Global Organic Soil Carbon and Nitrogen (Zinke et al.)

Summary:

This package contains worldwide soil carbon and nitrogen data for more than 3,500 soil profiles. The database was begun about 40 years ago with the collection and analyses by Zinke of soil samples from California. Additional data came from soil surveys of California, Italy and Greece, Iran, Thailand, Vietnam, various tropical Amazonian areas, U.S. forest soils, and from the soil survey literature. The main samples for laboratory analyses were collected at uniform soil depth increments and included bulk density determinations, but samples reported in the literature did not always have this uniformity. For the latter group of samples, only profiles that were samples to a meter depth or to actual depth were used; if bulk densities were not reported, then estimates were made from regressions based on organic carbon content of the soil samples associated with the profile.

Methods used for analytical carbon determinations were dry combustion, 'wet combustion', or loss on ignition with adjustments made to the values obtained with the last two methods. Nitrogen was determined by the Kjeldahl method on the soil fine earth fraction and reported as total organic nitrogen.

The data can be used to estimate the size of the soil's organic carbon and nitrogen pools at equilibrium with natural soil-forming factors. Most of the data are from profiles associated with natural vegetation so they constitute a baseline for evaluation of the effects that disturbance or modification to natural vegetation has on soil carbon equilibrium at either a global or regional scale. The data can also be used for understanding the range and viability of soil carbon and nitrogen pools for specific ecosystems or climatic regimes.

The soil profile carbon and nitrogen data plus biogeochemical classifications for the profile locations are provided in the original ASCII format (Zinke et al, 1986) and, as a service to our users, in ESRI shapefile format, and in ESRI interchange file format (*e00). Read software for the ASCII file is included in the companion file zinke_readme.txt (http://www.daac.ornl.gov/data/global_soil/ZinkeSoil/comp/zinke_readme.txt).

Data Citation:

Cite this data set as follows (citation revised on June 27, 2002):

Zinke, P. J., A. G. Stangenberger, W. M. Post, W. R. Emanuel, and J. S. Olson. 1998. Global Organic Soil Carbon and Nitrogen (Zinke et al.). Data set. Available on-line [http://www.daac.ornl.gov] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A. Previously published in Worldwide Organic Soil Carbon and Nitrogen Data, CDIAC NDP-018, Carbon Dioxide Information and Analysis Center, Oak Ridge National Laboratory, Oak Ridge, Tennessee, U.S.A., 1986.

References:

Olson, J. S., J. A. Watts, and L. J. Allison. 1983. Carbon in Live Vegetation of Major World Ecosystems. ORNL-5862, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Post, W. M., W. R. Emanuel, P. J. Zinke, and A. G. Stangenberger. 1982. Soil carbon pools and world life zones. Nature 298:156-159.

Post, W. M., J. Pastor, P. J. Zinke, and A. G. Stangenberger. 1985. Global patterns of soil nitrogen storage. Nature 317:613-616.

Zinke, P. J., A. G. Stangenberger, W. M. Post, W. R. Emanuel, and J. S. Olson. 1986. Worldwide Organic Soil Carbon and Nitrogen Data, NDP-018. Available on-line [http://cdiac.esd.ornl.gov/home.html] from Carbon Dioxide Information Analysis Center (CDIAC), Oak Ridge National Laboratory, Oak Ridge, Tennessee U.S.A.

Zinke, P. J., A. G. Stangenberger, W. M. Post, W. R. Emanuel, and J. S. Olson. 1984. Worldwide Organic Soil Carbon and Nitrogen Data. ORNL/TM-8857. Oak Ridge National Laboratory, Oak Ridge, Tennessee, U.S.A.

Data Format:

The original ASCII data file (http://www.daac.ornl.gov/data/global_soil/ZinkeSoil/data/zinke_soil.txt) contains the soil profile number and location; carbon (kg/m2) and nitrogen (g/m2) content; sample site latitude, longitude, and elevation (meters); source of data; and sample profile classification by Holdridge life zone, Olson ecosystem type, and parent material. The file is formatted as:

Variable	Description	Variable Type	Beginning Column	Ending Column
PROFILE	soil profile number and location	alphanumeric	1	22
CARBON	carbon (kg/m2)	real	23	29
NITROGEN	nitrogen (g/m2	real	31	38
LAT	sample site latitude	alphanumeric	41	46
LONG	sample site longitude	alphanumeric	50	55
ELEV	sample site elevation (meters)	alphanumeric	57	61
SOURCE	source of data (Zinke et al, 1986)	integer	63	68
HOLDRIDGE	sample site classification by Holdridge life zone	character	72	72
OLSON	sample site classification by Olson ecosystem type (Olsen et al, 1983)	integer	74	75
PARENT	sample site classification by soil parent material	alphanumeric	76	79

