

RESEARCH COMMUNICATION

AN INTERNATIONAL TREE-RING ISOTOPE DATA BANK— A PROPOSED REPOSITORY FOR TREE-RING ISOTOPIC DATA

ADAM Z. CSANK*

Laboratory of Tree-Ring Research, University of Arizona, Tucson, AZ 85721, USA

ABSTRACT

The International Tree-Ring Data Bank (ITRDB) is an invaluable resource, providing access to a massive and growing cache of tree-ring data. Oxygen, carbon, nitrogen and hydrogen isotope tree-ring studies, which have provided valuable climatic and ecological information, have proliferated for decades so an ITRDB expansion to include isotopic data would likewise benefit the scientific community. An international tree-ring *isotope* databank (ITRIDB) would: (1) allow development of transfer functions from extended isotopic data sets, (2) provide abundant tree-ring isotopic data for meta-analysis, and (3) encourage isotopic network studies. A Europe network already exists, but the international data bank proposed here would constitute a *de facto* global network. Associated information to be incorporated into the database includes not only the customary ITRDB entries, but also elements peculiar to isotope chronologies. As with the current ITRDB, submission of data would be voluntary and as such it will be crucial to have the support of the tree-ring isotope community to contribute existing and forthcoming isotope series. The plan is to institute this isotope database in 2010, administered by the National Climatic Data Center.

INTRODUCTION

Since its inception in 1974, the International Tree-Ring Data Bank (ITRDB) has become an invaluable tool for dendrochronological research and a premier paleoclimate database. Several influential studies have made use of convenient access to the multiple archived data sets to produce spatial networks or grids of tree-ring chronologies (e.g. Meko *et al.* 1993; Briffa *et al.* 2002; Cook *et al.* 2004). The ITRDB was established in response to the rapid world-wide expansion in development of tree-ring chronologies and is administered by the Paleoclimatology Program of the National Oceanic and Atmospheric Administration (NOAA), National Climatic Data Center (NCDC) (Grissino-Mayer and Fritts 1997). The recent explosion in the number of studies using isotopes (of oxygen, carbon, hydrogen, and nitrogen) in tree rings substantiates the need to expand the ITRDB to incorporate these data sets. For example, a European network of tree-ring isotope data has been developed by Treydte *et al.* (2007) illustrating the potential inherent in a large database of isotopic data. This study was, however, limited to one region and to datasets contributed by individual authors.

PURPOSE OF THE ITRIDB

The primary purpose for the expansion of the ITRDB to include tree-ring isotopes is consistent with its long-range mission of storage of all types of dendrochronological data from across the globe. This will consolidate and aid in dissemination and access to data that are often published in a diverse array of journals/reports. This repository would help protect against the loss of data through mishandling, relocation or termination of laboratories, and scientists who retire or pass away. Such an isotopic database linked to the ITRDB would provide access to the already extensive dendrochronological records for sites, which could add valuable ancillary information to dendroisotopic studies.

DATA SUBMISSION REQUIREMENTS

As with the ITRDB, certain types of metadata will be required for isotope submissions. Necessary information will include all the standard information from the ITRDB, such as site name, investigators, genus/species, latitude/longitude, elevation, country, state/province, measurement type, detrending method, collection purpose, sample type and publication citation information. Additionally, isotopic data will require information specific to this type of analysis. This

* Corresponding author: csank@ltrr.arizona.edu

will include whether or not a chronology was established, age information if no chronology (*e.g.* in the case of subfossil wood), whether they are pooled samples or single ring/single tree measurements, whole wood or alpha cellulose, method of pre-treatment, date analyzed, type of isotope analyzed (^2H , ^{13}C , ^{18}O , ^{15}N), analytical precision for each isotope analyzed, whether $\delta^{13}\text{C}$ is Suess-corrected or not and which correction was used, name of laboratory where analyses were conducted, and the uncertainties associated with the age model used if it is tropical data. Isotopic analysis is costly and time consuming, so in recognition of the efforts put forward by those responsible for collecting the data, the recommended citation for the dataset will be prominently featured in the metadata.

