Bibliometric Analysis

for the U.S. Environmental Protection Agency/Office of Research and Development's Land Research Program

This is a bibliometric analysis of the papers prepared by researchers of the U.S. Environmental Protection Agency (EPA) for the Land Research Program. For this analysis, a total of 1,376 publications published from 1997 to 2007 were reviewed. The 1,376 journal publications were cited 20,177 times in the journals covered by Thomson's *Web of Science*[1] and Scopus[2]. Of the 1,376 journal publications, 1,278 (92.9%) have been cited at least once in a journal.

Searches of Thomson Scientific's *Web of Science* and Scopus were conducted to obtain times cited data for the journal publications. The analysis was completed using Thomson's *Essential Science Indicators (ESI)* and *Journal Citation Reports (JCR)* as benchmarks. *ESI* provides access to a unique and comprehensive compilation of essential science performance statistics and science trends data derived from Thomson's databases. For this analysis, the *ESI* highly cited papers thresholds as well as the hot papers thresholds were used to assess the influence and impact of the Land publications. *JCR* is a recognized authority for evaluating journals. It presents quantifiable statistical data that provide a systematic, objective way to evaluate the world's leading journals and their impact and influence in the global research community. The two key measures used in this analysis to assess the journals in which the EPA Land papers were published are the Impact Factor and Immediacy Index. The Impact Factor is a measure of the frequency with which the "average article" in a journal has been cited in a particular year. The Impact Factor helps evaluate a journal's relative importance, especially when compared to other journals in the same field. The Immediacy Index is a measure of how quickly the "average article" in a journal is cited. This index indicates how often articles published in a journal are cited within the same year and it is useful in comparing how quickly journals are cited.

The report includes a summary of the results of the bibliometric analysis, an assessment of the 1,376 Land journal articles analyzed by *ESI* field (e.g., Chemistry, Environment/Ecology), an analysis of the journals in which the Land papers were published, a table of the highly cited researchers in the Land Research Program, and information on the patents/patent applications that have resulted from the program.

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[1] Thomson Scientific's *Web of Science* provides access to current and retrospective multidisciplinary information from approximately 8,830 of the most prestigious, high impact research journals in the world. *Web of Science* also provides cited reference searching.

[2] Scopus is a large abstract and citation database of research literature and quality Web sources designed to support the literature research process. Scopus offers access to 15,000 titles from 4,000 different publishers, more than 12,850 academic journals (including coverage of 535 Open Access journals, 750 conference proceedings, and 600 trade publications), 27 million abstracts, 245 million references, 200 million scientific Web pages, and 13 million patent records.

SUMMARY OF RESULTS

1. **More than one-sixth of the 1,376 Land journal publications are highly cited papers.** 247 (18.0%) of the 1,376 Land journal publications qualify as highly cited when using the *ESI* criteria for the top 10% of highly cited publications. This is 1.8 times the number expected. 17 (1.2%) of the Land journal papers qualify as highly cited when using the *ESI* criteria for the top 1%, which is 1.2 times the number expected. 2 (0.2%) of the Land publications qualify as very highly cited when using the criteria the ESI criteria for the top 0.1% of highly cited publications. No journal publications qualify as extremely highly cited when using the criteria for the top 0.01% threshold for the most highly cited papers.

2. **The Land journal publications are more highly cited than the average paper.** Using the *ESI* average citation rates for papers published by field as the benchmark, in 12 of the 16 fields in which the 1,376 Land journal papers were published, the ratio of actual to expected cites is greater than 1, indicating that the Land journal publications are more highly cited than the average papers in those fields. For all 16 fields combined, the ratio of total number of cites to the total number of expected cites (20,177 to 14,206) is 1.4, indicating that the Land journal papers are more highly cited than the average paper.

