**SUPPLEMENTARY MATERIAL**

**Training and Help Resources**

Neotoma PIs, Stewards, and developers have built and maintain a variety of resources designed to help orient new users, support educational and outreach activities, and to report issues. These are currently somewhat dispersed; in the future, we aim to better consolidate these resources. See Table S1 below for a full listing of Neotoma online resources.

***Training Workshops*.** We run several kinds of in-person training workshops and webinars. Some workshops are designed to support Neotoma data users and describe the tools available for exploring, viewing, and obtaining Neotoma data via Neotoma Explorer and the R *neotoma* package. Recent user-oriented workshops were held at the International Biogeography Society (2017), the American Quaternary Association (2016), the Society for Vertebrate Paleontology (2016), the European Pollen Database meeting (Giesecke et al. 2016), at PalEON Boot Camp (2014, 2016), the International Symposium on Ostracoda (2017), and in Chile for South American paleoecologists (Latorre et al., 2014). Other workshops train Data Stewards in how to prepare and upload data via Tilia. These Steward-oriented workshops have been provided as several-hour webinars, and as several-day workshops. We held Steward workshops at the American Quaternary Association (AmQua) 2016 biennial meeting and the European Pollen Database (2016). Instructional materials from these Steward- and user-oriented workshops and a template for developing new workshop materials are available on GitHub (<https://github.com/NeotomaDB/Workshops>). More workshops are planned.

Neotoma collaborated with the University of Wisconsin Cartography Lab to hold a day-long Design Challenge mapping workshop in February 2016, bringing together students in cartographic design and paleoecologists to explore new approaches for visualizing paleodata (<https://www.earthcube.org/workspace/c4p/cartography-lab-design-challenge>). Neotoma helped organize a Community Development Workshop (also called a Paleodata Hackathon) in June 2016, led by the Cyberinfrastructure for Paleogeosciences Research Coordination Network, in which interested scientific users and developers convened to explore, use, and link data from Neotoma, the Paleobiology Database, Macrostrat, and other resources.

**Manuals and Workbooks**. The Neotoma Manual is available at <http://neotoma-manual.readthedocs.org/en/latest/>. A Tilia Manual is available at <http://tilia-manual.readthedocs.io/en/latest/>. Tilia help is also available from <https://www.tiliait.com/help/>. Sample workbooks are also available that provide users with standard code and fully realized workflows for common analyses of paleoecological data (<http://neotomadb.github.io>).

**Educational Resources** are housed on the Neotoma website (<https://www.neotomadb.org/education/category/higher_ed/>) and at the Carleton SERC website (<http://serc.carleton.edu/neotoma/index.html>). These are varied, but most are interactive lab-based exercises, primarily geared towards college-level or high school courses. We welcome development of Neotoma-related educational materials and are happy to host or link to such content on the Neotoma home website. Interested contributors should contact the Neotoma Education and Outreach Committee.

Several **Visualization Resources** are in development and are intended for a mixture of educational, outreach, and research purposes. The Flyover Country app (<http://fc.umn.edu/>) is intended as an outreach and research tool that makes geological data available to any traveler with a smartphone (Loeffler et al., 2015), and showcases Neotoma fossil data holdings. An interactive map-based visualization, called Ice Age Mapper, is in development and is intended to replace the now-defunct Pollen Viewer (Williams et al., 2004). Pollen Viewer is no longer compliant with Java security standards and relied upon static images; Ice Age Mapper will dynamically link to Neotoma data holdings.

***Issue Tracking and Code Repositories***. Most code for Neotoma is stored in GitHub, in the NeotomaDB organization (<https://github.com/NeotomaDB/>). Individual code repositories within this organizational domain include the repository for minting DOIs (<https://github.com/NeotomaDB/AssignDOIs>), the *neotoma* R package (<https://github.com/NeotomaDB/neotoma>, forked from ropensci/neotoma), and code for mapping Neotoma to the DarwinCore standard (<https://github.com/NeotomaDB/DwC-Mapping>). The Neotoma API code is not currently open, but will be moved to an open repository in the near future (<https://github.com/NeotomaDB/Neotoma-API>). Issue tracking for Neotoma’s Stratigraphic Diagrammer within Neotoma Explorer is available at <https://bitbucket.org/neotomadb/stratigraphicdiagram/issues> but we plan to migrate this to GitHub.

