A Global Database of Litterfall Mass and Litter Pool Carbon and Nutrients

Get Data

Revision Date: March 30, 2015

Summary:

Measurement data of aboveground litterfall and littermass and litter carbon, nitrogen, and nutrient concentrations were extracted from 685 original literature sources and compiled into a comprehensive database to support the analysis of global patterns of carbon and nutrients in litterfall and litter pools. Data are included from sources dating from 1827 to 1997.

The reported data include the literature reference, general site information (description, latitude, longitude, and elevation), site climate data (mean annual temperature and precipitation), site vegetation characteristics (management, stand age, ecosystem and vegetation-type codes), annual quantities of litterfall (by class, kg m-2 yr-1), litter pool mass (by class and litter layer, kg m-2), and concentrations of nitrogen (N), phosphorus (P), and base cations for the litterfall (g m-2 yr-1) and litter pool components (g m-2).

The investigators intent was to compile a comprehensive data set of individual direct field measurements as reported by researchers. While the primary emphasis was on acquiring C data, measurements of N, P, and base cations were also obtained, although the database is sparse for elements other than C and N.

Note that litterfall and litter pool masses (as dry matter) were not converted to carbon. This conversion fraction (~0.5 by mass) can vary and so the data compilers did not convert the reported measurements so that others using the database can choose appropriate conversion factors.

Each of the 1,497 records in the database represents a measurement site. Replicate measurements were averaged according to conventions described in Section 5 and recorded for each site in the database. The sites were at 575 different locations.

The database is provided in a single comma delimited (.csv) format file. A Shapefile with litterfall and littermass, and selected nutrient data is also provided. Companion files include the bibliographic sources for the data provided, in both ASCII text (.txt) file and as a .pdf file, and a .pdf file with the definitions for Olson Ecosystem, Holdridge Life Zone, and Matthews vegetation type codes.

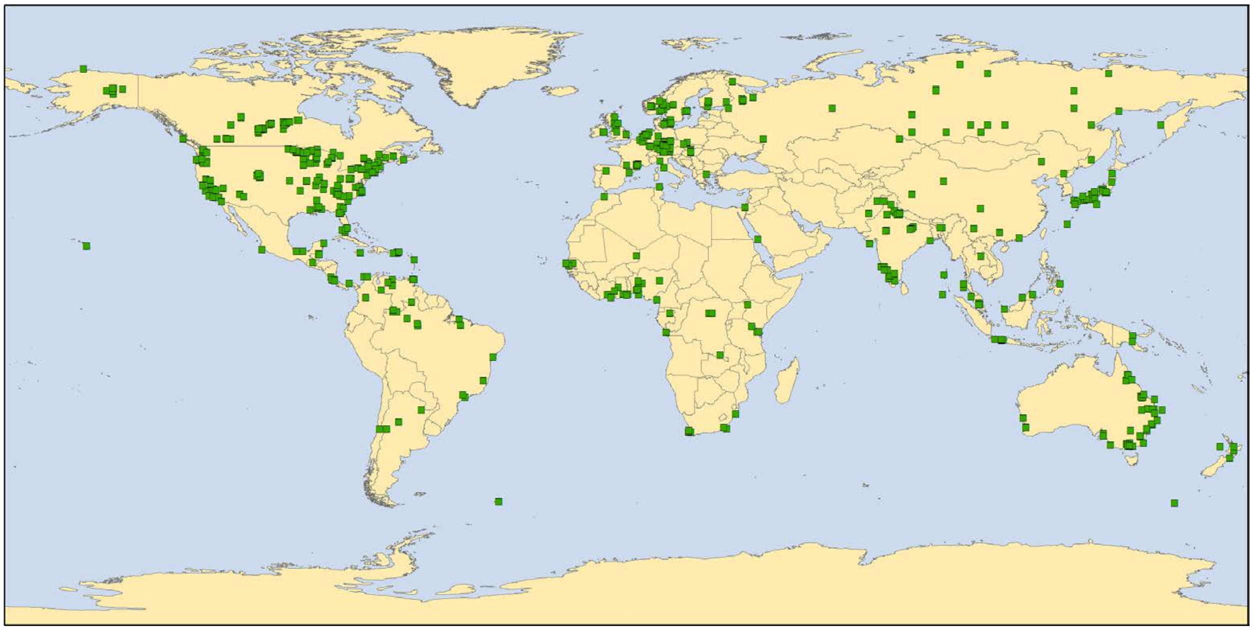

Figure 1. Global distribution of the 575 sites in the database.