An effort headed by Esther Jansma and Peter Brewer (with contributions of 79 dendrochronologists world wide) is underway to update the ITRDB with the eXtensible Markup Language (XML) schema for storage of metadata using a new global data standard for tree-ring data (TRiDaS) as the eventual standard for all data reported and stored in the ITRDB (Jansma *et al.* in press; see <http://www.tridas.org>). The TRiDaS data format presents distinct advantages over the current ITRDB schema, primarily because the TRiDaS schema can store many more searchable data objects (*e.g.* extra fields for isotopic data) than can be adequately stored in the current ITRDB. From a data submission standpoint, the new format will not appear radically different, as the form will still be web-based with data entry fields, but the downloadable data sets will appear different.

Ideally, a new member would serve on the ITRDB Advisory Committee with the responsibility to provide quality control of isotopic data. For examples of what the metadata will look like both in the present ITRDB format and the new TRiDaS format see **Supplementary Material** and/or at <http://ltrr.arizona.edu/~csank/>.

ITRDB HOLDINGS

Currently a limited quantity of isotopic data is available on the website for the World Data Center for Paleoclimatology <http://www.ncdc.noaa.gov/paleo/treering/isotope/tree-isotope.html>. However, in the near future the ITRDB will be revised to incorporate the necessary fields for isotopic data and will be available to receive submissions. Once the modifications are complete, isotopic data sets will be searchable and downloadable through the NOAA Paleoclimatology Program Tree-Ring Page at <http://www.ncdc.noaa.gov/paleo/treering.html>. The holdings will be

searchable using a web-based search engine linked from this site. Once a search is completed, one or all of the available files can be downloaded.

INCIPIENT ITRDB

The conception of the ITRDB envisioned an eventual expansion to include isotopic data sets (Grissino-Mayer and Fritts 1997), but it has simply taken longer to get to this point than originally thought. Although the ITRDB is still in the process of being revised to accept isotopic data, anyone wishing to submit now can download a metadata template from <http://www.ltrr.arizona.edu/~csank/>, and send data to isotope@ltrr.arizona.edu temporarily set up for early submissions. It is hoped this paper will stimulate interest and encourage submissions of isotopic data to the ITRDB, and to provide a glimpse of the future expanded ITRDB.

REFERENCES CITED

- Briffa, K. R., T. J. Osborn, F. H. Schweingruber, P. D. Jones, S. G. Shiyatov, and E. A. Vaganov, 2002. Tree-ring width and density data around the Northern Hemisphere: Part 1, local and regional climate signals. *The Holocene* 12(6):737–757.
- Cook, E. R., C. A. Woodhouse, C. M. Eakin, D. M. Meko, and D. W. Stahle, 2004. Long-term aridity changes in the western United States. *Science* 306:1015–1018.
- Grissino-Mayer, H. D., and H. C. Fritts, 1997. The International Tree-Ring Data Bank: An enhanced global database serving the global scientific community. *The Holocene* 7(2):235–238.
- Jansma, E., P. W. Brewer, and I. Zandhuis, *in press*. TRiDaS 1.1: The tree-ring data standard. *Dendrochronologia*.
- Meko, D. M., E. R. Cook, D. W. Stahle, C. W. Stockton, and M. K. Hughes, 1993. Spatial patterns of tree-growth anomalies in the United States and southeastern Canada. *Journal of Climate* 6:1773–1786.
- Treydte, K., D. Frank, J. Esper, L. Andreu, Z. Bednarz, F. Berninger, T. Boettger, C. M. D'Alessandro, N. Etien, M. Filot, M. Grabner, M. T. Guillemain, E. Gutierrez, M. Haupt, G. Helle, E. Hlasvouri, H. Jungner, M. Kalela-Brundin, M. Krapiec, M. Leuenberger, N. J. Loader, V. Masson-Delmotte, A. Pazdur, S. Pawelczyk, M. Pierre, O. Planells, R. Pukienė, C. E. Reynolds-Henne, K. T. Rinne, A. Saracino, M. Saurer, E. Sonninen, M. Stievenard, V. R. Switsur, M. Szczepanek, E. Szychowska-Krapiec, L. Todaro, J. S. Waterhouse, M. Weigl, and G. H. Schleser, 2007. Signal strength and climate calibration of a European tree-ring isotope network. *Geophysical Research Letters* 34, L24302, doi: 10.1029/2007GL031106.

Received 26 May 2009; accepted 4 June 2009.

Supplementary Material is available at <http://www.treeringsociety.org/TRBTRR/TRBTRR.htm>