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Archival Description Standards as a Knowledge Organization System: Challenges for Representing Climate-Related Records

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Abstract

The growing severity of the climate emergency has intensified the production of records related to risk management, environmental monitoring, and climate adaptation strategies. However, information about extreme climate events and their impacts is often dispersed across various documentary types and institutional archives, hindering their identification and retrieval. In this context, archival description plays a key role in enabling access to such records. This paper discusses archival descriptive standards—in particular ISAD(G) and the Records in Contexts (RiC) model—as structures that organize the representation and retrieval of information, as well as their articulation with Knowledge Organization Systems (KOS), which can function as complementary layers in the semantic enrichment of these representations. Through a conceptual analysis of the "Scope and Content" element, the study argues that while ISAD(G) effectively supports contextual representation, its descriptive structure may be insufficient to capture complex environmental phenomena. Finally, the paper discusses the possibilities of using complementary semantic layers based on Knowledge Organization Systems (KOS), such as controlled vocabularies, to enhance the representation and retrieval of climate-related archival records.

1.0 Introduction

The climate emergency has intensified in Brazil and several regions worldwide, where infrastructure vulnerabilities and socioeconomic inequalities tend to amplify the impacts of extreme events. In this context, the production of documents such as Climate Adaptation Plans plays a significant role in gathering information intended for territorial planning and risk management. However, Sousa et al. (2023, 396) point out that:

"[...] part of the documents found can be classified as primers, as they approach the topic superficially and have an educational rather than a performance or prescriptive nature. Most of these documents lack important details and may not be applicable to reality."

Given these limitations, it is important to consider that information about climate change and institutional response strategies may be dispersed across different documentary types, such as technical reports and institutional environmental studies.

In this context, archives play a fundamental role as informational mediators, capable of preserving records produced in situations of climate vulnerability. However, the effective retrieval of archival records depends on descriptive functions, archival standards, and conceptual models that guide this process, such as the General International Standard Archival Description (ISAD(G)) and the Records in Contexts (RiC) model.

This paper argues that archival descriptive standards can be understood as Knowledge Organization Systems (KOS) that structure documentary contexts, but that complex domains such as climate change require complementary semantic layers based on KOS to enhance information retrieval. To support this discussion, a bibliographic, exploratory, and documentary study was conducted, guided by the analysis of concepts related to archival description, knowledge organization (KO), and climate change, based on sources retrieved from databases such as Google Scholar, Periódicos CAPES, BRAPCI, and SciELO.

It is assumed that the incorporation of granular metadata—such as categories of climate phenomena, levels of severity (for example, millimeters of rainfall per hour), affected populations, and spatial granularity—can improve the identification of records related to extreme events. In this way, the semantic enrichment of archival description may foster information retrieval, expand access to records, and contribute to interoperability among systems in the context of the climate emergency.

2.0 Descriptive Standards as Knowledge Organization Systems

In Archival Science, transformations in how records are produced, organized, retrieved, and accessed—particularly in digital environments—have generated significant changes in professional practices and the field's theoretical foundations.

As observed by Tognoli et al. (2019), such transformations have expanded the role of archivists, linking their work to records management, governmental transparency, and the promotion of social justice. This shift moves archivists beyond the traditional role of mere custodians of records and requires professionals to continuously rethink archival practices.

In this context, the approximation across different fields of knowledge becomes necessary, particularly for those concerned with building theoretical and methodological frameworks to organize and represent socially produced knowledge in dynamic informational environments.

For the purposes of this study, we adopt the definition of Knowledge Organization proposed by Hjørland (2008, 86), who defines it as a field dedicated to activities such as the "description of documents, indexing and classification carried out in libraries, bibliographic databases, archives and other types of memory institutions." Regarding the relationship between Knowledge Organization and Archival Science, a connection can be observed in what has been termed "archival knowledge," understood as knowledge produced by a person or entity and organized into fonds (Tognoli et al. 2013).

