and cooperation among the Comparative Risk and Strategic Planning communities, the Risk Assessment Forum, and EMAP. As EPA develops and operates within its ecological risk assessment paradigm, the terminology communicates to decision makers, scientists, and other users the results of actual ecological risk assessments. It is, therefore, especially important that our language agree with other parts of this important initiative. EMAP uses EPA's definitions as first meanings with refinements noted, and EMAP plans to revise quarterly then publish this *Master Glossary* at least annually.

Access

This version of the *Master Glossary* supports access to EMAP's publications by supplying authors and seekers of information with words that can be used to search electronic information databases and find which EMAP documents are available and where they are kept. Terms in environmental science and the many disciplines that constitute it have come under scrutiny as people search for information in complex bibliographic data bases. Appendix B of the *Master Glossary* has been compiled as a selected list of Library of Congress Subject Headings (LCSH). It is intended to help authors choose supplemental descriptions from a controlled, cataloguing vocabulary to use as key words and to supplement the EMAP terms selected for titles and abstracts so that EMAP publications will be easier for users to find.

Also for convenience and access, Appendix C includes the *Glossary of Quality Assurance Terms* of the Quality Assurance Management Staff (QAMS) within the Office of Modeling, Monitoring Systems, and Quality Assurance in EPA's Office of Research and Development.

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Numbers for EMAP publications can be located through the Government Printing Office and NTIS bibliographic databases as well as in the *EPA Publications Bibliography*.

Glossary



abiotic: Nonliving characteristic of the environment; the physical and chemical components that relate to the state of ecological resources. (Term added 1993. See related: **biotic**, **condition indicator**, **indicator**.)

accuracy: The degree to which a calculation, a measurement, or set of measurements agree with a true value or an accepted reference value. "Accuracy includes a combination of random error (**precision**) and systematic error (**bias**) components which are due to sampling and analytical operations; a **data quality indicator**. EPA recommends that this term not be used and that **precision** and **bias** be used to convey the information usually associated with **accuracy** (QAMS 1993, 1)."

acid deposition: "A complex chemical and atmospheric phenomenon that occurs when emissions of sulfur and nitrogen compounds and other substances are transformed by chemical processes in the atmosphere, often far from the original sources, and then deposited on earth in either a wet or dry form. The wet forms, popularly called "acid rain," can fall as rain, snow, or fog. The dry forms are acidic gases or particulates." (EPA 1992, 1)

adaptive sampling strategy: A sampling strategy that allows modification of sampling design and analysis to adapt to changing objectives or to changing circumstances.

agroecosystem: A dynamic association of crops, pastures, livestock, other flora and fauna, atmosphere, soils and water. **Agroecosystems** are contained within larger landscapes that include uncultivated land, drainage networks, rural communities, and wildlife.

Alber's map projection: A standard map projection for representing the conterminous 48 United States. This is a conic equal area projection.

ancillary data: Data collected from studies within EMAP but not used directly in the computation of an indicator. **Ancillary data** can help characterize parameters and assist in the interpretation of data sets; time, stage of tide,

and weather conditions are examples of **ancillary data**. (Term added 1993. See related: **auxiliary data**.)

annual statistical summary: A document that presents a brief and comprehensive report of EMAP data collected on a single EMAP resource for a specific year. **Annual statistical summaries** may include **cumulative frequency distributions**, estimates of the extent of **nominal** or **subnominal** condition, comparisons among regions, or comparisons of data over time.

area frame: A **sampling frame** obtained by dividing a **region** into well-defined, identifiable subregions that in aggregate comprise the total area of the **region** of interest. The subregions are **sampling units** defined on maps or other cartographic materials. (See related: **frame**.)

area sample: The units selected for measurements from an **area frame**.

arid ecosystems: Terrestrial systems characterized by a climate regime where the potential evapotranspiration exceeds precipitation, annual precipitation is not less than 5 cm and not more than 60 cm, and daily and seasonal temperatures range from -40°C to 50°C. The vegetation is dominated by woody perennials, succulents, and drought resistant trees.

assessment: Interpretation and evaluation of EMAP results for the purpose of answering policy-relevant questions about ecological resources, including (1) determination of the fraction of the population that meets a socially defined value and (2) association among indicators of ecological condition and stressors.

assessment endpoint: Formal expressions of the actual environmental value that is to be protected (Suter 1990). Risk Assessment Forum defines this as an "explicit expression of the environmental value that is to be protected (RAF 1992, 37). Operationally in EMAP, an **assessment endpoint** is the range, proportion, or percentage of a resource that is known with statistical confidence to be in a specified condition. (See related: **condition indicator**, **nominal**, and **subnominal**.)

association rule: A rule that unambiguously links a single **resource sampling unit** with a grid point. Several **association rules** have been identified in selecting a **Tier 2 sample** via the EMAP grid.

attribute: Any property, quality, or characteristic of a sampling unit. The indicators and other measures used to characterize a sampling site or resource unit are representations of the attributes of that unit or site. A characteristic of a map feature (point, line, or polygon) described by numbers or text; for example, attributes of a tree, represented by a point might include height and species. (See related: *continuous*.)

augmented sample: A grid-based sample whose size has been increased by using a denser grid.

auxiliary data: Data derived from a source other than EMAP, that is, from an experiment or from another monitoring or sampling program, either Federal or State. The sampling methods and quality assurance protocols of auxiliary data must be evaluated before the data are used. It is always important to establish the **population** represented by auxiliary data. (Preferred term 1993; replaces "non-EMAP data," and "found data," deleted in 1993; see related: *ancillary data*.)

azimuthal map projection: One of a class of map projections formed by projecting coordinates from the Earth's surface directly onto a plane that is either tangent at a point on the surface or that intersects the surface in a circle. When the plane intersects the surface, the projection is said to be the *secant* case.



baseline grid: The fixed position of the EMAP grid as established by the position of the hexagon overlaying the United States. This is distinguished from the sampling grid, which is shifted a random direction and distance from the baseline grid. (See related: *grid*, *40-hex*.)

bias: In a sampling context, the difference between the conceptual weighted average value of an estimator over all possible samples and the true value of the quantity being estimated. An estimator is said to be *unbiased* if that difference is zero. The "systematic or persistent distortion of a measurement process which deprives the result of representativeness (i.e., the expected sample measurement is different than the sample's true value). A data quality indicator" (QAMS 1993, 3).

bioaccumulants: "Substances that increase in concentration in living organisms as they take in contaminated air, water, or food because the substances are very slowly metabolized or excreted" (EPA 1992, 4).

bioassay: A laboratory or field test in which living organisms are used to detect the presence of or test the effect of a particular substance, factor, or condition. Results are compared to a standard preparation or control

to determine the relative strength of the substance, factor, or condition.

biodiversity: The variety and variability among living organisms and the **ecosystems** in which they occur. Biodiversity includes the numbers of different items and their relative frequencies; these items are organized at many levels, ranging from complete ecosystems to the biochemical structures that are the molecular basis of heredity. Thus, **biodiversity** encompasses expressions of the relative abundances of different **ecosystems**, species, and genes (OTA 1987).

biogeographic province: Geographic areas characterized by specific plant formations and associated fauna.

biomarker: Biochemical, physiological, or histological indicators of either exposure to or effects of **xenobiotic** chemicals at the suborganismal or organismal level (Huggett et al. 1992).

biomass: "All of the living material in a given area; often refers to vegetation" (EPA 1992, 4).

biome: "Entire community of living organisms in a single major ecological area" (EPA 1992, 4).

biotic: Of or pertaining to living organisms. (Term added 1993. See related: **indicator**, **condition indicator**, **abiotic**, **stressor indicator**. **Biotic condition indicator** replaces: "response indicator.")



calibration: Statistical transformation of a variable to correct for scale or bias, or otherwise to impose the properties of another variable. Example: let two labs use different protocols of chemical analysis. Designate one protocol as the standard and generate a transformation function to convert the data from the second protocol into representation of the standard. Calibration will be required as a routine statistical procedure in many aspects of EMAP. New protocols will replace old ones. Surrogate attributes will be extensively measured, to be calibrated to represent the target attribute. Use of multiple laboratories invariably involves laboratory bias, which can be reduced by calibration. analytic equipment requires periodic calibration, and the data generated by such a process can also benefit from statistical calibration. Double-sample methods can utilize calibration in many ways to enhance the precision of estimates based on small subsamples.

candidate indicator (Deleted term 1993. See: **indicator development**.)

cdf: Cumulative distribution function. (See: **cumulative distribution**).

change: As used in EMAP, the difference in the distribution of measurements of **condition indicators** between two time periods. (See related: **status, trends**.)

characterization: Determination of the attributes of **resource units, populations, or sampling units**. A prominent use in EMAP is characterization of 40-hexes.

classification: The process of assigning a resource unit to one of a set of classes defined by values of specified attributes. For example, forest sites will be classified into the designated forest types, depending on the species composition of the forest. Systematic arrangement of objects into groups or categories according to established criteria.

Committee to Review EPA's Environmental Monitoring and Assessment Program (See: **National Academy of Sciences**.)

community: "All of the **populations** occupying a given area" (Odum 1959, 6); Odum's definition was adapted by the Risk Assessment Forum to read: "an assemblage of populations of different species within a specified location in space and time" (RAF 1992, 37). "In ecology, a group of interacting populations in time and space. Sometimes, a particular subgrouping may be specified, such as the fish community in a lake or the soil arthropod community in a forest" (EPA 1993, 6).

comparability: "The degree to which different methods, data sets and/or decisions agree or can be represented as similar; a **data quality indicator**" (QAMS 1993, 6).

completeness: "The amount of valid data obtained compared to the planned amount, and [it is] usually expressed as a percentage; a **data quality indicator**" (QAMS 1993, 6).

conceptual model: A "conceptual model describes a series of working hypotheses of how the stressor might affect ecological components. The conceptual model also describes the ecosystem potentially at risk, the relationship between **measurement [endpoints]** and **assessment endpoints**, and exposure scenarios" (RAF 1992, 37).

condition: The distribution of scores describing resource attributes without respect to any societal value or desired use, that is, a state of being. (New term 1993.)

condition indicator: A characteristic of the environment that provides quantitative estimates of the state of ecological **resources** and is conceptually tied to a **value**. (New term 1993; replaces environmental indicator. See related: **indicator, abiotic, biotic, stressor indicator**.)

confidence coefficient: "The probability statement that accompanies a confidence interval and is equal to unity minus the associated type I error rate (false positive rate). A **confidence coefficient** of 0.10 implies that 90% of the intervals resulting from repeated sampling of a population will include the unknown (true) population **parameter**" (QAMS 1993, 6).

confidence interval: An interval defined by two values, called *confidence limits*, calculated from sample data using a procedure which ensures that the unknown true value of the quantity of interest falls between such calculated values in a specified percentage of samples. Commonly, the specified percentage is 95%; the resulting confidence interval is then called a 95% confidence interval. A one-sided confidence interval is defined by a single calculated value called an upper (or lower) confidence limit. "The numerical interval constructed around a point estimate of a population **parameter**, combined with a probability statement (the **confidence coefficient**) linking it to the population's true **parameter** value. If the same confidence interval construction technique and assumptions are used to calculate future intervals, they will include the unknown population **parameter** with the same specified probability" (QAMS 1993, 6). (See related: **confidence coefficient**.)

conformal map projection: One of a class of map projections that preserves angular relationships between the map and the surface of the earth. At any point on the map, measurement of orientation angles is correct. A conformal map projection cannot be equal-area.

conical (or conic) map projection: One of a class of map projections formed by projecting coordinates from the earth's surface onto a cone that either intersects the surface of the earth or is tangent to a circle on the surface. When the cone intersects the sphere, the projection is said to be the *secant* case.

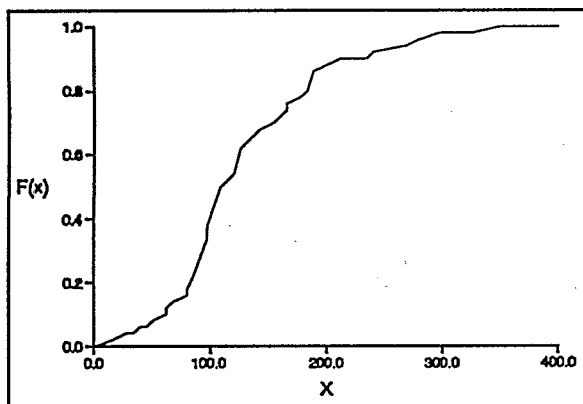
continuous: A characteristic of an **attribute** that is conceptualized as a surface over some region. Examples are certain attributes of a resource, such as chemical **stressor indicators** measured in estuaries.

core indicator (See: **indicator development**.)

cross-cutting group: In EMAP's Integration and Assessment section, one group of scientific and administrative personnel headed by a **technical coordinator (TC)** and charged with addressing specific cross-program, integrative issues in EMAP, such as Landscape Characterization, Design and Statistics, Indicator Development, Information Management, Assessment and Reporting, Logistics, Methods, and Quality Assurance. (See related: **resource group**.)

cumulative distribution: A means of representing the variation of some **attribute** by giving running totals of the **resource** with **attribute** values less than or equal to a

specified series of values. For example, a *cumulative areal distribution* of lakes would give, for any value α of area, the total area covered by lakes with individual area less than or equal to α . A *cumulative frequency distribution* for lake area would give the total number of lakes with area less than or equal to α . The *cumulative distribution function (cdf)* of some specified attribute of a population is the function $F(x)$ that gives the proportion of the population with value of the attribute less than or equal to x , for any choice of x . For example, if the attribute was lake area in hectares, $F(\alpha)$ would give the proportion of lakes with area less than or equal to α ha. (In some cases, the word "cumulative" may be omitted in discussions of the *cdf*, and the *cdf* is called the *distribution function*.)



Cumulative distribution function

cylindrical (or cylindric) map projection: One of a class of map projections formed by projecting coordinates from the earth's surface onto a cylinder that either intersects the surface in two small circles or is tangent to a great circle on the surface. When the cylinder intersects the surface, the projection is said to be the *secant* case.



data quality: "The totality of features and characteristics of data that bears on their ability to satisfy a given purpose; the sum of the degrees of excellence for factors related to data" (QAMS 1993, 7).

data quality indicators: "Quantitative statistics and qualitative descriptors that are used to interpret the degree of acceptability or utility of data to the user. The principal data quality indicators are bias, precision, accuracy, comparability, completeness, and representativeness" (QAMS 1993, 7).

data quality objective (DQO): "Quantitative and qualitative statements of the overall level of uncertainty that a decision-maker is willing to accept in results or

decisions derived from environmental data. DQOs provide the statistical framework for planning and managing environmental data operations consistent with the data user's needs" (QAMS 1993, 8). A **data quality objective** may include goals for accuracy, precision, and limits of detection. It may also include goals for completeness, comparability, and representativeness. **Data quality objectives** are established before sampling is begun and may influence the level of effort required to select a sample.

deconvolution: The process of removing the influence of extraneous variation from an apparent **cumulative distribution**. Extraneous variation--such as random errors in measurement--has the effect of inflating observed variation relative to true **population** variation. The **cumulative distribution** that will be estimated when extraneous variation is present is the convolution of the **population distribution** (which is the **cumulative distribution** of interest) and the distribution of the extraneous variable. The convolution **cumulative distribution** will be flatter (have longer tails) than the **population cumulative distribution**.

demonstration field program: A collection of demonstration research projects to provide preliminary estimates of resource condition for one or more indicators applied to one or more resource classes over a standard Federal region. A **demonstration field program** is likely to include a group of pilot research projects to increase the cost-effectiveness of the program. The **demonstration field program** does not have a data quality objective, but the individual pilot and demonstration research projects do have DQOs. (New term 1993. See related: **demonstration project**, **implementation field program**, **pilot field program**, **pilot project**.)

demonstration project: A field research project designed to provide preliminary estimates of a **resource condition** for a single indicator over a standard Federal region for one or more resource classes. Separate **demonstration projects** are defined for each indicator of condition; in a **demonstration project**, quality data objectives are stated for preliminary statistical estimates. (See related: **demonstration field program**, **implementation field program**, **pilot field program**, **pilot project**.)

design-based: Statistical inferences using methodology based on the sampling design. Such inferences derive their properties from the design protocols.

design-unbiased: Indicates that an estimator is unbiased under the design protocol. This property does not, however, prevent bias from entering estimates from other sources. **Design-unbiased** estimators of variance do not always exist under EMAP designs.

developmental indicator (Deleted term 1993. See: **indicator development**.)

diagnostic indicator (Deleted term 1993. See: **stressor indicator**.)

digital line graph (DLG): Digital data produced by the U.S. Geological Survey. These data include digital information from the USGS map base categories such as transportation, hydrography, contours, and public land survey boundaries.

discrete resource: A resource consisting of a collection of distinct units, such as lakes or stream reaches. Such a resource will be described as a finite population of such units. (See related: **attribute**, **continuous**, **extensive resource**, **resource**.)

distribution function (See: **cumulative distribution**.)

domain: The areal extent of a resource; the region occupied by a resource.

double sample: A sample of a sample. Specifically in EMAP, resource attributes from remote sensing or cartographic materials can be measured on a larger sample than those attributes requiring field measurements. Attributes on the former sample can be used to guide selection of the latter sample.



ecology: "The relationship of living things to one another and their environment, or the study of such relationships" (EPA 1992, 10).

ecological health: A metaphor used to invoke ideas about the integrity, complexity, and autonomy of an ecosystem (Norton 1991). A definition of ecosystem health as an actual entity with specific scale has not been resolved; the terms are useful because they facilitate "a set of rules of thumb, which can be thought of analogically, for analyzing what is going wrong when environing (sic) systems undergo rapid change" (Norton 1991, 116). (See related: **epidemiologic ecology**, **condition**, **nominal**, **subnominal**.)

ecological indicator (Deleted term 1993. See: **condition indicator**.)