3. **One-quarter of the Land journal papers are published in high impact journals.** 361 of the 1,376 journal papers were published in the top 10% of journals ranked by *JCR* Impact Factor, representing 26.2% of the Land journal publications. This number is 2.6 times higher than expected. 339 of the 1,376 papers appear in the top 10% of journals ranked by *JCR* Immediacy Index, representing 24.6% of EPA's Land journal publications. This number is 2.5 times higher than expected.

4. **There were two hot papers among the 1,376 Land publications.** Using the hot paper thresholds established by *ESI* as a benchmark, 2 (0.2%) hot papers were identified in the analysis. Hot papers are papers that are highly cited shortly after they are published. This number is twice the number expected.

5. **The authors of the Land journal publications cite themselves much less than the average author.** 965 of the 20,177 total cites are author self-cites. This 4.8% author self-citation rate is well below the accepted range of 10-30% author self-citation rate.

6. **41 of the 2,305 authors of the Land journal publications are included in *ISIHighlyCited.com***, which is a database of the world's most influential researchers who have made key contributions to science and technology during the period from 1981 to 1999.

7. **4 patents were issued and 1 patent application was filed** by investigators from 1997 to 2007 for research that was conducted under EPA's Land Research Program. The patents were cited by 5 other patents.

Highly Cited Land Publications

All of the journals covered by ESI are assigned a field, and to compensate for varying citation rates across scientific fields, different thresholds are applied to each field. Thresholds are set to select highly cited papers to be listed in *ESI*. Different thresholds are set for both field and year of publication. Setting different thresholds for each year allows comparable representation for older and younger papers for each field.

The 1,376 Land journal publications reviewed for this analysis were published in journals that were assigned to 16 of the 22 *ESI* fields. The distribution of the papers among these 16 fields and the number of citations by field are presented in Table 1.

Table 1. Land Journal Publications by *ESI* Fields

***ESI* Field**	**No. of Citations**	**No. of EPA Land Papers**	**Average Cites/Paper**
Agricultural Sciences	54	7	7.7
Biology & Biochemistry	967	72	13.4
Chemistry	2,565	173	14.8
Clinical Medicine	38	7	5.4
Computer Science	20	5	4.0
Engineering	1,432	185	7.7
Environment/Ecology	11,235	702	16.0
Geosciences	437	53	8.2
Materials Science	247	14	17.6
Mathematics	1	1	1.0
Microbiology	1,654	55	30.1
Molecular Biology & Genetics	116	5	23.2
Multidisciplinary	25	1	25.0
Pharmacology & Toxicology	405	15	27.0
Physics	204	11	18.5
Plant & Animal Science	777	70	11.1
Total = 16	**Total = 20,177**	**Total = 1,376**	**14.7**

There are 247 (18.0% of the 1,376 journal papers analyzed) highly cited Land journal publications in 13 of the 16 fields—Biology & Biochemistry, Chemistry, Clinical Medicine, Computer Science, Engineering, Environment/Ecology, Geosciences, Materials Science, Microbiology, Molecular Biology & Genetics, Multidisciplinary, Physics, and Plant & Animal Science—when using the *ESI*

criteria for the **top 10% of papers**. Table 2 shows the number of Land journal publications in those 13 fields that meet the **top 10% threshold in *ESI***.

Table 2. Number of Highly Cited Land Journal Publications by Field (top 10%)

***ESI* Field**	**No. of Citations**	**No. of Papers**	**Average Cites/Paper**	**% of Land Papers in Field**
Biology & Biochemistry	145	3	48.3	4.2%
Chemistry	1,210	29	41.7	16.8%
Clinical Medicine	8	1	8.0	14.3%
Computer Science	10	1	10.1	20.0%
Engineering	811	43	18.9	23.2%
Environment/Ecology	5,577	124	45.0	17.7%
Geosciences	184	6	30.7	11.3%
Materials Science	209	5	41.8	35.7%
Microbiology	774	10	77.4	18.2%
Molecular Biology & Genetics	64	1	64.0	20.0%
Multidisciplinary	25	1	25.0	100.0%
Physics	123	4	30.8	36.4%
Plant & Animal Science	493	19	25.9	27.1%
TOTALS	**Total = 9,633**	**Total = 247**	**39.0**	**18.0%**

