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Environmental Impact: A Preliminary Citation Analysis of Local Faculty in a New Academic Program in Environmental and Human Health Applied to Collection Development at Texas Tech University Library

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ABSTRACT

New academic programs in environmental science prompted a citation analysis of local faculty by the Texas Tech University Library (TTU). The purpose of this study is to characterize the citation patterns of the interdisciplinary field of environmental and human health as compared with other disciplines and to apply the results to collection development. Twenty-four articles were selected from 1996 and 1997 with over 1600 citations to more than 950 listed references. The average age of citations was 10.5 years for journals and 9.4 years for books. On average, journals were cited 67% of the time while books were cited 17% of the time. Proceedings, theses, and technical reports were also cited but that data was not applied to collection development. The impact on collection development has been to identify a small number of specific books which were frequently cited but were not in the collection and to identify important subject terms with which to guide the selection of related books. Finally, 12 new subscriptions to frequently cited journals will be reviewed with faculty to determine their suitability as additions to the collection.

INTRODUCTION

In response to two distinct requests from life science faculty on the TTU campus for a description of library support for new environmental studies programs, a document was prepared describing the collection, document delivery service options, spending patterns for acquisitions, etc. [[Appendix E](#)] In order to better understand how to support the research activity of these faculty, especially the group at the new Institute of Environmental and Human Health (TIEHH), a citation analysis was undertaken which would allow for refining the original description of program support by the University Library. It was also hoped that such a study would add a qualitative dimension to the Library's effort to gather use data amidst an ongoing debate over the validity of journal reshelving counts.

TIEHH was formed as a joint venture between Texas Tech University and Texas Tech University Health Sciences Center in 1997. It is dedicated to be a leader in research and teaching between environmental and human health. It will implement "good science" and technology in the interface of good environmental policy and economic development. The charter faculty of the Institute [[Appendix A](#)] established a solid record of original research and service while at Clemson. A representative sample of their scholarly output in 1996 & 1997 constitute the study sample for this analysis.

LITERATURE REVIEW

Citation studies reveal much about scholarly communication and can be an effective tool to guide collection development in academic libraries. These studies typically take one of two directions: "local" or "global." Studies of "local" faculty are believed by many to yield more relevant results than "global" investigations to assist librarians making serials selection decisions for their institutions. Aside from practical applications, citation studies offer objective insight into the fundamental research behavior of faculty and graduate students. For example, citation studies have been used to better understand how invisible colleges communicate, to identify discipline specific core journals, to make distinctions in research patterns between pure and applied scientists, etc.

In a study comparing two plant science journals considered either applied or basic in scientific content, [Nordstrom \(1987\)](#) characterized each based on citation age, proportion of cited formats, number of citations per article, and the distribution of citations among sections of each publication. He reported that basic science publications generally cited more works and that these works tended to be somewhat older than the applied science counterpart. Comparing the results of his study to this one with regard to these two parameters suggests that the group of environmental science faculty in the present study could be considered as belonging to the basic science group. However, Nordstrom suggested that applied scientists relied on journals 68% of the time and used technical reports with some frequency. These aspects of the present study suggest that environmental researchers fall into the applied science group. The interdisciplinary nature of environmental studies suggests that they do not fit neatly into either group but lie on a continuum somewhere in between.

Systematics research, like environmental studies is quite synthetic, drawing information from a wide range of other disciplines. This is where similarities end, however. Citations to the taxonomic literature are generally much older and follow a unique set of international

"rules and standards." For example, citations associated with synonymies may not appear in the literature cited section of a publication. Some 11% of journal citations and 23% of book citations could be overlooked if analysis failed to include the list of synonymies.

[[Delendick 1989](#)] Many other types of citations may not be listed in the bibliography of an article on taxonomy. The environmental literature studied here also contained citations to scientific and corporate names not listed in the references at the end of some articles. While the frequency of this practice was not measured, 36% of the articles studied had such "non-bibliographic" citations.

Faculty citation patterns reflect dynamic research priorities, offering guidance as academic libraries seek to support campus research and teaching activities. Library support for scientific research has become quite a challenge at the end of the 20th century due to shrinking budgets, escalating costs of scientific journals, and the advent of the electronic journal. Local citation patterns can help serials managers make objective selection decisions, saving money and creating a collection that will be more widely used. [[McCain 1981](#)]

Citation studies of the scientific literature consistently demonstrate that journals continue to be more heavily utilized in the exchange of information with some disciplines reporting that journals are cited as much as 92% of the time with all other formats making up the remaining 8% of citations. [[Walcott 1994](#)] It is often helpful to conduct some form of faculty survey in association with a citation study to uncover complimentary information and clear up questions prompted by the citation analysis. [[Crotteau 1997](#)] While no formal survey was conducted here, numerous email messages have been exchanged with faculty and have proven helpful in keeping this study on track. For example, some faculty were not aware that some journals were available electronically through Academic Press (IDEAL). The dialogue prompted by this study has fostered an exchange of information about products and services offered by the University Library making faculty more aware of how the Library supports their teaching and research activities in a growing electronic landscape.