Ecological Effects Committee (See: **Science Advisory Board**.)

ecological risk assessment: A process that evaluates the likelihood that adverse ecological effects may occur or are occurring as a result of exposure to one or more stressors (RAF 1992, 37). (See related: **risk assessment**.)

ecoregion: A relatively homogeneous geographic area "perceived by simultaneously analyzing a combination of causal and integrative factors including land surface form, soils, land uses, and potential natural vegetation. (Omernik 1987, 123) **Ecoregions** "was coined by J.M. Crowley (1967) and popularized by R.G. Baily (1976) to define a mapped classification of ecosystem regions of the U.S.. . . Ecoregions are generally considered to be the regions of relative homogeneity in ecological systems or in relationships between organisms and their environments" (123).

ecosystem: The biotic community and its abiotic environment (Krebs 1978) within a specified location in space and time (added by RAF 1992). "The interacting system of a biological community and its non-living environmental surroundings" (EPA 1992, 10).

ecosystem functions: Energy circuits, food chains, diversity patterns in time and space, nutrient cycles, development and evolution, and control within an ecosystem. (Odum 1971, 8)

ecosystem structure: Pattern of the interrelations of organisms in time and in spatial arrangements. (Odum 1971, 8-9)

ecotone: A habitat created by the juxtaposition of distinctly different habitats; an edge habitat; an ecological zone or boundary where two or more ecosystems meet.

entire: Being whole, not convoluted or divided into distinct spatial parts. In EMAP, this property affects the precision of certain sample statistics. (See related: **fragmented**.)

environment: "The sum of all external conditions affecting the life, development, and survival of an organism" (EPA 1992, 11). (See related: **habitat**.)

environmental assessment: An environmental analysis prepared pursuant to the National Environmental Policy Act to determine whether a Federal action should significantly affect the environment and thus require a more detailed environmental impact statement.

environmental indicator (Deleted term 1993. See: **indicator**.)

environmental value (See: **value**.)

epidemiologic ecology: The study of the effects of human, physical, biological, and chemical stressors on conditions of ecosystems, broadly conceived. This area of ecology uses epidemiological concepts and methods to associate ecological effects or responses with stressors through assessments, long-term monitoring data, and results of research. (Proposed new term 1993. See related: **ecological health**, **condition**, **nominal**, **subnominal**, **stressor**.)

equal-area (equivalent) projection: One of a class of map projections that preserves area relationships between the map and the surface of the Earth. On an equal-area projection, two areas that are equal on the surface of the Earth will also be equal on the map. A projection cannot be both conformal and equal-area.

estuary: "Regions of interaction between rivers and nearshore ocean waters, where tidal action and river flow mix fresh and salt water. Such areas include bays, mouths of rivers, salt marshes, and lagoons. These brackish water ecosystems shelter and feed marine life, birds, and wildlife" (EPA 1992, 11). In EMAP, large estuaries are defined as those estuaries greater than 260 km² in surface area and with aspect ratios (i.e., length/average width) of less than 20. Large tidal rivers are defined as that portion of the river that is tidally influenced (i.e., detectable tide > 2.5 cm), greater than 260 km², and with an aspect ratio of greater than 20. Small estuaries and small tidal rivers are those systems whose surface areas fell between 2.6 km² and 260 km². (See related: wetlands.)

exposure indicator (Deleted term 1993. See: **stressor indicator**.)

extensive resource: A resource covering a large area that is not ecologically integrated and is not a collection of natural units, for example, large marshes or rangelands. Characterization of an extensive resource is scale-dependent.



40-hex: The landscape description hexagon that is established on each of the grid points in the EMAP grid. Actual size of these hexagons is $634.5/16 = 39.7\text{km}^2$.

forest: Land with at least 10% of its surface area stocked by trees of any size or formerly having had such trees as cover and not currently built-up or developed for agricultural use (USDAFS 1989).

found data (Deleted term 1993. See: **auxiliary data**, **judgment sample**.)

fragmented: Being divided or convoluted into distinct parts, rather than entire. In EMAP, the spatial fragmentation of resources and the spatial/temporal fragmentation of resource attributes affect the precision of certain population statistics, so that attention must be given to this state. (See related: **entire**.)

frame: A representation of a population, used to implement a sampling strategy as, for example, (1) a list frame that lists the identifying units in the population--

for instance, a list of all the lakes in the United States between 10 and 2000 ha--or (2) an area frame that consists of explicit descriptions of a partition of the areal extent of an areal universe--like the NASS frame. (See related: **area frame**, **sampling unit**.)

frame, conceptual: An explicit definition of a frame that does not involve a tangible realization.



geographic information system (GIS): A collection of computer hardware, software, and geographic data designed to capture, store, update, manipulate, analyze, and display geographically referenced data.

Great Lakes: In EMAP, the resource that encompasses the five Great Lakes--Superior, Michigan, Huron, Erie, and Ontario, including river mouths up to the maximum extent of lake influence; **wetlands** contiguous to the lakes; and the connecting channels, Lake St. Clair and the upper portion of the St. Lawrence Seaway.

grid: A data structure commonly used to represent map features. A cellular-based data structure composed of cells or pixels arranged in rows and columns (also called a "raster"). (See related: **40-hex**.)

grid enhancement: Increasing the grid density, a method for augmenting the sample. When the sample size is too small, as will occur for rare resources, the grid density may be increased in order to obtain a sample size adequate for population description. **Grid enhancement** is one method of producing an augmented sample.

grid, hierarchical: Having nested levels and structure; the density of the EMAP grid is readily increased or reduced in a regular manner into hierarchical levels of density. Adjacent levels may differ in density by a variety of factors: 3, 4, 7, or many functions of these base factors. The grid of points at one level will be contained in the grid at a higher density.

grid randomization: The process of randomly positioning the grid so that each (discrete) unit of area of fixed size is equally likely to contain a grid point. This process is the basis for the probability sample designation for EMAP monitoring.

grid, triangular (EMAP): A lattice of points in exact equilateral triangular structure on a plane. The EMAP grid points are 27.1 km apart.

H

habitat: "The place where a population (e.g., human, animal, plant, microorganism) lives and its surroundings, both living and non-living" (EPA 1992, 14).

habitat indicator (Deleted term 1992. See: **abiotic condition indicator**.)

heuristic method: In EMAP, a process for exploring and organizing information to conceptually discover and describe or postulate relationships among indicator variables and key processes of an ecosystem or resource. (New term 1993.)

hierarchial geometric decomposition: The mathematical process of breaking down a geometric structure into component parts. In the EMAP grid, the process by which the triangular grid is subdivided into higher density grids is **hierarchial geometric decomposition**. Related notions are enhancement and disaggregation; the opposite notion is composition of components into a larger whole.

hierarchical model: A construct in which component variables and systems of ecological entities are defined to have the smallest unit of spatial and temporal detail in the lowest level; each higher level reflects processes and interactions occurring at ever larger spatial and temporal scales. Behaviors of a particular level in the **hierarchical model** are determined both by constraints imposed by the levels above and filtered or averaged behaviors of components and subsystems of levels below. (New term 1993.)

I

implementation field program: The decision by EMAP to make a long-term commitment to provide scientifically defensible estimates of current status, trends, and changes in condition indicators and association of these indicators with selected stressors. The decision will include consideration of (1) the link between **values** and **indicators** proposed for implementation, (2) the scientific basis for the **indictor**, (3) the scientific validity of the proposed national sampling design, (4) a demonstrated ability to meet the EMAP status and trends program quality objectives, and (5) explicit plans that ensure the implementation can be conducted and produce **annual statistical summaries**. (New term 1993. See related: **demonstration field program**, **demonstration project**, **pilot project**, **pilot field program**.)

inclusion probability: The probability of including a specific sampling unit within a **sample**.

index: Mathematical aggregation of **indicators** or metrics.

index period: The period of the year when measurement of an **indicator** yields meaningful information.

index sample: A standardized **judgment sample** for which explicit rules for generating the index measure are formally prescribed. An **index sample** is appropriate only for ecologically integrated systems. For example, in the National Lake Survey, a lake in the **probability sample** of lakes was field sampled at a prescribed season of the year (**index period**), in a prescribed standardized location in the lake (**index site**), and in a prescribed manner (field protocol). (See related: **judgment sample**, **sample**.)

indicator: In EMAP, characteristics of the environment, both **abiotic** and **biotic**, that can provide quantitative information on ecological **resources**. (Revised definition 1993. Preferred term for environmental indicator, deleted 1993.) "In biology, an organism, species, or **community** whose characteristics show the presence of specific environmental conditions, good or bad" (EPA 1992, 15). (See related: **condition indicator**, **stressor indicator**, **biotic**, **abiotic**.)

indicator development: The process through which an **indicator** is identified, tested, and implemented. A candidate **indicator** is identified and reviewed by peers before it is selected for further evaluation as a research **indicator**. Existing data are analyzed, simulation studies are performed with realistic scenarios, and limited field tests are conducted to evaluate the research **indicator**. In the past, this research **indicator** was called a "probationary core **indicator**" or a "development **indicator**" as it was evaluated in regional **demonstration projects**. An **indicator** is considered a core **indicator** when it is selected for long-term, **ecological monitoring** as a result of its acceptable performance, demonstrated ability to satisfy the **data quality objectives**.

integrated assessment (Deleted term 1993. See: **assessment**.)

integration: The formation, coordination, or blending of units or components into a functioning or unified whole. In EMAP, **integration** refers to a coordinated approach to environmental **monitoring**, research, and **assessment**, both among EMAP **resource groups** and with other environmental **monitoring programs**. Integration in EMAP also refers to the technical processes involved in normalizing and combining data for interpretation and **assessment**.

interpenetrating subsamples: If a sample is partitioned into subsamples, each of which closely reflects the structure of the full design, then the subsamples are said to mutually interpenetrate the **frame**. The EMAP design prescribes 4 interpenetrating grids, each with density one-fourth of the base grid. Together, these four grids constitute the **baseline grid**.

J

judgment sample: A form of non-probability sample in which the sample is chosen according to the judgment of the sampler.

K

kriging: A weighted, moving-average estimation technique based on geostatistics that uses the spatial correlation of point measurements to estimate values at adjacent, unmeasured points (Hunsaker and Carpenter 1990, xxiii).

A sophisticated technique for filling in missing data values, kriging is named after a South African engineer, D.G. Krige, who first developed the method. The kriging routine preserves known data values, estimates missing data values, and also "estimates the variance at every missing data location. . . After kriging, the filled matrix contains the best possible estimate of the missing data values, in the sense that the variance has been minimized" (Fortner 1992; 215, 167-176).

L

lake: In EMAP, a standing body of water greater than 1 hectare (about 2.5 acre) that has at least 1000 m² (about 0.25 acre) of open water and is at least 1 meter (about 3 feet) deep at its deepest point. (See related: **surface waters, wetlands.**)

Lambert's azimuthal map projection: The map projection used for laying out the EMAP grid. This is an equal-area projection.

landscape: The set of traits, patterns, and structure of a specific geographic area, including its biological composition, its physical environment, and its anthropogenic patterns. An area where interacting ecosystems are grouped and repeated in similar form.

landscape characterization: Documentation of the traits and patterns of the essential elements of the landscape, including attributes of the physical environment, biological composition, and anthropogenic patterns. In EMAP, landscape characterization emphasizes the process of describing land use or land cover, but also includes

gathering data on attributes such as elevation, demographics, soils, physiographic regions, and others.

landscape ecology: The study of distribution patterns of communities and ecosystems, the ecological processes that affect those patterns, and changes in pattern and process over time (Forman and Godron 1986). In EMAP, a resource group.

landscape indicator (Deleted term 1993. See: **condition indicator.**)

list frame: (See: **frame.** See related: **area frame.**)

M

management indicator (Deleted term 1993. See: **stressor indicator.**)

map projection: A mathematical formula or algorithm for translating the coordinates of features on the surface of the Earth to a plane for representation on a flat map.

map resolution: The accuracy with which the location and shape of map features are depicted for a given map scale.

map scale: A statement of a measure on the map and the equivalent measure on the earth, often expressed as a representative fraction of distance, such as 1:24,000.

marginal condition: The state that exists when the nominal and subnominal criteria are not contiguous.

measurement: A quantifiable attribute that is tied to an indicator.

measurement endpoint: A measurable ecological characteristic that is related to the valued characteristic chosen as the assessment endpoint (Suter 1990). RAF added to Suter: "Measurement endpoints are often expressed as the statistical or arithmetic summaries of the observations that comprise [sic] the measurement" (RAF 1992, 38).

meridian: One of a group of abstract lines on the surface of the Earth formed by the longitude and latitude coordinate system. Meridians represent lines of equal longitude and thus converge at the poles. All meridians are great circles. (See related: **parallel.**)

meridional zones: Areas on the surface of the earth formed by adjacent meridians.

modeling: "Development of a mathematical or physical representation of a system or theory that accounts for all or some of its known properties. Models are often used to test the effect of changes of components on the overall performance of the system" (EPA 1992, 18).

monitoring: In EMAP, the periodic collection of data that is used to determine the condition of ecological **resources**. "Periodic or continuous surveillance or testing to determine the level of compliance with statutory requirements and/or pollutant levels in various media [air, soil, water] or in humans, plants, and animals" (EPA 1992, 18).

N

National Academy of Sciences (NAS): The National Academy of Sciences/National Research Council (NRC) performs level 2 peer review to determine if EMAP projects have overall scientific merit and integrate both internally and with other government-sponsored monitoring programs. Two commissions of the NRC--the Commission on Geosciences, Environment, and Resources (specifically, its Water Science and Technology Board) and the Commission on Life Sciences--jointly organized the Committee to Review EPA's Environmental Monitoring and Assessment Program in 1991.

This NAS/NRC committee holds about 12 meetings and produces two or three reports every two years; its primary purpose is to consider the scientific and technical aspects of EMAP as designed as well as considering ways to increase EMAP's usefulness in monitoring conditions and trends in six representative types of ecosystems. The Committee also reviews the overall design objectives of the program, the indicator strategies, data collection methods, data analysis interpretation, and communication plans. Preparation for NAS/NRC reviews is coordinated by the Director of OMMSQA, EPA-ORD, who is also responsible for funding. (Term added 1993.)

nominal: Referring to the state of having desirable or acceptable ecological condition. The quantified standard established for a **condition indicator** to represent the desirable or acceptable condition is called a **nominal assessment endpoint**. (See related: **marginal, subnominal, assessment endpoint**.)

NRC (See: National Research Council)

O

off-frame data (See preferred term: **auxiliary data**.)

Office of Modeling, Monitoring Systems, and Quality Assurance (OMMSQA): The office within EPA's Office of Research and Development responsible for EMAP management within the Agency.

on-frame data: Data acquired by a sampling approach that provides a **probability sample**. (See preferred term: **attribute**.)