Seventeen (1.2%) of the journal publications analyzed qualify as highly cited when using the *ESI* criteria for the **top 1% of papers**. These publications are in 6 of the *ESI* fields—Chemistry, Engineering, Environment/Ecology, Geosciences, Materials Science, and Microbiology. Table 3 shows the 17 papers by field that meet the **top 1% threshold in *ESI***. The citations for these 17 papers are provided in Tables 4 through 9. Two (0.2%) of the Land journal publications meet the **top 0.1%** *ESI* thresholds for highly cited papers, which is twice the number expected to meet this threshold. These publications are listed in Table 10. None of the Land journal publications actually meet the **top 0.01%** threshold in *ESI*, which is not surprising given that the expected number of publications to meet this threshold for this program is 0.1.

Table 3. Number of Highly Cited Land Journal Publications by Field (top 1%)

ESI Field	No. of Citations	No. of Papers	Average Cites/Paper	% of Land Papers in Field
Chemistry	379	3	126.3	1.7%
Engineering	179	4	44.8	2.2%
Environment/Ecology	527	5	105.4	0.7%
Geosciences	14	1	14.0	1.9%
Materials Science	180	2	90.0	14.3%
Microbiology	324	2	162.0	3.6%
TOTALS	**Total = 1,603**	**Total = 17**	**94.3**	**1.2%**

Table 4. Highly Cited Land Journal Publications in the Field of Chemistry (top 1%)

No. of Cites	First Author	Paper
148	Wang J	Sol-gel-derived thick-film amperometric immunosensors. *Analytical Chemistry* 1998;70(6):1171-1175.
130	Ravikovitch PI	Unified approach to pore size characterization of microporous carbonaceous materials from N-2, Ar, and CO_2 adsorption isotherms. *Langmuir* 2000;16(5):2311-2320.
101	Ravikovitch PI	Characterization of micro- and mesoporosity in SBA-15 materials from adsorption data by the NLDFT method. *Journal of Physical Chemistry B* 2001;105(29):6817-6823.

Table 5. Highly Cited Land Journal Publications in the Field of Engineering (top 1%)

No. of Cites	First Author	Paper
67	Annable MD	Partitioning tracers for measuring residual NAPL: field-scale test results. *Journal of Environmental Engineering-ASCE* 1998;124(6):498-503.
54	Puls RW	Long-term performance monitoring for a permeable reactive barrier at the US Coast Guard Support Center, Elizabeth City, North Carolina. *Journal of Hazardous Materials* 1999;68(1-2):109-124.

No. of Cites	First Author	Paper
49	Feeney R	Microfabricated ultramicroelectrode arrays: developments, advances, and applications in environmental analysis. *Electroanalysis* 2000;12(9):677-684.
9	He F	Stabilization of Fe-Pd nanoparticles with sodium carboxymethyl cellulose for enhanced transport and dechlorination of trichloroethylene in soil and groundwater. *Industrial & Engineering Chemistry Research* 2007;46(1):29-34.

Table 6. Highly Cited Land Journal Publications in the Field of Environment/Ecology (top 1%)

No. of Cites	First Author	Paper
120	Xia GS	Adsorption-partitioning uptake of nine low-polarity organic chemicals on a natural sorbent. *Environmental Science & Technology* 1999;33(2):262-269.
106	Su CM	Arsenate and arsenite removal by zerovalent iron: kinetics, redox transformation, and implications for in situ groundwater remediation. *Environmental Science & Technology* 2001;35(7):1487-1492.
240	Hites RA	Polybrominated diphenyl ethers in the environment and in people: a meta-analysis of concentrations. *Environmental Science & Technology* 2004;38(4):945-956.
29	Lien HL	High-level arsenite removal from groundwater by zero-valent iron. *Chemosphere* 2005;59(3):377-386.
32	Hoh E	Brominated flame retardants in the atmosphere of the east-central United States. *Environmental Science & Technology* 2005;39(20):7794-7802.

