



Digital Sequence information, Open Access, and Sustainable Benefit Sharing: Scientific Input to International Policy Decisions

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Venue: Zoological Research Museum Alexander Koenig (Leibniz Association)

Hosted by the Leibniz Institute DSMZ and the Leibniz Institute IPK Gatersleben.

Report

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Background and Brief Overview

The Parties to the Convention on Biological Diversity (CBD) will meet in October 2020 in Kunming, China to negotiate and define the international biodiversity targets for the next 10 years¹. In parallel to these discussions, the issue of benefit sharing from “Digital Sequence Information” (DSI) arising from Genetic Resources accessed under the Nagoya Protocol (NP) and CBD will also be negotiated. At stake in these negotiations for biologists is open access to sequence data via the large public databases. In order to avoid worst-case scenarios, science-based solutions for benefit sharing that do not endanger open access are urgently needed.

As a result, the German Federal Ministry of Education and Research (BMBF) has funded an interdisciplinary project led by the Leibniz Institute DSMZ and the Leibniz Institute IPK Gatersleben to research DSI policy options and involve the scientific stakeholder community. The project, “**Wissenschaftsbasierte Lösungsansätze für Digitale Sequenzinformation (WiLDSI)**”, aims to develop a scientifically sound concept for the DSI policy dilemma and to investigate its applicability and practicability so that German and European Commission negotiators have a science-based tool kit for the upcoming international negotiations. An important aspect in the WiLDSI project² is to engage the scientific stakeholder community in Germany and to proactively develop interdisciplinary and fair solutions for all concerned in advance of these negotiations.

To this end, the workshop on Digital Sequence Information, Open Access, and Sustainable Benefit Sharing: Scientific Input to International Policy Decisions was held on 21-22 January 2020. The workshop was organised by the Leibniz Institute DSMZ and the Leibniz Institute IPK Gatersleben at our Leibniz partner institute, Zoological Research Museum Alexander Koenig in Bonn. The objective of the workshop was to raise awareness and to involve the scientific stakeholder community in Germany in the policy developments surrounding the issue of DSI.

The DSI workshop was attended by 60 participants from different German institutions and infrastructures. The participants were a heterogeneous mixture comprising of scientists and researchers who have experience in the generation, handling and distribution of DSI with some knowledge or experience concerning the NP and the DSI issue, while some participants were policy officials who have been actively involved in the discussion on DSI. Other participants included lawyers who were also familiar with DSI related issues. A graphic recorder was also present to visually record the progress of the workshop and created several graphic images during the course of the workshop³. These images provided an excellent visual representation of the entire workshop.

¹ This meeting has now been postponed due to the recent COVID-19 pandemic.

² For more information on the WiLDSI project: <https://www.dsmz.de/collection/nagoya-protocol/digital-sequence-information>

³ The graphic images can be found here: <https://www.dsmz.de/collection/nagoya-protocol/digital-sequence-information/dsi-workshop-january-2020>

The workshop helped raise awareness among the scientific stakeholder community in Germany concerning the political debate surrounding the DSI issue as well as offered the participants a platform to voice their opinions and contribute to the various solutions discussed.

Day 1

The workshop was opened by Prof. Dr. Bernhard Misof, (Director, Museum Koenig) who introduced the organisers, Dr. Amber H. Scholz and Dr. Jens Freitag. He also welcomed the German representatives, Dr. Frank Begemann, Thomas Greiber, Dr. Stefan Lütkes and Dr. Meike Teschke.

Presentations

Setting the stage

Overview of the CBD decision-making process surrounding DSI

Thomas Greiber, LLM (Federal Agency for Nature Conservation, BfN) began with providing a status –quo on the NP on the eve of the protocol’s 10 year anniversary. He then proceeded to provide an historical background on how the topic of DSI actually came into consideration in the various CBD meetings held over the course of several years. He informed the participants about what has happened so far with respect to the science and policy-based process under the CBD in year 2019/2020. He also explained the tentative time-line of the entire process in terms of when the different decision-making meetings will take place. He included the timeline of the parallel informal processes too⁴. Finally, he mentioned where all the information could be found online on the CBD website. In all, Thomas Greiber gave the participants a brief outline of the entire CBD decision-making process surrounding the topic of DSI.