Acknowledgments:

This data collection started with a sabbatical visit in 1987 by W.M. Post to Dr. Paul Zinke's laboratory at the University of California, Berkeley. Dr. Zinke's collection of reference materials and those in the UC Berkeley Forestry Library provided a wealth of worldwide data from forestry reports and international literature sources. Additional support for assembling more recently published data was supported by NASA with funding from the ORNL DAAC to Elizabeth Holland, James Sulzman, and Robbie Staufer working at NCAR. A large collection of Russian data was contributed by Olga Krankina. Data published after 1997 are not included in this database.

Data and Documentation Access:

Get Data: http://daac.ornl.gov/cgi-bin/dsviewer.pl?ds_id=1244

Companion Files:

1) The bibliographic sources for the data are provided in ASCII text format, Litterfall_source_bibliography.txt and as Litterfall_source_bibliography.pdf file.

2) The Litterfall_code_companion.pdf file provides the definitions for Olson Ecosystem, Holdridge Life Zone, and Matthews vegetation type codes.

Data Citation:

Cite this data set as follows:

Holland, E. A., W. M. Post, E. Matthews, J. Sulzman, R. Staufer, and O. Krankina. 2015. A Global Database of Litterfall Mass and Litter Pool Carbon and Nutrients. Data set. Available on-line [http://daac.ornl.gov] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, USA. http://dx.doi.org/10.3334/ORNLDAAC/1244

Previous Version Note: The metadata and documentation for this product were previously available from the ORNL DAAC as:

Holland, E. A., W. M. Post, E. Matthews, J. Sulzman, R. Staufer, and O. Krankina. 2005. Global Patterns of Litterfall and Litter Pool Carbon and Nutrients. Data set. Available on-line [http://daac.ornl.gov/] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A.

Previously, the data were only available upon request from W.M. Post. The ORNL DAAC reviewed the site and location data before posting the files on-line. One duplicate site and four locations were corrected (e.g., positive longitudes changed to negative). Documentation was updated to reflect the latest description of SITE_ID (formerly ID) and row uniqueness.

Table of Contents:

1. Data Set Overview:

Measurement data of aboveground litterfall and littermass and litter carbon, nitrogen, and nutrient concentrations were extracted from 685 original literature sources and compiled into a comprehensive database to support the analysis of global patterns of carbon and nutrients in litterfall and litter pools. Data are included from sources dating from 1827 to 1997.

The reported data include the literature reference, general site information (description, latitude, longitude, and elevation), site climate data (mean annual temperature and precipitation), site vegetation characteristics (management, stand age, ecosystem and vegetation-type codes), annual quantities of litterfall (by class, kg m-2 yr-1), litter pool mass (by class and litter layer, kg m-2), and concentrations of nitrogen (N), phosphorus (P), and base cations for the litterfall (g m-2 yr-1) and litter pool components (g m-2).

Note that litterfall and litter pool masses (as dry matter) were not converted to carbon. This conversion fraction (~0.5 by mass) can vary and so the data compilers did not convert the reported measurements so that others using the data base can choose appropriate conversion factors.

The investigators intent was to compile a comprehensive data set of individual direct field measurements as reported by researchers. While the primary emphasis was on acquiring C data, measurements of N, P, and base cations were also obtained, although the database is sparse for elements other than C and N.

Each of the 1,497 records in the database represents a measurement site. Replicate measurements were averaged according to conventions described in Section 5 and recorded for each site in the database. The sites were at 575 different locations.

2. Data Characteristics:

Spatial Coverage

There is a generally global distribution of the 575 sites included in the database.

Temporal Coverage

The data are from published studies between 1827-01-01 and 1997-12-31

Site boundaries: (All latitude and longitude given in decimal degrees)

Site (Region)	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude
Global	-156.7	176.2	72.5	-54.5

Data File Information

There is one comma separated (.csv) data file and one Shapefile provided with this data set. Missing numeric and text values are represented by -99.

File: Global_Litterfall.csv

What columns uniquely define a row?

- Note that SITE_ID alone does not uniquely define a data row. SITE_ID values are not unique.
- The combinations of (1) SITE_ID and REFERENCE1 or (2) SITE_ID with LATITUDE and LONGITUDE do uniquely identify a row.