Table 7. Highly Cited Land Journal Publications in the Field of Geosciences (top 1%)

No. of Cites	First Author	Paper
14	Lin CJ	Scientific uncertainties in atmospheric mercury models I: model science evaluation. *Atmospheric Environment* 2006;40(16):2911-2928.

Table 8. Highly Cited Land Journal Publications in the Field of Materials Science (top 1%)

No. of Cites	First Author	Paper
81	Neimark AV	Capillary condensation in MMS and pore structure characterization. *Microporous and Mesoporous Materials* 2001;44:697-707.
99	Zhang WX	Nanoscale iron particles for environmental remediation: an overview. *Journal of Nanoparticle Research* 2003;5(3-4):323-332.

Table 9. Highly Cited Land Journal Publications in the Field of Microbiology (top 1%)

No. of Cites	First Author	Paper
189	Macnaughton SJ	Microbial population changes during bioremediation of an experimental oil spill. *Applied and Environmental Microbiology* 1999;65(8):3566-3574.
135	Gelvin SB	Agobacterium-mediated plant transformation: the biology behind the 'gene-Jockeying' tool. *Microbiology and Molecular Biology Reviews* 2003;67(1):16+.

Table 10. Very Highly Cited Land Journal Publications (top 0.1%)

No. of Cites	ESI Field	Paper
9	Engineering	He F, et al. Stabilization of Fe-Pd nanoparticles with sodium carboxymethyl cellulose for enhanced transport and dechlorination of trichloroethylene in soil and groundwater. *Industrial & Engineering Chemistry Research* 2007;46(1):29-34.
240	Environment/ Ecology	Hites RA. Polybrominated diphenyl ethers in the environment and in people: a meta-analysis of concentrations. *Environmental Science & Technology* 2004;38(4):945-956.

Ratio of Actual Cites to Expected Citation Rates

The expected citation rate is the average number of cites that a paper published in the same journal in the same year and of the same document type (article, review, editorial, etc.) has received from the year of publication to the present. Using the *ESI* average citation rates for papers published by field as the benchmark, in 12 of the 16 fields in which the EPA Land journal papers were published, the ratio of actual to expected cites is greater than 1, indicating that the Land journal publications are more highly cited than the average papers in those fields (see Table 11). For all 16 fields combined, the ratio

of total number of cites to the total number of expected cites (20,177 to 14,206) is 1.4, indicating that the Land journal publications are more highly cited than the average paper.

Table 11. Ratio of Actual Cites to Expected Cites for Land Journal Publications by Field

***ESI* Field**	**Total Cites**	**Expected Cite Rate**	**Ratio**
Agricultural Sciences	54	45.9	1.2
Biology & Biochemistry	967	1,178.4	0.8
Chemistry	2,565	1,872.0	1.4
Clinical Medicine	38	35.0	1.1
Computer Science	20	17.9	1.1
Engineering	1,432	795.2	1.8
Environment/Ecology	11,235	7,824.0	1.4
Geosciences	437	445.8	1.0
Materials Science	247	56.5	4.4
Mathematics	1	5.2	0.2
Microbiology	1,654	1,022.0	1.5
Molecular Biology & Genetics	116	128.7	0.9
Multidisciplinary	25	6.4	3.9
Pharmacology & Toxicology	405	178.3	2.3
Physics	204	97.7	2.1
Plant & Animal Science	777	497.0	1.6
TOTAL	**20,177**	**14,206.0**	**1.4**

***JCR* Benchmarks**

Impact Factor. The *JCR* Impact Factor is a well known metric in citation analysis. It is a measure of the frequency with which the "average article" in a journal has been cited in a particular year. The Impact Factor helps evaluate a journal's relative importance, especially when compared to others in the same field. The Impact Factor is calculated by dividing the number of citations in the current year to articles published in the 2 previous years by the total number of articles published in the 2 previous years.

