

# Strategic plan for SBDI, the Swedish Biodiversity Data Infrastructure, for 2021-2025

## Introduction

The Swedish Biodiversity Data Infrastructure (SBDI) is a national research infrastructure which provides informatics infrastructure, tools and support to the biodiversity and ecosystems research communities in Sweden and abroad. SBDI is supported by the Swedish Research Council in the 2019 call for the period 2021–2024, and co-funded by the eleven organizations forming the SBDI consortium<sup>1</sup>. SBDI is based on the previous national research infrastructures Swedish Life Watch (SLW) and Biodiversity Atlas Sweden (BAS), and it includes the Swedish national node of the Global Biodiversity Information Facility (GBIF).

The Strategic Plan was drafted and discussed by the Executive Office, the Steering Committee and the Coordination Group of the merging BAS and SLW infrastructures during the spring and summer of 2020. The final text has been formally endorsed by the joint SLW/BAS Steering Committee. In the Strategic Plan, we first outline the overarching vision and then describe the implementation strategy and specific goals for the coming five-year period.

## Vision and strategic framework

The overall vision of SBDI is to provide a cost-effective, cutting-edge infrastructure that supports Swedish and international biodiversity and ecosystems research. SBDI will provide Swedish researchers with unified and open access to biodiversity data, and to a wide range of tools for querying, visualizing and analyzing this data. SBDI will be based on the Living Atlases (LA) software platform, and the Swedish instance will be further developed together with the LA and GBIF (LA-GBIF) community. Priorities in developing SBDI services will primarily be based on supporting scientific excellence. Care will be taken to ensure that the services are equally accessible to all Swedish users regardless of home institution, gender, ethnicity, or functional variations. Similar considerations will apply when recruiting staff to construct and operate the infrastructure. To realize the vision, we have identified the following five priority areas.

**Delivery of relevant data.** SBDI will provide access to the data resources and the aggregated data products needed by biodiversity researchers of all types and by policymakers to support conservation and sustainable development. We will work together with users in defining state-of-the-art requirements for data delivery and data products, and with providers in curating source data to the highest possible standard.

**Development of the national research infrastructure.** SBDI will be continuously developed primarily to meet the needs of Swedish researchers, but also the needs of any other relevant group holding or requiring biodiversity data for research, and leveraging the collected skills and resources of all relevant informatics teams. Systems development will be based on international collaboration within the LA-GBIF and related communities, ensuring that Sweden benefits from and contributes to the development efforts of the global biodiversity informatics community.

**Delivery of tools for data access, visualization, and analysis.** SBDI will provide a wide range of services and tools enabling researchers and other stakeholders to discover, access, analyze and visualize biodiversity data. This will include support for popular computing environments, such as R

---

<sup>1</sup> Karolinska Institute, KTH Royal Institute of Technology, Linnaeus University, Lund University, Stockholm University, Swedish Meteorological and Hydrological Institute, Swedish Museum of Natural History, Swedish University of Agricultural Sciences, Umeå University, University of Gothenburg, Uppsala University.

and Python, as well as the provision of Web-based graphical user interfaces, virtual research environments and online computing platforms facilitating big-data analyses.

**Enhanced outreach.** SBDI will implement an ambitious outreach program, with the aim of educating and supporting national and international researchers, data publishers, governmental bodies, decision makers, and the general public in how to use the available tools to their fullest extent. In particular, the outreach program will focus on the critical importance of the SBDI infrastructure in addressing the biodiversity decline, the rapidly changing environment, and the climate emergency.

**Empowerment of the biodiversity informatics network.** SBDI will cooperate with national and international initiatives, research programs, infrastructures and other stakeholders in delivering the best possible services to the biodiversity and ecosystem research communities, and in promoting the widest possible use of biodiversity data in other scientific disciplines and in society at large.

## Goals for the period 2021–2025

The specific goals cover five main areas: (1) governance, (2) technical maintenance and development, (3) outreach and user support, (4) national and international collaboration, and (5) development of a funding and business model. In-depth information on the principles and working procedures that will be followed in implementing the infrastructure and fulfilling the goals within each of these priority areas are outlined in Appendix 2.