P

parallel: One of a group of abstract lines on the surface of the earth formed by the latitude and longitude coordinate system: **parallels** represent lines of equal latitude. Only the **parallel** at the equator is a great circle; other **parallels** are small circles. (See related: **meridian**.)

parameter: "Any quantity such as a mean or a standard deviation characterizing a population. Commonly misused for 'variable,' 'characteristic,' or 'property'" (QAMS 1993, 15).

pattern: In EMAP, the location, distribution, and composition of structural **landscape** components within a particular geographic area or in a spatial context.

peer review: In EMAP, **peer review** means written, critical response provided by scientists and other technically qualified participants in the process. EMAP documents are subject to formal peer review procedures at laboratory and program levels. In EMAP, Level 1 **peer reviews** are performed by EPA's Science Advisory Board, level 2 by the NAS National Research Council, level 3 by specialist panel peer reviews, and level 4 by internal EPA respondents. (Added term 1993. See related: **National Academy of Sciences, Science Advisory Board**.)

pilot field program: A collection of **pilot projects** whose objectives are to provide the scientific information required prior to a decision to implement a monitoring design for a resource. Preliminary estimates of resource condition are not planned and will not be made from a **pilot field program**, which does not have a data quality objective; the individual **pilot projects** and **demonstration projects** do have **DQOs**. (New term 1993. See related: **demonstration field program, demonstration project, implementation field program, pilot project**.)

pilot project: A research project that requires field work to meet a stated research project quality objective, and the objective is not to provide preliminary estimates of resource condition. Each research activity on an indicator should be described as an individual pilot project usually during a single index period. Pilot projects are used to evaluate indicators, sampling strategy, methods, and logistics. (See related: **demonstration field program**, **demonstration project**, **implementation field program**, **pilot field program**.)

population: "A group of interbreeding organisms occupying a particular space; the number of humans or other living creatures in a designated area" (EPA 1992, 22 after Odum [1953] 1959, 6). In statistics and sampling design, the total universe addressed in a sampling effort; an assemblage of units of a particular resource, or any subset of extensive resources, about which inferences are desired or made. RAF defines **population** to be "an aggregate of individuals of a species within a specified location in space and time" (RAF 1992, 38).

population estimation: Classic survey estimation of **population parameters**. Such estimates will not reflect spatial configuration except through identification of the **population**, or of **subpopulations**, which may be defined by spatial attributes.

population units: The entities that make up a target **population**. The units can be defined in many ways, depending on the survey objectives and the type of measurement to be made. Typically, definitions of environmental units include (1) an explicit statement of the characteristics each **population unit** must possess in order to be considered a member of the target **population** and a (2) specification of location in space and time.

precision: The degree to which replicate measurements of the same attribute agree or are exact. "The degree to which a set of observations or measurements of the same property, usually obtained under similar conditions, conform to themselves; a **data quality indicator**" (QAMS 1993, 16). (See related: **accuracy**, **bias**.)

probability sample: A sample chosen in such a manner that the probabilities of including the selected units in the sample are known, and all **population units** have a positive probability of selection. This implies that the target **population** is represented by the sample and that the target **population** is explicitly defined.

probationary core indicator (Deleted term 1992. See: **indicator development**.)

projection: A mathematical model that transforms the locations of features on the Earth's surface to locations on a two-dimensional surface. (Term added 1993.)



quality assessment: "The evaluation of environmental data to determine if they meet the quality criteria required for a specific application" (QAMS 1993, 17).

quality assurance (QA): "An integrated system of activities involving planning, **quality control**, **quality assessment**, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence" (QAMS 1993, 7).

In EMAP, **quality assurance** consists of multiple steps taken to ensure that all **data quality objectives** are achieved. (See related: **quality assessment**, **data quality objectives**, **quality control**.)

quality control (QC): "The overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users. The aim is to provide quality that is satisfactory, adequate, dependable, and economical" (QAMS 1993, 17).

In EMAP, **quality control** consists of specific steps taken during the data collection process to ensure that equipment and procedures are operating as intended and that they will allow **data quality objectives** to be achieved. (See related: **data quality objectives**, **quality assessment**, **quality assurance**, **QA/QC**.)

QA/QC: Quality Assurance/Quality Control. "A system of procedures, checks, audits, and corrective actions to ensure that all EPA research design and performance, environmental monitoring and sampling, and other technical and reporting activities are of the highest achievable quality" (EPA 1992, 23).

quantile: The value of an attribute indexing a specified proportion of a **population distribution** or **distribution function**. Quartiles (25th, 50th, and 75th percentiles), the median (50th percentile), and other percentiles are special cases of **quantiles**.



recovery: The partial or full return of a **population** or **community** to a condition that existed before the introduction of the **stressor** (RAF 1992, 38).

randomization: The process of imposing an element of chance on the selection of a sample. **Randomization** is a step in the design protocol and may take many forms; it is the basis for determining the **design-based** properties of the resulting probability sample.

reference condition: The set of attributes of ecological resources that assist in identifying the location of a portion of the resource population along a condition continuum from the worst possible condition to the best possible condition given the prevailing topography, soil, geology, potential vegetation, and general land use of the region. **Reference condition** typically refers to the best resource condition, but it is used more broadly in EMAP. (Term added 1993.)

reference site: One of a population of bench mark or control sampling locations that, taken collectively, represent an ecoregion or other large biogeographic area; the sites, as a whole, represent the best ecological conditions that can be reasonably attained, given the prevailing topography, soil, geology, potential vegetation, and general land use of the region or clearly subnominal condition.

region: Any explicitly defined geographic area. In the EMAP objectives, **region** refers to the ten standard Federal regions (OMB 1974).

relation: The concept of function, correlation, or association between or among attributes, which may be qualitative as well as quantitative.

representativeness: "The degree to which data accurately and precisely represent the frequency distribution of a specific variable in the population; a **data quality indicator**" (QAMS 1993, 20).

research indicator (Deleted term 1993. See: **indicator development**)

research project: A single, focussed activity with a single primary research objective. The project includes the entire research process of initial planning, conduct of research (including field work if necessary), and evaluation (analysis and reporting). A **research project** involving field work may require several years to complete. Many EMAP **research projects** will not require field work: such projects include development of conceptual models for an indicator, development of a proposed national sampling design strategy, analysis of existing data for indicator development, and others.

resource: In EMAP, an ecological entity that is identified as a target of sampling and is a group of general, broad ecosystem types or ecological entities sharing certain basic characteristics. Seven such categories currently are identified within EMAP: estuaries, Great Lakes, inland surface waters, wetlands, forests, arid ecosystems, and agroecosystems. These categories define the organizational structure of **monitoring groups** in EMAP and are the resources addressed by EMAP assessments. A **resource** can be characterized as belonging to one of two types, discrete and extensive, that pose different problems of sampling and representation.

resource assessment (See: **assessment**.)

resource class: A subdivision of a resource; examples include small lakes, oak-hickory forests, emergent estuarine wetlands, field cropland, small estuaries, and sagebrush dominated desert scrub.

resource domain: The areal extent of a resource; the region occupied by a resource.

resource group: In EMAP's Resource Monitoring and Research section, a group of scientific and administrative personnel, headed by a **technical director (TD)**, responsible for research, **monitoring**, and **assessments** for a given EMAP resource. There are seven such groups in EMAP: Estuaries, Great Lakes, Inland Surface Waters, Wetlands, Forests, Arid Ecosystems, and Agroecosystems. Landscape ecology is also considered a **resource group** in EMAP. (See related: **cross-cutting group**.)

resource unit: A unit of a discrete resource. for example, a lake. A **population** of such a resource will be an explicit set of **resource units**.

response indicator (Deleted term 1993. See: **biotic condition indicator**.)

risk: "A measure of the probability that damage to life, health, property, and/or the environment will occur as a result of a given hazard" (EPA 1992, 25). In statistics, "the expected loss due to the use of a given decision procedure" (QAMS 1993, 20).

risk assessment: "Qualitative and quantitative evaluation of the risk posed to human health and/or the environment by the actual or potential presence and/or use of specific pollutants" (EPA 1992, 25).

risk characterization: Determination of the nature of a given risk and quantifying of the potential for adverse change to the environment from that risk. "A phase of ecological risk assessment that integrates the results of the exposure and ecological effects analyses to evaluate the likelihood of adverse ecological effects associated with exposure to a stressor. The ecological significance of the adverse effects is discussed, including consideration of the types and magnitudes of the effects, their spatial and temporal patterns, and the likelihood of recovery" (RAF 1992, 38).

risk communication: "The exchange of information about environmental risks among risk assessors, risk managers, the general public, news media, special interest groups, and others" (EPA 1992, 25).

risk management: "The process of evaluating and selecting alternative regulatory and non-regulatory responses to

risk. The selection process necessarily requires the consideration of scientific, legal, economic, and behavioral factors" (EPA 1992, 25).



sample: A subset of the units from a **frame**. A sample may also be a subset of **resource units** from a **population** or a set of **sampling units**. (See related: **judgment sample**, **probability sample**.)

sampling strategy: A sampling design, together with a plan of analysis and estimation. The design consists of a **frame**, either explicit or implicit, together with a protocol for selection of **sampling units**.

sampling unit: An entity that is subject to selection and characterization under a sampling design. A **sample** consists of a set of **sampling units** or sites that will be characterized. **Sampling units** are defined by the **frame**; they may correspond to **resource units**, or they may be artificial units constructed for the sole purpose of the sampling design.

Science Advisory Board (SAB): A peer review panel internal to EPA. The Ecological Effects Committee of the SAB conducts reviews of EMAP's overall program and the conceptual framework for integrating EMAP with ORD's Ecological Risk Assessment program. Preparation for SAB reviews is coordinated by the Director of the Office of Modeling, Monitoring systems, and Quality Assurance (OMMSQA); the Assistant Administrator for ORD is responsible for funding. SAB review is considered level 1 peer review.

spatial model: A set of rules and procedures for conducting spatial analysis to derive new information that can be analyzed to aid in problem solving and planning. (New term 1993.)

spatial statistics: Statistical methodology and theory that accounts for spatial aspects of a spatially distributed data set. Conventional **population** estimation does not normally account for **spatial attributes**, except perhaps for **spatial identity** of **subpopulations**.

status: The distribution of scores for **condition indicators** with relation to the **reference condition** associated with specific social values or desired uses for a specific time period. (Term added 1993. See related: **change**, **condition**, **trends**.)

stratum (strata): A sampling structure that restricts **sample randomization/selection** to a subset of the **frame**. Inclusion probabilities may or may not differ among **strata**.

stressor: "Any physical, chemical, or biological entity that can induce an adverse response" (RAF 1992, 38).

stressor indicator: A characteristic of the **environment** that is suspected to elicit a change in the state of an **ecological resource**, and they include both natural and human-induced stressors. Selected **stressor indicators** will be monitored in EMAP only when a relationship between specific condition and stressor indicators are known or if a testable hypothesis can be formulated. (See related: **indicator**, **condition indicator**.)

subnominal: Having undesirable or unacceptable ecological condition. The quantified standard established for a condition indicator to represent unacceptable or undesirable ecological condition is called the **subnominal assessment endpoint**. (See related: **assessment endpoint**, **marginal**, **nominal**.)

subpopulation: Any subset of a **population**, usually having a specific **attribute** that distinguishes its members from the rest of the **population**, for example, lakes from a specified **population** that are above 1000 m in elevation. **Subpopulations** are important entities in the EMAP plan. Any defined **subpopulation** is subject to characterization via estimation of **subpopulation attributes** and comparison to other **subpopulations**. It is this focus that imposes the greatest restrictions on the EMAP design and establishes the primary directions of the EMAP analyses.

surface fitting: A statistical procedure of estimating the **parameters** of a surface model or of approximating an implied surface by distribution free methods from a spatially distributed sample. A two-dimensional generalization of regression.

surface waters: The inland surface waters consisting of all the Nation's **lakes** (other than the **Great Lakes**), rivers, and streams. **Lakes** are distinguished from **wetlands** by depth and by size. Streams (and rivers) will be identified from stream traces on maps and confirmed in field visits. Streams are operationally defined as any first or higher order stream that is represented as a blue line on a USGS 1:100,000 topographic map.

"All water naturally open to the atmosphere (rivers, lakes, reservoirs, ponds, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors directly influenced by surface water" (EPA 1992, 28). (See related: **lake**, **wetlands**.)

systematic sample: A sampling design that utilizes regular spacing between the **sample points**, in one sense or another. The EMAP design selects **samples** via the triangular grid. Spatial arrangement of the selected **resource units** is not always strictly systematic, but the systematic grid is an important aspect of the design.

T

target population: A specific resource set that is the object or target of investigation.

technical coordinator (TC): The individual responsible for directing the activities of an individual **cross-cutting group**.

technical director (TD): The individual responsible for directing the activities of an individual **resource group**.

tessellation: A pavement or tiling of a space by a mosaic pattern. The EMAP design prescribes a regular tessellation on the United States, consisting of hexagons of 634.5 km².

Tier 1 resource: A specific designation given an EMAP resource class that will be treated as a stratum at Tier 2.

Tier 1/Tier 2: The EMAP design is a multi-stage, or multi-phase, design. These two terms describe the multi-stage structure of EMAP's monitoring activities. **Tier 1** refers to studies that reflect the structure of the sampling grid, and these studies characterize the extent of the resource and its geographical distribution. **Tier 2** refers to a double sample from a **Tier 1 sample**; these studies quantify the ecological condition on a national or regional basis. (See related: **Tier 3/Tier 4**.)

Tier 3/Tier 4: The general investigation of status and nature of environmental issues involves other levels of investigation below those of monitoring: in EMAP, these activities are designated as **Tier 3** or **Tier 4**. **Tier 3** studies are specialized, intensive studies of a finite duration to help diagnose or determine the extent of a degraded condition. **Tier 4** studies are basic research studies that support EMAP, and they complement **Tier 1**, **Tier 2**, and **Tier 3** studies.

total quality management (TQM): A system that is implemented in every aspect of an organization with the focus of providing quality; that is, highly **valued** products. The system provides a framework for planning, documentation, communication, etc. and strongly emphasizes a client-oriented perspective. "The process whereby an entire organization, led by senior management, commits to focusing on quality as a first priority in every activity. **TQM** implementation creates a culture in which everyone in the organization shares the responsibility for continuously improving the quality of products and services in order to satisfy the customer" (QAMS 1993, 26).

trends: The changes in the distribution of scores for **condition indicators** over multiple time periods. (See related: **status, change**.)

trophic levels: "A functional classification of taxa within a **community** that is based on feeding relationships (e.g., aquatic and terrestrial green plants comprise (sic) the first trophic level and herbivores comprise (sic) the second.) (RAF 1992, 38).

U

universal transverse mercator (UTM) projection: The map projection used in many standard map series. This projection uses the Mercator projection formula on meridional zones; it is a cylindrical conformal projection.

universe: The total entity of interest in a sampling program, often together with some structural features. The EMAP **universe** is the entire United States, together with adjoining waters. (See related: **population**.)

V

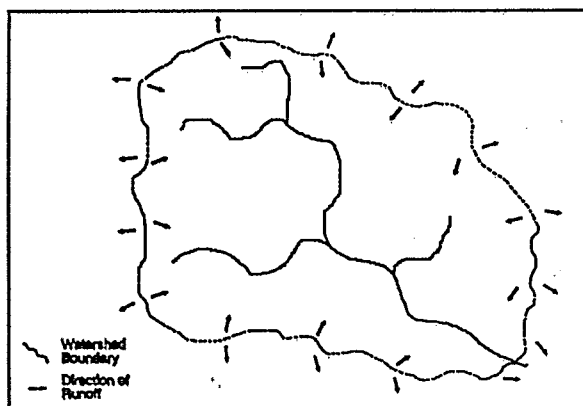
value: A characteristic of the environment that is desired. In the past, the term "environmental value" was defined to mean characteristic of the environment that contributes to the quality of life provided to an area's inhabitants; for example, the ability of an area to provide desired functions such as food, clean water and air, aesthetic experience, recreation, and desired animal and plant species. **Biodiversity**, sustainability, and aesthetics are examples of environmental **values** (Suter 1990). A quantity's magnitude.

variance: A measure of the variability or precision of a set of observations.

vector: A coordinate-based data structure commonly used to represent map features. (Term added 1993.)



watershed: "The terrestrial area of the landscape contributing to flow at a given stream location. The land area that drains into a stream" (EPA 1992, 31).