Archival description, together with classification, is part of this set of archival practices aimed at organizing archives, since it seeks to organize and represent information about records in order to enable their management and retrieval. As Vital and Brascher (2016, 214) state, "[...] description deals with the organization and representation of information to manage and retrieve documents."

From this perspective, Barros (2015) emphasizes the need to reflect on archival representation, considering that description and classification constitute fundamental functions in the archival field. This understanding makes it possible to bring archival description closer to discussions in Knowledge Organization (KO), since both involve the organization and representation of concepts, relationships, and contexts that support access to and retrieval of information.

In addition to these practices, it is important to consider the role of Knowledge Organization Systems (KOS) in archival practice. According to Mazzocchi (2018), KOS correspond to a set of instruments designed to organize concepts and establish semantic relationships among them, enabling the representation, navigation, and retrieval of knowledge in different informational contexts.

Additionally, Zeng (2008) highlights that Knowledge Organization Systems (KOS) encompass different structures and levels of complexity, performing functions such as eliminating ambiguity, controlling synonyms, establishing relationships—both hierarchical and associative—and presenting appropriate relationships. The author organizes these systems into groups, including term lists, metadata-like models, classification and categorization systems, and relationship models, thereby demonstrating the diversity of approaches to the organization and representation of knowledge.

From this broader perspective, it can be argued that archival descriptive standards themselves can also be understood as specific forms of KOS, insofar as they structure conceptual categories, define entities, and establish relationships among informational elements.

In this sense, archival descriptive standards play a fundamental role in the standardization of information representation and retrieval, since they establish elements intended to record and describe the scope and content of records, thereby strengthening the search for contextual information and supporting records management through organizational processes.

ISAD(G) represents a milestone in the standardization of archival description by establishing guidelines aimed at the consistent representation of archival records. According to the standard, description aims to "[...] identify and explain the context and content of archival material in order to promote its accessibility" (International Council on Archives 2000, 7). From this perspective, ISAD(G) contributes to the standardization of the representation of information contained in these records, favoring their retrieval, organization, and access across different institutional contexts.

Thus, standards such as ISAD(G) and, more recently, the Records in Contexts (RiC) model organize archival knowledge through a set of entities, attributes, and relationships that guide the representation of the contexts of record creation and retrieval.

The Records in Contexts (RiC) model was developed by the Experts Group on Archival Description (EGAD), established within the International Council on Archives (ICA), in order to analyze the possibilities for integrating existing archival description models. According to the International Council on Archives (2023, 1), "RiC-CM is a high-level conceptual model that focuses on intellectually identifying and describing records, the people that created and use(d) them, and the activities pursued by the people that the records both facilitate and document." By structuring description through entities and relationships, the model expands the possibilities for representing archival context, shifting the focus from a record-centered description to a more relational approach among documents, agents, and the context of production, which constitute structuring elements of representation (Oliveira et al. 2024). This configuration makes it possible to highlight the connections established among the different categories involved in the creation and use of records.

However, when analyzed in light of complex and highly dynamic informational domains—such as climate change and extreme events—these structures reveal certain limitations. Although they are effective in representing organic relationships between records, creators, and administrative functions, such standards were primarily designed to describe relatively stable institutional contexts and not necessarily to represent complex environmental phenomena characterized by multiple spatial, temporal, and socio-environmental variables.

3.0 Limits of archival description for representing climate-related phenomena

ISAD(G) was developed to represent the content and context of archival records and facilitate access (ICA 2000). For the purposes of this paper, we consider only the Content and Structure Area of ISAD(G), which brings together elements related to the scope and content (3.1) of the units of description. With regard to scope, the standard addresses the time period and geographical location. Content, in turn, refers to documentary forms, subjects, and administrative processes, providing for the recording of information related to the units of description.

From the perspective of archival representation, Linden et al. (2017) point out that descriptive standards include fields for content and context. However, the authors emphasize that "there is no consensus as to what should be described within both fields" (Linden et al. 2017, 51). As a result, these standards are considered structural rather than content standards; that is, they standardize the fields that must be completed to retrieve the content and context of records, but they do not establish standards for how this should be done or which elements should comprise them.