The provided file is sorted by SITE_ID and REFERENCE1.

Why do some columns contain only missing values?

The investigators intent was to compile a comprehensive data set of individual direct field measurements as reported by researchers. While the primary emphasis was on acquiring C data, measurements of N, P, and other base cations were also sought, but not always obtained. The blank cells and columns indicate that the reference sources were reviewed for these measurements but no measurements were reported. Therefore, the database is sparse for elements other than C and N. The table below includes two columns that show the completeness of each reported data column.

File: Global_Litterfall.zip

When unzipped, this shapefile contains six files (*.shx, *.dbf, *.prj, *.sbn, *.sbx, and *.shp). Due to shape file volume constraints, the columns Reference and Reference2 were omitted and the sets of columns for Mn, Na, and K concentration were also omitted.

Parameters of the shapefile:

Geometry Type: Point
Geographic Coordinate System: GCS_WGS_1984
Datum: D_WGS_1984
Prime Meridian: Greenwich

Angular Unit: Degree

Extent-
North: 72
South: -54
East: 176
West: -157

Attributes are defined in the following description table.

Table 1. Data file description

Column Number	Column Heading	Column Name	Units	Notes	Number of non-missing values. 1,497 records.	Percent completeness
Site Information Fields (0 – 15)				**Missing data code: -99**		
0	SITE_ID	SITE_ID	5-7 digit code	Digits 1-3 identify the source publication and digits 4-7 represent different sites for which measurements are reported. Sites defined as “0000” indicate that data are reported for only one site. SITE_ID values are not unique.	1,497	100
1	PLOTNAME	PLOTNAME		General description of the measurement location, such as country, state, and/or region.	1,497	100
2	LATITUDE	LATITUDE	Decimal degrees	If exact longitude and latitude are not given in the data source, we used descriptions of the site, together with detailed maps, to estimate the longitude and latitude of the site.	1,497	100
3	LONGITUDE	LONGITUDE	Decimal degrees	If exact longitude and latitude are not given in the data source, we used descriptions of the site, together with detailed maps, to estimate the longitude and latitude of the site.	1,497	100
4	ELEVATION	ELEVATION	m	Elevation in meters as reported in the data source.	1,497	100
5	MEANTEMP	MEANTEMP	degrees C	Mean annual temperature was recorded if reported. Otherwise, we used nearest weather station data to estimate MAT for the site.	1,497	100
6	BIOTEMP	BIOTEMPERATURE	degrees C	Biotemperature is the annual mean unit-period temperature with substitution of zero for all temperature values below 0 degrees C and above 30 degrees C.	55	3.7
7	PRECIP	PRECIPITATION	mm	If precipitation was not reported, we used a climate atlas to estimate precipitation.	1,497	100
8	OLSON	OLSON CODE	Olson	Olson Ecosystem codes, 0-99. See code companion file for definitions.	810	54.2
9	LIFEZONE	LIFEZONE	numeric	Holdridge Life Zone Codes, 0-37. See code companion file for definitions.	1,497	100
10	MATTHEWS	MATTHEWS CODE	numeric	Matthews vegetation type code, 1-32. See code companion file for definitions.	1,497	100

11	VEGETATION	VEGETATION	text	Based on the source document, we recorded dominant species, lifeforms, physiognomic descriptions, environmental conditions.	1494	99.8
12	MANAGED	MANAGED CODE	text	Code: Yes (Y); No (N). A site was considered unmanaged if relatively undisturbed at the time measurements were made and managed if strongly influenced by humans.	789	52.8
13	AGE	PLOT AGE	years	If stand is not known to be disturbed then “mature” was assigned.	925	61.8
14	REFERENCE1	REFERENCE1	text	Short citation (Author, year, publication, volume, pages) of source publications. See Litterfall_source_bibliography companion file (In combination with SITE_ID, uniquely identifies a data row)	1,497	100
15	REFERENCE2	REFERENCE2	text	Short citation (Author, year, publication, volume, pages) of source publications. See Litterfall_source_bibliography companion file.	188	12.6