### 1. Governance

The SBDI governance model will ensure transparency and efficiency. The model (Fig. 1) is outlined in the SBDI proposal, and is based on the current governance of the joint BAS and SLW infrastructures. The model will be described in detail in the SBDI consortium agreement, which will be finalized and signed by all consortium members in 2020. An overview is given below.

The **Consortium Member Assembly** consists of the vice chancellors (or similar) from all consortium members. This group meets at least once annually and is the forum for decisions on changes to the budget, or other major changes, that the SC may propose. The Consortium Member Assembly was outlined in the governance model presented in the SBDI application in 2019, and it will be established by early 2021.

The external **Steering Committee (SC)** ensures that the SBDI consortium fulfills its scientific and administrative goals. The SC is responsible for strategic decisions, and for resolving any problems that may arise in the operation and development of SBDI. The SC chair communicates regularly with the heads of the consortium member organizations, decision makers at other partner organizations, and the head of the principal organization. SC members include representatives of academic and non-academic user groups, scientists from relevant disciplines and infrastructure specialists. The members must not have any conflict of interest with respect to SBDI. They are suggested by the consortium member assembly and formally appointed by the principal organization.

The **Scientific Committee (SciC)** advises the SC on scientific questions of strategic relevance for SBDI. SciC members include internationally established biodiversity scientists and research infrastructure experts. Candidates to the SciC are suggested by the partner organizations and the SC, and formally appointed by the SC.

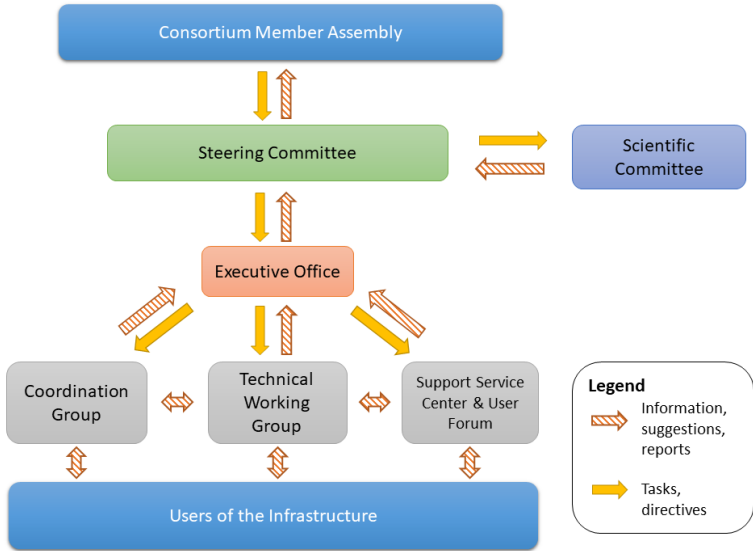
The operative management of SBDI will be overseen by an **Executive Office (ExO)**, led by a Director (50%) who is responsible for operationalizing the strategies decided by the SC and for the daily management of SBDI. The ExO also includes a Deputy Director (30%), a Project Manager (100%) and

a Communications Officer (30%). The Director and Deputy Director are recruited and employed by NRM and SLU, resp., with advice from the SC. The Director and Deputy Director report regularly to the SC and their organizations on the status of the infrastructure. Members of the ExO will spend time both at NRM and SLU to ensure effective communication and synergies. The ExO establishes working groups when the need arises and appoints their members. The following two working groups are mandatory.

The **Coordination Group (CG)** consists of at least one member of each partner organization, representing its interests in the consortium. The members are appointed by the partner organizations, and work closely together with the ExO to manage daily tasks, fulfill deliverables and report the status of ongoing work. The group is organized in thematic teams organized around data types or use cases. The thematic teams are responsible for the operation and development of SBDI components within their domain of expertise. The teams communicate closely with each other in order to ensure seamless operation and development of the SBDI infrastructure. The CG normally meets twice per year.

The **Technical Working Group (TWG)** coordinates the technical development of the infrastructure. It consists of developers from all teams contributing to the technical development and operation of the infrastructure. It is led by the SBDI system architect (100% position); all other members are appointed by the ExO in cooperation with the CG. The TWG gives advice to the ExO on technical aspects of the infrastructure and communicates closely with the CG on the operation and development of the SBDI platform. The TWG also oversees the SBDI development contributions to the LA-GBIF community.