Comparisons between local citation patterns and the international data provided by *Journal Citation Reports* (JCR) of the Institute of Scientific Information help to point out the strength of journals among the international research community. A frequently used international ranking, referred to as an impact factor, has been used by some in identifying "core journals" or journals considered basic to any collection offering coverage in a corresponding discipline. [[McCain 1991](#)] Impact factors from the JCR are found in the list of journals cited for a global perspective on the importance of the journals cited by faculty in this study. [[Appendix B](#)] Yet, a high impact factor alone does not necessarily mean that a particular journal should be added to a collection since other factors such as local research interest and price should be considered.

METHODS

A narrowly defined group of faculty and their scholarly output are essential first steps in this qualitative study. In order to better understand and support the new program in environmental and human health on campus, the charter faculty at the Institute of

Environmental and Human Health were selected. Graduate student theses from this institute will offer the opportunity to refine these faculty findings in the future. The most recent, complete two years (1996 & 1998) of published research were selected to keep the sample size from becoming unmanageable and to insure timely relevance to present research needs. The fact that only the scholarly output of local faculty were considered is a good measure of local relevance. The University Library's mission is to support specific campus programs, therefore, a generic study on environmental research around the world, may be of interest for comparative purposes, but it would not be as useful to apply to collection building in the University Library.

Locally available FirstSearch databases were searched by author, including Agricola, BasicBiosis, Environment, CAS Student Edition, Medline, and Biological and Agricultural Index. It was difficult to specify authors in those databases where they did not include the author's first name. A listing of faculty publications was also consulted on the TIEHH Web site. Due to time limitations, a representative sample rather than a comprehensive collection of publications was sought. Interlibrary loan services were heavily utilized. Each article was reviewed in its entirety rather than simply examining the list of sources at the end of the article since some of these sources were not cited at all while others were cited to varying degrees throughout the paper.

A spreadsheet program was used to list, organize, and perform calculations on cited sources. Two distinct files were created, one to characterize the author's articles and the other to examine the cited sources in those articles. References were classified as either journals, books, theses, technical reports, or proceedings. Journal abbreviations were translated into full titles using standard reference tools. Non-literary citations were noted along with non-bibliographic citations, which refer to literature that may be so fundamental as to be taken for granted and not listed in the article's bibliography. [[Delendick 1989](#)]

Two definitions should be kept in mind. The first is, "Technical Report." It is easier to say what this is not, rather than what it is. Technical reports in this study are not journals, books, proceedings, or theses. In other words, they are most any thing else, including patents, departmental publications, agency reports, etc. The second is, "Self Citation." Authors frequently cite themselves for a variety of reasons. All TIEHH charter faculty were considered authors of every article in this study whether or not they appear as such. Due to the team-like structure of this group, it is likely that they are more apt to be aware of each others publications regardless of how the authors of each paper are listed. Their Web page listing staff publications is an example of this more collegial level of information exchange.

RESULTS

Discussion

The 24 publications studied herein listed over 950 references which were cited more than 1650 times. A few papers listed references that were never cited. This occurred, five percent of the time on average. Most of the bibliographies with these articles included self citations, that is references to works authored by colleagues. This occurred an average of 13% of the time. In general these publications were 12 1/2 pages long and authored by five

individuals. They listed 39 references which were cited 65 times, on average.

TABLE 1: Format Proportion and Average Age of Cited Works

Format of Cited Works	Relative Proportion When Present (%)	Average Age (yrs)	TTU Owned (%)
Journal	67	10.5	66
Book	17	9.4	58
Technical Report	16	7.9	
Proceedings	10	9.4	
Theses	7	9.1	

The range of formats cited was quite diverse, including journals, books, technical reports, theses/dissertations, electronic databases, and non-literary sources. [Table 1] The latter includes references to the scientific names of organisms, soil classifications, corporate names, and of course - personal communication. Many of these references could be traced to a literary source, such as the original publication documenting the first time an organism was identified, named, and described. Thirty-six percent of the publications studied, included such citations, but they were rarely listed in the references. Not every format was represented in each

citing publication so the overall percentage may not equal 100. But when present, these formats were cited proportionally as listed in Table 1.

