

The Biodiversity Heritage Library  
Life and Literature  
Weaving Indra's Net

We have had a full and engaging two days. The four panels on Biodiversity Research, Publishing, Education, and Arts and Humanities have revealed the wider landscape of biodiversity literature, its uses, and its users. The four breakout sessions have made excellent suggestions for the priorities for the next five years along with concrete recommendations for immediate actions.

As we enter a period of reduced funding, the Biodiversity Heritage Library (BHL) is still a virtual organization, geographically distributed, providing digitized biodiversity texts. However, the BHL is a pilot project no more. Five years ago, we described ourselves thusly, “the Biodiversity Heritage Library (BHL) is a consortium of natural history and botanical libraries that cooperate to digitize and make accessible the legacy literature of biodiversity held in their collections and to make that literature available for open access and responsible use as a part of a global “biodiversity commons.” The BHL consortium works with the international taxonomic community, rights holders, and other interested parties to ensure that this biodiversity heritage is made available to a global audience through open access principles cooperating to make the published record of biodiversity literature available.” That was an ambitious beginning. The BHL is now part of the infrastructure for botanical and zoological research. From this conference we are hearing many good suggestions to stretch that earlier definition. Let’s work on that together.

The “biodiversity commons” mentioned in our earlier mission is not merely a metaphor. Our lives and the quality of them are absolutely dependent on it. There is the true, carbon-based biodiversity commons, the entire web of life as well as the knowledge and information of that commons. In both senses there are strong forces closing the commons. And I don’t just mean some publishers. To list a few: turf-focused knowledge institutions, special interest groups (Authors Guild, I am looking at you), international media organizations, myopic or paid-off politicians, researchers who feel it’s someone else’s business because “hey I’m a scientist” and turn over copyright and access to their funded work to very exclusionary organizations out of sloth, habit, or vanity; aggregators hiding behind “value add” as an excuse to fence off behind high walls public goods. These are very strong forces. However, this conference shows that there are other forces working on sane ways to maintain the commons. This is encouraging but there is much to do here and I hope everyone here will reflect on his or her role in the keeping the commons open and fertile.

I want to see more. I want to see the older biodiversity literature fully interoperate with contemporary and future data sets. Of course, many of you know all too well that even contemporary datasets don’t really interoperate with each other. Nevertheless, it really seems possible in the long run as technologies improve for semantic processing of text. I want more literature scanning. My estimates are we have done close to 33% of the core zoological and botanical taxonomic literature pre-1923 and 7% of the total core literature so far. Funding, copyright, loss of focus, loss of texts are big obstacles. But the first step of getting what is not digital, digitized opens the door to everything else. I want vastly improved multi-lingual optical character recognition. OCR is our Achilles heel. And I want and you want more services- more, more, and more. The texts need to be “cracked open” by software in ways that educators and others can serve up and integrate in their work easily. It’s too hard now to do this. We aren’t doing this well but in our next phase I am confident we can find the resources to get a start.

I want to address why those of us who have been working on the BHL are doing it. I thank Dr. Sandra Knapp who in her talk delved into the motivation biologists have to publish. We need to understand these “drivers” in ourselves and our users. Why bother doing what we are doing? I can rattle off the obvious: access, improving zoological, botanical, and mycological and biodiversity research; keeping knowledge preserved; serving new audiences, Etc. However, while keeping focused on what is deliverable, scalable, fundable, we also need to keep

the widest vision in mind. What are we collectively engaged in? I venture to assert we are weaving Indra's Net. And, with others, with countless others, we can weave Indra's Net.

Indra's Net is described in the Avatamsaka Sutra, a Buddhist text of the Hwa Yen school. You may have heard of interdependent origination. Here it is explained through a metaphor. In the Avatamsaka Sutra the story is told of the god, Indra. Gods in these texts are quasi-mythological characters used for metaphors not beings to worship. I quote from the Francis Cook translation:

*Far away in the heavenly abode of the great god Indra, there is a wonderful net which has been hung by some cunning artificer in such a manner that it stretches out infinitely in all directions. In accordance with the extravagant tastes of deities, the artificer has hung a single glittering jewel in each "eye" of the net, and since the net itself is infinite in dimension, the jewels are infinite in number. There hang the jewels, glittering like stars in the first magnitude, a wonderful sight to behold. If we now arbitrarily select one of these jewels for inspection and look closely at it, we will discover that in its polished surface there are reflected all the other jewels in the net, infinite in number. Not only that, but each of the jewels reflected in this one jewel is also reflecting all the other jewels, so that there is an infinite reflecting process occurring.*

This is an expansive vision of the enterprise of human knowledge. You are engaged in it. You are the “cunning artificer.” Yes, you who are trying to find the first naming of *Bidens aristosa*, the mid-western tickseed. You who are putting volume 79 of the botanical journal, *Rhodora*, under the scanner for digitization. You who are mapping the metadata from multiple journal articles to internal data structures prior to ingesting them into an aggregator system. You who are preparing a lesson plan for high school students about the fauna of their neighborhood. You who are grappling with problems of scale for linking similar content originating from heterogeneous data sources. You who are trying to identify from the entomological literature the rare desiccated insect specimen you collected a week ago. You who are putting that just-used volume back on the shelf so it can be found again. You who have verified that the citations that purport to support the author's argument actually refer to something existent. You who are banging heads with others over which organization will pay for which component of the digital project. Yeah, you! You are weaving Indra's Net. And don't you forget it.

There is no center here, in Indra's Net or anywhere else for that matter. All there are are semi-autonomous nodes within the ecology of knowledge where there is no king but there are emergent behaviors. To me this implies radical responsibilities for each of us. The Biodiversity Heritage Library is one of these semi-autonomous nodes, one jewel in the net of jewels.

One of the activities that we animals, we primates, we *Homo sapiens*, do is look at, study, compare, name, categorize and reflect on other living organisms. Doing this is as natural for a human being as raising a child. We have been doing this at least since the Paleolithic as a review of the cave paintings from that period will show. And we do it in an inter-connected web that includes such players as biologists, publishers, librarians, computer scientists, artists, farmers, foresters, funders, hobbyist, and those who happen to be taking an in-breath.

After these two days I ask you to see your work in the widest possible perspective. This Indra's Net of biodiversity is a small reflection of the greater web it blends into. And I am not referring to the World Wide Web but that web of human interconnections with what is. And part of that web is the enterprise of human knowledge. E.O. Wilson's controversial book (aren't they all getting that way), *Consilience: the unity of knowledge*, argues that human knowledge, imperfect as it is, must be seen at its root as a unified continuum, not as an aggregate of incompatible specialties. Remember George Dyson's superb talk, *Darwin among the Machines*, about the early days of computers and the reflections of great minds on “evolution” there? How can human being not see “signs of life.” So going back to the topic of motivation that I mentioned earlier, may we add curiosity and wonder? You will return to your diverse jobs and incompatible conceptual silos tomorrow. In reflecting on the many, wildly different activities that feed into the creation, review, advancement, and preservation, of biodiversity knowledge I see your work, our work as an integrated net. This net antedates the “net,” and is grounded in being human.

And here, here in little BHL land, we take your work very, very seriously. Every one of you ‘cunning artificers.’ We are just one little part of the weave but I want all of you to be certain that we have listened and will take your concerns into our planning. We have your contact information and know how to reach you. You know how to reach us. Let's continue working together and create something real. Thanks.