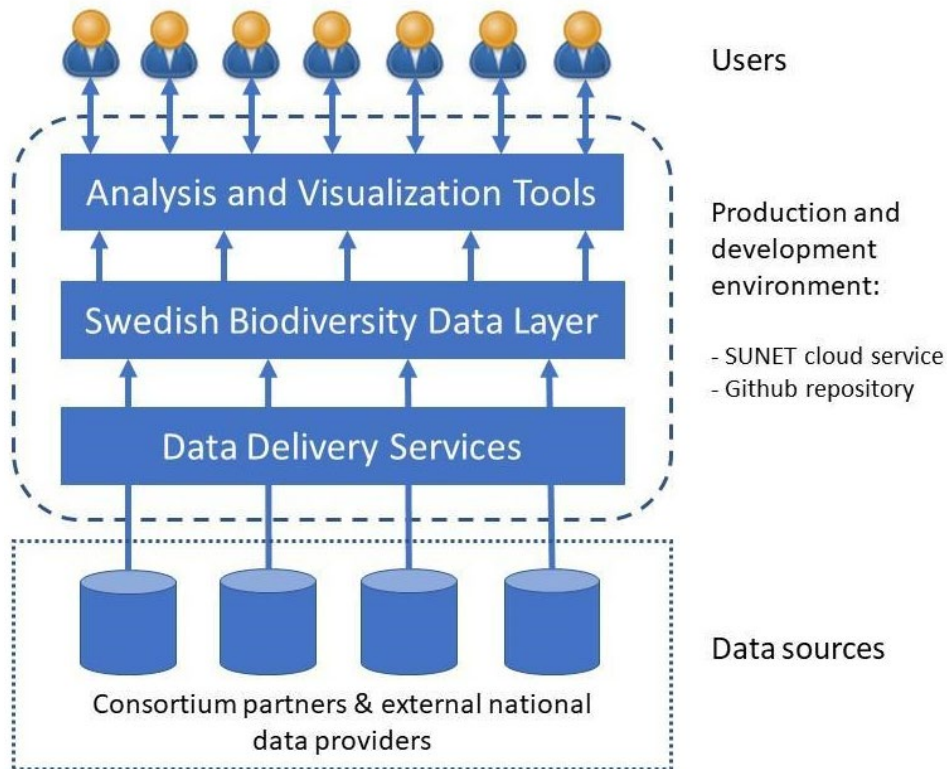
**Other working groups.** The ExO may create additional working groups, beside the TWG, in order to effectively operate, maintain and develop the infrastructure. The ExO decides on the remit and composition of each working group on a case by case basis.



**Figure 1.** SBDI governance model. The Steering Committee, formally appointed by the Principal organization of the SBDI consortium, communicates with the Executive Office, which in turn links to the consortia partners representation, the Coordination Group. The Technical Working Group advises both the Coordination Group, the Support Service Center and the Executive Office on technical issues. The independent Scientific Committee provides advice to the Steering Committee as required. The Coordination Group, Technical Working Group and Support Service Center receive continuous input from the user community.

## 2. Technical maintenance and development

SBDI will maintain a single technical platform based on the LA software, providing unified access to Swedish biodiversity data. The platform will be continuously developed and refined in collaboration with the international LA-GBIF community, of which SBDI will be an active member. Technical solutions will adhere to the FAIR principles and principles of open access to data and open-source licensing of code. The platform will also provide support for open and reproducible research. The general principles and procedures that will be followed are described in detail in Appendix 2.



**Figure 2.** Simplified view of the SBDI technical infrastructure with the Data Delivery Services, harvesting biodiversity data from national data providers into the common Swedish Biodiversity Data Layer, accessible for users through Analysis and Visualization Tools.

The core SBDI technical platform consists of three different layers (Fig. 2): the analysis and visualization layer (front-end), the data layer (back-end), and the data delivery services layer harvesting the underlying data sources. The front-end and back-end layers together with the data delivery services are run in a joint production and development environment, which is available on equal terms to all participating developers. The environment is currently based on the SUNET cloud service (provided by SafeSpring) and a shared [GitHub repository](#). The TWG will continuously monitor alternative offerings to make sure that SBDI continues to rely on the most appropriate and cost-effective technical platforms and services.