Watershed

weights: In a probability sample, the sample weights are the inverses of the inclusion probabilities; these are always known for a probability sample.

wetlands: Lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or where shallow water covers the land and where at least one of the following attributes holds: (1) at least periodically, the land supports aquatic plants predominantly; (2) undrained hydric soils are the predominant substrate; and (3) at some time during the growing season, the substrate is saturated with water or covered by shallow water (Cowardin et al. 1979).

"An area that is saturated by surface or ground water with vegetation adapted for life under those soil conditions, as swamps, bogs, fens, marshes, and estuaries (EPA 1993, 30).



xenobiotic: "A chemical or other stressor that does not occur naturally in the environment. Xenobiotics occur as a result of anthropogenic activities such as the application of pesticides and the discharge of industrial chemicals to air, land, or water" (RAF 1992, 38).

Appendix A: Concordance

abiotic
accuracy
acid deposition
adaptive sampling strategy
agroecosystem
Alber's map projection
ancillary data
annual statistical summary
area frame
area sample
arid ecosystem
assessment
assessment endpoint
association rule
attribute
augmented sample
auxiliary data
azimuthal map projection
baseline grid
bias
bioaccumulants
bioassay
biodiversity
biogeographic province
biomarker
biomass
biome
biotic
calibration
candidate indicator
cdf
changes
characterization
classification
Committee to Review
community
comparability
completeness
conceptual model
condition
condition indicator
confidence coefficient
confidence interval
conformal map projection
continuous
cross-cutting group
cumulative distribution
cylindrical map projection

cylindric map projection
data quality
data quality indicators
data quality objective
DQO
deconvolution
demonstration field program
demonstration project
design-based
design-unbiased
digital line graph
DLG
discrete resource
domain
double sample
ecology
Ecological Effects Committee
ecological health
ecological risk assessment
ecoregion
ecosystem
ecosystem function
ecosystem health
ecosystem structure
ecotone
entire
environment
environmental assessment
epidemiologic ecology
equal-area projection
equivalent projection
estuary
extensive resource
40-hex
forest
fragmented
frame
frame, conceptual
geographic information system
GIS
Great Lakes
grid
grid enhancement
grid, hierarchical
grid randomization
grid, triangular
habitat
heuristic method

hierarchical geometric decomposition	reference site
hierarchical model	region
implementation field program	relation
inclusion probability	representativeness
index	research project
index period	resource
index sample	resource class
indicator	resource domain
indicator development	resource group
integration	resource unit
interpenetrating subsamples	risk
judgment sample	risk assessment
kriging	risk characterization
Lambert's azimuthal map projection	risk communication
landscape	risk management
landscape characterization	sample
landscape classification	sampling strategy
landscape description	sampling unit
landscape ecology	Science Advisory Board
map projection	SAB
map resolution	spatial statistics
map scale	status
marginal condition	strata
measurement	stratum
measurement endpoint	stressor
meridian	stressor indicator
meridional zones	subnominal
modeling	subpopulation
monitoring	surface fitting
National Academy of Sciences	surface waters
NAS	systematic sample
National Research Council	target population
NRC	technical coordinator
nominal	TC
Office of Modeling, Monitoring Systems, and Quality Assurance	technical director
OMMSQA	TD
on-frame data	tessellation
parallel	Tier 1 resource
parameter	Tier 1/Tier 2
pattern	Tier 3/Tier 4
peer review	total quality management
pilot field program	TQM
pilot project	trends
population	trophic levels
population estimation	universal transverse mercator projection
population units	UTM
precision	universe
probability sample	value
quality assessment	variance
quality assurance	watershed
QA	weights
quality control	wetlands
QC	xenobiotic
QA/QC	
quantile	
randomization	
recovery	
reference condition	

Appendix B: Library of Congress Subject Headings

Library of Congress Subject Headings (LCSH) describe the most specific contents of publications for cataloging purposes. It is important for authors to select a suite of key words that represent EMAP's national or regional scope, multiple indicators, and many conditions in each of their documents--that is, the more general scope for a narrow topic. Otherwise, catalogers and indexers of electronic bibliographic systems will assign terms based on their perception of a specific organism, single resource, and particular geographic location as well as on traditional effects-oriented rather than stress-oriented use of professional terminology. Both the Government Printing Office database and the National Technical Information Service database employ LCSH, abstracts, and key words in their indexing and cataloging. Furthermore, EPA's Public Information Product Inventory requires key words on its newest certification form (EPA Form 2200-5 [1-92]).

For example, the concept of "ecological indicators" is not a LCSH; "environmental indicators" is, but by LCSH definition, "environmental indicators" means single-point source of pollution in one place at one time. If an author wanted to describe an EMAP statistical summary for estuaries, LCSH does contain the terms "estuarine ecology" and "indicators (biology)," and both can be further refined by adding a geographic subdivision such as "--United States" or the floating subheading "--statistics," which would adequately convey the contents of the work. It is likely that a cataloger would assign "environmental indicators," or a specific plant, animal, or chemical name, and provide a geographic subdivision for each state or local site mentioned in the work--a LCSH description that essentially loses the multiple indicator, status-and-trends, national or regional nature of the EMAP study. Of course, such specific cataloging also would make the EMAP study difficult, if not impossible, to find in the literature.

Consequently, it is important for authors to consider a suite of key words from LCSH to complement or supplement technical, scientific, or EMAP terms used in the title and abstract of a work. Since the Library of Congress online catalog, the Government Printing Office database, and the National Technical Information Service database permit electronic searching of titles, abstracts, and subject heading fields, careful construction of such a suite of key words will enable seekers of EMAP information to find it. Moreover, this practice is encouraged by LC-trained catalogers who seriously consider terms selected by an author when assigning LCSH to a work. In GPO and NTIS, the terms are simply taken from authors' suggestions.

LCSH evolve as the disciplines adapt and alter their terminology; however, the Library maintains LCSH as a controlled vocabulary, specifying certain numbers of location for collections of works by subject--the Library of Congress call number system. In March 1993, the Library proposed the

new general terms, **environmental conditions** (catalog numbers GE140, general works; GE150--United States; GE160, other regions or countries) and **environmental risk assessment** (GE145), to accommodate the many multidisciplinary texts emerging in the field.

To make the list of LCSH below easier to read and follow, acronyms notify the reader about the hierarchy of the terms:

- UF = used for. . .the term that follows UF
- USE = use the term specified as the preferred LCSH
- BT = broader term
- NT = narrower term
- RT = related term

Free-floating Subdivisions

For Library of Congress Subject Headings (**boldfaced** in the selection below), the following terms can be added as free-floating subdivisions for more specific description (*italics* have been used here to show character-by-character what must follow the subject heading; *italics* are not needed when an author constructs a key word):

- atlases*
- charts, diagrams, etc.*
- data processing*
- decision making*
- design*
- environmental aspects*
- evaluation*
- experiments* ("how to," methods)
- field work* ("how to," methods)
- graphic methods* (problem solving using graphs)
- handbooks, manuals, etc.*
- laboratory manuals*
- management*
- measurement*
- observations*
- planning*
- quality control*
- remote sensing*
- research* (may subdivide geographically)
- risk*
- risk assessment*
- scientific applications*
- social aspects* (people groups)
- sociological aspects* (institutional groups)
- standards* (may subdivide geographically)
- statistical methods* (problem solving, after topic)
- statistics*
- tables*
- technique*
- testing* (drugs and chemicals)
- toxicology*
- With names of places (geographic features or jurisdictions)
- environmental conditions*

Selected Library of Congress Subject Headings (LCSH)

agricultural ecology (may subdivide geographically)
[S441 through S481 (local)]; [S589.7 (general)]

- UF agriculture-ecology
- BT agriculture-environmental aspects ecology
- RT agricultural pollution permaculture
- NT agricultural conservation crops-ecology crops and climate field crops-ecology garden ecology

agricultural geography (may subdivide geographically)
[S439 through S482 (local)]; [S494.5.G46 (general)]

- UF geography, agricultural
- BT economic geography physical geography
- NT agricultural systems crop zones soil geography

agricultural services (may subdivide geographically)
[S21 through S482]

- UF services, agricultural
- BT agriculture
- NT agriculture-information services

agricultural statistics

- USE agriculture-statistical methods agriculture-statistics

agricultural surveys (may subdivide geographically)
[S21 through S400 (documents)]; [S441 through S482 (local)]; [S494.5.E8 (methodology)]

- Works on the methods and techniques employed in conducting agricultural surveys, and reports of individual surveys.
- BT surveys
- United States

agricultural systems (May subdivide geographically)
[S439 through S481 (local)]; [S494.5.S95 (general)]

- UF farming systems systems, agricultural systems, farming
- BT agricultural geography
- RT farm management
- NT agroforestry agropastoral systems alternative agriculture cropping systems grazing pastoral systems tillage

agriculture-information systems

[S494.5.I47]

- BT agricultural services agriculture-documentation communication in agriculture

agriculture-research

[S539.5 through S542.3]

- UF agricultural research
- NT national agricultural research systems

agriculture-statistics

- UF agricultural census agricultural statistics

agriculture and politics (may subdivide geographically)

- UF agriculture-political aspects politics and agriculture
- BT politics, practical

agriculture and state (may subdivide geographically)

- UF agrarian question agricultural policy agriculture=government policy state and agriculture
- BT economic policy industry and state
- RT land reform

-environmental aspects (may subdivide geographically)

- Works on the environmental aspects of government agricultural policy

AGRIS (information retrieval system)

[Z699.5.A5]

- UF International Information System for the Agricultural Sciences and Technology
- BT information storage and retrieval systems-agriculture

agro-forestry

- USE agroforestry

agroforestry (may subdivide geographically)

[S494.5.A45 (agriculture)]

Works on any sustainable land use system that maintains or increases total yields by combining agricultural crops, tree crops, forest trees, and/or livestock on the same unit of land, either alternately or at the same time, using management practices that suit the social and cultural characteristics of the local people and the economic and ecological conditions of the area.

- UF agro-forestry
- BT agricultural systems agriculture forests and forestry land use, rural
- RT food crops intercropping

- multiple cropping
- shifting cultivation
- tree crops
- NT **hedgerow intercropping**
- research (may subdivide geographically)
- on-farm [S494.5.A5]
- UF on-farm experimentation in agroforestry
- on-farm research in agroforestry

- agropastoral systems** (may subdivide geographically) [S494.5.A47]
- BT **agricultural systems**

- arid regions** (may subdivide geographically) [GB611 through GB618]
- UF arid zones
- semiarid regions
- BT **Earth**
- extreme environments**
- NT **deserts**
- wadis**

- arid regions agriculture** (may subdivide geographically) [S612 through S616]
- UF dryland farming
- BT **agriculture**
- crop zones**
- desert reclamation**
- NT **arid regions forestry**
- dry farming**
- irrigation farming**

- arid regions climate** (may subdivide geographically) [QC93.7]
- Subdivision usually subdivided by place, i.e., **arid regions climate-United States**

- arid regions ecology** (may subdivide geographically)
- BT **ecology**
- NT **desert ecology**

- arid soils** (may subdivide geographically) [S592.17.A73 (general)];[S599 through S599.9 (local)]
- UF aridic soils
- aridisols

- arid zone research**
- USE **arid regions-research**

- arid zones**
- USE **arid regions**

- benthos** (may subdivide geographically)
- BT **aquatic biology**
- marine microbiology**
- ocean bottom**

- ecological agriculture**
- USE **organic farming**

- ecological communities**
- USE **biotic communities**

- ecological competition**
- USE **competition (biology)**

- ecological genetics**
- BT **ecology**
- genetics**
- NT **plant ecological genetics**

- ecological heterogeneity** (may subdivide geographically) [QH541.14.E24]
- UF heterogeneity, ecological
- BT **ecology**

- ecological indicators**
- USE **environmental indicators**
- RT **indicators (biology)**

- ecology** (may subdivide geographically) [QH540-QH541]
- Works on the relationship between organisms and their environment. Works on the relationship between humans and the natural environment described by **human ecology**. Works on the relationship between humans and the geographical environment are described by **human geography**.
- UF balance of nature
- biology-Ecology
- bionomics
- environment
- environmental biology
- ecology
- RT population biology
- SA **subdivision**
- environmental aspects* after subjects, e.g.
- agricultural chemicals--environmental aspects**
- NT **agricultural ecology**
- anaerobiosis**
- animal ecology**
- animal-plant relationships**
- aquatic ecology**
- arid regions ecology**
- bioclimatology**
- biogeochemical cycles**
- biological productivity**
- biotic communities**
- botany-ecology**
- canal ecology**
- cave ecology**
- chaparral ecology**
- chemical ecology**
- colonies (biology)**
- communism and ecology**
- competition (biology)**

conservation of natural resources
 ecological genetics
 ecological heterogeneity
 ecotones
 environmental chemistry
 extreme environments
 fire ecology
 forest ecology
 food chains (ecology)
 freshwater ecology
 grassland ecology
 habitat (ecology)
 habitat partitioning (biology)
 hedgerow ecology
 household ecology
 human ecology
 indicators (biology)
 island ecology
 lagoon ecology
 lake ecology
 landscape ecology
 life zones
 llanos ecology
 meadow ecology
 microbial ecology
 microclimatology
 mountain ecology
 mud flat ecology
 niche (ecology)
 paleoecology
 paramo ecology
 pasture ecology
 prairie ecology
 predation (biology)
 radioecology
 range ecology
 resource partitioning (ecology)
 restoration ecology
 riparian ecology
 roadside ecology
 sand dune ecology
 savanna ecology
 seashore ecology
 shrubland ecology
 soil ecology
 steppe ecology
 tidal flat ecology
 tide pool ecology, landlocked
 tundra ecology
 urban ecology
 urban ecology (biology)
 wetland ecology
 xeric ecology

--bibliography

RT environmental literature

--experiments

--philosophy

UF ecophilosophy

NT Gaia hypothesis

--research (may subdivide geographically)

[QH541.2-QH541.264]

UF ecological research

NT research natural areas

stable isotopes in ecological research

--social aspects

USE human ecology

--study and teaching (may subdivide geographically)

NT games in ecology education

national environmental study areas

--activity programs

BT activity programs in education

ecology, social

USE human ecology

ECOMAP (computer program)

UF ecological mapping (computer program)

environment

USE subdivision

--environmental aspects after subject, e.g.

agricultural chemicals--environmental aspects

USE acclimatization

adaptation (biology)

ecology

euthenics

man-influence of environment

environment (aesthetics)

[BH301.E58]

environmental auditing (may subdivide geographically)

[TD194.7]

UF environmental compliance auditing

environmental biology

USE ecology

environmental chemistry (may subdivide geographically)

[TD193]

NT air-pollution

environmental geochemistry

also USE information storage and retrieval systems--
 -environmental chemistry

environmental conditions (proposed new term March 1993)

([GE140] proposed new call number)

environmental contaminants

USE pollutants

environmental effects

USE environmental engineering

environmental engineering (may subdivide geographically)

UF environmental control

- environmental effects
- environmental management
- environmental stresses
- BT **engineering**
- RT **environmental health**
- environmental protection**
- pollution**
- NT **environmental auditing**
- environmental impact consultants**
- environmental impact statements**
- environmental indexes**
- environmental indicators**
- environmental monitoring**

- environmental indexes**
[GF23.I53 (human ecology)]
Works on the construction of environmental indexes. The indexes themselves are described by the heading **human ecology** subdivided by place or **ecology** subdivided by place.
- UF **environmental indices**
- indexes, environmental**
- BT **environmental engineering**
- environmental monitoring**
- human ecology**
- NT **air quality indexes**

- environmental indicators** (may subdivide geographically)
[TD193.2]
- UF **ecological indicators**
- BT **environmental engineering**
- environmental indicators, biological**
- USE **indicators (biology)**
- environmental indices**
- USE **environmental indexes**

- environmental geology** (may subdivide geographically)
[QE38]
- UF **geoecology**
- geology, environmental**
- BT **environmental protection**
- physical geology**

- environmental monitoring** (may subdivide geographically)
[QH541.15.M64 (ecology)]
- UF **ecological monitoring**
- monitoring, environmental**
- BT **environmental engineering**
- RT **pollution-measurement**
- NT **environmental impact analysis** (may subdivide geographically [TD194.6])
- UF **environmental assessment**
- BT **environmental monitoring**
- RT **environmental auditing**
- SA **subdivision**
- measurement** under special pollutants or other environmental subjects, i.e., **water quality--measurement**

- environmental laboratories** (may subdivide geographically)
[TD178.8]