The biodiversity crisis & why we need a post-2020 Biodiversity Framework

Dr. Christof Schenck (Director, Frankfurt Zoological Society) gave us a detailed insight into the current climate and biodiversity crisis and how the dimension of this crisis is not being recognised globally. He mentioned the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) report that was published in 2019 highlighting the unprecedented human-induced loss of biological diversity and extinction of species. He went on to give an impactful presentation detailing this crisis with powerful examples. He concluded that 2020 is the year to act before it’s too late for human kind and the urgent need for a post -2020 Biodiversity Framework.

⁴ The international processes have now been postponed due to the recent COVID-19 pandemic.

Why do we have open access sequence databases? What do they offer?

Dr. Guy Cochrane (Head of the European Nucleotide Archive, EMBL-EBI) provided information regarding open access public sequence databases. He began his presentation with an interesting analogy by comparing data generated from bioinformatics (Molecular Biology data) to an organic machine that runs autonomously which needs to be fed with DNA sequences (input) that is then processed in order to generate knowledge (output). He then went on to explain the importance of open data. He spoke about the International Nucleotide Sequence Database Collaboration (INSDC) and the three main large sequence databases that belong to it: The European Molecular Biology Laboratory - European Bioinformatic Institute (EMBL-EBI), The DNA Databank of Japan (DDBJ) and GenBank, which is hosted by the National Centre for Biotechnology Information (NCBI). He briefly described the data submission process and presented an impressive figure (world map) depicting the enormous scale of usage of DNA sequences worldwide for EMBL-EBI. He also gave a brief description of secondary databases such as UniProt, MirBase, SILVA etc. He concluded by saying that high productivity drives scientific progress (referring to his life science machine analogy) and that high productivity drives access and benefit sharing (ABS). He stated that we need to understand this productivity and maintain it. We need to understand the risks that could damage the productivity of the machine, assert core features that need to be preserved and identify opportunities to improve it. Finally, he emphasized that open access is very crucial for scientific progress.

Scientific Stakeholder Input

Eight participants were invited to give short impulse talks (5min). These participants presented information regarding the usage of sequence data in their research as well as the role and importance of open access. The impulse talks gave, in particular, the legal and policy members of the audience a better understanding of how and why DSI is used in research and why any new regulatory framework that significantly alters the existing infrastructure and practices for non-commercial researchers would lead to severe consequences.

Below are the names of the 8 participants:

1. Dr. Ximo Mengual (Zoologisches Forschungsmuseum Alexander Koenig)
2. Prof. Dr. Gerhard Haszprunar (Staatliche Naturwissenschaftliche Sammlungen Bayerns)
3. Dr. Véronique Helfer (Leibniz Centre for Tropical Marine Research)
4. Prof. Dr. Jörns Fickel (Leibniz-Institut für Zoo- und Wildtierforschung)
5. Prof. Dr. Michael T Monaghan (Leibniz-Institute of Freshwater Ecology and Inland Fisheries)
6. Dr. Andrey Yurkov (Leibniz Institute DSMZ)
7. Prof. Dr. Alexander Sczyrba (Bielefeld University)
8. Dr. Janine Felden (Alfred Wegener Institute Helmholtz Centre for Polar- and Marine Research)

Political mandate for scientists

What is at stake? Why should scientists get involved in the policy process?

Dr. Stefan Lütkes (Head of Division for Nature Conservation and Landscape Management Legislation, BMU) began by saying that recent scientific reports (such as the 2019 IPBES Global Assessment Report) have shown the need for urgent action to address biodiversity loss, climate change and related challenges. He stated that in 2020, the international community has a chance to change the course. He presented a detailed 2020 roadmap of all the upcoming CBD meetings, processes and negotiations that will take place at different levels. He then went on to present and explain the post 2020-Biodiversity Framework Zero Draft (13 January 2020). In brief, he mentioned that the draft also contains a first proposal for goals regarding the sharing of benefits from the utilization of genetic resources and associated traditional knowledge. In the annex to the zero draft, a preliminary draft monitoring framework is provided. He explained that the Goal 5 on benefit-sharing has 2 elements concerning monetary as well as non-monetary benefits and that draft indicators are also suggested. Importantly, he stated that it should be noted, however, that DSI is neither mentioned in the annex nor in the text of the zero draft as such, yet. In the end, he explained the need for the scientific community to get involved in the political discussions. He presented that benefit sharing (BS) is an issue that concerns various sectors including basic science. The scientific community will be affected, and should therefore get involved not only to echo their interests & positions but also to try and be part of the solutions. He concluded by saying that, of course, BS concerns need to be taken into consideration, but at the same time they also need to be balanced in the political processes.