Column Number	Column Heading	Column Name	Number of non-missing values. 1,497 records	Percent completeness
Litter Data Fields (16 – 191) Missing data code: -99				
Litterfall: Units are in kg m-2 yr-1				
16	LFLLW	LEAF_FALL	670	44.8
17	SWFLLW	SMALL_WOOD_FALL	401	26.8
18	FINFLLW	LEAF_AND_SMALL_WOOD_FALL	134	
19	RPRFLLW	REPRODUCTIVE_FALL	302	20.2
20	LTRFLLW	TOTAL_FINE_LITTER_FALL	650	43.5
21	LWFLLW	LARGE_WOOD_FALL	72	4.9
Litter Pool Masses: Units are in kg m-2				
22	LLEAFW	L_LEAF_WEIGHT	83	5.6
2.7	LSWW	L_SMALL_WOOD_WEIGHT	39	2.7
24	LFINW	L_FINE_WEIGHT	1	0.1
25	LRPRW	L_REPRODUCTIVE_WEIGHT	38	2.6
26	LLTRW	L_LITTER_WEIGHT	66	4.5
27	FLEAFW	F_AND_H_LEAF_WEIGHT	51	3.5
28	FSWW	F_AND_H_SMALL_WOOD_WEIGHT	8	0.6
29	FFINW	F_AND_H_FINE_WEIGHT	26	1.8
30	FRPRW	F_AND_H_REPRODUCTIVE_WEIGHT	8	0.6
31	FLTRW	F_AND_H_LITTER_WEIGHT	94	6.3
32	TLEAFW	TOTAL_LEAF_WEIGHT	142	9.5
33	TSWW	TOTAL_SMALL_WOOD_WEIGHT	151	10.1
34	TFINW	TOTAL_FINE_WEIGHT	121	8.1

35	TRPRW	TOTAL_REPRODUCTIVE_WEIGHT	27	1.9
36	TLTRW	TOTAL_LITTER_WEIGHT	467	31.2
37	LWW	LARGE_WOOD_WEIGHT	164	11
Litterfall N: Units are in g m-2 yr-1				
38	LFLLN	LEAF_FALL_N	222	14.9
39	SWFLLN	SMALL_WOOD_FALL_N	122	8.2
40	FINFLLN	FINE_FALL_N	36	2.5
41	RPRFLLN	REPRODUCTIVE_FALL_N	68	4.6
42	LTRFLLN	LITTER_FALL_N	335	22.4
43	LWFLLN	LARGE_WOOD_FALL_N	39	2.7
Litter Pool N: Units are in g m-2				
44	LLEAFN	L_LEAF_N	4	0.3
45	LSWN	L_SMALL_WOOD_N	1	0.1
46	LFINN	L_FINE_N	2	0.2
47	LRPRN	L_REPRODUCTIVE_N	2	0.2
48	LLTRN	L_LITTER_N	43	2.9
49	FLEAFN	F_AND_H_LEAF_N	2	0.2
50	FSWN	F_AND_H_SMALL_WOOD_N	1	0.1
51	FFINN	F_AND_H_FINE_N	1	0.1
52	FRPRN	F_AND_H_REPRODUCTIVE_N	1	0.1
53	FLTRN	F_AND_H_LITTER_N	49	3.3
54	TLEAFN	TOTAL_LEAF_N	36	2.5
55	TSWN	TOTAL_SMALL_WOOD_N	28	1.9
56	TFINN	TOTAL_FINE_N	5	0.4
57	TRPRN	TOTAL_REPRODUCTIVE_N	21	1.5
58	TLTRN	TOTAL_LITTER_N	220	14.7
59	LWN	LARGE_WOOD_N	30	2.1
Litterfall P: Units are in g m-2 yr-1				
60	LFLLP	LEAF_FALL_P	180	12.1
61	SWFLLP	SMALL_WOOD_FALL_P	98	6.6
62	FINFLLP	FINE_FALL_P	40	2.7
63	RPRFLLP	REPRODUCTIVE_FALL_P	59	4
64	LTRFLLP	LITTER_FALL_P	308	20.6
65	LWFLLP	LARGE_WOOD_FALL_P	21	1.5
Litter Pool P: Units are in g m-2				
66	LLEAFP	L_LEAF_P	3	0.3
67	LSWP	L_SMALL_WOOD_P	1	0.1
68	LFINP	L_FINE_P	2	0.2
69	LRPRP	L_REPRODUCTIVE_P	2	0.2
70	LLTRP	L_LITTER_P	32	2.2
71	FLEAFP	F_AND_H_LEAF_P	2	0.2
72	FSWP	F_AND_H_SMALL_WOOD_P	1	0.1
73	FFINP	F_AND_H_FINE_P	1	0.1
74	FRPRP	F_AND_H_REPRODUCTIVE_P	1	0.1
75	FLTRP	F_AND_H_LITTER_P	39	2.7
76	TLEAFP	TOTAL_LEAF_P	72	4.9