The age of cited works was much less diverse. [Table 1] It was surprising to find that the average age of a journal citation was greater than all other formats - ten and a half years. This age corresponds with other disciplines such as systematic botany [Delendick 1989] and statistics [Johnson 1996], yet the literature of environmental and human health is fundamentally different than these other disciplines. For one thing, while the literature of plant taxonomy and the environment are both quite interdisciplinary, the former is more descriptive, the latter presents experimental studies conducted in the field or laboratory. More timely reporting of such experiments was expected. This result alone carries important implications for collection development as discussed in the next section. Statistics faculty, on the other hand, rely more heavily on books with their slower publication schedule than do the environmental scientists, yet this explanation is inadequate in and of itself to account for the similarity between these disciplines in the average age of cited research.

Application

Holdings of specific titles of the more heavily cited journals [Appendix B] and books [Appendix C] were searched for in the TTU Library online system. It was found that 58% of the books and 66% of the journals are now in the collection. Eight additional book titles from the list are considered suitable for the collection and are being purchased, bringing the current holdings of cited books to 73%. Additional books will be selected based on subject terms associated with cited books, key words as listed in some of the faculty publications, and the TIEHH Web site of current research projects. [Appendix D]

All heavily cited journals not currently subscribed to (12 titles), will be carefully reviewed

with faculty to determine whether or not it would be appropriate to initiate a subscription at this time. The tendency of this group to cite older journals, suggests that membership in JSTOR may be appropriate since these retrospective electronic holdings are older than five years. It should also be noted that, for the most part, the heavily cited journals by this group of faculty also have rather high impact factor ratings by ISI, the Institute for Scientific Information. Proceedings, technical reports, and theses are not being incorporated into the collection development process as a result of this study due to the relatively low number of citations found for each group and the greater difficulty of acquiring these materials.

ACKNOWLEDGEMENTS

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- Walcott, Rosalind. Local citation studies - a shortcut to local knowledge. *Science and Technology Libraries* 1994 vol. 14(3): 1-14.

APPENDIX A: FACULTY & PUBLICATIONS USED IN ANALYSIS

- Todd A. Anderson
- George P. Cobb
- Catherine M. Bens
- Richard L. Dickerson
- Kenneth R. Dixon

- Mike Hooper
- Thomas La Point
- Ernest E. Smith
- Scott McMurry

Title / Source

- An ecological risk assessment for the use of the biocide DBNPA in industrial cooling systems
Environmental Toxicology and Chemistry
- Atrazine degradation in pesticide-contaminated soils: phytoremediation potential
ACS Symposium Series 664
- Demography and condition of populations of white-footed mice (*Peromyscus leucopus*) in late and early successional habitats
Journal of Mammalogy
- Ecological risk assessment of atrazine in North American surface waters
Environmental Toxicology and Chemistry
- Ecological risk assessment procedures for U.S. Army sites
ASTM special publication technical bulletin 1317
- Effect of chloride, hardness, and dissolved organic carbon on silver solubility in aquatic toxicity test
Transport, fate, and effects of silver in the environment
- Enhanced mineralization of [¹⁴C] atrazine in *Kochia scoparia*, rhizospheric soil from a pesticide -contaminated site
Pesticide Science
- Environmental age and sex effects on cotton rat (*Sigmodon hispidus*) hematology
Journal of Wildlife Diseases
- Evaluation of the use of vegetation for reducing the environmental impact of deicing agents
ACS Symposium Series 664
- Fate of methyl bromide in fumigated soils
ACS Symposium Series 652
- Fish bioturbation of cadmium contaminated sediments factors affecting Cd availability to *Daphnia magna*
Environmental Toxicology and Chemistry
- Habitat differences in mass-specific litter sizes of hispid cotton rats
Journal of Mammalogy
- Influence of age sensitivity on the acute toxicity of silver to fathead minnows at various water quality parameters
Transport, fate, and effects of silver in the environment
- Monitoring Great Horned Owls for pesticide exposure in southcentral Iowa
Journal of Wildlife Management
- Northern bobwhite habitat use and survival on a South Carolina plantation during winter
Wildlife Society Bulletin
- Organic chemicals in the environment
Journal of Environmental Quality