Table 12 indicates the number of Land journal publications published in the top 10% of journals, based on the *JCR* Impact Factor. Three hundred sixty-one (361) of 1,376 journal papers were published in the top 10% of journals, representing 26.2% of EPA's Land journal publications. This indicates that

more than one-quarter of the Land journal publications are published in the highest quality journals as determined by the *JCR* Impact Factor, which is 2.6 times higher than the expected percentage.

Table 12. Land Journal Publications in Top 10% of Journals by *JCR* Impact Factor

EPA Land Papers in that Journal	Journal	Impact Factor (IF)	*JCR* IF Rank
1	Science	30.028	9
1	Annual Review of Pharmacology and Toxicology	22.808	26
1	Microbiology and Molecular Biology Reviews	15.864	40
1	Chemical Society Reviews	13.690	61
1	FEMS Microbiology Reviews	8.691	140
1	Trends in Microbiology	8.335	146
3	Trends in Biotechnology	7.843	163
2	Journal of the American Chemical Society	7.696	168
1	Current Opinion in Biotechnology	6.949	193
1	Plant Journal	6.565	213
1	Nucleic Acids Research	6.317	222
3	Plant Physiology	6.125	232
4	Environmental Health Perspectives	5.861	255
1	Journal of Biological Chemistry	5.808	260
1	Structure	5.738	267
17	Analytical Chemistry	5.646	276
1	Chemistry of Materials	5.104	330
1	TRAC-Trends in Analytical Chemistry	5.068	337
1	Toxicology and Applied Pharmacology	4.722	397
1	Environmental Microbiology	4.630	406
1	Critical Reviews in Solid State and Materials Sciences	4.500	427
1	Antioxidants and Redox Signaling	4.491	431
1	Progress in Energy and Combustion Science	4.333	456
1	Journal of Materials Chemistry	4.287	464
2	Genetics	4.242	475

EPA Land Papers in that Journal	Journal	Impact Factor (IF)	*JCR* IF Rank
2	Biosensors & Bioelectronics	4.132	496
3	Journal of Physical Chemistry B	4.115	501
8	Electrophoresis	4.101	506
1	Biochemical Journal	4.100	507
199	Environmental Science & Technology	4.040	518
6	Journal of Bacteriology	3.993	533
9	Applied Catalysis B-Environmental	3.942	548
1	Inorganic Chemistry	3.911	557
10	Langmuir	3.902	558
1	Advances in Colloid and Interface Science	3.790	591
4	Geochimica et Cosmochimica Acta	3.751	609
2	Biomacromolecules	3.664	642
3	Drug Metabolism and Disposition	3.638	646
1	Biochemistry	3.633	648
3	Journal of Analytical Atomic Spectrometry	3.630	650
6	Toxicological Sciences	3.598	662
1	Journal of Chromatography A	3.554	678
32	Applied and Environmental Microbiology	3.532	682
1	Electrochemistry Communications	3.484	699
2	Ecological Applications	3.470	708
4	Journal of Membrane Science	3.442	717
1	Journal of the American Society for Mass Spectrometry	3.307	767
1	Limnology and Oceanography	3.287	774
3	Analyst	3.198	804
2	Journal of Chemical Physics	3.166	814
1	Chemical Research in Toxicology	3.162	818
3	FEMS Microbiology Ecology	3.157	822

EPA Land Papers in that Journal	Journal	Impact Factor (IF)	*JCR* IF Rank
1	Journal of Physical Chemistry A	3.047	863
Total = 361			

Immediacy Index. The *JCR* Immediacy Index is a measure of how quickly the *average article* in a journal is cited. It indicates how often articles published in a journal are cited within the year they are published. The Immediacy Index is calculated by dividing the number of citations to articles published in a given year by the number of articles published in that year.