77	TSWP	TOTAL_SMALL_WOOD_P	27	1.9
78	TFINP	TOTAL_FINE_P	4	0.3
79	TRPRP	TOTAL_REPRODUCTIVE_P	19	1.3
80	TLTRP	TOTAL_LITTER_P	175	11.7
81	LWP	LARGE_WOOD_P	31	2.1
Litterfall Ca: Units are in g m-2 yr-1				
82	LFLLCA	LEAF_FALL_CA	153	10.3
83	SWFLLCA	SMALL_WOOD_FALL_CA	80	5.4
84	FINFLLCA	FINE_FALL_CA	36	2.5
85	RPRFLLCA	REPRODUCTIVE_FALL_CA	51	3.5
86	LTRFLLCA	LITTER_FALL_CA	282	18.9
87	LWFLLCA	LARGE_WOOD_FALL_CA	21	1.5
Litter Pool Ca: Units are in g m-2				
88	LLEAFCA	L_LEAF_CA	2	0.2
89	LSWCA	L_SMALL_WOOD_CA	1	0.1
90	LFINCA	L_FINE_CA	2	0.2
91	LRPRCA	L_REPRODUCTIVE_CA	2	0.2
92	LLTRCA	L_LITTER_CA	37	2.5
93	FLEAFCA	F_AND_H_LEAF_CA	2	0.2
94	FSWCA	F_AND_H_SMALL_WOOD_CA	1	0.1
95	FFINCA	F_AND_H_FINE_CA	1	0.1
96	FRPRCA	F_AND_H_REPRODUCTIVE_CA	1	0.1
97	FLTRCA	F_AND_H_LITTER_CA	43	2.9
98	TLEAFCA	TOTAL_LEAF_CA	64	4.3
99	TSWCA	TOTAL_SMALL_WOOD_CA	20	1.4
100	TFINCA	TOTAL_FINE_CA	8	0.6
101	TRPRCA	TOTAL_REPRODUCTIVE_CA	19	1.3
102	TLTRCA	TOTAL_LITTER_CA	171	11.5
103	LWCA	LARGE_WOOD_CA	21	1.5
Litterfall Mg: Units are in g m-2 yr-1				
104	LFLLMG	LEAF_FALL_MG	131	8.8
105	SWFLLMG	SMALL_WOOD_FALL_MG	66	4.5
106	FINFLLMG	FINE_FALL_MG	29	2
107	RPRFLLMG	REPRODUCTIVE_FALL_MG	45	3.1
108	LTRFLLMG	LITTER_FALL_MG	258	17.3
109	LWFLLMG	LARGE_WOOD_FALL_MG	21	1.5
Litter Pool Mg: Units are in g m-2				
110	LLEAFMG	L_LEAF_MG	2	0.2
111	LSWMG	L_SMALL_WOOD_MG	1	0.1
112	LFINMG	L_FINE_MG	2	0.2
113	LRPRMG	L_REPRODUCTIVE_MG	2	0.2
114	LLTRMG	L_LITTER_MG	31	2.1
115	FLEAFMG	F_AND_H_LEAF_MG	2	0.2
116	FSWMG	F_AND_H_SMALL_WOOD_MG	1	0.1
117	FFINMG	F_AND_H_FINE_MG	1	0.1
118	FRPRMG	F_AND_H_REPRODUCTIVE_MG	1	0.1