- Phytoremediation of contaminated water and soil
ACS Symposium Series 664
- Phytoremediation of herbicide-contaminated surface water with aquatic plants
ACS Symposium Series 664
- Phytoremediation of soils contaminated with organic pollutants
Advances in Agronomy
- Survival and cover seeking response of northern bobwhites and mourning doves
dosed with Aldicarb
Environmental Toxicology and Chemistry
- The bioconcentration and bioaccumulation of silver in an experimental freshwater
ecosystem
Transport, fate, and effects of silver in the environment
- The role of quality in today's research university
Quality assurance, good practice, regulation, and law
- Use of undisturbed soil columns under controlled conditions to study the fate of
[14C] deethylatrazine
Journal of Agricultural Food Chemistry
- Water quality components affecting silver toxicity in *Daphnia magna* and
Pimephales promelas
Transport, fate, and effects of silver in the environment

APPENDIX B: JOURNALS CITED MOST

The final three titles were not among the most heavily cited (cited 5 or more times) but were mentioned by a faculty member as important to his research. The combination of being cited at least once and requested by a faculty member prompted their inclusion on the final list.

Journal Title	Number of Times Cited	Current TTU Holdings	ISI Impact Factor 1996	Price U.S. \$
Environmental Toxicology and Chemistry	136	Yes	2.142	na
Environmental Science and Technology	53	Yes	3.534	na
Bulletin of Environmental Contamination and Toxicology	49	No	Not Listed	\$277
Journal of Environmental Quality	40	Yes	1.835	na
Archives of Environmental Contamination and Toxicology	39	No	1.396	\$635
Chemosphere	32	No	1.204	\$2693
Applied and Environmental Microbiology	30	Yes	3.129	na
Ecology	30	Yes	3.438	na

Weed Science	27	Yes	1.136	na
Estuaries	21	No	1.272	\$230
Journal of Mammalogy	21	Yes	0.839	na
Journal of Agricultural and Food Chemistry	18	Yes	1.732	na
Water Research	18	Yes	1.674	na
Journal of Wildlife Management	16	Yes	1.075	na
Ecotoxicology and Environmental Safety	15	Yes *	0.914	na
Environmental Pollution	14	Yes	1.506	na
Pesticide Science	14	Yes	0.799	na
Science	12	Yes	23.605	na
Plant Physiology	8	Yes	3.696	na
Aquatic Toxicology	7	Yes	1.777	na
Critical Reviews in Environmental Science and Technology	6	No	2.400	\$375
Gidrobiologicheskii Zhurnal	6	No	Not Listed	\$410
Hydrobiologia	6	Yes	0.592	na
Marine Environmental Research	6	No	1.160	\$996
Water Science and Technology	6	No	0.622	\$3313
Archiv fuer Hydrobiologie Supplementband	5	No	1.881	Price varies
Canadian Journal of Fisheries and Aquatic Sciences	5	Yes	1.346	na
Journal of Environmental Sciences and Health (A, B, C)**	5	No	0.580, 1.000, ?	\$1150, \$775, \$395
Proceedings of the National Academy of Science	5	Yes	10.244	na
Review of Plant Protection Research	5	No	Not listed	Not listed
Environmental Health Perspectives	2	Yes***	1.688	na
Toxicology & Applied Pharmacology	2	Yes*	2.590	na
Biochemical Pharmacology	1	No	2.612	\$4500

* Electronic subscription through Academic Press (IDEAL)

** Specific edition unclear from citations

*** Electronic subscription, password required

APPENDIX C: BOOKS CITED MOST

Book Title	Number of Times Cited	TTU Holdings
Using mesocosms to assess the aquatic ecological risk of pesticides: theory and practice 1989	10	No
Chemical deicers and the environment Lewis 1992	9	Yes
Environmental fate reference data source book for atrazine 1994	9	No
Evolution of life histories of mammals theory and pattern Yale Univ 1988	7	Yes
Aquatic mesocosm studies in ecological risk assessment Lewis 1994	6	Yes
Environmental cleanup of fertilizer and agri-chemical dealer sites 1993	6	No
Microbial ecology fundamentals and applications 1993	6	Yes
Biodegradation and bioremediation Academic Press 1994	5	Yes
Bioremediation through rhizosphere technology ACS 1994	5	No
Phytoremediation of soil and water contaminants	5	Yes
Soil Microbiology and Biochemistry Academic Press 1989	5	Yes
Microbiology McGraw-Hill 1986	4	No
Plant microbiology 1985	4	Yes
Aquatic toxicology and hazard assessment 10th v.	3	Yes
Biometry: the principles and practice of statistics in biological research 2nd ed 1981	3	Yes
Cholinesterase-inhibiting insecticides vol 2 Elsevier 1991	3	No
Handbook of environmental Fate & Exposure Data for Organic Chemicals; Lewis Publishers 1991	3	Yes
Herbicide Handbook of the Weed Science Society of America; Weed Science Society of America: 1989	3	Yes