- environmental law** (may subdivide geographically)
- UF **environmental control**
- environmental management**
- environmental protection--law and legislation**
- BT **environmental policy**
- environmental protection**
- RT **environmental auditing**
- NT **acid deposition-law and legislation**
- acid rain-law and legislation**
- air-pollution-law and legislation**
- costal zone management-law and legislation**
- environmental monitoring-law and legislation**
- estuarine area conservation-law and legislation**
- estuarine pollution-law and legislation**
- marine pollution-law and legislation**
- natural areas-law and legislation**
- natural resources-law and legislation**
- pollution-law and legislation**
- renewable natural resources-law and legislation**
- sediment control--law and legislation**
- shore protection-law and legislation**
- water-pollution-law and legislation**

- environmental literature** (may subdivide geographically)
- UF **ecological literature**
- literature, ecological**
- literature, environmental**
- RT **ecology-bibliography**

- environmental mapping** (may subdivide geographically)
- UF **environmental value mapping**
- mapping, environmental**
- value mapping, environmental**
- BT **cartography**
- environmental protection-maps**

- environmental policy** (may subdivide geographically)
[HC79.E5] (proposed call number 1993: GE170-190)
- UF **environment and state**
- environmental control**
- environmental management**
- state and environment**
- BT **environmental engineering**
- RT **environmental auditing**
- environmental protection**
- human ecology**
- NT **conservation of natural resources**
- environmental law**
- pollution**
- research** (may subdivide geographically)
- UF **environmental policy research**

- environmental protection** (may subdivide geographically)
[TD169 through TD171.5]
- UF **environmental quality management**
- protection of environment**
- RT **environmental engineering**

- NT environmental policy
 - agriculture-environmental aspects
 - conservation of natural resources
 - environmental geology
 - environmental impact analysis
 - environmental impact consultants
 - environmental impact statements
 - environmental law
 - landscape protection
 - water resources development-environmental aspects
- environmental quality management
- USE environmental protection
- environmental risk assessment (proposed subject heading 1993) ([GE145] proposed call number)
 - UF environment risk assessment
 - risk assessment, environmental
 - BT risk
 - risk assessment
- environmental specimen banking (may subdivide geographically)
 - UF banking, environmental specimen
 - specimen banking, environmental
 - BT environmental monitoring
 - environmental protection
- environmental sciences (proposed subject heading 1993) ([GE140] proposed call number for general works)
- environmental stresses
 - USE environmental engineering
- environmental testing [TA171]
 - UF environment testing
 - BT environmental engineering testing
- environmental value mapping
 - USE environmental mapping
- estuaries (may subdivide geographically) [GC96 through GC97.8]
 - UF branching bays
 - crowned river mouths
 - firths
 - BT coasts
 - rivers
 - computer program
 - research (may subdivide geographically)
- estuarine area conservation (may subdivide geographically)
 - BT wetland conservation
- law and legislation (may subdivide geographically)
 - BT environmental law
- estuarine biology (may subdivide geographically)
 - BT aquatic biology
 - brackish water biology
- estuarine ecology (may subdivide geographically) [QH541.5E8]
 - BT marine ecology
 - research (may subdivide geographically)
- estuarine fauna (may subdivide geographically) [QL139]
 - BT coastal fauna
 - marine fauna
 - NT tidemarsh fauna
- estuarine fisheries
 - BT fisheries
- estuarine flora (may subdivide geographically) [QK108 through QK474.5 (local)]; [QK938.E (general)]
 - BT aquatic plants
 - coastal flora
 - NT tidemarsh flora
- estuarine oceanography (may subdivide geographically) [GC96 through GC97.8]
 - Works on estuarine oceanography of a particular locality are described by the heading **oceanography** subdivided by locality, e.g. **oceanography-Chesapeake Bay**.
 - BT oceanography
 - NT estuarine sediments
- estuarine pollution (may subdivide geographically)
 - BT marine pollution
 - law and legislation (may subdivide geographically)
 - BT environmental law
- estuarine sediments (may subdivide geographically)
 - BT estuarine oceanography
 - marine sediments
 - sediments (geology)
- eutrophication (may subdivide geographically) [QH96.8.E9]
 - BT limnology
 - RT lake renewal
 - NT lakes-destratification
 - lakes-fertilization
 - reservoirs-destratification
 - water bloom
 - control (may subdivide geographically)

evapotranspiration (may subdivide geographically)
[QC915.5 through QC915.7 (general)]; [QK873 (plant pathology)]; [S600.7.E93 (crops and climate)]

- UF consumptive use
- BT water supply
- RT evaporation (meteorology)
- plants-transpiration
- plants-water requirements

forest biomass (may subdivide geographically)
[SD387.B48 (forestry)]

- BT biomass
- forests and forestry

forest conservation (may subdivide geographically)
[SD411 through SD428]

- UF conservation of forests
- forest preservation
- preservation of forests
- BT conservation of natural resources
- forest management
- plant conservation
- RT deforestation-control

forest declines (may subdivide geographically)
[SB762 through SB764 (local)]; [SB765 (general)]

- UF forest dieback
- BT dieback
- tree declines

forest depletion

- USE deforestation

forest districts (may subdivide geographically)

- UF districts, forest
- divisions, forest
- forest administrative districts
- forest divisions
- BT forests and forestry

forest ecology (may subdivide geographically)
[QH541.5.F6 (general)]; [QK938.F6 (botany)]

- UF forests and forestry-ecology
- BT botany-ecology
- NT forest dynamics
- forest meteorology
- forest microclimatology
- forest site quality
- jungle ecology
- old growth forests
- rain forest ecology
- taiga ecology
- timberline
- trees-growth

forest fauna (may subdivide geographically)
[QL112]

- UF forest animals

- BT zoology
- NT forest birds
- forest insects
- jungle fauna
- mangrove fauna
- rain forest fauna

forest flora (may subdivide geographically)
[QK108 through QK474.5 (local)];
[QK938.F6 (general)]

- UF Forest plants
- woodland plants
- BT forests and forestry
- plants
- RT woodland garden plants
- NT castanga plants
- mangrove plants
- rain forest plants

forest hydrology

- USE hydrology, forest

forest influences (may subdivide geographically)
[SD416 through SD416.3 (general)]

- UF forests and floods
- forests and rainfall
- forests and water-supply

forest landscape design (may subdivide geographically)
[SB475.9.F67 (landscape architecture)]

- UF Design of forest landscapes
- forest design
- forest landscapes, design of
- landscape design of forests
- BT forests and forestry
- landscape architecture

forest landscape management (may subdivide geographically) [SD387.L35 (forestry)]

- UF landscape management of forests
- management of forest landscapes
- BT forest management
- landscape protection

forest mapping (may subdivide geographically)
[SD387.M3]

- UF forests and forestry-mapping
- BT cartography
- forest surveys
- forests and forestry-maps
- vegetation mapping

forest policy (may subdivide geographically)
[SD561 through SD668]

- UF forestry and state
- government and forestry
- state and forestry

forest productivity (may subdivide geographically)

- UF forest production
- forest yield
- productivity, forest
- BT agricultural productivity
- forests and forestry
- primary productivity (biology)
- RT forest site quality

forest protection (may subdivide geographically)
[SD411 through SD428]

- UF protection of forests

forest reproduction (may subdivide geographically)

Works on the reproduction of forests by natural processes.
Works on artificial reproduction of forests are described
by reforestation.

- UF forest regeneration
- regeneration (forestry)
- BT reforestation

forest research laboratories

- USE forestry laboratories

forest reserves (may subdivide geographically)

[SD426 through SD428]

- UF forest preserves
- forests, national
- forests, state
- national forests
- preserves, forest
- reserves, forest
- state forests

forestry law and legislation (may subdivide geographically)

- UF forest law
- timber laws and legislation

forests and forestry (may subdivide geographically) [SD]

- UF forest planting
- forest production
- forestation
- forestry industry
- silviculture
- sylviculture
- woods (forests)
- BT agriculture
- natural resources
- NT aerial photography in forestry
- agroforestry
- arid regions forestry
- brush
- chaparral
- communication in forestry
- community forests
- energy crops
- exotic forestry
- exotic forests
- explosives in forestry

floodplain forestry
forest biomass
forest districts
forest flora
forest landowners
forest landscape design
forest productivity
forest site quality
forestry innovations
forestry projects
forests, submerged
frozen ground forestry
hardwoods
hydrology, forest
jungles
landscape gardening
old growth forests
planting (plant culture)
radioactive tracers in forestry
rain forests
reforestation
silvicultural systems
slash (logging)
sustainable forestry
taigas
tree farms
tree felling
tree planting
trees-growth
urban forestry
woodlots

-information storage and retrieval systems

- USE information storage and retrieval systems-forestry

-maps

- NT forest mapping

-mensuration [SD551 through SD557]

- UF forest mensuration
- log scaling
- timber-mensuration
- timber cruising
- NT dendrometer

--computer programs**--data processing**

- NT SILVI-STAR (computer system)

-research (may subdivide geographically)**-social aspects (may subdivide geographically)**
[SD387.S55]**-thermographic methods****indicator plants**

- USE plant indicators

indicators (biology) [QH541.15.I5]

- UF biological environmental indicators
- biological indicators
- ecological indicators
- environmental indicators, biological
- sentinel organisms
- BT ecology
- RT biological monitoring
- biological reagents
- NT biochemical markers

plant indicators
water quality bioassay

indicators and test-papers
[QD77 (Analytic chemistry)]

UF chemical indicators
test-papers, chemical
BT chemistry--laboratory manuals
chemistry, analytic
volumetric analysis
RT chemical tests and reagents
NT biological reagents
chromogenic compounds
methylene blue
resazurin

indices

USE indexes

landscape (may subdivide geographically)
[BH301.L3 (aesthetics)]; [QH75 (natural history)]

UF natural scenery
scenery
scenic beauty
BT nature
NT mountains in literature
natural monuments
nature in literature
sea in literature

landscape assessment (may subdivide geographically)
[GF90 through GF91]

UF assessment, landscape
environmental perception
landscape evaluation
landscape perception
perception, landscape
BT human ecology
RT land use
landscape protection

landscape changes (may subdivide geographically)

UF change, landscape
BT geomorphology

landscape ecology (may subdivide geographically)
[QH541.15.L35]

BT ecology

landscape evaluation

USE landscape assessment

landscape protection (may subdivide geographically)
[QH75]

UF beautification of the landscape
conservation of scenic beauty
natural beauty conservation

preservation of natural scenery
protection of scenic beauty
scenery preservation

BT environmental protection
nature conservation
RT landscape architecture
landscape assessment
regional planning
NT forest landscape management
natural monuments
stream conservation
-law and legislation (may subdivide
geographically)

resource allocation

[T57.77 (operations research)]

Works describing the apportionment of available resources
among different uses.

UF allocation of resources
resources allocation
BT economics
management
operations research
organization
planning
RT feasibility studies

resource allocation for commercial and recreational fishing

USE fishery resources-commercial vs. recreational use

resource-efficient agriculture

USE sustainable agriculture

**resource partitioning (ecology) (may subdivide
geographically)**

UF partitioning, resource (ecology)
BT competition (biology)
ecology
niche (ecology)
NT habitat partitioning (biology)
habitat selection

resource recovery

USE recycling (waste, etc.)

resources, agricultural

USE agricultural resources

resources, aquatic

USE aquatic resources

resources, marine

USE marine resources

resources, natural

USE natural resources

resources, renewable natural
USE renewable natural resources

resources allocation
USE resource allocation

risk (may subdivide geographically)
[HB615]

BT economics
uncertainty
RT probabilities
profit

-Sociological aspects
[HM201]

UF sociology of risk
sociology of uncertainty
uncertainty-sociological aspects
BT sociology

risk analysis
USE risk assessment

risk assessment (may subdivide geographically)

UF analysis, risk
assessment, risk
risk analysis
risk evaluation
BT evaluation
SA subdivision
--risk assessment after individual term, e.g.,
hazardous substances--risk assessment

risk communication
[T10.68]

UF communication of risk information
BT communication of technical information
NT health risk communication

risk evaluation
USE risk assessment

risk management (may subdivide geographically)
[HD61] (relates to health, insurance, business management)

risk perception (may subdivide geographically)

UF awareness, risk
perception, risk
risk awareness
BT perception

risk-taking (psychology) (may subdivide geographically)
[BF637.R57]

BT choice (psychology)
decision-making
motivation (psychology)

soil ecology (may subdivide geographically)
[QH541.5.S6]
BT ecology
RT roots (botany)-ecology

soil geography (not subdivided geographically)
Works describing the scientific aspects of soil distribution.
Works on the soil geography of a particular place are
described by soils--local subdivision.
UF geography, soil
BT agricultural geography
soil science

soil surveys (may subdivide geographically)
[S592.14 (general)]; [S599 through S599.9 (local)];
[TE208 (highway engineering)]
BT natural resources surveys

statistics (may subdivide geographically)
[HA]

Works consisting of general statistical data not limited to a
specific place or topic and works on the discipline of
statistics; the latter description may be subdivided by
place. Works of statistical data on a specific place or
topic described by the place or topic with the subdivision -
statistics.

UF statistical methods
NT average
biometry
correlation (statistics)
data editing
data reduction
degree of freedom
error analysis (mathematics)
experimental design
frequency curves
large deviations
linear models (statistics)
numeracy
outliers (statistics)
panel analysis
political statistics
regression analysis
sampling (statistics)
smoothing (statistics)
spherical data
standard deviations
statistical decision
statistical services

-charts, diagrams, etc.

-computer programs

NT CSS (computer program)
FILESTAT (computer programs)
Interactive Statistical Programs
(computer programs)
KEYSTAT (computer programs)
STATCAT (computer programs)
STATLIB (computer programs)
STATMASTER (computer
programs)

-data processing

NT Genstat (computer system)

- INDIOS (computer system)
S (computer system)
STATPAK (computer system)
- graphic methods [HA31]**
UF diagrams, statistical
statistical diagrams
RT curve fitting
NT correlation (statistics)
maps, statistical
response surfaces (statistics)
trend surface analysis
- stream classification
USE rivers-classification
- stream conservation** (may subdivide geographically)
UF preservation of streams and rivers
river conservation
stream improvement (ecology)
stream preservation
BT landscape protection
nature conservation
river engineering
stream ecology
water conservation
RT fish habitat improvement
- stream ecology** (may subdivide geographically)
[QH541.S57]
UF river ecology
BT freshwater ecology
NT coulee ecology
stream conservation
tailwater ecology
valley ecology
- stream fauna** (may subdivide geographically)
[QL145]
UF river fauna
- stream flora
USE stream plants
- stream measurements** (may subdivide geographically)
[GB1201 through GB1398 (hydrology)]
UF measurement of streams
river discharge measurements
stream flow measurements
stream gauging
streamflow data
BT hydraulic measurements
RT streamflow
streamflow velocity
water-power
NT bedload-measurement
flood routing
flow meters
stream gaging stations
water current meters
- sustainable agriculture** (may subdivide geographically)
[S441 through S482 (local)]; [S494.5.S86 (general)]
UF low-input agriculture
low-input sustainable agriculture
lower input agriculture
resource-efficient agriculture
BT agriculture
RT alternative agriculture
NT sustainable forestry
- sustainable forestry**
[SD387.S87]
UF forest productivity, maintenance of long term
long-term forest productivity, maintenance of
maintenance of long-term forest productivity
BT forests and forestry
sustainable agriculture
- water-pollution** (may subdivide geographically)
[TD419 through TD428]
UF lakes-pollution
rivers-pollution
stream pollution
water contamination
water pollutants
water pollution
BT pollution
NT acid pollution of rivers, lakes, etc.
aquatic organisms-effect of water pollution on
marine pollution
oil pollution of water
radioactive pollution of water
thermal pollution of rivers, lakes, etc.
viral pollution of water
water bloom
water salinization
--measurement
--point source identification
- water quality**
UF water-quality
- water-sampling**
UF water sampling
- water-sensory evaluation**
[TD375]
BT sensory evaluation
water quality
- wetland conservation** (may subdivide geographically)
[QH75 through QH77]
UF wetlands conservation
BT nature conservation
NT estuarine area conservation
mangrove swamp conservation
-law and legislation (may subdivide geographically)

wetland ecology (may subdivide geographically)

[QH541.5.M3]

- UF wetlands ecology
- BT ecology
- NT bog ecology
- marsh ecology
- moor ecology
- peatland ecology
- swamp ecology

wetland fauna (may subdivide geographically)

[QL113.8 through QL114.5]

- UF wetlands fauna
- BT aquatic animals
- NT marsh fauna
- moor fauna
- swamp fauna

wetland flora (may subdivide geographically)

[QK938.M3]

- UF wetlands flora
- RT freshwater flora
- NT marsh flora
- muskeg flora
- peatland flora
- pond flora
- spring flora
- swamp flora

wetlands (may subdivide geographically)

[QH87.3]

- BT aquatic resources
- NT bogs
- constructed wetlands
- fens
- marshes
- moors and heaths
- muskeg
- peatlands
- swamps
- tidal flats

-law and legislation (may subdivide geographically)

Appendix C: Glossary of Quality Assurance Terms¹

Terms

Absolute method: a body of procedures and techniques for which measurement is based entirely on physically defined, fundamental quantities.