119	FLTRMG	F_AND_H_LITTER_MG	38	2.6
120	TLEAFMG	TOTAL_LEAF_MG	63	4.3
121	TSWMG	TOTAL_SMALL_WOOD_MG	20	1.4
122	TFINMG	TOTAL_FINE_MG	8	0.6
123	TRPRMG	TOTAL_REPRODUCTIVE_MG	19	1.3
124	TLTRMG	TOTAL_LITTER_MG	141	9.5
125	LWMG	LARGE_WOOD_MG	20	1.4
Litterfall K: Units are in g m-2 yr-1				
126	LFLLK	LEAF_FALL_K	145	9.7
127	SWFLLK	SMALL_WOOD_FALL_K	84	5.7
128	FINFLLK	FINE_FALL_K	37	2.5
129	RPRFLLK	REPRODUCTIVE_FALL_K	54	3.7
130	LTRFLLK	LITTER_FALL_K	283	19
131	LWFLLK	LARGE_WOOD_FALL_K	21	1.5
Litter Pool K: Units are in g m-2				
132	LLEAFK	L_LEAF_K	4	0.3
133	LSWK	L_SMALL_WOOD_K	1	0.1
134	LFINK	L_FINE_K	2	0.2
135	LRPRK	L_REPRODUCTIVE_K	2	0.2
136	LLTRK	L_LITTER_K	28	1.9
137	FLEAFK	F_AND_H_LEAF_K	2	0.2
138	FSWK	F_AND_H_SMALL_WOOD_K	1	0.1
139	FFINK	F_AND_H_FINE_K	1	0.1
140	FRPRK	F_AND_H_REPRODUCTIVE_K	1	0.1
141	FLTRK	F_AND_H_LITTER_K	35	2.4
142	TLEAFK	TOTAL_LEAF_K	63	4.3
143	TSWK	TOTAL_SMALL_WOOD_K	20	1.4
144	TFINK	TOTAL_FINE_K	8	0.6
145	TRPRK	TOTAL_REPRODUCTIVE_K	19	1.3
146	TLTRK	TOTAL_LITTER_K	160	10.7
147	LWK	LARGE_WOOD_K	24	1.7
Litterfall Na: Units are in g m-2 yr-1				
148	LFLLNA	LEAF_FALL_NA	42	2.9
149	SWFLLNA	SMALL_WOOD_FALL_NA	22	1.5
150	FINFLLNA	FINE_FALL_NA	11	0.8
151	RPRFLLNA	REPRODUCTIVE_FALL_NA	12	0.9
152	LTRFLLNA	LITTER_FALL_NA	75	5.1
153	LWFLLNA	LARGE_WOOD_FALL_NA	9	0.7
Litter Pool Na: Units are in g m-2				
154	LLEAFNA	L_LEAF_NA	1	0.1
155	LSWNA	L_SMALL_WOOD_NA	1	0.1
156	LFINNA	L_FINE_NA	2	0.2
157	LRPRNA	L_REPRODUCTIVE_NA	2	0.2
158	LLTRNA	L_LITTER_NA	12	0.9
159	FLEAFNA	F_AND_H_LEAF_NA	1	0.1
160	FSWNA	F_AND_H_SMALL_WOOD_NA	1	0.1

161	FFINNA	F_AND_H_FINE_NA	1	0.1
162	FRPRNA	F_AND_H_REPRODUCTIVE_NA	1	0.1
163	FLTRNA	F_AND_H_LITTER_NA	11	0.8
164	TLEAFNA	TOTAL_LEAF_NA	38	2.6
165	TSWNA	TOTAL_SMALL_WOOD_NA	2	0.2
166	TFINNA	TOTAL_FINE_NA	5	0.4
167	TRPRNA	TOTAL_REPRODUCTIVE_NA	1	0.1
168	TLTRNA	TOTAL_LITTER_NA	19	1.3
169	LWNA	LARGE_WOOD_NA	2	0.2
Litterfall Mn: Units are in g m-2 yr-1				
170	LFLLMN	LEAF_FALL_MN	2	0.2
171	SWFLLMN	SMALL_WOOD_FALL_MN	2	0.2
172	FINFLLMN	FINE_FALL_MN	2	0.2
173	RPRFLLMN	REPRODUCTIVE_FALL_MN	0	0
174	LTRFLLMN	LITTER_FALL_MN	19	1.3
175	LWFLLMN	LARGE_WOOD_FALL_MN	0	0
Litter Pool Mn: Units are in g m-2				
176	LLEAFMN	L_LEAF_MN	0	0
177	LSWMN	L_SMALL_WOOD_MN	0	0
178	LFINMN	L_FINE_MN	0	0
179	LRPRMN	L_REPRODUCTIVE_MN	0	0
180	LLTRMN	L_LITTER_MN	0	0
181	FLEAFMN	F_AND_H_LEAF_MN	0	0
182	FSWMN	F_AND_H_SMALL_WOOD_MN	0	0
183	FFINMN	F_AND_H_FINE_MN	0	0
184	FRPRMN	F_AND_H_REPRODUCTIVE_MN	0	0
185	FLTRMN	F_AND_H_LITTER_MN	0	0
186	TLEAFMN	TOTAL_LEAF_MN	1	0.1
187	TSWMN	TOTAL_SMALL_WOOD_MN	0	0
188	TFINMN	TOTAL_FINE_MN	0	0
189	TRPRMN	TOTAL_REPRODUCTIVE_MN	0	0
190	TLTRMN	TOTAL_LITTER_MN	0	0
191	LWMN	LARGE_WOOD_MN	0	0

3. Data Application and Derivation:

These data can be used to support the analysis of global patterns of carbon and nutrients in litterfall and litter pools of carbon and nutrients.

