# Table S1. PRISMA-ScR Checklist

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| --- | --- | --- | --- |
| Section | Item | PRISMA-ScR Checklist | Reported on Page # |
| **TITLE** | | |  |
| Title | 1 | Identify the report as a scoping review. | 1 |
| **ABSTRACT** | | |  |
| Structured Summary | 2 | Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives | 1 |
| **INTRODUCTION** | | |  |
| Rationale | 3 | Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach. | 2-3 |
| Objectives | 4 | Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives | 2-3 |
| **METHODS** | | |  |
| Protocol and registration | 5 | Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses. | 5 |
| Eligibility Criteria | 6 | Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale. | 5 |
| Information Sources | 7 | Describe all information sources in the search (e.g., databases with coverage dates and contact with authors to identify additional sources), and the date the most recent search was executed. | 5, Table 1, Table S3 |
| Search | 8 | Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated. | Table 1, Table S3 |
| Selection of sources of evidence | 9 | State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review. | 5-6 |
| Data Charting Process | 10 | Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators | Table S4 |
| Data Items | 11 | List and define all variables for which data were sought and any assumptions and simplifications made | Table S4 |
| Critical appraisal of individual sources of evidence | 12 | If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate). | N/A |
| Synthesis of results | 13 | Describe the methods of handling and summarizing the data that were charted. | 7 |
| **RESULTS** | | |  |
| Selection of sources of evidence | 14 | Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram | 6-7 |
| Characteristics of sources of evidence | 15 | For each source of evidence, present characteristics for which data were charted and provide the citations. | Table S5 |
| Critical appraisal within sources of evidence | 16 | If done, present data on critical appraisal of included sources of evidence (see item 12). | N/A |
| Results of individual sources of evidence | 17 | For each included source of evidence, present the relevant data charted relating to the review questions and objectives. | 7-25 |
| Synthesis of results | 18 | Summarize and/or present the charting results as they relate to the review questions and objectives. | 7-25 |
| **DISCUSSION** | | |  |
| Summary of evidence | 19 | Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups. | 25 |
| Limitations | 20 | Discuss the limitations of the scoping review process. | 28 |
| Conclusions | 21 | Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps. | 29 |
| **Funding** | | |  |
| Funding | 22 | Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review. | 30 |

# Table S2. Literature search themes and combinations of search terms

|  |  |  |
| --- | --- | --- |
| Theme | Search terms | Combinations |
| Co-concept | * co-create * co-creation * co-design * co-produce * co-production * co-develop * co-development | co-creat\* OR co-design\* OR co-produc\* OR co-develop\* |
| Digital | * digital * virtual * online * internet * web | digital OR virtual OR online OR internet OR web |
| Tool/Platform | * tool * platform * website * application * app * information communication technology * online resource * portal * repository | tool OR platform OR website OR application OR app OR "information communication technology" OR ict OR "online resource" OR portal OR repository |
| Social innovation | * social good * social change * social justice * social innovation | "social good" OR "social change" OR "social justice" OR "social innovation" |
| Environment | * climate * sustainability * environment * ecology * biodiversity * conservation | climate OR sustainab\* OR environmental OR ecolog\* OR biodiversity OR conservation |

# Table S3. Literature search strategy and results

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Search No. | Database | Search String | Search Restrictions | Results |
| 1 | Scopus | (co-creat\* OR co-design\* OR co-produc\* OR co-develop\*) AND ( ( digital OR virtual OR online OR internet OR web ) NEAR/3 ( tool OR platform OR website OR application OR app OR "information communication technology" OR ict OR "online resource" OR portal OR repository) ) AND ("social good" OR "social change" OR "social justice" OR "social innovation" OR climate OR sustainab\* OR environmental OR ecolog\* OR biodiversity OR conservation) | Year: 2010 – 2025 Language: English Document type: article | 636 |
| 2 | Web Of Science | ^ | Year: 2010 – 2025 Language: English Document type: article | 409 |
| 3 | IEEE Xplore | ^ | Year: 2000 – 2024 Language: English Document type: article | 109 |

# Table S4. Data charting scheme

|  |  |  |
| --- | --- | --- |
| Category | Criteria | Information Abstracted |
| Reference | Reference Information | Paper Name, Authors, Year of publication |
| Place / Location | Geographic Boundaries1 | Country |
| Study Methods | Data Collection Methods | Secondary research, Interview, Survey, Workshop, Focus group, Community engagement session |
| Population/Setting | Stakeholders/Rightsholders | Participant types |
| Focus | Co-concepts | Co-concept framework used, theoretical foundation for co-concept |
| Tool2 | Name of tool, type, purpose |

1Based on the geographic descriptor reported in the study.