Example data records from zinke_soil.txt

```
0062031  69A211          30.9   1774.    38.4N   120.2W  1890     25   D 22 35
0062032  69B104          30.9   1074.    38.4N   120.3W  1646     25   D 22 35
0062033  22D305           6.4    225.    40.6N   121.7W  1798     25   D 22 34
0062034  33A201           2.9     65.    40.4N   121.7W  1280     25   D 22 30
0062035  33B309          18.3    594.    40.3N   121.9W   610     25   E 27 40
0062036  33B327          15.5    861.    40.3N   121.9W   518     25   E 27 40
0062037  68A403           7.8    355.    38.3N   120.6W   732     25   E 27 04
0062038  69B210           9.9    375.    38.4N   120.4W  1036     25   E 27 04
0062039  90C404          11.5    491.    37.1N   119.3W  1372     25   D 22 04
0062040  90C407          16.8    746.    37.1N   119.3W  1250     25   D 22 04
0062042  14C102          12.9    509.    41.2N   122.3W   671     25   E 27 10
0062043  24D405          12.6    585.    40.6N   122.6W   427     25   E 27 69
```

Coded values:

Source of data -- See Zinke et al, 1986, Table E, Reference List
Holdridge life zone -- See "Table B" below
Olson ecosystem type -- See "Table C" below
Parent material -- See "Table D" below

Table B. Key to Holdridge life zone codes

Life zone	Code	Life zone	Code
Dry tundra	1	Warm temperate wet forest	L
Moist tundra	2	Warm temperate rain forest	M
Wet tundra	3	Subtropical desert	N
Rain tundra	4	Subtropical desert bush	O
Boreal desert	5	Subtropical thorn woodland	P
Boreal dry bush	6	Subtropical dry forest	Q
Boreal moist forest	7	Subtropical moist forest	R
Boreal wet forest	8	Subtropical wet forest	S
Boreal rain forest	9	Subtropical rain forest	T
Cool temperate desert	A	Tropical desert	U
Cool temperate desert bush	B	Tropical desert bush	W
Cool temperate steppe	C	Tropical thorn woodland	W
Cool temperate moist forest	D	Tropical very dry forest	Y
Cool temperate wet forest	E	Tropical dry forest	Z
Cool temperate rain forest	F	Tropical moist forest	$
Warm temperate desert	G	Tropical wet forest	#
Warm temperate desert bush	H	Tropical Rain Forest	*
Warm temperate thorn steppe	I	Disturbed/agricultural	Blank
Warm temperate dry forest	J	Unclassified	?
Warm temperate moist forest	K		

Table C. Key to ecosystem codes

Ecosystem	Code	Ecosystem	Code
Main taiga	20	Marsh, swampwoods and littoral	45
Main taiga	21	Mediterranean scrub/wood/savanna	46
Cool conifer forest	22	Sparse woodland or shrubland	47
Cool hardwoods-conifer mixed woods	23	Warm semiarid woodlands	48
Warm broad-leaved conifer mixed woods	24	Low scrub	49
Cool deciduous forest	25	Sand/scrub/herbs or bare desert	50
Warm broad-leaved forest	26	Hot subdesert/desert shrubland	51
Warm conifer forest	27	Cool/cold semidesert/desert shrubland	52
Tropical/subtropical broad-leaved humid forest	29	Tundra	53
Cool farms or grass/scrub	30	Cool farms, grass/scrub with woods	55
Warm farm or grass/scrub	31	Warm forest/farm complex	56
Seasonally dry tropical woodland	32	Cool forest/farm complex	57
Paddylands and associated woods	36	Warm farm, grass, or scrub with woods	58
Cool grassland	40	Tropical thorn/succulent woods	59
Miscellaneous grassland	41	Midcontinental southern taiga	60
Cold rangelands	42	Northern or maritime taiga/subalpine	62
Tropical savanna and woodland	43	Wooded tundra	63
Bogs and bog woods	44	Heath, moorland	64

Table D. Coding for parent rocks

Code	Rock
0XX	ACID INTRUSIVE
00X	Granites
01X	Syenites
02X	Nepheline syenites
03X	Monzonites
04X	Diorites
05X	Quartz diorites
1XX	BASIC INTRUSIVE
10X	Gabbros
11X	Alkali gabbros
12X	Basic feldspathoids
2XX	ULTRABASIC
20X	Peridotites
21X	Serpentinite
3XX	ACID EXTRUSIVE
30X	Rhyolites
31X	Trachytes
32X	Phonolites
33X	Latites
34X	Dacites
35X	Andesites
4XX	BASIC EXTRUSIVE
40X	Basalt
41X	Tephrites
42X	Basaltic nephelinites
43X	Limburgites
5XX	SEDIMENTARY ROCKS (consolidated)
50X	Sandstones
51X	Argillaceous rocks
52X	Calcareous rocks
53X	Siliceous rocks
54X	Iron rich sediments
55X	Phosphatic sediments
56X	Anhydrites and gypsum
57X	Conglomerate (consolidated clastic)
58X	Mixed conglomerate (consolidated)
59X	Unconsolidated materials
6XX	METAMORPHIC ROCKS
60X	Hornfelses
61X	Slates and phyllites
62X	Schists
63X	Amphibolites
64X	Gneisses
65X	Granulites
66X	Cataclastic, mylonites, and phyllonites
67X	Marble
68X	Quartzite
69X	Autometamorphic
7XX	SEDIMENTARY ROCKS (weakly consolidated—terraces, river sediments, dunes, etc.)
70X	Sandstone materials
71X	Argillaceous materials
72X	Calcareous materials
73X	Siliceous materials
74X	
75X	
76X	
8XX	ORGANIC MATERIAL
0XX	ACID INTRUSIVE
00X	*Granite*
000	Alaskite
001	Graphic granite
002	Alkali granite
003	Charnockite
004	Luxullianite
005	Granite porphyry
006	Aplite
007	Granite pegmatite
008	
009	