4. Quality Assessment:

Data sources did not always divide litterfall into the same categories. To accommodate various reporting practices a hierarchy of six categories was developed. Leaf, small wood, reproductive, and large wood were chosen as nominal categories. In addition, “leaf+small wood” and “total fine” are provided for those studies that did not subdivide the component fractions (Table 2, below).

Different investigators applied different definitions of small wood. The cutoff between small and large wood ranges from 2 mm to 5 cm in diameter. Small wood is defined as <5 mm when possible. Otherwise the investigators’ definition (sometimes unstated) was used. As a result, the size of material considered to be small wood varies among the data sources.

5. Data Acquisition Materials and Methods:

Literature Review:

Investigators exclusively used literature sources reporting primary measurements of litterfall and littermass. The litter database was developed from about 685 original documents. Data was extracted from published and unpublished documents in the categories of journal articles, books, edited books, technical reports, and theses with publication dates ranging from 1867 to 1997. A complementary bibliographic data set comprising every document used in the compilation was created.

These collections were greatly aided by the reviews of Bray and Gorham (1964), Hutson and Veitch (1985), O'Neill and DeAngelis (1981), Proctor (1983), Vitousek (1984), and Vogt et al. (1986), A first assessment of the utility and thoroughness of our collection took place at a working group meeting hosted by the Max Planck Institute for Biogeochemistry.

Attention was paid to getting relatively complete representation of sites across ecosystem type, climatic regime, and global spatial distribution. Carbon data was of primary concern but measurements for other nutrients were also obtained and include N, P, magnesium (Mg), calcium (Ca), potassium (K), sodium (Na), and manganese (Mn). The data set remains sparse for elements other than C and N. When possible, compositional information (leaf, small wood, reproductive, coarse wood) was retained. Turnover times and decay rates were able to be estimated using this information.

Guidelines for Extracting and Reporting Data:

With such a wide-ranging collection of source literature, deriving a consistent set of guidelines for extracting the data proved difficult. Our approach was to develop guidelines and to include notes with the measurements to increase the probability that the details would be clear about how the primary data was handled. In summary, the reference, site information, and measurements of carbon and nutrients or litter fall and litter pool components were recorded. The measurements were reported in many different units and converted into kg m-2 for dry mass, and into g m-2 for N, P, and nutrients.

Note that dry matter was not converted to carbon. This conversion fraction (~0.5 by mass) can vary and so the reported measurements were not converted so that others using the database could choose appropriate conversion factors.

Each record in the database represents a site. The intention was to compile a comprehensive data set of individual direct field measurements reported by researchers. Most often site averages from replicate research plots were reported in the literature source. However, reported measurements were averaged under the following two circumstances. (1) replicate measurements obtained from a series of plots or litterfall traps at a single site were averaged when the plots were established to characterize spatial variability within a relatively uniform cover type. (2) measurements obtained in consecutive years at a single site were averaged when these measurements were designed to capture interannual variability of a relatively uniform cover type. The averages were recorded in the database. If several measurements were reported, even if for the same litter feature (like leaf litter pool or coarse wood pool), but otherwise distinguished as different by the author (e.g., along an elevational gradient, chronosequence, or completely unrelated in space), these measurements were treated as representing different sites. If several measurements were made during the year to account for seasonal variation then we summed litterfall measurements and reported an annual total and average litter pool measures and reported an annual average. In most cases only a single measurement period is reported. In the case of litterfall this is most often at the beginning of the dormant period when most, but not all, the litterfall occurs. For littermass, one-time measurements are problematic in ecosystems with large seasonal variation in the amount of littermass. If measurements are not taken in the same season then unintended variation is introduced. Often, littermass is measured when it is maximal, at the beginning of the dormant season. Seasonal variation was not adjusted when one time measurements were reported.