2Based on the tool descriptor reported in study.

# Table S5. Key characteristics of the articles included in the review

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Index | Title | Authors | Publication Year | Country | Data Collection Methods | Participant Types | Framework Used | Theoretical Foundation | Tool Name | Tool Type | Tool Purpose |
| 1 | Building Resilient Communities: The Environmental Observatory for Mining Projects and Climate Change Indicators | Bergamini, K.; Ángel, P.; Rugiero, V.; Medina, J.I.; Mollenhauer, K. | 2023 | Chile | Interviews, Surveys, Workshops | Academic, Community (civil society), Public & Private Organizations, Organized civil society | co-create | Yes, theoretical foundation for the co-creation process by the Public Innovation Lab (2017) | Environmental Observatory for Mining | Climate information tool | Developed in response to the gaps in access to and communication of environmental information in Chile and the need to build resilient communities in the face of climate change. Oriented both to the public and private sectors and to civil society |
| 2 | Toward Food Sovereignty for Coastal Communities of Eastern Québec: Co-designing A Website to Support Consumption of Edible Resources from the St. Lawrence River, Estuary, and Gulf | Fallon, Catherine; Lemire, Mélanie; Dumont, Dany; Parent, Elizabeth; Figueroa, Esteban; Cummings, Isabelle; Brousseau, Julie; Marquis, Marie; Paquet, Nicolas; Plante, Steve; Witteman, Holly O. | 2022 | Canada | Interviews, Workshops, Secondary research | Academic, Civil society, Organized civil society, Industry | co-design | No, but authors discuss "user-centered design" , Witteman et al. (2015) | Sustenance from our St. Lawrence | Climate information tool | A tool that facilitates informed choices about consuming local edible marine resources based on seasonal and regional availability, food safety, nutrition, and sustainability |
| 3 | Coproducing weather forecast information with and for smallholder farmers in Ghana: Evaluation and design principles | Gbangou, T.; Sarku, R.; Van Slobbe, E.; Ludwig, F.; Kranjac-Berisavljevic, G.; Paparrizos, S. | 2020 | Ghana | Interviews, Focus group discussion, Workshops | Academic, Community (civil society), Organized civil society | co-produce, co-design | No, other than saying "following a user-driven design approach" | FarmerSupport | Climate monitoring tool | A weather app used by farmers to collect real-time data on local forecast indicators and rainfall |
| 4 | Enabling Participatory Flood Monitoring Through Cloud Services | Grajales, D.P.; Degrossi, L.C.; Barros, D.D.R.; Khan, M.R.; Silva, F.L.E.; Cunha, M.A.; Trajber, R.; Porto de Albuquerque, J. | 2022 | Brazil | Community engagement activities, Focus groups | Academic, Community (civil society), Organized civil society | co-design | No, but the authors define "participatory design process" | "Dados à Prova d’Água" | Climate monitoring tool | A digital platform to collect, store and exchange flood-related data whilst also enabling citizen participation and engagement of communities with flood monitoring |
| 5 | EcoViz: co-designed environmental data visualizations to communicate ecosystem impacts, inform management, and envision solutions | Kendall-Bar, Jessica; Nealey, Isaac; Costello, Ian; Lowrie, Christopher; Nguyen, Kevin Huynh; Ponganis, Paul J.; Beck, Michael W.; Altintas, Ilkay | 2024 | United States | Secondary | Academic, Community (civil society), Organized civil society, Government | co-design | No, other than defining following universal design goals inspired by Harold et al. 2016 | EcoViz | Climate monitoring tool | A visualization tool showcasing multidimensional datasets to illustrate ecosystem changes above and below sea level as well as at the land-sea interface where coastal risks are rising |
| 6 | Pathway to design a multiparameter application for environmental monitoring to contribute to citizen well-being | Kouadio, J.S.; Grandvaux, E.; Waksberg, A. | 2024 | France | Workshops, Surveys, Secondary research (comparative study) | Academic, Organized civil society, NGO, Civil society | co-create | No | Under development | Climate monitoring tool | A digital tool that could be useful for urban planners in their process to build new green infrastructure and to apply participatory planning in urban NBS. This tool is designed to receive input from interested citizens about wellbeing characteristics such as thermal comfort and air, water and soil quality |