Table 13 indicates the number of Land journal publications published in the top 10% of journals, based on the *JCR* Immediacy Index. Three hundred thirty-nine (339) of the 1,376 papers appear in the top 10% of journals, representing 24.6% of the Land journal papers. This indicates that nearly one-fourth of the Land journal papers are published in the highest quality journals as determined by the *JCR* Immediacy Index, which is 2.5 times higher than the expected percentage.

Table 13. Land Journal Publications in Top 10% of Journals by *JCR* Immediacy Index

EPA Land Papers in that Journal	Journal	Immediacy Index (II)	*JCR* II Rank
1	Annual Review of Pharmacology and Toxicology	7.059	8
1	Science	5.555	16
1	Chemical Society Reviews	2.586	68
1	Nucleic Acids Research	1.744	131
1	Journal of the North American Benthological Society	1.568	158
2	Journal of the American Chemical Society	1.510	168
1	Microbiology and Molecular Biology Reviews	1.472	182
1	Structure	1.323	213
1	Plant Journal	1.222	243
1	Antioxidants and Redox Signaling	1.131	281
1	Journal of Biological Chemistry	1.110	291
3	Trends in Biotechnology	1.025	344
4	Environmental Health Perspectives	0.994	373
1	FEMS Microbiology Reviews	0.976	377

EPA Land Papers in that Journal	Journal	Immediacy Index (II)	*JCR* II Rank
1	Trends in Microbiology	0.959	389
3	Journal of Analytical Atomic Spectrometry	0.940	399
3	Analyst	0.925	404
2	Genetics	0.919	409
3	Plant Physiology	0.900	423
6	Journal of Bacteriology	0.894	426
1	Journal of Materials Chemistry	0.882	440
1	Environmental Microbiology	0.850	469
1	Earth Planets and Space	0.848	472
1	Biochemical Journal	0.847	473
17	Analytical Chemistry	0.795	524
1	Limnology and Oceanography	0.784	537
3	Drug Metabolism and Disposition	0.768	557
2	Biosensors & Bioelectronics	0.756	573
1	TRAC-Trends in Analytical Chemistry	0.752	578
1	Journal of the American Society for Mass Spectrometry	0.746	586
6	Toxicological Sciences	0.734	597
1	Journal of Physical Chemistry A	0.730	602
1	Biochemistry	0.726	608
2	Journal of Chemical Physics	0.721	616
1	Journal of Experimental Biology	0.719	621
2	Ecological Engineering	0.716	626
1	Inorganic Chemistry	0.699	648
1	Chemistry of Materials	0.692	661
3	Journal of Geophysical Research	0.684	673
1	Chemical Research in Toxicology	0.663	703
4	Geochimica et Cosmochimica Acta	0.658	707
199	Environmental Science & Technology	0.646	729
3	Journal of Physical Chemistry B	0.637	746

EPA Land Papers in that Journal	Journal	Immediacy Index (II)	*JCR* II Rank
32	Applied and Environmental Microbiology	0.634	751
10	Langmuir	0.623	770
1	Tetrahedron Letters	0.597	820
1	Pure and Applied Chemistry	0.586	840
1	Environmental Research	0.583	844
2	Biomacromolecules	0.566	880
Total = 339			

Hot Papers

ESI establishes citation thresholds for hot papers, which are selected from the highly cited papers in different fields, but the time frame for citing and cited papers is much shorter—papers must be cited within 2 years of publication and the citations must occur in a 2-month time period. Papers are assigned to 2-month periods and thresholds are set for each period and field to select 0.1% of papers.

Using the hot paper thresholds established by *ESI* as a benchmark, 2 hot papers, representing 0.2% of the Land papers, were identified in two fields—Environment/Ecology and Materials Science. The number of Land hot papers is 2 times higher than expected. The hot papers are listed in Table 14.