Acceptable quality level: a limit above which quality is considered satisfactory and below which it is not. In sampling inspection, the maximum percentage of defects or failures that can be considered satisfactory as an average.

Acceptable quality range: the interval, between specified upper and lower limits of a sequence of values, within which the values are considered to be satisfactory.

Acceptable value: an observed or corrected value that falls within the acceptable range. See Corrected value and Observed value.

Acceptance sampling: the procedure of drawing samples from a lot or population to determine whether to accept or reject a sampled lot or population.

Accepted reference value: a numerical quantity that serves as an agreed-upon basis for comparison, and which is derived as; 1) a theoretical or established quantity based on scientific principles, 2) an assigned value, based on experimental work of some recognized organization, or 3) a consensus quantity based on collaborative experimental work under the auspices of a scientific or engineering group.

Accreditation: a formal recognition that an organization (e.g., laboratory) is competent to carry out specific tasks or specific types of tests. See also Certification.

Accreditation criterion: a requirement that a laboratory must meet to receive authorization and approval to perform a specified task.

Accredited laboratory: a laboratory which has been evaluated and given approval to perform a specified

measurement or task, usually for a specific property or analyte and for a specified period of time.

Accuracy: the degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. EPA recommends that this term not be used and that precision and bias be used to convey the information usually associated with accuracy. See Precision and Bias.

Action limit: See Control limit.

Adjusted value: the observed value after adjustment for values of a blank or bias of the measurement system.

Aliquant: a subsample derived by a divisor that divides a sample into a number of equal parts but leaves a remainder; a subsample resulting from such a divisor. See Subsample.

Aliquot: a subsample derived by a divisor that divides a sample into a number of equal parts and leaves no remainder; a subsample resulting from such a division. In analytical chemistry the term aliquot is generally used to define any representative portion of the sample.

Alpha error: See "Type I Error."

Alternate method: any body of procedures and techniques of sample collection and/or analysis for a characteristic of interest which is not a reference or approved equivalent method but which has been demonstrated in specific cases to produce results comparable to those obtained from a reference method.

Analysis (chemical): the determination of the qualitative and/or quantitative composition of a substance.

Analyte: the substance, a property of which is to be measured by chemical analysis.

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Analytical batch: a group of samples, including quality control samples, which are processed together using the same method, the same lots of reagents, and at the same time or in continuous, sequential time periods. Samples in each batch should be of similar composition and share common internal quality control standards.

Analytical blank: See Reagent blank.

Analytical limit of discrimination: See Method detection limit.

Analytical reagent (AR): the American Chemical Society's designation for the highest purity of certain chemical reagents and solvents. See Reagent grade.

Arithmetic mean: the sum of all the values of a set of measurements divided by the number of values in the set, usually denoted by \bar{x} ; a measure of central tendency. See Measure of central tendency.

Assignable cause: a factor or an experimental variable shown to significantly change the quality of an effect or a result.

Audit: a systematic evaluation to determine the conformance to quantitative specifications of some operational function or activity. See Audit of data quality, Performance evaluation audit, and Technical systems audit, and also Review, and Management systems review.

Audit of data quality (ADQ): a qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality.

Audit sample: See Performance evaluation sample.

Average: See Arithmetic mean.

Background level (environmental): the concentration of substance in a defined control area during a fixed period of time before, during or after a data gathering operation.

Batch: a quantity of material produced or processed in one operation, considered to be a uniform discrete unit.

Batch-lot: the samples collected under sufficiently uniform conditions to be processed as a group. See Batch, Batch size.

Batch-sample: one of the samples drawn from a batch.

Batch-size: the number of samples in a batch-lot.

Beta error: See Type II Error.

Bias: the systematic or persistent distortion of a measurement process which deprives the result of representativeness (i.e., the expected sample measurement is different than the sample's true value.) A data quality indicator.

Blank sample: a clean sample or a sample of matrix processed so as to measure artifacts in the measurement (sampling and analysis) process.

Blind sample: a subsample submitted for analysis with a composition and identity known to the submitter but unknown to the analyst and used to test the analyst's or laboratory's proficiency in the execution of the measurement process. See Double-blind sample.

Bulk sample: a sample taken from a larger quantity (lot) for analysis or recording purposes.

Calibrant: See Calibration standard.

Calibrate: to determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter or other device, or the correct value for each setting of a control knob. The levels of the calibration standards should bracket the range of planned measurements. See Calibration curve.

Calibration-check: See Calibrate.

Calibration-check standard: See Calibration standard.

Calibration curve: the graphical relationship between the known values for a series of calibration standards and instrument responses.

Calibration drift: the difference between the instrument response and a reference value after a period of operation without recalibration.

Calibration standard: a substance or reference material used to calibrate an instrument.

Candidate method: a body of procedures and techniques of sample collection and/or analysis that is submitted for approval as a reference method, an equivalent method, or an alternative method.

Carrying-agent: any diluent or matrix used to entrain, dilute or to act as a vehicle for a compound of interest.

CAS#: Chemical Abstracts Service registry number of elements, chemical compounds, and certain mixtures.

Cause-effect diagram: a graphical representation of an effect and possible causes. A popular one is the Ishikawa "fish bone diagram."

Central line: the line on a control chart that represents the expected value of the control chart statistic; often the mean. See Control chart.

Certification: the process of testing and evaluation against specifications designed to document, verify, and recognize the competence of a person, organization, or other entity to perform a function or service usually for a specified time. See also Accreditation.

Certification of Data Quality: the real-time attestation that the activities of an environmental data collection operation's individual elements (e.g., sampling design, sampling, sample handling, chemical analysis, data reduction, etc.) have been carried out in accordance with the operation's requirements and that the results meet the defined quality criteria.

Certified Reference Material (CRM): a reference material that has one or more of its property values established by a technically valid procedure and is accompanied by or traceable to a certificate or other documentation issued by a certifying body. See Certification and Reference material.

Certified value: the reported numerical quantity that appears on a certificate for a property of a reference material.

Chain-of-custody: an unbroken trail of accountability that insures the physical security of samples, data and records.

Chance cause: an unpredictable, random determinant of variation of a response in a sampling or measurement operation.

Characteristic: See Property.

Check sample: an uncontaminated sample matrix spiked with known amounts of analytes usually from the same source as the calibration standards. It is generally used to establish the stability of the analytical system but may also be used to assess the performance of all or a portion of the measurement system. See also Quality control sample.

Check standard: a substance or reference material obtained from a source independent from the source of the calibration standard; used to prepare check samples.

Chi-square test: a statistical test of the agreement between the observed frequency of events and the frequency expected according to some hypothesis.

Clean sample: a sample of a natural or synthetic matrix containing no detectable amount of the analyte of interest and no interfering material.

Coefficient of variation (CV): a measure of relative dispersion (precision.) It is equal to the ratio of the

standard deviation divided by the arithmetic mean. See also Relative standard deviation.

Collaborative testing: the evaluation of an analytical method by typical or representative laboratories using subsamples prepared from a homogeneous standard sample.

Collocated sample: one of two or more independent samples collected so that each is equally representative for a given variable at a common space and time.

Collocated samplers: two or more identical sample collection devices, located together in space and operated simultaneously, to supply a series of duplicate or replicate samples for estimating precision of the total measurement system/process.

Comparability: the degree to which different methods, data sets and/or decisions agree or can be represented as similar; a data quality indicator.

Completeness: the amount of valid data obtained compared to the planned amount, and usually expressed as a percentage; a data quality indicator.

Component of variance: a part of the total variance associated with a specified source of variation.

Composite sample: a sample prepared by physically combining two or more samples having some specific relationship and processed to ensure homogeneity. See Flow-proportioned sample and Time-proportioned sample.

Confidence coefficient: the probability statement that accompanies a confidence interval and is equal to unity minus the associated type I error rate (false positive rate). A confidence coefficient of 0.90 implies that 90% of the intervals resulting from repeated sampling of a population will include the unknown (true) population parameter. See Confidence interval.

Confidence interval: the numerical interval constructed around a point estimate of a population parameter, combined with a probability statement (the confidence coefficient) linking it to the population's true parameter value. If the same confidence interval construction technique and assumptions are used to calculate future intervals, they will include the unknown population parameter with the same specified probability. See Confidence coefficient.

Control chart: a graph of some measurement plotted over time or sequence of sampling, together with control limit(s) and, usually, a central line and warning limit(s). See Central line, Control limit and Warning limit.

Control limit: a specified boundary on a control chart that, if exceeded, indicates a process is out of statistical control, and the process must be stopped, and corrective action

taken before proceeding (e.g., for a Shewhart \bar{x} chart the control limits are the mean plus and minus three standard deviations, i.e., the 99.72% confidence level on either side of the central line.)

Control sample: See Quality control sample and Check sample.

Control standard: See Check standard.

Controlled variable: a variable that is set at a pre-selected level when a controlled experiment is conducted.

Correlation: a measure of association between two variables. See also Correlation coefficient.

Correlation coefficient: a number between -1 and 1 that indicates the degree of linearity between two variables or sets of numbers. The closer to -1 or +1, the stronger the linear relationship between the two (i.e., the better the correlation.) Values close to zero suggest no correlation between the two variables. The most common correlation coefficient is the product-moment, a measure of the degree of linear relationship between two variables.

Critical-toxicity range: the interval between the highest concentration at which all test organisms survive and the lowest concentration at which all test organisms die within the test period.

Daily standard: synonym for Calibration standard.

Data: facts or figures from which conclusions can be inferred.

Data quality: the totality of features and characteristics of data that bears on their ability to satisfy a given purpose; the sum of the degrees of excellence for factors related to data.

Data quality indicators: quantitative statistics and qualitative descriptors that are used to interpret the degree of acceptability or utility of data to the user. The principal data quality indicators are bias, precision, accuracy, comparability, completeness, and representativeness.

Data Quality Objective (DQO): qualitative and quantitative statements of the overall level of uncertainty that a decision-maker is willing to accept in results or decisions derived from environmental data. DQOs provide the statistical framework for planning and managing environmental data operations consistent with the data user's needs.

Data reduction: the process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useful form.

Data set: all the observed values for the samples in a test or study; a group of data collected under similar conditions and which, therefore, can be analyzed as a whole.

Datum: the singular of data. See Data and Value.

Defensible: the ability to withstand any reasonable challenge related to the veracity or integrity of laboratory documents and derived data.

Degrees of freedom: the total number of items in a sample minus the number of independent relationships existing among them; the divisor used to calculate a variance term; in the simplest cases, it is one less than the number of observations.

Dependent variable: See Response variable.

Detection limit (DL): the lowest concentration or amount of the target analyte that can be determined to be different from zero by a single measurement at a stated level of probability. See Method detection limit.

Determination: the application of the complete analytical process of measuring the property of interest in a sample, from selecting or measuring a test portion to the reporting of results. See Test determination.

Diluent: a substance added to another to reduce the concentration and resulting in a homogeneous end product without chemically altering the compound of interest.

Dilution factor: the numerical value obtained from dividing the new volume of a diluted substance by its original volume.

Document control: a systematic procedure for indexing documents by number, date and revision number for archiving, storage, and retrieval.

Double-blind sample: a sample submitted to evaluate performance with concentration and identity unknown to the analyst. See Blind sample.

Duplicate: an adjective describing the taking of a second sample or performance of a second measurement or determination. Often incorrectly used as a noun and substituted for "duplicate sample." Replicate is to be used if there are more than two items. See Replicate.

Duplicate analyses or measurements: the analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory.

Duplicate samples: two samples taken from and representative of the same population and carried through all steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variance of the total method including sampling and analysis. See Collocated sample.

Dynamic blank: a sample-collection material or device (e.g., filter or reagent solution) that is not exposed to the material to be selectively captured but is transported and processed in the same manner as the sample. See Field blank, Instrumental blank and Sampling equipment blank.

Dynamic calibration: standardization of both the measurement and collection systems using a reference material similar to the unknown. For example, a series of air-mixture standards containing sulfur dioxide of known concentrations could be used to calibrate a sulfur dioxide bubbler system.

Environmental sample: a sample of any material that is collected from an environmental source.

Environmentally related measurement: any assessment of environmental concern generated through or for field, laboratory, or modelling processes; the value obtained from such an assessment.

Equivalent method: any method of sampling and/or analysis demonstrated to result in data having a consistent and quantitatively known relationship to the results obtained with a reference method under specified conditions, and formally recognized by the EPA.

Error (measurement): the difference between an observed or corrected value of a variable and a specified, theoretically correct, or true value.

Error function: the mathematical relationship of the results obtained from the measurement of one or more properties and the error of the applied measurement process. See Normal distribution.

Experimental variable: See Independent variable.

External quality control: the activities which are routinely initiated and performed by persons outside of normal operations to assess the capability and performance of a measurement process.

False negative decision: See Type II Error.

False negative result: estimating (incorrectly) that an analyte is not present when it actually is present.

False positive decision: See Type I Error.

False positive result: estimating (incorrectly) that an analyte is present when it is actually not present.

Field blank: a clean sample (e.g., distilled water), carried to the sampling site, exposed to sampling conditions (e.g., bottle caps removed, preservatives added) and returned to the laboratory and treated as an environmental sample. Field blanks are used to check for analytical artifacts and/or background introduced by sampling and analytical procedures. See Dynamic blank and Sampling equipment blank.

Field duplicates: See Duplicate sample.

Field reagent blank: See Field blank.

Field sample: See Sample.

Flow rate: the quantity-per-unit time of a substance passing a point, plane, or space; for example the volume or mass of gas or liquid emerging from an orifice, pump, or turbine or moving through a point in a conduit or channel.

Flow-proportioned sample: a sample or subsample collected from a fluid system at a rate that produces a constant ratio of sample accumulation to matrix flow rate.

Fortify: synonym for Spike.

Full-scale response: the maximum output of a measurement instrument in a given range as displayed on a meter or scale.

Functional analysis: a mathematical evaluation of each component of the measurement system (sampling and analysis) in order to quantitate the error for each component. A functional analysis is usually performed prior to a ruggedness test in order to determine those variables which should be studied experimentally.

Geometric mean: the antilogarithm of the mean of the logarithms of all the values in a set.

Good laboratory practices (GLP): either general guidelines or formal regulations for performing basic laboratory operations or activities that are known or believed to influence the quality and integrity of the results.

Goodness-of-fit: the measure of agreement between the data in a data set and the expected or hypothesized values.

Grab sample: a single sample which is collected at one point in time and place.

Gross sample: See Bulk sample.

Homogeneity: the degree of uniformity of structure or composition.

In-control: a condition indicating that performance of the quality control system is within the specified control limits, i.e., that a stable system of chance is operating and resulting in statistical control. See Control chart.

Independent variable: See Controlled variable.

Inspection criterion: the specification(s) and rationale for rejecting and accepting samples in a particular sampling plan.

Instrument blank: a clean sample processed through the instrumental steps of the measurement process; used to determine instrument contamination. See Dynamic blank.

Interference: a positive or negative effect on a measurement caused by a variable other than the one being investigated.

Interference equivalent: the mass or concentration of a foreign substance which gives the same measurement response as one unit of mass or concentration of the substance being measured.

Interlaboratory calibration: the process, procedures, and activities for standardizing a given measurement system to ensure that laboratories participating in the same program can produce comparable data.

Interlaboratory method validation study (IMVS): the formal study of a sampling and/or analytical method, conducted with replicate, representative matrix samples, following a specific study protocol and utilizing a specific written method, by a minimum of seven laboratories, for the purpose of estimating interlaboratory precision, bias and analytical interferences.

Interlaboratory precision: a measure of the variation, usually given as the standard deviation, among the test results from independent laboratories participating in the same test.