Lillie's Development of the Chick. Holt & Company: New York 1952	3	Yes
Long Range Transport of Pesticides. Lewis 1990	3	No
Molecular Mechanisms of herbicide Selectivity, Oxford University Press 1989	3	No
Pesticide effects on terrestrial wildlife, Taylor & Francis, London 1990	3	Yes
The development and function of roots academic 1975	3	No
The restoration of land: the geology and reclamation of derelict and degraded land	3	Yes
Ultrasturcture of the root-soil interface 1983	3	Yes
Casarett and Doull's toxicology. The basic science of poisons	2	Yes
Ecological risk assessment Lewis 1993	2	Yes
Ecological risk estimation Lewis 1992	2	Yes
Environmental extrapolation of biotransformation data role of biodegradation kinetics in predicting environmental fate 1980	2	No
Environmental impacts of soil component interactions Lewis 1995	2	No
Environmental toxicology and risk assessment ASTM	2	Yes
Heavy metal tolerance in plants: evolutionary aspects	2	Yes
Humic substances in soil and crop sciences selected readings 1990	2	Yes
In situ bioreclamation applications and investigations for hydrocarbon and contaminated site remediation	2	Yes
Interaction between Sediment and freshwater	2	No
Methods of soil analysis part 1 Agron Mono 9 ASA 1986	2	No
Microbial Ecology of Leaves; Springer-Verlag	2	No
Multimedia Environmental Models Lewis 1991	2	No
Performing ecological risk assessment Lewis 1993	2	Yes
Pesticide waste management technology and regulation ACS 1992	2	No
Physiological ecology Sinauer	2	No
Plant contamination modeling and simulation of organic chemical processes Lewis 1995	2	Yes
Plants for toxicity assessment ASTM 1990	2	Yes
Pollution and sea life 1972	2	No

Quantitative ecology and the brown trout Oxford Univ 1994	2	Yes
Research methods in weed science 3rd ed. 1986	2	No
SAS user's guide. Version 5. SAS Inst. 1985	2	No
Singlet oxygen Academic Press 1979	2	No
The Biologic & Economic Assessment of Methyl Bromide; NAPIAP: Washington, DC 1993	2	No
The rhizosphere Springer 1986	2	Yes
Toxicological chemistry Lewis 1992	2	Yes
Treatment Wetlands	2	Yes

APPENDIX D: SUBJECTS/KEY WORDS DERIVED FROM CITED PUBLICATIONS AND THE TIEHH WEB SITE

Subject Term / Key Word

- Agricultural ecology
- Alligators
- Animals effects of pesticides
- Aquatic endocrine disrupters
- Atmospheric diffusion
- Bioenergetics
- Biotic communities
- Botanical chemistry
- Computer-automated behavioral assay
- Crocodiles
- Cross media pollution mathematical models
- Ecophysiology
- Endocrine disrupting chemicals (EDC's)
- Freshwater ecology
- Herbicides metabolism
- Herbicides research
- Herbicides resistance
- Lake sediments
- Leaves microbiology
- Mammal population levels
- Mammal reproduction
- Maturation-induces steroid
- Microbial ecology
- Microbiology
- Microorganisms
- Ocean circulation
- Organic compounds environmental aspects mathematical models

- Organochlorine chemicals
- Pesticide law and regulations United States
- Pesticide waste management
- Pesticides environmental aspects
- Pesticides risk assessment
- Pheromones
- Phytoremediation
- Plant microbe relationships
- Plants effect of herbicides
- Plants metabolism
- Plants physiology
- Pollutants environmental aspects
- Pollution environmental aspects
- Pollution mathematical models
- Polychlorinated biphenyls (PCB's)
- Raccoons
- Resource partitioning ecology
- Rhizosphere
- Roots
- Soil amendments
- Soil analysis
- Soil conservation
- Soil degradation
- Soil remediation
- Water quality biological assessment
- Weeds control research
- Zebrafish (*Brachydanio rerio*)

APPENDIX E: LIBRARY ENVIRONMENTAL PROGRAM SUPPORT AS DESCRIBED PRIOR TO THIS STUDY

Ecology and Environmental Toxicology: TTU Libraries Program Support

Recent Library Expenditures in Support of this Program and Related Areas

Library Expenditures for areas related to this program are based on the "fund codes" that are assigned by librarians to each subscription. While each title assigned a relevant code will vary in its applicability to this program, the funds expended are indicative of the overall support for this program. The interdisciplinary nature of this program makes it difficult to come up with exact figures. The fund codes used to calculate overall support include ENT - entomology, RAN - range, FIS - fisheries, BIO - biology, BIC - biochemistry, ICA - ICASALS, and CIV - civil engineering. The civil engineering fund is a

moderately large fund but is much less relevant than the fields of biology, fisheries, etc. By the same token, a number of funds such as physics, mathematics, chemistry, etc. will be used to purchase relevant titles but were not included in the calculation. Therefore, the following figures are approximate and only useful for broad comparisons. Several other expenditures for Reference titles, database access, etc. are not included but are important elements in supporting every program on campus. The following table includes appropriations, not actual expenditures. Occasionally, expenditures exceed appropriations.