Table 14. Hot Papers Identified Using *ESI* Thresholds

Field	*ESI* Hot Papers Threshold	No. of Cites in 2-Month Period	Paper
Environment/ Ecology	8	9 cites in January-February 2005	Hites RA. Polybrominated diphenyl ethers in the environment and in people: a meta-analysis of concentrations. *Environmental Science & Technology* 2004;38(4):945-956.
Materials Science	3	4 cites in July-August 2001	Neimark AV, Ravikovitch PI. Capillary condensation in MMS and pore structure characterization. *Microporous and Mesoporous Materials* 2001;44:697-707.

Author Self-Citation

Self-citations are journal article references to articles from that same author (i.e., the first author). Because higher author self-citation rates can inflate the number of citations, the author self-citation rate

was calculated for the Land papers. Of the 20,177 total cites of the 1,376 journal publications, 965 are author self-cites—a 4.8% author self-citation rate. Garfield and Sher[3] found that authors working in research-based disciplines tend to cite themselves on the average of 20% of the time. MacRoberts and MacRoberts[4] claim that approximately 10-30% of all the citations listed fall into the category of author self-citation. Kovacic and Misak[5] reported a 20% author self-citation rate for medical literature. Therefore, the 4.8% self-cite rate for the Land papers is well below the range for author self-citation.

Highly Cited Researchers

A search of Thomson's *ISIHighlyCited.com* revealed that 41 (1.8%) of the 2,305 authors of the Land papers are highly cited researchers. *ISIHighlyCited.com* is a database of the world's most influential researchers who have made key contributions to science and technology during the period from 1981 to 1999. The highly cited researchers identified during this analysis of the Land publications are presented in Table 15.

Table 15. Highly Cited Researchers Authoring Land Journal Publications

Highly Cited Researcher	Affiliation	*ESI* Field
Abriola, Linda M.	University of Michigan	Environment/Ecology
Alexander, Martin	Cornell University	Environmental Ecology Microbiology
Allen, Herbert E.	University of Delaware	Environment/Ecology
Ankley, Gerald	U.S. Environmental Protection Agency	Environment/Ecology
Arey, Janet	University of California-Riverside	Environment/Ecology
Brusseau, Mark L.	University of Arizona	Environment/Ecology Engineering
Curl, Robert F.	Rice University	Chemistry
Dillon, Peter J.	Trent University	Environment/Ecology
Drew, Malcolm C.	Texas A&M University	Plant & Animal Science
Giesy, John P.	Michigan State University	Environment/Ecology
Gillham, Robert W.	University of Waterloo	Environment/Ecology Engineering
Gray Jr., Leon Earl	U.S. Environmental Protection	Pharmacology

[3] Garfield E, Sher IH. New factors in the evaluation of scientific literature through citation indexing. *American Documentation* 1963;18(July):195-210.

[4] MacRoberts MH, MacRoberts BR. Problems of citation analysis: a critical review. *Journal of the American Society of Information Science* 1989;40(5):342-349.

[5] Kovacic N, Misak A. Author self-citation in medical literature. *Canadian Medical Association Journal* 2004;170(13):1929-1930.