Crossing the Rubicon: the BMBF WiLDSI project -- what are its goals?

Dr. Amber.H.Scholz (Deputy to the Director, Leibniz Institute DSMZ) gave a brief history of the WiLDSI project and how the project came into being. She stated the urgent need for scientists to engage in the DSI policy process and highlighted the underlying important reasons supporting this. The first being the harsh lessons learned from the NP with respect to the compliance problems, and the huge delays caused in biodiversity research. She stated that the Nagoya system at best, is clunky and leads to jurisdiction shopping and questioned its worth for biodiversity conservation. She then proceeded to explain why sequencing has become the next target for BS by giving examples of biopiracy accusations. Furthermore, it was explained that biodiversity is global and that biodiversity research requires Nucleotide Sequence Data (NSD) databases. An interesting question was raised asking if the Global North was really taking advantage of the Global South and who is actually benefitting from it all? Surprisingly, data shows that most of the DSI does not come from the Global South and 52% of the NSD is generated by the following 4 countries: China, United States, Canada and Japan. There are approx. 15 million users of NSD and they are located worldwide. Moreover, 50% of NSD users live in countries that do not contribute to NSD infrastructure costs. Basically, there is already BS taking place.

Furthermore, Dr. Scholz emphasized that a new DSI ABS system should potentially be

- Compatible with existing free, open access INSDC
- Administratively nimble or invisible for scientists
- Integrated and NOT a stand-alone system (e.g., blockchain)
- Income-generating in a painless way without explicit public sector funds
- Clear in legal scope and compatible with CBD/NP and other legal mechanisms
- Satisfy the demands of the developing world
- Stop being „DSI“ and become something else

In all, the history, background and goals of the WiLDSI project was explained and a timeline of what the project hopes to achieve this year was also provided. The WiLDSI steering committee members were also introduced. Dr. Scholz then provided the outline for day 2 of the workshop and gave a brief description of the breakout sessions and the topics for discussion.

Day 2

Kathrin Faensen (Graphic Recorder) gave a short recap of the previous day from the point of view of an outsider. Dr. Jens Freitag then proceeded to explain the overview of Day 2 and how the breakout sessions would be divided. The objective of the breakout session was to involve the participants in the DSI issue and to allow them to express their views and give their valuable feedback. The 2 main questions discussed during the breakout sessions were

1. How can you make money from an open system?
2. What are the non-monetary benefits that arise from the open system?

Presentation

Scenario Development “Open Science & Benefit Sharing”

Crash course in international finance mechanisms

Torsten Thiele (Potsdam Institute for Advanced Sustainability Studies, IASS) gave an interesting talk on DSI and the sharing of monetary benefits. He started by explaining what exactly is monetary BS under the CBD and gave examples of monetary payments such as royalties, subscription fees, micro-levies, voluntary payments and innovative finance mechanisms. He proposed that the system should be designed in such a way that it delivers optimal (science) outcomes. Financial structures need to be put in place that satisfies both, the beneficiaries and the funders. He stated that feedback loops and system benefits need to be considered in order to optimize innovative funding mechanisms. He mentioned that one must also take into account the proposed new post-2020 Global Biodiversity Framework zero draft (13 January 2020). He then proceeded to explain financial concepts and provided relevant information on the Global Vaccine Alliance as an example of innovative finance mechanism. He concluded by mentioning the breakout session#1 questions (see below) and asking the audience for their valuable input during the session.

Breakout Session #1: Ideas for open access and monetary benefit sharing

The WiLDSI steering committee members moderated the sessions and provided a brief summary at the end of each session. Two breakout sessions were planned. Each breakout session was divided into 2 groups: Group A and Group B.

Table set up: 6 tables, 6-7 participants + 1 moderator per table. Each group had 30 minutes for discussion and then the groups were switched.

Moderators for Group A: Prof. Dr. Esther van Zimmerman, Dominic Muyldermans and Torsten Thiele.