Interlaboratory test: a test performed by two or more laboratories on the same material for the purpose of assessing the capabilities of an analytical method or for comparing different methods.

Internal quality control: See Intralaboratory quality control.

Internal standard: a standard added to a test portion of a sample in a known amount and carried through the entire determination procedure as a reference for calibration and controlling the precision and bias of the applied analytical method.

Intralaboratory quality control: the routine activities and checks, such as periodic calibrations, duplicate analyses and spiked samples, that are included in normal internal procedures to control the accuracy and precision of measurements.

Intralaboratory precision: a measure of the method/sample specific analytical variation within a laboratory; usually given as the standard deviation estimated from the results of duplicate/replicate analyses. See also Standard deviation and Variance.

Laboratory accreditation: See Accredited laboratory and Accreditation.

Laboratory blank: See Reagent blank.

Laboratory control sample: See Quality control sample.

Laboratory duplicates: synonym for Duplicate analyses.

Laboratory performance check solution: a solution of method and surrogate analytes and internal standards; used to evaluate the performance of the instrument system against defined performance criteria.

Laboratory replicates: See Replicate analysis or measurement.

Laboratory spiked blank: See Spiked laboratory blank.

Laboratory spiked sample: See Spiked sample.

Laboratory sample: a subsample of a field, bulk or batch sample selected for laboratory analysis.

Least squares method: a technique for estimating model coefficients which minimizes the sum of the squares of the differences between each observed value and its corresponding predicted value derived from the assumed model.

Limit of detection (LOD): See Method detection limit.

Limit of quantification (LOQ): the concentration of analyte in a specific matrix for which the probability of producing analytical values above the method detection limit is 99 percent.

Linearity: the degree of agreement between the calibration curve of a method and a straight line assumption.

Lot: a number of units of an article or a parcel of articles offered as one item; commonly, one of the units, such as a sample of a substance under study. See Batch.

Lot size: the number of units in a particular lot. See Batch lot and Batch size.

Lower control limit: See Control limit.

Lower warning limit: See Warning limit.

Management systems review (MSR): the qualitative assessment of a data collection operation and/or organization(s) to establish whether the prevailing quality management structure, practices, and procedures are adequate for ensuring that the type and quality of data needed and expected are obtained. See Review and Audit

Matrix: a specific type of medium (e.g., surface water, drinking water) in which the analyte of interest may be contained. See Medium.

Matrix spike: See Spiked sample.

Matrix spike duplicate sample analysis: See Matrix, Duplicate analysis and Spiked sample.

Maximum contaminant level: the highest permissible concentration of a pollutant that may be delivered to any receptor.

Maximum holding time: the length of time a sample can be kept under specified conditions without undergoing significant degradation of the analyte(s) or property of interest.

Mean: See Arithmetic mean.

Measurement range: the range over which the precision and/or recovery of a measurement method are regarded as acceptable. See Acceptable quality range.

Measurement standard: a standard added to the prepared test portion of a sample (e.g. to the concentrated extract or the digestate) as a reference for calibrating and controlling measurement or instrumental precision and bias.

Measure of central tendency: a statistic that describes the grouping of values in a data set around some common value (e.g., the median, arithmetic mean, or geometric mean.)

Measure of dispersion: a statistic that describes the variation of values in a data set around some common value. See Coefficient of variation, Range, Variance and Standard deviation.

Medium: a substance (e.g., air, water, soil) which serves as a carrier of the analytes of interest. See Matrix.

Medium blank: See Field blank and/or Laboratory blank.

Median: the middle value for an ordered set of n values; represented by the central value when n is odd or by the mean of the two most central values when n is even.

Method: a body of procedures and techniques for performing a task (e.g., sampling, characterization, quantification) systematically presented in the order in which they are to be executed.

Method blank: a clean sample processed simultaneously with and under the same conditions as samples containing an analyte of interest through all steps of the analytical procedure.

Method check sample: See Spiked laboratory blank.

Method detection limit (MDL): the minimum concentration of an analyte that, in a given matrix and with a specific method, has a 99% probability of being identified, qualitatively or quantitatively measured, and reported to be greater than zero. See Detection limit.

Method of least squares: See Least squares method.

Method performance study: See Interlaboratory method validation study.

Method quantification limit (MQL): See Limit of quantification and also Method detection limit.

Minimum detectable level: See Method detection limit.

Mode: the most frequent value or values in a data set.

Multipoint calibration: the determination of correct scale values by measuring or comparing instrument responses at a series of standardized analyte concentrations; used to define the range for generating quantitative data of acceptable quality.

Noise: the sum of random errors in the response of a measuring instrument.

Normal distribution: an idealized probability density function that approximates the distribution of many random variables associated with measurements of natural phenomena and takes the form of a symmetric "bell-shaped curve."

Observation: a fact or occurrence that is recognized and recorded.

Observed value: the magnitude of a specific measurement; a variable; a unit of space, time or quantity; a datum. The observed value is that reported before correction for a blank value. See Corrected value.

Outlier: an observed value that appears to be discordant from the other observations in a sample. One of a set of observations that appears to be discordant from the others. The declaration of an outlier is dependent on the

significance level of the applied identification test. See also Significance level.

Parameter: any quantity such as a mean or a standard deviation characterizing a population. Commonly misused for "variable", "characteristic" or "property."

Percentage standard deviation: synonym for Relative standard deviation.

Performance evaluation audit: a type of audit in which the quantitative data generated in a measurement system are obtained independently and compared with routinely obtained data to evaluate the proficiency of an analyst or laboratory.

Performance evaluation sample (PE sample): a sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified performance limits. See Blind sample and Performance evaluation audit.

Population: all possible items or units which possess a variable of interest and from which samples may be drawn.

Precision: the degree to which a set of observations or measurements of the same property, usually obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. See also Standard deviation and Variance.

Preventative maintenance: an orderly program of activities designed to ensure against equipment failure.

Primary reference standard: See Primary standard.

Primary standard: a substance or device, with a property or value that is unquestionably accepted (within specified limits) in establishing the value of the same or related property of another substance or device.

Probability: a number between zero and one inclusive, reflecting the limiting proportion of the occurrence of an event in an increasingly large number of identical trials, each of which results in either the occurrence or nonoccurrence of the event.

Probability sampling: sampling in which: (a) every member of the population has a known probability of being included in the sample; (b) the sample is drawn by some method of random selection consistent with these probabilities; and (c) the known probabilities of inclusion are used in forming estimates from the sample. The probability of selection need not be equal for members of the population.

Procedure: a set of systematic instructions for performing an operation.

Proficiency testing: a systematic program in which one or more standardized samples is analyzed by one or more laboratories to determine the capability of each participant.

Property: a quality or trait belonging and peculiar to a thing; a response variable is a measure of a property. Synonym for Characteristic.

Protocol: a detailed written procedure for a field and/or laboratory operation (e.g., sampling, analysis) which must be strictly adhered to.

Quality: the sum of features and properties/characteristics of a product or service that bear on its ability to satisfy stated needs.

Quality assessment: the evaluation of environmental data to determine if they meet the quality criteria required for a specific application.

Quality assurance (QA): an integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence.

Quality Assurance Narrative Statement: a description of the quality assurance and quality control activities to be followed for a research project.

Quality Assurance Objectives: the limits on bias, precision, comparability, completeness and representativeness defining the minimal acceptable levels of performance as determined by the data user's acceptable error bounds.

Quality Assurance Program Plan (QAPP): a formal document describing the management policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an agency, organization or laboratory for ensuring quality in its products and utility to its users.

Quality Assurance Project Plan (QAPjP): a formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved.

Quality Circle: a small group of individuals from an organization or unit who have related interests and meet regularly to consider problems or other matters related to the quality of the product or process.

Quality control (QC): the overall system of technical activities whose purpose is to measure and control the

quality of a product or service so that it meets the needs of users. The aim is to provide quality that is satisfactory, adequate, dependable, and economical.

Quality control chart: See Control chart.

Quality control check sample: See Calibration standard.

Quality control sample: an uncontaminated sample matrix spiked with known amounts of analytes from a source independent from the calibration standards. It is generally used to establish intralaboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system. See also Check sample.

Quantitation limits: the maximum or minimum levels or quantities of a target variable that can be quantified with the certainty required by the data user.

Random: lacking a definite plan, purpose or pattern; due to chance.

Random error: the deviation of an observed value from a true value, which behaves like a variable in that any particular value occurs as though chosen at random from a probability distribution of such errors. The distribution of random error is generally assumed to be normal.

Random sample or subsample: a subset of a population or a subset of a sample, selected according to the laws of chance with a randomization procedure.

Random variable: a quantity which may take any of the values of a specified set with a specified relative frequency or probability. It is defined by a set of possible values, and by an associated probability function giving the relative frequency of occurrence of each possible value.

Randomization: the arrangement of a set of objects in a random order; a set of treatments applied to a set of experimental units is said to be randomized when the treatment applied to any given unit is chosen at random from those available and not already allocated.

Randomness: a basic statistical concept and property implying an absence of a plan, purpose or pattern, or of any tendency to favor one outcome rather than another.

Range: the difference between the minimum and the maximum of a set of values.

Raw data: any original factual information from a measurement activity or study recorded in laboratory worksheets, records, memoranda, notes, or exact copies thereof and that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photographs, microfilm or microfiche copies,

computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments. If exact copies of raw data have been prepared (e.g., tapes which have been transcribed verbatim, dated, and verified accurate by signature), the exact copy or exact transcript may be substituted.

Reagent blank: a sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps to error in the observed value.

Reagent grade: the second highest purity designation for reagents which conform to the current specifications of the American Chemical Society Committee on Analytical Reagents.

Records system (or plan): a written, documented group of procedures describing required records, steps for producing them, storage conditions, retention period and circumstances for their destruction or other disposition.

Recovery efficiency: in an analytical method, the fraction or percentage of a target analyte extracted from a sample containing a known amount of the analyte.

Reference material: a material or substance, one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or assigning values to materials.

Reference method: a sampling and/or measurement method which has been officially specified by an organization as meeting its data quality requirements.

Reference standard: See Calibration standard.

Relative standard deviation: the standard deviation expressed as a percentage of the mean recovery, i.e., the coefficient of variation multiplied by 100.

Reliability: the likelihood that an instrument or device will function under defined conditions for a specified period of time.

Repeatability: the degree of agreement between mutually independent test results produced by the same analyst using the same test method and equipment on random aliquots of the same sample within a short period of time.

Replicability: See Repeatability.

Replicate: an adjective or verb referring to the taking of more than one sample or to the performance of more than one analysis. Incorrectly used as a noun in place of replicate analysis. Replicate is to be used when referring to more than two items. See Duplicate.

Replicate analyses or measurements: the analyses or measurements of the variable of interest performed identically on two or more subsamples of the same sample within a short time interval. See Duplicate analyses or measurements.

Replicate samples: two or more samples representing the same population characteristic, time, and place, which are independently carried through all steps of the sampling and measurement process in an identical manner. Replicate samples are used to assess total (sampling and analysis) method variance. Often incorrectly used in place of the term "replicate analysis." See Duplicate samples and Replicate analysis.

Representative sample: a sample taken so as to reflect the variable(s) of interest in the population as accurately and precisely as specified. To ensure representativeness, the sample may be either completely random or stratified depending upon the conceptualized population and the sampling objective (i.e., upon the decision to be made.)

Representativeness: the degree to which data accurately and precisely represent the frequency distribution of a specific variable in the population; a data quality indicator.

Reproducibility: the extent to which a method, test or experiment yields the same or similar results when performed on subsamples of the same sample by different analysts or laboratories.

Response variable: a variable that is measured when a controlled experiment is conducted.

Result: the product of a calculation, test method, test or experiment. The result may be a value, data set, statistic, tested hypothesis or an estimated effect.

Review: the assessment of management/operational functions or activities to establish their conformance to qualitative specifications or requirements. See Management systems review and also, Audit.

Risk: the probability or likelihood of an adverse effect.

Risk (statistical): the expected loss due to the use of a given decision procedure.

Robustness: (in)sensitivity of a statistical test method to departures from underlying assumptions. See Ruggedness.

Rounded number: a number, reduced to a specified number of significant digits or decimal places using defined criteria.

Routine method: a defined plan of procedures and techniques used regularly to perform a specific task.

Ruggedness: the (in)sensitivity of an analytical test method to departures from specified analytical or environmental conditions. See Robustness.

Ruggedness testing: the carefully ordered testing of an analytical method while making slight variations in test conditions (as might be expected in routine use) to determine how such variations affect test results. If a variation affects the results significantly, the method restrictions are tightened to minimize this variability.

Sample: a part of a larger whole or a single item of a group; a finite part or subset of a statistical population. A sample serves to provide data or information concerning the properties of the whole group or population.

Sample data custody: See Chain-of-custody.

Sample variance (statistical): a measure of the dispersion of a set of values. The sum of the squares of the difference between the individual values of a set and the arithmetic mean of the set, divided by one less than the number of values in the set. (The square of the sample standard deviation.) See also Measure of dispersion.

Sampling: the process of obtaining a representative portion of the material of concern.

Sampling equipment blank: a clean sample that is collected in a sample container with the sample-collection device and returned to the laboratory as a sample. Sampling equipment blanks are used to check the cleanliness of sampling devices. See Dynamic blank.

Sampling error: the difference between an estimate of a population value and its true value. Sampling error is due to observing only a limited number of the total possible values and is distinguished from errors due to imperfect selection, bias in response, errors of observation, measurement or recording, etc. See also Probability sampling.

Scheduled maintenance: See Preventative maintenance.

Screening test: a quick test for coarsely assessing a variable of interest.

Secondary standard: a standard whose value is based upon comparison with a primary standard.

Selectivity (analytical chemistry): the capability of a method or instrument to respond to a target substance or constituent in the presence of nontarget substances.

Sensitivity: capability of method or instrument to discriminate between measurement responses representing different levels of a variable of interest.

Significance level: the magnitude of the acceptable probability of rejecting a true null hypothesis or of accepting a false null hypothesis; the difference between the hypothetical value and the sample result.

Significant digit: any of the digits 0 through 9, excepting leading zeros and some trailing zeros, which is used with its place value to denote a numerical quantity to a desired rounded number. See Rounded number.

Significant figure: See Significant digit.

Single operator precision: the degree of variation among the individual measurements of a series of determinations by the same analyst or operator, all other conditions being equal.

Site: the area within boundaries established for a defined activity.

Span-drift: the change in the output of a continuous monitoring instrument over a stated time period during which the instrument is not recalibrated.

Span-gas: a gas of known concentration which is used routinely to calibrate the output level of an analyzer. See Calibration check standard.

Specimen: See Sample.

Spike: a known mass of target analyte added to a blank sample or subsample; used to determine recovery efficiency or for other quality control purposes.

Spiked laboratory blank: See Spiked reagent blank.

Spiked reagent blank: a specified amount of reagent blank fortified with a known mass of the target analyte; usually used to determine the recovery efficiency of the method.

Spiked sample: a sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Spiked samples are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Spiked sample duplicate analysis: See Duplicate analysis and Spiked sample.

Split samples: two or more representative portions taken from a sample or subsample and analyzed by different analysts or laboratories. Split samples are used to replicate the measurement of the variable(s) of interest.

Standard (measurement): a substance or material with a property quantified with sufficient accuracy to permit its use to evaluate the same property in a similar substance or material. Standards are generally prepared by placing a reference material in a matrix. See Reference material.

Standard addition: the procedure of adding known increments of the analyte of interest to a sample to cause increases in detection response. The level of the analyte of interest present in the original sample is subsequently established by extrapolation of the plotted responses.

Standard curve: See Calibration curve.

Standard deviation: the most common measure of the dispersion or imprecision of observed values expressed as the positive square root of the variance. See Variance.

Standard material: See Standard (measurement), Reference material.

Standard method: an assemblage of techniques and procedures based on consensus or other criteria, often evaluated for its reliability by collaborative testing and receiving organizational approval.

Standard operating procedure (SOP): a written document which details the method of an operation, analysis or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks.

Standard reference material (SRM): a certified reference material produced by the U.S. National Institute of Standards and Technology and characterized for absolute content independent of analytical method.

Standard reference sample: See Secondary standard.

Standard solution: a solution containing a known concentration of analytes, prepared and verified by a prescribed method or procedure and used routinely in an analytical method.