Based on this understanding, archival representation is not limited to the application of established descriptive elements but also involves selecting information relevant to understanding and retrieving records. This issue becomes particularly significant for documents related to climate change and extreme events, since these phenomena involve

multiple informational dimensions that challenge the conventional forms of representation used in archival description.

In general terms, ISAD(G) aims to "enable users to evaluate the potential relevance of the unit of description" (ICA 2000, 30). However, the guidance provided remains at a broad level and does not specify more detailed forms of representation for complex phenomena such as climate-related events. Although ISAD(G) plays a fundamental role in the standardization of archival description and in the representation of the context of record creation, its descriptive elements were designed in broad terms to allow their application across different types of collections and institutions. In this sense, the standard does not establish restrictions on the use of controlled vocabularies, thematic access points, or other complementary indexing mechanisms that may contribute to a more specific representation of documentary content.

In this context, the Records in Contexts (RiC) model stands out, as it was developed to expand the possibilities for representing records and their contexts of creation, agents, and activities.

Unlike more hierarchical descriptive models, RiC favors a relational understanding of archival records, enabling the highlighting of the multiple contexts of their creation, use, and circulation. In the case of documents related to climate change and extreme events, the model can support more complex descriptions by enabling associations among records, climate phenomena, affected territories, creating institutions, impacted communities, and administrative actions resulting from these events. However, its limitations lie in the fact that RiC provides a conceptual structure for representing relationships, but does not, by itself, define which terms, categories, or vocabularies should be used to name and qualify specific climate phenomena. For this reason, its application can be strengthened through articulation with Knowledge Organization Systems (KOS), such as controlled vocabularies, thesauri, and thematic taxonomies, which can provide greater semantic precision to the description and retrieval of climate-related archival records.

This observation also applies to ISAD(G). Thus, the point is not to claim that ISAD(G) prevents a more detailed thematic representation of records related to climate change. On the contrary, the standard allows archival institutions to adopt additional instruments to organize and retrieve information. However, its descriptive elements—particularly in the Content and Structure Area—are formulated at a relatively general level and do not, by themselves, provide specific guidelines for representing complex and multivariable phenomena, such as extreme climate events.

In this context, archival representation can be enriched by a complementary semantic layer built on Knowledge Organization Systems. Rather than replacing the descriptive elements established by archival standards, such systems can operate in an integrated manner with description, contributing to a more consistent and specific representation of complex informational domains. Among these systems, controlled vocabularies, authority files, and thesauri stand out, as they enable terminological standardization, conceptual organization, and the establishment of relationships among concepts relevant to information retrieval, organization, and access.

At a more advanced level of semantic representation, these complementary layers may also support the future development of knowledge graphs, capable of connecting archival records to agents, places, events, hazards, impacts, and institutional responses. In this sense, knowledge graphs should be understood as relational infrastructures that depend on controlled vocabularies, authority control, taxonomies, thesauri, or ontologies to ensure semantic consistency. Although their implementation exceeds the scope of this paper, they point to a promising direction for expanding the interoperability and analytical potential of archival descriptions related to climate change. Table 1 demonstrates the descriptive standards and the possible complementary semantic layers discussed so far.

Table 1 Descriptive standards and complementary semantic layers for climate-related archival records

Resource	Main function	Contribution to climate-related archival description	Limitation
ISAD(G)	Standardizes archival description through descriptive areas and elements	Supports the representation of context, scope, content, dates, provenance, and institutional custody	Does not provide specific vocabularies or detailed categories for complex climate phenomena
Records in Contexts (RiC)	Models archival description through entities, attributes, and relationships	Enables relational representation among records, agents, activities, places, events, and contexts	Requires complementary semantic instruments to name and qualify specific climate-related phenomena
Controlled vocabularies and thesauri	Standardize terms and establish semantic relationships	Improve consistency in the representation of hazards, impacts, affected territories, and types of events	Depend on adequate selection, maintenance, and institutional adoption
Ontologies	Formalize concepts and relationships within a domain	Can support semantic interoperability and conceptual modeling of climate-related records	Require more complex modeling and technical infrastructure
Knowledge graphs	Connect entities and relationships in a machine-readable semantic structure	May integrate records, agents, places, hazards, impacts, and institutional responses	Depend on data quality, authority control, semantic modeling, and institutional capacity