Current SBDI data harvesting (i.e. data delivery from data sources) mechanisms include automated, incremental SLW solutions as the 'Species Observation System' (SOS), and delivery through GBIF's [Integrated Publishing Toolkit](#), in both cases through the [Darwin Core Archive format](#) used by the LA-GBIF community. In some cases, data delivery involves the use of more specialized solutions tailored to the data source. Together with the LA-GBIF community, the TWG will investigate and implement improved data delivery solutions to the SBDI users and GBIF, with the goal of offering near-real-time provision of data in the LA platform.

SBDI currently provides a single data layer for open data with unified access through the GBIF Application Programming Interfaces (APIs) and the LA platform APIs. This is complemented with functionality based on SLW components and APIs, providing additional options for some datasets such as access to sensitive data. Currently, access to sensitive data primarily targets stakeholders outside of the research community. Going forward, the TWG will analyze potential opportunities for synergies, with the goal of merging as many of the services as possible. If services cannot be merged, the TWG will ensure that the data provided are consistent, using data mirroring where needed.

The Swedish LA instance is currently operated in parallel with the [SLW Analysis Portal](#). Customization and adaptation of the LA platform to fully replace the Analysis Portal is ongoing. The Analysis Portal will be decommissioned when the LA platform and its services cover the needs of the SBDI user community, and there has been sufficient time for user training.

Based on the priorities of the research community, SBDI will continuously seek to expand its scope with respect to data mobilization, analysis and visualization services offered, and tools and system components developed. The efforts will be coordinated with the LA-GBIF community and will be targeted to areas where the Swedish biodiversity research community has special needs or can make unique contributions. Specific activities for 2021-2024 are detailed in the revised budget and Gantt chart for SBDI. The planning will be continuously updated in connection with the presentation of the Operational Plans for the coming year.

No major investments in physical hardware are foreseen in the coming five-year period. However, operation and development of SBDI will entail considerable cloud computing and software engineering costs. Both increased usage of, and demands on, the Infrastructure, as well as costs for senior software development staff, are expected (based on current trends) to increase significantly in the coming years. The TWG will work together with the ExO and SC in addressing these trends through cost savings, identification of more effective synergies among partners, and contributions from users receiving substantial support or other benefits from SBDI.

### 3. Outreach and user support

SBDI will use the web as the primary channel for communication with the user communities. Its Service Support Centre (SSC) will coordinate the handling of user support requests, and provide consultancy services. The SSC will also organize face-to-face workshops and provide online training modules supporting current users of the Infrastructure and encouraging new users.

The SBDI web site will be launched in early 2021. It will be used to publish important news releases pertaining to the infrastructure and its activities. The web site will also highlight projects using the infrastructure, and relay external news of relevance to the SBDI user communities. The web site will also provide information about the SBDI infrastructure and direct users to SBDI tools and services, including support services.

The SSC will maintain and develop the SBDI user forum, and will design and prioritize activities based on requests received by SBDI users. The SSC will seek to use and contribute to existing educational resources, such as the [Biodiversity Informatics Training Curriculum](#) and other initiatives, such as the [Biodiversity Information for Development Initiative \(BID\)](#) and the [Capacity Enhancement Support Programme \(CESP\)](#). The SSC will promote biodiversity informatics training at Swedish academic institutions through courses both at the undergraduate and graduate levels, as well as education of and support to data publishers, governmental bodies, decision makers, and the general public by supplying tutorials and web-based courses. In line with the principles of similar national

infrastructures (e.g. NBIS) a fee may be applied for individual users or research projects requiring extensive support.

#### 4. National and international collaboration

SBDI will collaborate with relevant national research infrastructures, government agencies, non-governmental organizations, and enterprise partners. It will consider cooperation with, or membership of, international initiatives or organizations where it supports the Swedish and international biodiversity and ecosystems research communities.

Specifically, SBDI will collaborate with the national [NBIS](#), [NGI](#), [SND](#), [SNIC](#) and [SITES](#) infrastructures on topics of common interest. SBDI will also explore opportunities for collaboration with other national infrastructures, such as SciLifeLab. Efforts will also be coordinated with the Swedish Environmental Protection Agency (Naturvårdsverket), the Swedish Agency for Marine and Water Management (SwAM), as well as other government agency stakeholders with an interest in using or contributing to national biodiversity informatics infrastructure for research.