Highly Cited Researcher	**Affiliation**	***ESI* Field**
	Agency	
Gschwend, Philip Michael	Massachusetts Institute of Technology	Environment/Ecology Engineering
Hammock, Bruce D.	University of California-Davis	Agricultural Sciences
Hansen, Dave J.	U.S. Environmental Protection Agency (formerly)	Environment/Ecology
Hildemann, Lynn M.	Stanford University	Environment/Ecology Engineering
Hites, Ronald A.	Indiana University	Engineering Environment/Ecology
Inouye, Sumiko	University of Medicine and Dentistry of New Jersey	Microbiology
Jones, Ronald Norman	JONES Group/JMI Laboratories	Microbiology
Jury, William A.	University of California-Riverside	Engineering Environment/Ecology
Kitanidis, Peter K.	Stanford University	Engineering Environment/Ecology
Landrum, Peter F.	National Oceanic and Atmospheric Administration	Environment/Ecology
Lee, Kuo-Hsiung	University of North Carolina	Agricultural Sciences
Lindberg, Steven E.	Oak Ridge National Laboratory	Environment/Ecology
Luthy, Richard G.	Stanford University	Environment/Ecology Engineering
McCarty, Perry L.	Stanford University	Engineering Environmental/Ecology
McClements, David Julian	University of Massachusetts	Agricultural Sciences
Müller, Rolf	Philipps University, Germany	Microbiology
Navrotsky, Alexandra	University of California-Davis	Geosciences
Pignatello, Joseph J.	Connecticut Agricultural Experiment Station	Environment/Ecology Engineering
Rao, P. Suresh Chandra	Purdue University	Engineering Environment/Ecology
Reeves, Philip G.	U.S. Department of Agriculture	Agricultural Sciences
Roberts, Paul V.	Stanford University	Engineering Environment/Ecology
Ryals, John A.	Paradigm Genetics, Inc.	Plant & Animal Science

Highly Cited Researcher	Affiliation	*ESI* Field
Schindler, David W.	University of Alberta	Environment/Ecology
Seib, Paul A.	Kansas State University	Agricultural Sciences
Sparks, Donald Lewis	University of Delaware	Environment/Ecology
Suidan, Makram T.	University of Cincinnati	Environment/Ecology
Tiedje, James M.	Michigan State University	Microbiology Environment/Ecology
Weber, Walter J.	University of Michigan	Engineering Environment/Ecology
White, David C.	University of Tennessee	Microbiology
Total = 41		

Patents

There were four patents issued to and one patent application filed by investigators from 1997 to 2007 for research that was conducted under EPA's Land Research Program. The patents were cited by five other patents (see Table 16).

Table 16. Patents from the Land Research Program (1997-2007)

Patent/Patent Application No.	Inventor(s)	Title	Patent Date	Patents that Referenced This Patent
U.S. Patent No. 6,248,218	Linkous CA Muradov NZ	Closed cycle photocatalytic process for decomposition of hydrogen sulfide to its constituent elements.	June 19, 2001	Referenced by 2 patents: (1) 7,220,391 UV photochemical option for closed cycle decomposition of hydrogen sulfide (2) 6,964,755 Method for producing high activity photocatalyst, photoactivity catalyst, and method for treating hydrogen sulfide for recovering hydrogen gas under low energy by using high activity photocatalyst

Patent/Patent Application No.	Inventor(s)	Title	Patent Date	Patents that Referenced This Patent
U.S. Patent No. 6,455,759	Vierstra RD Walker JM Wisconsin Alumni Research Foundation assignee	Expression of multiple proteins in transgenic plants.	September 24, 2002	Referenced by 2 patents: (1) 7,230,080 Fluorescent and colored proteins, and polynucleotides that encode these proteins (2) 7,160,698 Fluorescent and colored proteins, and polynucleotides that encode these proteins
U.S. Patent No. 6,572,829	Linkous CA, Muradov NZ University of Central Florida assignee	Closed cycle photocatalytic process for decomposition of hydrogen sulfide to its constituent elements.	June 3, 2003	Referenced by 1 patent: (1) 6,964,755 Method for producing high activity photocatalyst, photoactivity catalyst, and method for treating hydrogen sulfide for recovering hydrogen gas under low energy by using high activity photocatalyst
U.S. Patent No. 7,220,391	Huang CP, Linkous CA University of Central Florida assignee	UV photochemical option for closed cycle decomposition of hydrogen sulfide	May 22, 2007	Referenced by 0 patents
U.S. Patent Application No. 200060021928	Diallo MS California Institute of Technology assignee	Water treatment by dendrimer enhanced filtration	February 2, 2006	Not applicable

This bibliometric analysis was prepared by
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