In the context of climate change and extreme events, specialized terminological resources can contribute to this semantic enrichment. Examples include the terminological resources made available by the United Nations Office for Disaster Risk Reduction (UNDRR), among them the Disaster Risk Reduction (DRR) Glossary, the Sendai Framework Terminology on Disaster Risk Reduction, the Hazard Information Profiles (HIPs), and the Disasters A to Z resource, which bring together standardized definitions and concepts related to different types of hazards and disasters. The incorporation of these resources into archival description can support the representation of aspects such as event type, severity, geographical location, and impacts, functioning as relevant characteristics for a more detailed and comprehensive understanding of records.

In addition, the controlled vocabulary of the Global Change Master Directory (GCMD) is noteworthy, as it organizes keywords in a multilevel hierarchical structure, supporting terminological standardization for more consistent representation and retrieval of metadata related to a variety of categories, such as Earth science, granule data formats, and other categories.

Thus, a record concerning a flood could retain its archival description according to ISAD(G) or the Records in Contexts (RiC) model, while being complemented by a semantic layer based on controlled terms and Knowledge Organization resources. In an applied example, such as technical reports issued by the Civil Defense of Rio de Janeiro, elements already present in the documentary structure—such as date, municipality, registration protocol, disaster level, causes and recurrence, human, material, and environmental damage, as well as response actions and resource mobilization—could be associated with standardized terms referring to event types, impacts, geographical location, and categories of critical infrastructure. This articulation between archival description and controlled vocabularies enables a more detailed and structured representation of documents, expanding their possibilities for information access, organization, and analysis.

4.0 Conclusion

This article discussed the possibilities and limits of archival descriptive standards, particularly ISAD(G) and the Records in Contexts (RiC) model, for the representation and retrieval of archival records related to climate change and extreme events. The analysis showed that the limitations identified do not derive exclusively from the structure of ISAD(G), but also from institutional descriptive practices, representation policies adopted by archival institutions, and the functionalities of the information retrieval systems used to provide access to these collections. In many cases, the absence of more detailed semantic representation mechanisms may lead to the use of broad or generic terms in the subject field, making it difficult to identify records that document specific climate events.

In this context, it is important to consider complementary representation mechanisms capable of expanding the semantic granularity of archival description. The incorporation of more specific metadata and additional semantic layers can enrich the representation of records related to climate change, facilitating their retrieval in information systems and broadening access to relevant information for researchers, public managers, and other professionals involved in risk management and climate adaptation.

Thus, archival descriptive standards should not be understood as obstacles to the thematic representation of climate-related records, but as structural frameworks that can be complemented by Knowledge Organization Systems (KOS). Controlled vocabularies, taxonomies, thesauri, and thematic ontologies can function as semantic layers that support a more precise representation of complex phenomena, such as climate events, environmental impacts, territorial vulnerabilities, and social risks. Their integration into archival description may contribute to more granular access points, improve retrieval in complex information domains, and enhance interoperability among systems that handle environmental data and institutional records.

As a future research agenda, the use of knowledge graphs may be further explored as a more advanced semantic infrastructure for representing and connecting archival records related to climate change. By modeling relationships among records, agents, places, events, hazards, impacts, and institutional responses, knowledge graphs may support a more relational and contextualized representation of climate-related documentation. However, their implementation requires well-defined modeling decisions, authority control, data quality, semantic interoperability, and institutional capacity. For this reason, knowledge graphs should be understood not as an immediate solution, but as a promising line of investigation for expanding the articulation between archival description, Knowledge Organization Systems, and complex environmental domains.

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During the preparation of this work, the authors used *Grammarly pro* in order to check spelling and grammar. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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