**Table S1: Summary of on-line resources**

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| --- | --- | --- |
|  | **URL** | **Description** |
| Main Page | [www.neotomadb.org](http://www.neotomadb.org) | Main website for Neotoma Paleoecology Database |
| Data Access and Analysis | [www.github.com/NeotomaDB](http://www.github.com/NeotomaDB) | GitHub code repository for Neotoma DB and associated software |
| <http://apps.neotomadb.org/explorer/> | Neotoma Explorer interface for finding, downloading, and quickly visualizing data |
| <http://api.neotomadb.org> | APIs for programmatic access to Neotoma |
| <https://cran.r-project.org/web/packages/neotoma/index.html> | CRAN repository and download source for *neotoma* R package |
| <https://github.com/ropensci/neotoma> | GitHub code repository for neotoma R package |
| <http://www.neotomadb.org/snapshots> | Archived snapshots of the Neotoma database |
| <https://dx.doi.org/10.6084/m9.figshare.3376393.v1> | Example of an archived snapshot posted to figShare. |
| <https://data.neotomadb.org/datasets/1001/> | Example of a digital object identifier (DOI) and associated landing page for an individual Neotoma dataset. |
| Data Contributions | <https://www.neotomadb.org/data/category/contribution> | Starting page for scientists interested in contributing data to Neotoma |
| <https://www.tiliait.com/> | Website for downloading Tilia software and licenses. |
| Governance, Membership, Policy | <http://www.neotomadb.org/about/category/governance> | Neotoma's Governance Policy and By-Laws |
| <http://bit.ly/2tzjEsZ> | List of Data Stewards (Google Docs) |
| <https://tinyurl.com/NeotomaMember> | Webform to sign up as Neotoma member |
| <http://www.neotomadb.org/data/category/use> | Data Use Policy |
| Help and Training Resources | <http://www.neotomadb.org/uploads/NeotomaManual.pdf> | Neotoma Database Manual, with information about relational database |
| <http://neotoma-manual.readthedocs.org/en/latest/> | A port of the Neotoma Database Manual to the readthedocs.org website, which |
| <https://www.tiliait.com/help/> | Help page for Tilia software |
| <http://tilia-manual.readthedocs.io/en/latest/> | Port of the Tilia manual to readthedocs.org |
| <https://github.com/NeotomaDB/FAUNMAP_Import> | Example of a batch script for importing data into the Tilia .tlx format |
| <http://neotomadb.github.io> | Sample scripts and analytical workflows making use of Neotoma data |
| Teaching Resources | <https://www.neotomadb.org/education/category/higher_ed/> | Access location for contributed teaching exercises and other educational researchers |
| <http://serc.carleton.edu/neotoma/index.html> | Educational resources for college and high school courses developed in partnership with the Science Education Research Center (SERC) at Carleton |
| Allied and Linked Resources | <http://www.earthlifeconsortium.org/api_v1/ui/> | EarthLifeConsortium APIs that simultaneously search Neotoma and the Paleobiology Database. |
| <http://fc.umn.edu/> | Flyover Country, a mobile app for discovering geological data during travel. |
| <http://www.gbif.org/> | Global Biodiversity Information Facility. We are in the process of exporting Neotoma data to GBIF. |
| <https://globalpollenproject.org/> | Global Pollen Project, a community platform for pollen images and identification |
| (<https://www.ncdc.noaa.gov/data-access/paleoclimatology-data> | NOAA Paleoclimatology Portal, searches will retrieve Neotoma data |