Standardization: the process of establishing the quantitative relationship between a known mass of target material (e.g., concentration) and the response variable (e.g., the measurement system or instrument response.) See Calibration, Calibration curve and Multipoint calibration.

Statistic: an estimate of a population characteristic calculated from a data set (observed or corrected values), e.g., the mean or standard deviation.

Stratification: the division of a target population into subsets or strata which are internally more homogeneous with respect to the characteristic to be studied than the population as a whole.

Stratified sampling: the sampling of a population that has been stratified, part of the sample coming from each stratum. See Stratification.

Stock solution: a concentrated solution of analyte(s) or reagent(s) prepared and verified by prescribed

procedure(s), and used for preparing working standards or standard solutions.

Subsample: a representative portion of a sample. A subsample may be taken from any laboratory or a field sample. See Aliquant, Aliquot, Split sample and Test portion.

Surrogate analyte: a pure substance with properties that mimic the analyte of interest. It is unlikely to be found in environmental samples and is added to them for quality control purposes.

Surveillance: the act of maintaining supervision of or vigilance over a well-specified portion of the environment so that detailed information is provided concerning the state of that portion.

Synthetic sample: a manufactured sample. See Quality control sample.

Systematic error: a consistent deviation in the results of sampling and/or analytical processes from the expected or known value. Such error is caused by human and methodological bias.

Systems audit: See Technical systems audit.

Systems error: See Total systems error.

Target: the chosen object of investigation for which qualitative and/or quantitative data or information is desired, e.g., the analyte of interest.

Technical systems audit: a thorough, systematic on-site, qualitative review of facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system.

Technique: a principle and/or the procedure of its application for performing an operation.

Test: a procedure used to identify or characterize a substance or constituent. See Method.

Test data: See Data.

Test determination: See Determination.

Test method: See Method.

Test portion: a subsample of the proper amount for analysis and measurement of the property of interest. A test portion may be taken from the bulk sample directly, but often preliminary operations, such as mixing or further reduction in particle size, are necessary. See Subsample.

Test result: a product obtained from performing a test determination. See Test determination.

Test sample: See Test portion.

Test specimen: See Test portion.

Test unit: See Test portion.

Time-proportioned sample: a composite sample produced by combining samples of a specific size, collected at preselected, uniform time intervals.

Total Quality Management (TQM): the process whereby an entire organization, led by senior management, commits to focusing on quality as a first priority in every activity. TQM implementation creates a culture in which everyone in the organization shares the responsibility for continuously improving the quality of products and services, (i.e., for "doing the right thing, the right way, the first time, on time.") in order to satisfy the customer.

Total measurement error: the sum of all the errors that occur from the taking of the sample through the reporting of results; the difference between the reported result and the true value of the population that was to have been sampled.

Traceability: an unbroken trail of accountability for verifying or validating the chain-of-custody of samples, data, the documentation of a procedure, or the values of a standard.

Treatment (experimental): an experimental procedure whose effect is to be measured and compared with the effect of other treatments.

Trip blank: a clean sample of matrix that is carried to the sampling site and transported to the laboratory for analysis without having been exposed to sampling procedures.

Tuning: the process of adjusting a measurement device or instrument, prior to its use, to ensure that it works properly and meets established performance criteria.

Type I error, (alpha error): an (incorrect) decision resulting from the rejection of a true hypothesis. (A false positive decision.)

Type II error, (beta error): an (incorrect) decision resulting from acceptance of a false hypothesis. (A false negative decision.)

Uncertainty: a measure of the total variability associated with sampling and measuring that includes the two major error components: systematic error (bias) and random error.

Universe: See Population.

Upper control limit: See Control limit.

Upper warning limit: See Warning limit.

User check: an evaluation of a written procedure (e.g., chemical analysis method) for clarity and accuracy in which an independent laboratory analyzes a small number of spiked samples, following the procedure exactly.

Valid study: a study conducted in accordance with accepted scientific methodology, the results of which satisfy predefined criteria.

Validated method: a method which has been determined to meet certain performance criteria for sampling and/or measurement operations.

Validation: the process of substantiating specified performance criteria.

Value: the magnitude of a quantity. A single piece of factual information obtained by observation or measurement and used as a basis of calculation.

Variable: an entity subject to variation or change.

Variance: See Sample variance.

Verifiable: the ability to be proven or substantiated.

Warning limit: a specified boundary on a control chart that indicates a process may be going out of statistical control and that certain precautions are required. For example; for a Shewhart \bar{x} chart the warning limits are placed at plus and minus two standard deviations of the mean (i.e., at the 95% confidence interval.)

Working standard: See Secondary standard.

Zero drift: the change in instrument output over a stated time period of nonrecalibrated, continuous operation, when the initial input concentration is zero; usually expressed as a percentage of the full scale response.

Acronyms

AAPCO	American Association of Pest Control Officials
ACS	American Chemical Society
ADQ	Audit of Data Quality
ANPRM	Advanced Notice of Proposed Rule Making
AOAC	Association of Official Analytical Chemists
AQCR	Air Quality Control Region
ARAR	Applicable or Relevant and Appropriate Standards, Limitations, Criteria, and Requirements
ASTM	American Society for Testing and Materials
BACT	Best Available Control Technology
BDAT	Best Demonstrated Available Technology
CA	Cooperative Agreement
CAA	Clean Air Act
CAIR	Comprehensive Assessment Information Rule
CAR	Corrective Action Report
CAS	Chemical Abstract Service
CBI	Compliance Biomonitoring Inspection
CEI	Compliance Evaluation Inspection
CEPP	Chemical Emergency Preparedness Program
CERCLA	Comprehensive Environmental Responsibility, Compensation and Liability Act
CFR	Code of Federal Regulations
CGI	Comprehensive Ground Water Inspection
CGME	Comprehensive Ground-Water Monitoring Evaluation
CIS	Compliance Inspection Strategy
CLP	Contract Laboratory Program
CME	Construction Management Evaluation
COE	U.S. Army Corps of Engineers
CRM	Certified Reference Material
CSI	Compliance Sampling Inspection

CV	Coefficient of Variation	HDPE	High Density Polyethylene
CWA	Clean Water Act	HRS	Hazard Ranking System
DL	Detection Limit	HWDMs	Hazardous Waste Data Management System
D&R	Demolition and Renovation	I/A	Innovative/Alternative (Technology)
DMR-QA	Discharge Monitoring Report—QA Program	I&M	Inspection and Maintenance
DPO	Deputy Project Officer	ICP	Inductivity Coupled Atomic Emission Plasma Spectrometry
DQO	Data Quality Objectives	ICR	Information Collection Request
DU	Decision Unit	IFB	Invitation for Bidders
EDCA	Environmental Data Collection Activity	IMR	Immediate Removal
EDL	Estimated Detection Level	IMVS	Interlaboratory Method Validation Study
EHMW	Extra High Molecular Weight	IRM	Initial Remedial Measure
EMAP	Environmental Monitoring and Assessment Program	ISS	Interim Status Survey
EMS	Enforcement Management System	IU	Industrial User
EMPC	Estimated Maximum (Protocol) Concentration	LAER	Lowest Achievable Emissions Rate
ERAMS	Environmental Radiation Ambient Monitoring System	LOEC	Lowest Observed Effect Concentration
ERC	Emergency Response Contractor	LOIS	Loss of Interim Status
ERCS	Emergency Response Cleanup Service	LOQ	Limit of Quantification
ERT	Emergency Response Team	MCL	Maximum Contaminant Level
ESAT	Environmental Service Assistance Team	MCLG	Maximum Contaminant Level Goals
ESP	Electrostatic Precipitator	MCP	Municipal Compliance Plan
FDA	Food and Drug Administration	MDL	Method Detection Limit
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act	MIT	Mechanical Integrity Test
FISMP	Field Inspection with Sampling	MPRSA	Marine Protection, Research and Sanctuaries Act
FIT	Field Investigation Team	MSR	Management Systems Review
FR	Federal Register	MSIS	Model State Information System
FRDS	Federal Reporting Data System	MTR	Minimum Technology Requirements
FS	Feasibility Study	NAAQS	National Ambient Air Quality Standards
GLP	Good Laboratory Practice	NADB	National Aerometric Data Bank
		NAMS	National Air Monitoring Stations

NBAR	Non-binding Preliminary Allocation of Responsibility	PCI	Pretreatment Compliance Inspection
NCLAN	National Crop Loss Assessment Network	PCS	Permit Compliance System
NCP	National Contingency Plan	PE	Performance Evaluation
NEDS	National Emissions Data Base	PE	Program Element
NEIC	National Enforcement Investigations Center (OECM, Denver)	PI	Principal Investigator
NESHAP	National Emission Standards for Hazardous Air Pollutants	PMC	Project Management Conference
NHANES	National Health and Nutrition Examination Study	PO	Project Officer
NPDWR	National Primary Drinking Water Regulations	POTW	Publicly-Owned Treatment Works
NIOSH	National Institute of Occupational Safety and Health	PQL	Practical Quantitation Limits
NIST	National Institute of Standards and Technology	PRP	Potential Responsible Party
NMP	National Municipal Policy	PSD	Prevention of Significant Deterioration
NOD	Notice of Deficiency	PTE	Potential to Emit
NOEC	No-Observed Effect Concentration	PTI	Permit to Install
NOPEs	Non-Occupational Pesticide Exposure Study	PWSSP	Public Water System Supervision Program
NPAP	National Performance Audit Program	QA	Quality Assurance
NPDES	National Pollutant Discharge Elimination System	QAMS	Quality Assurance Management Staff
NPHAP	National Pesticide Hazard Assessment Program	QAPjP	Quality Assurance Project Plan
NPL	National Priority List	QAPP	Quality Assurance Program Plan
NPO	National Program Office	QC	Quality Control
NPRM	Notice of Proposed Rule Making	QNCR	Quarterly Non-Compliance Report
NRC	National Resource Center	RA	Remedial Action
NSPS	New Source Performance Standards	RACM	Reasonably Available Control Measures
NSR	New Source Review	RACT	Reasonably Available Control Technologies
NTIS	National Technical Information Service	RAS	Routine Analytical Service (CLP)
O&M	Operation and Management	RCRA	Resource Conservation and Recovery Act
OSHA	Occupational Safety and Health Administration	RD	Remedial Design
PA/SI	Preliminary Assessment/Site Inspection	RE	Relative Error
PA	Preliminary Assessment	REM	RI/FS Contractors
PARS	Precision and Accuracy Reporting System	RFA	RCRA Facility Assessment (RCRA site version of PA/SI)
		RFD	Reference Doses

RFP	Request for Proposals	TCM	Traffic Control Measures
RFP	Reasonable Further Progress (toward attainment)	TDD	Technical Direction Document
RI	Reconnaissance Inspection	TEAM	Total Exposure Assessment Methodology
RI	Remedial Investigation	TEGD	Technical Enforcement Guidance Document
RI/FS	Remedial Investigation/Feasibility Study	TMDL	Total Maximum Daily Load
RMCL	Recommended Maximum Contaminant Level	TOC	Total Organic Carbon
ROD	Record of Decision	TOX	Total Organic Halides
RPM	Remedial Project Manager	TQM	Total Quality Management
RSCC	Regional Sample Control Center (CLP)	TSA	Technical System Audit
RSD	Risk Specific Doses	TSCA	Toxic Substances Control Act
SAP	Sample Analysis Plan	TSD	Temporary Storage and Disposal
SARA	Superfund Amendments and Reauthorizations Act of 1986	TSDF	Temporary Storage and Disposal Facility
SAROAD	Storage and Retrieval of Aeromagnetic Data	TSP	Total Suspended Particulates
SAS	Special Analytical Service (CLP)	TTO	Total Toxic Organics (NPDES permits)
SBO	Senior Budget Official	UIC	Underground Injection Control
SCAP	Superfund Comprehensive Accomplishment Plan	UST	Underground Storage Tanks
SDWA	Safe Drinking Water Act	VE	Value Engineering
SI	Site Inspection	VE	Visual Emissions
SIF	Site Inspection Follow-up	VOA	Volatile Organics Analysis
SIP	State Implementation Plan	VOC	Volatile Organic Contaminants
SLAM	State and Local Air Monitoring Stations	VOC	Volatile Organic Chemicals
SNC	Significant Non-Compliance	WAM	Work Assignment Manager
SNUR	Significant New Use Rule (TSCA 5(e))	WAP	Waste Analysis Plan
SOP	Standard Operating Procedure	WENDB	Water Enforcement National Data Base
SRM	Standard Reference Material	WLA	Waste Load Allocation
SS	Site Survey	WQM	Waste Quality Management
SSID	Site/Spill Identification Designation		
STC	Special Terms and Conditions		
TAT	Technical Assistance Team		
TCLP	Toxicity Characteristic Leaching Procedure		

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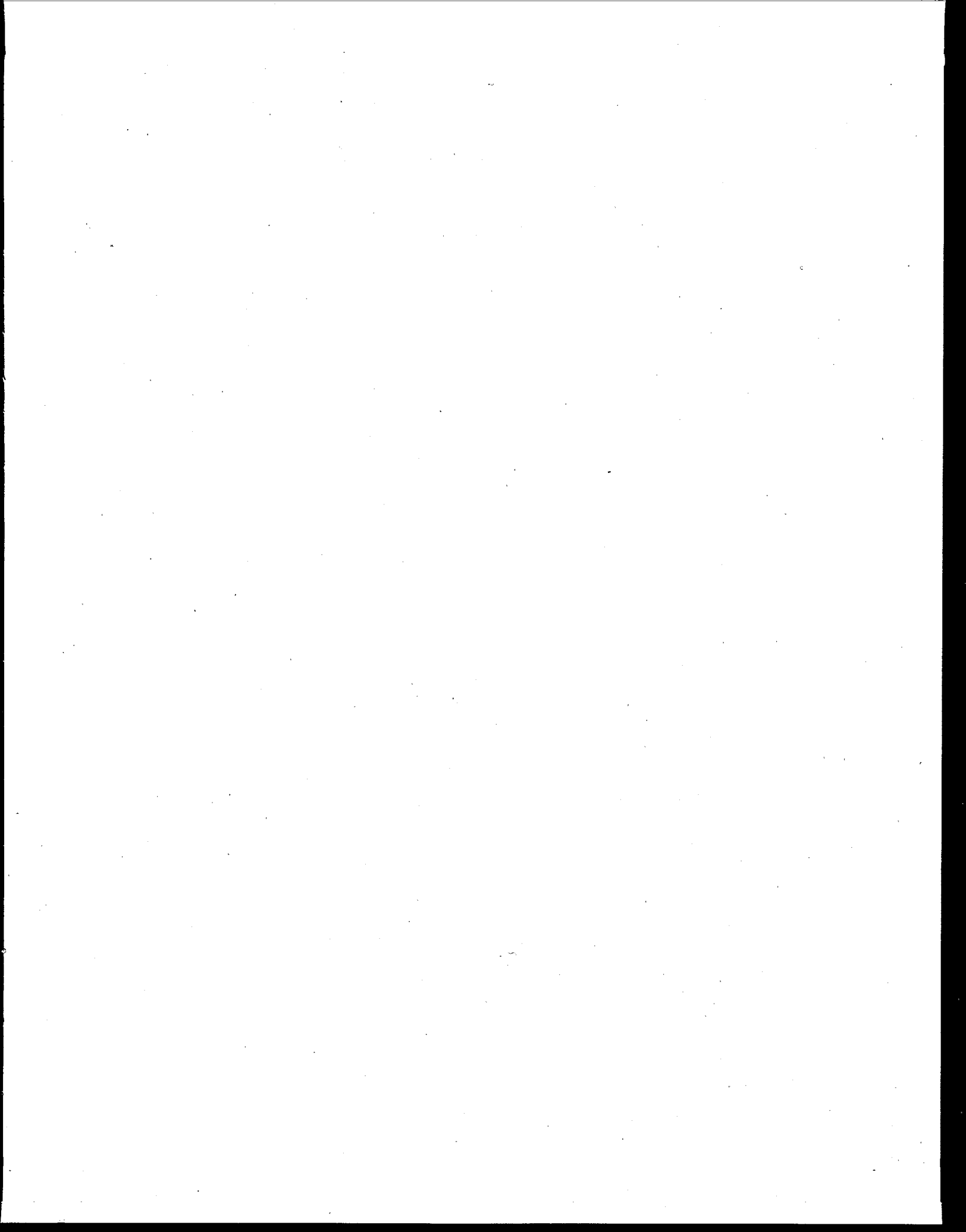
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