| 7 | Co-development of a risk assessment tool for use in First Nations water supply systems: A key step to water safety plan implementation | Lane, Kaycie; Fuller, Megan; Dyment, Travis; Gagnon, Graham | 2022 | Canada | Interviews, Community Engagement Sessions | Academic, Community, Government | co-develop | No | Risk assessment web-based application (RAWA) | Climate warning tool | To create a risk assessment web-based application (RAWA) to facilitate the hazard identification and risk assessment processes central to a WSP management approach |
| 8 | Community-Level, Participatory Co-Design for Landslide Warning with Implications for Climate Services | Lempert, RJ; Busch, L; Brown, R; Patton, A; Turner, S; Schmidt, J; Young, T | 2023 | United States, Alaska | Participant observation, Interviews, Surveys | Academic, NGO, Government, Community | co-design | Yes, discussing Moser (2016) "The sustainability literature often envisions co-design as a process in which academic and non-academic partners jointly develop research questions and research agendas as an initial phase in the co-production of knowledge" | Landslide warning system (LWS) | Climate warning tool | Empower Sitka residents to make their own decisions regarding landslide risk |
| 9 | The Chronicles of Kunene: The Lion, the Omuhimba and the Drone | Muashekele, Chris; Winschiers-Theophilus, Heike; Rodil, Kasper; Stanley, Colin; MuAshekele, Hina | 2022 | Southern Africa | Workshops, Secondary research | Academic, Civil society, Organized civil society | co-design | Yes, discussing community-based co-design | Wildlife Activity Recording (WAR) App | Climate monitoring tool | To achieve a constant non-obstructive collection and dissemination of wildlife data and continuous monitoring, providing insight and consciousness on environmental patterns such as movement and presence of predators |
| 10 | Participatory development of storymaps to visualize the spatiotemporal dynamics and impacts of extreme flood events for disaster preparedness | Munz, L; Kauzlaric, M; Mosimann, M; Fehlmann, A; Martius, O; Zischg, AP | 2023 | Switzerland | Interviews, Workshops | Academic, Organized civil society, Government | co-develop | No | Flood Dynamics | Climate monitoring tool | The goal is to providea dynamic visualization of extreme river floods in Switzerland and their impacts. Furthermore, the goal is to contribute to the inter-regional and national perspective on the hydraulic system concerning flood evolution and recession. |
| 11 | Holistic Model for Designing a Climate Service Application on the KaiOS Platform | Myllynpää, Ville; Haakana, Jani; Virtanen, Julius; Sutinen, Erkki | 2020 | Namibia | Secondary (i.e. literature review and passed field study experiences) | Academic, Civil society | co-design | No, but the authors do not define this platform as co-designed yet | Under development | Climate monitoring tool | to provide farmers with information, action options and notifications, based on the up-to-date forecast and current research, on how to cope with these changing climate conditions |
| 12 | Promoting environmental justice through integrated mapping approaches: The map of water conflicts in Andalusia (Spain) | Pedregal, B.; Laconi, C.; del Moral, L. | 2020 | Spain | Interviews, Workshops, Secondary research | Academic, Organized civil society, NGO, Civil society | co-create, co-produce, co-design | No, but authors discuss the theory of participatory mapping | Map-RedNCA | Climate information tool | A tool to promote action research in environmental justice and support the work of social movements through the creation of outreach material to document and make conflicts, debates, and social initiatives around water visible in Andalusia, and to serve as a potential tool to channel public participation in institutional water planning cycles |
| 13 | Participatory and Integrated Modelling under Contentious Water Use in Semiarid Basins | Rojas, R.; Castilla-Rho, J.; Bennison, G.; Bridgart, R.; Prats, C.; Claro, E. | 2022 | Chile | Workshops, Working session, Surveys | Academic, Civil society, Organized civil society, Government | co-design | No, but they discuss "participatory involvement" | SimCopiapo | Climate monitoring tool | The purpose of the tool is exploring “on-the-fly” alternative water management strategies and potential policy pathways with stakeholders |