Year	\$ for Journals	% Change	\$ for Books	% Change	\$ for Approval Plan*
1995	\$286,179		\$19,976		N/A
1996	\$340,139	+ 19%	\$22,847	+ 14%	N/A
1997	\$379,176	+ 11%	\$22,626	- 1%	\$27,215

* The Approval Plan is a systematic method of receiving regular shipments of books based on profiles set up by subject librarians. The Approval Plan vendor is Blackwell North America. The primary profile used to receive books relevant to this program is the Biology profile, though related titles are regularly received based on profiles for nutrition, chemistry, agriculture, etc.

Specific library holdings added in the last three years in anticipation of this program are difficult to assess precisely. However, a list of new books related to toxicology is maintained at (<http://www.lib.ttu.edu/biology/tox-nb.htm>). Many titles are in the process of being ordered at this time, such as the thirteen volume set "Comprehensive Toxicology" and cannot now be listed. New journals include:

- Applied Biochemistry and Biotechnology
- Journal of Industrial Ecology
- Environmental Manager
- Journal of Analytical Toxicology
- Journal of Biochemical and Molecular Toxicology

Due to the obvious importance of journals to this discipline, adequate access to this material is our top priority. A page listing the top journals in the field has been created which lists our holdings, those of the Health Science Center Library, and provides access to two tables-of-contents services at (<http://www.lib.ttu.edu/biology/tox-jo.htm>). For those titles we do not own, specific articles may be requested online from FirstSearch or through the Library Information System. Requests for new titles may be submitted at any time. Decisions are finalized early in the fall semester. These titles are often quite costly, therefore, each title is carefully considered.

Future Library Expenditures in Support of this Program and Related Areas

Expenditures for serials are expected to increase by 7% to 10% just to keep pace with inflation. Funds for book purchases are also expected to rise by a more moderate rate of 5%.

Present TTU Library Holdings & Resources

Personnel

Library resources begin with library personnel. Briefly, these personnel consist of Reference Librarians and Subject Librarians. The latter group, as the title implies, have subject specialties whereby they may assist patrons with detailed queries, such as those brought up by research oriented faculty and graduate students.

A complete list of these individuals may be found on the Library's Web page (<http://www.lib.ttu.edu/collections/liaisons.htm>), but the seven individuals most likely to be involved with this program include: Oleta Armstrong, *Reference*; Jack Becker, *Agriculture*; Michael Golden, *Chemistry, Biochemistry, and Geosciences*; Bill Johnson, *Biology, Mathematics, and Physics*; Susan Norrisey, *Engineering and Computer Science*; Brian Quinn, *Health*; and Tom Rohrig, *Government Documents*.

Spending by these individuals for materials related to this program may occur individually or collectively as part of a team such as the Science Team or the Reference Collection Committee. Requests may be submitted to these people in a variety of ways from students or faculty.

Books

Books, documents, and other individually packaged information sources, either print or electronic number approximately 50,000, based on keyword searching in TechPAC, the Library's online catalog out of about 1.4 million volumes. This number represents only a portion of the materials held on the Tech campus for it does not include those items available from the Health Science Center Library. It is hoped that this program will foster collaborative collection development activities by these two campus Libraries. Additionally, the Law School Library holds environmental law materials not included in the figure above.

Several other factors should be considered in assessing the adequacy of the collection in meeting the information needs of faculty, staff, and students in addition to merely counting volumes held at the University Library. The first factor is the growing number of electronic resources that will be counted on more and more to support academic programs at TTU. Another factor is the Government Documents collection. Texas Tech is home to one of only two Regional Depository Libraries in Texas. Therefore, it not only offers a wealth of print materials, some 1.3 million documents and 1 million microforms, but it now offers the full text of U.S. patents for the past twenty years on CD-ROM, in print, or on microfilm. Finally, the Southwest Collection houses rare books and original manuscripts, many specifically related to the history of this region, that may offer support to specialized research centering on the environmental history of the Southwest. Additionally, numerous departmental libraries may offer access to specialized materials and the Geosciences Reading

Room offers information sources related to geology and maps, including the latest GIS (Geographic Information System) software.