Internationally, SBDI will function as the Swedish GBIF node, helping to develop and implement the [GBIF Strategic Plan](#). SBDI will contribute to all aspects of the GBIF network, including data delivery, development of the technical infrastructure, organizational activities, and capacity building. Synergies among biodiversity e-infrastructures in the Nordic and Baltic countries will be strengthened, leveraging funding initiatives like the Nordic e-Infrastructure Collaboration (NeIC) and other opportunities that may arise. SBDI will actively participate in the [Living Atlases Community](#), where coordination will be sought in particular with European organizations running LA-based portals, such as the National Biodiversity Network in the UK. SBDI will actively engage in the development of data and analysis services for the [European Open Science Cloud \(EOSC\)](#) and continue to cooperate with both the different national LifeWatch nodes in Europe and with the European research infrastructure consortium (ERIC) [LifeWatch](#). SBDI will seek to ensure that the international LifeWatch cooperation complements rather than parallels the efforts of the LA-GBIF community.

#### 5. Business model and funding

During the funding period the business model of SBDI will be further developed, including different forms for potential user contributions. SBDI will also seek to broaden the base for its core activities by discussing potential funding contributions from other funders and stakeholders that directly or indirectly benefit from the SBDI infrastructure. SBDI will also encourage consortium members and thematic groups in the infrastructure to seek support from national and international funding agencies for their activities. Finally, SBDI will develop a competitive proposal for the Swedish Research Council call in 2023 for support of national research infrastructures.

#### Revision of the strategic plan

The Strategic Plan will be revised biannually. The process will be led by the Coordination Group, and relevant stakeholders will be consulted before the plan is agreed on by the Steering Committee. The Strategic Plan will change in coming revisions in an agile approach to adapt to changing needs from the research community and rapid technical development. Furthermore, we will encourage increased collaboration with partners outside academia and involvement with the European Open Science Cloud (EOSC), so that the infrastructure may serve society in a wider sense. This is outside the scope of the current strategic plan but may be included in coming revisions.

## Appendix 1. Risk Analysis

<b>Risk</b>	<b>Probability</b>	<b>Impact</b>	<b>Mitigation strategy</b>
Consequences of 2020 COVID-19 pandemic	medium	medium	The world is facing economic recession due to the pandemic, the future funding situation is increasingly insecure: mitigation strategies: see below [Funding strategies]. However, infrastructure construction and operations operate relatively independent of physical consequences of societies locking down. Much work related to systems development and operation is not affected. Rather the significance of SBDI 'products' will, once available, increase as will the understanding of its significance.
Lack of trust between the Infrastructure Partners	medium - low	high	<p>The Executive Office meets (usually) weekly to suggest solutions to strategic issues, including delimitation of scope.</p> <p>The Strategic Plan will be revised biannually.</p> <p>The Partners will engage in team-building efforts and targeted activities to increase understanding of specific cultures and limitations among partner organizations, especially for IT developers.</p> <p>All new job adverts for either consortium will be discussed by the Coordination Group and published by all partners.</p>
Lack of overall coordination and delimitation of scope	low	high	<p>Meetings between the Steering Committee chair and the members of the Consortium Member Assembly (deputy vice chancellor for infrastructure or equivalent of the partner organizations), are planned at least once a year.</p> <p>A Steering Committee in cooperation with the Technical Working Group and Scientific Committee oversees the practical coordination of the work on all levels.</p> <p>The Steering Committee oversees a biannual revision of the Strategic Plan, including a revised delimitation of scope of the Infrastructure.</p> <p>The Steering Committee will oversee development and submission of a follow-up proposal in 2023.</p> <p>Regular meetings of the committees will ensure feedback on the level of coordination.</p>
Ineffective overall management	low	high	Effective management is ensured through the use of project management software (wiki, issue tracker, gdocs) and effective communication tools (video conferences, email lists, etc.).