| 14 | Digital media, political affect, and a youth to come: rethinking climate change education through Deleuzian dramatisation | Rousell, David; Wijesinghe, Thilinika; Cutter-Mackenzie-Knowles, Amy; Osborn, Maia | 2023 | Australia | Workshops | Academic, Industry, Community (youth/students) | co-design, co-develop | No, but defined “experience design”, and more specifically, to the design of “affective interfaces” | Climate Action Adventure! | Climate information tool | The application meant to bring together elements of climate education, environmental science, speculative fiction, gaming, social media, and hacktivism as techniques for dramatizing climate change |
| 15 | Mapeo | Ryan, Aliya; León Villalobos, José María; Rodríguez Lombardo, Mir | 2023 | Kenya | Participant observation, Focus groups | Academic, Community (civil society) | co-create | No, but they include a "ethical consideration" framework | Mapeo | Climate information tool | Mapeo was built with and for earth defenders to document environmental and human rights information and to collect data about their land |
| 16 | Co-designing a data platform to impact nature policy and management: experiences from the Dutch Caribbean | Verweij, P.; Cormont, A.; Hoetjes, P.; de Meyer, K.; van Bussel, T.; Roosenschoon, O.; Henkens, R.; Schmidt, A.; Janssen, S. | 2019 | Dutch Caribbean | Workshop | Academic, NGO (park managers & conservationnists), Government (island governments & dutch government) | co-design | No, other than "in co-design, users collaborate in exploring, developing and testing solutions to shared challenges. Co-design is a form of co-creation in which the initiative lies with a public organisation (Voorberg et al., 2015; Ramaswamy and Ozcan, 2018) and is considered to be useful for solving complex issues and realizing changes" | Dutch Caribbean Biodiversity Database (DCBD) | Climate information tool | A central knowledge store for policy making to assist nature management and spatial planning and for science to exchange research information |
| 17 | Co-production of climate services: A story map for future coastal flooding for the city of Flensburg | Vollstedt, Bente; Koerth, Jana; Tsakiris, Maureen; Nieskens, Nora; Vafeidis, Athanasios T. | 2021 | Germany | Survey, Workshops | Academic, Community (civil society), Organized civil society, Government | co-produce | No, other than defining the Living Lab method, which involves co-creation and activities that take place in real-life environments | SLR Story Map | Climate information tool | The purpose of the SLR story map is to raise awareness among the general public and to initiate action for adaptation in order to better cope with future coastal flooding in Flensburg, a city situated at the German Baltic Sea coast. |
| 18 | Co-Designing an Air Quality Web App with School Pupils and Staff: The SAMHE Web App | West, S.E.; Castro-Faccetti, C.; Way, L.; Chatzidiakou, L.; Archer, R.; Kumar, P.; Beale, V.J.; Vouriot, C.; Bland, S.; Williams, N.; Burridge, H. | 2023 | United Kingdom | Discussion sessions, Workshop, Asynchronous survey, Panels | Academic, Community | co-design | Yes, theoretical foundation for the co-design process by Sanders and Stappers (2008) | Schools’ Air Quality Monitoring for Health and Education (SAMHE) | Climate monitoring tool | SAMHE aims to increase knowledge about air quality in schools, which could strengthen the evidence base to reduce school exposure, whilst supporting the UK’s next generation to think differently about air quality |
| 19 | An integrated climate and water resource climate service prototype for long term water allocation in the Upper Yellow River region of China | Willis, Thomas; Siu, Yim Ling; Taylor, Andrea; Dessai, Suraje; Su, Buda; Jiang, Tong; Turner, Andrew; Griffiths, Guy; Rostron, John | 2024 | China | Interviews, Surveys, Workshops | Academic, Community | co-develop | No, other than "In this process, a collaboration is made with end users throughout the prototype development phase" | Integrated Climate Water Resource Management tool (iC-WRM) | Climate information tool | Using a user-led design approach, the prototype was constructed in collaboration with climate scientists and from the findings of research that established Chinese water managers’ needs and requirements |