Texas Tech University Libraries were recently admitted into the Association of Research Libraries (ARL) and this represents a significant commitment on the part of the Libraries and the University administration in continuing the support for additional materials and personnel expenditures required to attain this distinction.

Journals

Journals, magazines, periodicals, newspapers, and newsletters are among the most critical type of information to scientific research and teaching. In addition to the [429](#) titles subscribed to and available in print at the University Library, a number of [additional titles](#) are held in the Health Science Center Library (<http://www.lib.ttuhscc.edu/>) and the Law Library. Due to the escalating price of print journal subscriptions, and the inability of any academic library to "keep up", we have had to cut serials from time to time. This activity is not only hard on programs, it is hard on people. In order to minimize this "defensive" posture, the Library has entered into a number of agreements to subscribe to electronic journals either as individual titles or as part of subscription packages. Relevant examples to this program include [Academic Press \(IDEAL\)](#) (73 titles) and [Springer-Verlag](#) (10 titles). A few titles are also available from TexShare through the [Periodical Abstracts](#) database (30 titles). The latter option includes titles with selected articles offered in ASCII text. Thus, some 542 periodicals are available in print or electronic formats from the University Library relevant to this program, not counting Government Documents, Law, or the Health Science Center Library.

Reference Tools

As mentioned above, Reference constitutes a distinct collection area with a separate budget and selection procedure. Acquiring materials in this area is essentially dependent on the initiative of each subject specialist to request items and supply the appropriate documentation to the Reference Collection Committee in light of "competing" requests. The overall philosophy of the University Library, with regard to the Reference collection, has been to focus on usefulness to as broad an audience as possible. Thus specialized materials are not always approved, yet many titles, in order to be of any value, must be specialized. Also, online databases have been favored over CD-ROM resources. This may be changing with the advent of a new CD-ROM tower that has recently been installed. The ERS Office (Electronic Reference Services) is also available for online searches, for a fee, to access databases where we have no current subscription such as Zoological Record, via Dialog.

General, as well as specialized [reference resources](#) number approximately 1% of the overall collection in this subject area. These materials are available in print and electronic formats. Major print indexing/abstracting services related to this area include: Science Citation Index - Q1 S365, Chemical Abstracts - QD1 A51, Biological Abstracts - QH301 B37, Biological Research Index (Biological Abstracts/RRM) - QH301 B371, Cumulated Index Medicus - R2 I3, Pollution Abstracts - TD12 P77, and Zoological Record - QL2 Z8 (up to 1981). The primary

collection of bibliographic databases is available online from OCLC (Online Computer Library Center) via FirstSearch. OCLC is a nonprofit, membership, library computer service and research organization dedicated to the public purpose of furthering access to the world's information. While the number of available databases via FirstSearch varies slightly from year to year, we now have unlimited access to some 60 databases with at least 13 of those relevant to this field: [Agricola](#), [Applied Science and Technology Index](#), [BasicBiosis](#), [Biological/Agricultural Index](#), CAS-StudentEdition (*Chemistry*), Contents1st (*Table-of-Contents Service*), Dissertation Abstracts, [Geobase](#), Georef (*Geosciences*), [GPO](#), and [Worldcat](#). The advantage to having access to online resources is that the information is more conveniently and more efficiently available for our patrons.

Additionally, three full text and bibliographic resources have become available or have been developed for TTU Library patrons. The first is a locally developed database that specializes in environmental information related to playa lakes and the Ogallala Aquifer. It is a digital library initiative that includes citations, full text articles, and an image gallery. It also offers water rights/environmental law information. It is located at <http://www.lib.ttu.edu/playa/>. This is an educational site, freely available to anyone without restriction. The next two resources are marginally related to this field: [Lexis-Nexis Universe](#) (legal information) and [Compendex](#) (engineering information). Both sites are restricted to TTU affiliated parties only. [Cambridge Scientific Abstracts](#), Biological Database, has recently been made available as well.

Guidelines for the discipline include the Clapp-Jordan formula. This formula appeared in the literature over 30 years ago (*College and Research Libraries* 26:371-80). An article appeared in the 1972 volume of this same journal (vol. 33 no. 3, pp.190-198), challenging the validity of this formula. Searching the library literature now (LibraryLit & INSPEC) for information on this formula results in nothing. An Internet search using Altavista results in 2 occurrences where it is only mentioned. Basically, it attempts to measure the adequacy of a library's collection for the patron's on campus by counting faculty, students, programs, books, journals, and documents. Obviously, the formula fails to include electronic access to information, the Internet, and the consortial relationships, such as those used for Inter Library Loan, that are common to academic libraries today. Thus, it is not considered a worthwhile measure of adequacy for academic libraries in the transition from print to electronic resources, even though a large number of those resources remain in a print format.