Moderators for Group B: Dr. Jens Freitag, Dr. Guy Cochrane and Dr. Carmen Richerzhagen.

Questions addressed during this session:

Group #A: If a new post-2020 DSI system is open access, how can monetary benefits still be created? What type of financial mechanism(s) would you use? Who should pay? When? Why? For what?

Group #B: How does the current open access system need to adapt to enable a monetary benefit-sharing system? Do the sequence databases need to change or not? Should the usage of sequences be traced/tracked? Should a new system attempt to monitor the volume of sequence data used or should it be one-size-fits-all? Should a non-monetary and monetary benefit sharing be connected somehow?

Synthesis from Breakout Session #1

Group A: The following points were summarized based on the feedback and opinions from the participants:

- Is the distinction between monetary and non-monetary BS really relevant? We need to think beyond this.
- Make people aware of all the costs involved. To put a price tag on the sequences/quantify the value of the sequences.
- There is already high level BS sharing taking place. To be careful in the wordings.
- Some referred to the creation of value resulting from the use as a different angle.
- It was also discussed whether in applied research there should be a distinction in the definition of utilization between research enabling innovation and actually developing new (commercial) products.
- Some suggested to broaden and expand the INSDC infrastructure by adding satellites or data distribution centres, for example in China, Brazil, South Africa and India to increase capacity and overcoming internet bandwidth challenges experienced in South America, Africa, and Asia.
- Participants were not against monetary proposals.

- Proposals for a subscription model, micro-levy system.
- Payments for 'blockbuster' products developed from DSI above a certain profit margin.
- Competent building system- digital object identifier (DOI) tagging.
- Advertising model proposal.
- Copyright collecting society.
- Subscription fee
 - Who gets the money?
 - Issue of allocation (needs have to be identified).
 - Distinguish between commercial and non-commercial.
 - How to define? What is commercial use and what kind of system to set up?
 - Define a percentage coming from all countries and allocate accordingly.
- A careful design which serves the purpose of conservation of biodiversity
 - Who should pay and how to address this challenge.
- Biodiversity is the way of life.
- Any monitoring system developed has to protect the researcher.
 - The issue (loophole) of obtaining sequencing data not from a database, but directly from the sequencing machine (company) was raised.
- The feasibility of tracking and tracing was questioned.
- DSI solution should be multilateral and implemented on a national level.

Group B

- General opinion: Open access is crucial!!
- INSDC should raise its profile.
- Put numbers i.e. costs should be made transparent.
- Track the grants.
- Track the country of origin.
- A system that should not alienate the commercial users.
- Monetary mechanism-intra advertisements to raise money.
- Learn lessons from Food and Agriculture Organisation multilateral system (FAO-MLS).
- Incentivising system
 - Email to users (who have used a lot) to make appropriate donations.
- Quality of data – importance of reliable metadata, both to enable and trace benefit sharing and to increase scientific value.
- Scientific quality
 - If more information is connected (elab books), digitalisation. Opportunity to connectivity
- Traceability issue generated mixed reviews.
- Two major aspects need to be improved: (1) technical aspects to enabling accurate benefit quantification and (2) stronger participation of provider countries in biodiversity research, which will only be possible if (a) open access remains and (b) capacity and infrastructure development takes places (integrated global effort).

Establishment of competence centers (e.g. database mirrors) in provider countries to increase their involvement in data access. More clarity is required on what is actually expected by provider countries to avoid having the same discussion again in 10 years.

Presentation

Crash course in non-monetary benefit sharing

Dr. Carmen Richerzhagen (German Development Institute) gave a brief history of benefit sharing starting with the first textual reference in 1948 by the Universal Declaration of Human Right “everyone has the right freely to participate in the cultural life of the community, to enjoy the arts and to share in scientific advancement and its benefits” (art. 27). She then proceeded to give a brief overview of benefit sharing under the CBD. She went on to explain the NP, giving a brief history and how the protocol entered into force. She discussed the Nagoya Protocol Annex with respect to monetary and non-monetary benefits. Further, she spoke about the Zero draft post 2020 protocol (13 January) and mentioned the non-monetary benefits element with the suggested draft indicators.

Breakout Session #2: How to quantify non-monetary benefit sharing from DSI created through open access?