			Regular meetings of the management level of all partner organizations, i.e. the Consortium Member Assembly, will ensure close coordination enabling effective management.
Ineffective technical coordination	medium	high	<p>The Technical Working Group will hold bi-weekly meetings and use integration technology as e.g. Docker.</p> <p>The coordination will progress from easy to more difficult integration tasks.</p> <p>The partners will initially focus their collaboration style on fewer people with more dedicated work time.</p> <p>The learning curve for new technology will be mitigated by open workshops.</p>
Unforeseen international technical development	low	medium	<p>The Technical Working Group will annually revise the technical strategy plan and adapt it if necessary to include new international technical development.</p> <p>The Coordination Group is responsible for an international outlook and networking to address any new developments in their respective area.</p> <p>The User Forum will formulate needs and suggestions on technical development.</p>
Delays in deliverables	medium	low - medium	<p>The Steering Committee and the Executive Office will deploy necessary mechanisms for effective monitoring of project progress. A system will be implemented to spot and foresee delays of critical deliverables.</p> <p>Mitigating actions will be discussed with relevant task-leaders to keep the project on schedule.</p>
Technical task failure	medium	medium - high	Some technical tasks may not reach the expected goals. In these cases the Steering Committee will adopt agile work routines and either adapt the task goals accordingly, or shift resources between tasks.
Changes in personnel	medium	high	If appointed staff leaves the project, the partner organizations in cooperation with the Steering Committee will either replace the post with an equally qualified person or shift resources to another organization to carry out the respective tasks. To prevent loss of knowledge we will implement working procedures where personnel share knowledge and work collaboratively.
Funding shortfall	medium	high	Any funding shortfall caused by changes in the funding received from VR or co-funding by the partners will be handled as stipulated in the consortium agreement by the Steering Committee and the Coordination Group and includes revision of the partners' budget and



		<p>deliverables which may lead to decommissioning of parts of the infrastructure or limited availability of data or tools.</p> <p>To mitigate the risk of losing participating consortium members we will ensure that there is a strong anchoring with the leadership at the partner universities.</p> <p>A prerequisite for receiving funding is that the Infrastructure remains relevant for researchers, universities and other stakeholders. Thus we will develop working procedures for dialogue with all of the above.</p> <p>If no funding can be obtained the Steering Committee will initiate the decommission plan.</p>
--	--	---

## Appendix 2. Principles and procedures in maintaining and developing SBDI

Implementation of SBDI will be based on existing Swedish biodiversity infrastructure, and the active involvement of all relevant Swedish data owners, user communities and biodiversity informatics teams. SBDI will adhere to the principles of open access to data and open-source licensing of code, and it will provide support for open and reproducible research. SBDI will be based on the Living Atlases (LA) software platform, and it will be developed within the LA-GBIF community as follows:

- The Infrastructure will primarily be based on free and open source software (FOSS).
- All data handling within SBDI will be based on the [FAIR principles](#) (Findable, Accessible, Interoperable, Re-usable).
- Where appropriate, existing Swedish infrastructure components developed by SLW and others will be integrated with software developed by the LA-GBIF community and the Swedish GBIF node, and provided as contributions towards community efforts.
- SBDI will actively engage in the LA-GBIF system development community. Swedish development efforts will be coordinated with the rest of the community, and will be provided as contributions towards meeting community goals.
- Prioritization of development efforts will be guided by Swedish research needs and by the needs of the LA-GBIF community as a whole. Development projects will only be initiated when there are no adequate solutions based on existing FOSS components.
- Open licenses for source code and data will be adopted wherever possible. The licenses should be widely used within the LA-GBIF community, give free and open access, and guarantee that derived works remain free and open. Examples of suitable choices include [GPL](#) and several licenses within the [Creative Commons](#) framework.
- SBDI will adhere to best practices for open software development, including free access to up-to-date code repositories, using for example GitHub for collaborating on source code and [Docker Hub](#) for delivering software builds. Distributed software development engaging the LA-GBIF community and other interested code contributors will be supported by adopting standard collaboration styles and modern DevOps practices.
- SBDI will use a modular architecture, allowing parallel development work in smaller teams addressing specific concerns. Where possible, system integration at a higher system level will utilize container technology, such as [Docker](#), to package and ship modules or components. For data services, documented open Web APIs will be used, where RESTful web services are preferred over SOAP-based services.
- SBDI will implement existing standards for open data exchange, such as those established by the Biodiversity Information Standards organization ([TDWG](#)). Where existing standards are not adequate, established mechanisms for [extending or improving them](#) will be followed. Contributions to the continuous development and refinement of international standards will be prioritized.
- SBDI will strive towards real-time data provision where appropriate, based on existing SLW functionality and enhancements considered in the LA-GBIF community.