Exclusions and Exceptions:

For every source document, the site description, method, and results were carefully reviewed. If a study site was not described well enough to locate within 0.5 degree latitude or longitude, measurements from the source were not used. Data were also omitted if litter fall or litter pools were not reported as oven-dry weight or if units were indecipherable. The only exception made to this dry-weight standard was for standing dead mass since this material is extremely difficult to harvest and dry. Often the weight of standing dead material is estimated using a volume estimate which is already converted to dry weight. The presence or absence of ash, an estimate of non-organic matter in litter and frequently reported with dry mass measurements, was not a criterion used to include or exclude measurements. However, if ash was reported separately from dry mass, the ash weight was subtracted and ash free dry weight was reported.

General Description of Litterfall and Littermass Data Categories

Litterfall:

In nearly every data source only aboveground litterfall production was reported. This database is therefore limited to aboveground litterfall. All reported measurements were converted to weight per unit area and totaled, when appropriate, to year values. For litterfall dry weight we report kg m-2 yr-1. For nutrients we use g m-2 yr-1.

Litterfall may be divided into many categories. Data sources did not always divide litterfall into the same categories. To accommodate various reporting practices we developed a hierarchy of 6 categories. We chose leaf, small wood, reproductive, and large wood as nominal categories. We also provide "leaf+small wood" and "total fine" for those studies that did not subdivide the component fractions (Table 2).

Table 2. Hierarchy of litterfall and littermass categories for plant tissue category used in the database.

Lumped Categories		Nominal Categories	Split Categories
Total fine	Leaf + Small wood	Leaf	Blade
			Petiole
			Bud scales
		Small wood	Twig
			Small branch
			Bark
			Flower

	Reproductive	Reproductive	Pollen
			Fruit (seed, fleshy part, husk, cone, etc.)
Large wood		Large wood	Large branch (fallen)
			Bole (fallen)
			Standing dead
Not included		Not included	Roots (fine, small, large)

When possible reported measurements were either lumped or split to fit our nominal categories. If this was not possible the information was recorded in the appropriate lumped categories. In many cases, particularly for reproductive and large wood, not all categories of litterfall were reported. In these cases the corresponding nominal category and any lumped categories that contain this nominal category were marked missing. Different investigators applied different definitions of small wood. The cutoff between small and large wood ranges from 2 mm to 5 cm in diameter. Small wood was defined as <5 mm when possible. Otherwise the investigators' (sometimes unstated) definition was used. As a result, the size of material considered to be small wood varies among the data sources.

Littermass:

Littermass measurements reported were converted to weight per unit area. Littermass dry weight is reported as kg m-2. Littermass nutrients is reported as g m-2.

Littermass measurements were divided into categories based on types of plant tissues in the same fashion as litterfall described above.

Littermass pools are often divided into temporal categories based on the degree of decomposition of the constituent materials. These are frequently reported separately because of their differences in nutrient content and importance in nutrient cycling (Aber et al. 1978). These different littermass pools form vertical layers with the most decomposed layer next to the soil surface and the freshest material on the top. The surface or L-layer consists of freshly fallen material that is intact and relatively undecomposed. The next layer down is called the fermentation or F-layer and is largely fragmented, colonized by microbial and fungal decomposers, but still recognizable as to the category of plant tissue. The third layer, in contact with the mineral soil surface is considerably transformed, physically and chemically. This layer is referred to as the humification or H-layer and may or may not be easily distinguished from the surface mineral soil layer. The L, F and H layers are alternatively referred to as the Oa, Oe and Oi layers respectively. In practice it is difficult to objectively distinguish the F and H layers so they are often combined into a F+H layer. If the investigator distinguished separate littermass layers the data were recorded separately into L and F+H categories. If these layers were not distinguished the littermass data were entered as Total category for each plant tissue category (see Table 3).

Table 3. Hierarchy of littermass categories for decomposition category used in the database.

Lumped Categories	Nominal Categories	Split Categories	
Total litter	L layer	L layer	Oa layer
	F+H layer	F layer	Oe layer
		H layer	Oi layer

6. Data Access:

These data are available through the Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC).

Data Archive Center:

Contact for Data Center Access Information:

E-mail: uso@daac.ornl.gov
Telephone: +1 (865) 241-3952

7. References:

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The bibliographic sources for the data are provided as a companion file in ASCII text format, **Litterfall_source_bibliography.txt.**