Moderators for Group A: Prof. Dr. Esther van Zimmeren, Dominic Muyldermans and Prof.Dr. Claudia Seitz

Moderators for Group B: Dr. Jens Freitag, Dr. Guy Cochrane and Dr. Carmen Richerzhagen.

Questions addressed during this session:

Group #A: How does non-monetary benefit sharing in research work on a global scale? How well do the draft monitoring framework indicators (post-2020 framework) match your own experience? Is anything missing or inaccurate? What connections are there to biodiversity? The zero draft indicators were also discussed in this context. Below are the draft indicators for non-monetary BS as published in the zero draft of the post-2020 Global Biodiversity Framework:

- Number of research and development results shared
- Number of collaborations in scientific research
- Number of participations in product development
- Number of transfers of technology
- Number of people trained
- Number of jobs created
- Number of joint ownerships of relevant intellectual property rights

Group #B: How can we quantify non-monetary benefit sharing? What are good metrics, data sources, or analyses that can be used to measure non-monetary benefit sharing? How can we show the network effects of international research (spider web of scientific interactions)?

Synthesis from Breakout Session #2

Group A: The following points were summarized:

- Needs assessment: provider and user
- In terms of discussing the post-2020 Global Biodiversity Framework zero draft indicators:
 - General perception was that these were good indicators.
 - The question was raised who is paying for the implementation/ measurement/ documentation of the non-monetary benefit criteria?
 - It was however indicated that the indicators are quantitative and not qualitative – just counting the numbers was seen as incomplete.
 - Some indicators need a more clear description and need to be more specific.
 - Missing indicators included 1) make data available more effectively, 2) building infrastructure, 3) developments of standards, best practices.
 - It is key to measure the impact in the receiving country. This could include measuring how many citizens are positively affected; p.e. re food security and human health; or quantifying the value of acquired skills resulting from transfer of technology or know how.
 - The projects that target conservation of biodiversity could be specifically quantified.
 - It is important to define a baseline.
 - In the context of the proposed indicators, also measure if Nagoya had negative effect on international collaboration

Group B:

- Discussing the draft indicators:
 - The general perception here was also that these were good indicators.
 - However, some would be difficult to measure such as:
 - product development
 - Jobs created
 - reports
- To increase education / raise awareness of biodiversity within countries.
- Career Expats
- Progress in science and science policy.

- Impact evaluation
 - Research on biodiversity
 - Publications
- There were discussions surrounding the term “non-monetary” benefits with respect to the monetary value which is often undermined/undervalued as there are huge costs associated with it (for e.g. costs for maintaining database infrastructure, personnel etc.).
- Search for better term instead of non-monetary BS – some suggestions
 - Virtual/in kind/invisible
- Quantify benefits arising from existing infrastructure and current open access system.
- Make use of already available metadata on the databases (e.g. as done in the scoping studies) to define indicators.
- Digitalising biodiversity books to make them more accessible to the world.
- Biodiversity Impact factor
 - Measure the success of these activities

Outlook and Next Steps

Dr. Amber Scholz and Dr. Jens Freitag gave the closing remarks highlighting the main take home messages:

1. DSI is a topic that is popping up.
 - a. Which information is defined by DSI (DNA, RNA, Protein and metadata)?
2. Biology is a data based science and sequence data is extremely important.
3. What is essential for us?
 - a. Clear definition (DSI is only a placeholder term) - sequence data, nucleotide sequence data, genetic resource sequence data.
4. Keep open access databases open.
 - a. Raise transparency in terms of costs.
 - b. Public goods exemptions? Or does everything belong together?
5. There was a general agreement that any DSI legislation that is implemented should be multilateral.

Summary

The workshop on Digital Sequence Information, Open Access, and Sustainable Benefit Sharing: Scientific Input to International Policy Decisions held on 21-22 January 2020, in Bonn, helped set the scene and raise awareness among the German scientific stakeholder community with respect to the political debate surrounding the topic of DSI. The participants were informed about the CBD decision-making process surrounding DSI. An overview about the WiLDSI project and its goals was also explained. The reasons and the urgency why the scientific community needs to step in and get involved were also made clear. The workshop enabled the participants to wholly engage in the DSI issue, voice their opinions and suggest possible solutions. In all, it was a legitimization of the on-going process and provided a platform to the scientific community to express their views and give valuable feedback.