Strengths and Weaknesses

Strengths

TTU Libraries offer several strong assets in support of this program such as knowledgeable, service oriented librarians to manage the dynamic and interdisciplinary information resources characteristic of this field. These services combined with numerous networking relationships with other research institutions make available an outstanding

interlibrary loan program and access to specialized bibliographic databases via Dialog.

Other strong points include the government documents collection, one of only two regional depositories in Texas, and electronic access to numerous bibliographic and full text resources such as OCLC's FirstSearch, Lexis-Nexis Universe, Compendex, and a local database covering playa lakes and the Ogallala Aquifer.

It is hoped that access to additional databases such as Cambridge Scientific Abstracts will be offered in the future.

Weaknesses

Specialized materials for teaching and research, in all formats, need to be added. Many items that are older and in different languages, important to a research collection, are lacking. Access rather than ownership will be the dominant strategy used to make these materials available. Expensive, though valuable journals, such as Aquatic Toxicology, are also needed.

Numerous recent book titles are in the process of being ordered. The Science Team is gathering information whereby the needed items, mentioned above, may be considered for adding to our collection.

Access to Non-TTU Library Resources via Cooperative Library Arrangements

There is a great deal of information available regarding TTU Libraries exchange activity with other research institutions in the latest annual report by the [Access Services Department](#). Selected portions of that report will be used to give an idea of how this service works and who generally takes advantage of it. Financial realities brought on by the information explosion necessitate the cooperative lending of scholarly information between academic libraries. TTU patrons may request journal articles, books, conference proceedings, documents, etc. in a variety of formats through the Interlibrary Loan Department. Costs for this service are NOT passed on to our patrons.

Interlibrary Loan Summary

Activity	1995/1996 Requests	% change
Borrowing	38,455	14%
Lending	22,415	- 6%
Turnaround time for Books	76% within 7 days (10,367 books)	13%
Turnaround time for Articles	87% within 5 days (21,271 articles)	2%
Number of Unique Book Titles Borrowed	11,353	5%

Number of Unique Journal Titles Borrowed	12,479	9%
Document Delivery Subsidy	\$77,000 (approx.)	n/a
*Cost per item (based on the cost report of 94/95 prepared for GMRLC)	\$5.85 for Borrowing \$2.81 for Lending	n/a
Income from Lending	14,000 (approx.)	n/a

Turnaround Time for Articles

# of days	92/93	93/94	94/95	95/96
1-2 days	47%	49%	54%	56%
3-5 days	36%	42%	31%	31%
6-7 days	7%	2%	7%	6%
8 days +	10%	7%	8%	7%

Turnaround Time for Books

Time	92/93	93/94	94/95	95/96
3 days	2%	11%	30%	34%
4-7 days	24%	36%	33%	42%
8-10 days	37%	17%	14%	13%
11 days +	37%	36%	23%	12%

Top Ten Suppliers of Books and Articles for TTU Patrons

Books	Articles
(3,491 items supplied by the following libraries)	(14,672 items supplied by the following libraries)
Angelo State University	University of Houston
University of Texas -Austin	Baylor University
Texas A&M University	Texas Christian University
Southern Methodist University	Texas A&M University
University of Houston	British Lending Library
Texas Christian University	Southern Methodist University
East Texas University	East Texas University
West Texas A&M University	Arizona State University
Texas Tech Law	University of Texas --Austin

University of North Texas	Lamar University
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Just as we borrow from others, so too, others borrow from us:

Top Ten Borrowers (Loans from Tech Library)

Books (2,068 items were supplied to the following libraries.)	Articles (3,033 items were supplied to the following libraries.)
Dallas Public Library	Northern Arizona University
Mahon Public Library	Texas A&M
Austin Public Library	Texas A&M University
Houston Public Library	Baylor University
West Texas A&M University	University of New Mexico
San Antonio Public Library	University of Texas --Austin
Corpus Christi Public Library	East Texas State U
Texas A&M University	Southwest Research Institute Library
Baylor University	Texas Women's University
University of North Texas	University of Houston

TTU Libraries are committed to supporting this program with knowledgeable, service oriented personnel, adequate materials in a variety of formats for research and teaching, and timely access to remote information. Academic libraries are partners with faculty, staff, and students in creating solutions to the challenging task of storing, organizing, and making available scholarly information in a fast-paced, high tech educational environment. Please let us know how we can more effectively and efficiently meet your information needs in the field of toxicology and environmental health.

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