Table D (continued)

Code	Rock
01X	*Syenite*
010	Quartz syenite
011	Alkali syenite
012	Pulaskite
013	Nordmarkite
014	Larvikite
015	Shonkinite
016	Syenite porphyry
017	Syenite aplite
018	Syenite pegmatite
019	
02X	*Nepheline Syenite*
020	Leucite syenite
021	Sodalite syenite
022	Foyaite
023	Malignite
024	Ditroite
025	Nepheline syenite porphyry
026	Nepheline aplite
027	Nepheline pegmatite
028	
029	
03X	*Monzonites*
030	Quartz monzonite
031	Quartz monzonite porphyry
032	Quartz monzonite aplite
033	Quartz monzonite pegmatite
034	Monzonite
035	Monzonite prophyry
036	Monzonite aplite
037	Monzonite pegmatite
038	Nepheline monzonite
-39	Nepheline monzonite porphyry
04X	*Diorites*
040	Grandiorite
041	Grandiorite porphyry
042	Grandiorite aplite
043	Grandiorite pegmatite
044	Diorite
045	Diorite porphyry
046	Diorite aplite
047	Diorite pegmatite
048	Trondhjemite
049	
05X	*Quartz diorites*
050	Quartz diorite (tonalite)
051	Quartz diorite porphyry
052	Quartz diorite aplite
053	Quartz diorite pegmatite
054	
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1XX	BASIC INTRUSIVE
10X	*Gabbros*
100	Gabbro-clinopyroxene
101	Norite
102	Olivine gabbro
103	Troctolite
104	Anorthite
105	Quartz gabbro
106	Gabbro porphyry
107	Gabbro aplite
108	Gabbro pegmatite
109	Diabase
11X	*Alkali gabbros*
110	Theralite
111	Essexite
112	Teschenite
113	Olivine theralite
114	Theralite porphyry
115	
116	
117	
118	
12X	*Basic feldspathoids*
120	Missourite
121	Ijolite
122	Fergusite
123	Melililteia
124	
125	
126	
127	
128	
129	

Table D (continued)

Code	Rock
2XX	ULTRABASIC
20X	*Peridotites*
200	Peridotite-pyroxene and olivine
201	Harzburgite
202	Picrite
203	Dunite
204	Pyroxenite
205	Hornblendite
206	Peridotite porphyry
207	Kimberlite
21X	*Serpentinite*
210	Serpentine (pure mineral)
211	Serpentine schist
212	Serpentine talc
213	
214	
215	
216	
217	
218	
219	
3XX	ACID EXTRUSIVE
30X	*Rhyolites*n
300	Rhyolite
301	Rhyolite porphyry
302	Rhyolite obsidian
303	Rhyolite pitchstone
304	Rhyolite pumice
305	Rhyolite perlite
306	Rhyolite scoria
307	Rhyolite vitrophyre
308	Rhyolite tuff
309	Tuff-breccia
31X	*Trachytes*
310	Trachyte
311	Trachyte porphyry
312	Trachyte obsidian
313	Trachyte pitchstone
314	Trachyte pumice
315	Trachyte perlite
316	Trachyte scoria
317	Trachyte vitrophyre
318	Trachyte tuff
319	Trachyte tuff-breccia
32X	*Phonolites*
320	Phonolite
321	Phonolite porphyry
322	Leucite phonolite
323	Tinguaite
324	Wyomingite
325	Generalized volcanic
326	Pumice
327	
328	
329	
33X	*Lattites*
330	Quartz latite
331	Quartz latite porphyry
332	Latite
333	Latite porphyry
334	Nepheline latite
335	Nepheline latite prophyry
336	
337	
338	
339	
34X	*Dacites*
340	Dacite
341	Dacite porphyry
342	Dacite obsidian
343	Dacite pitchstone
344	Dacite vitrophyre
345	Dacite perlite
346	Dacite pumice
347	Dacite scoria
348	Dacite tuff
349	Dacite tuff-breccia
35X	*Andesites*
350	Andesite
351	Andesite porphyry
352	Andesite obsidian
353	Andesite pitchstone
354	Andesite vitrophyre
355	Andesite perlite
356	Andesite pumice
357	Andesite scoria
358	Andesite tuff
359	Andesite tuff-breccia

Table D (continued)

Code	Rock	Code	Rock
4XX	BASIC EXTRUSIVE	5XX	SEDIMENTARY ROCKS (consolidated)
40X	*Basalts*	50X	Sandstone
400	Basalt	500	Wackes and graywackes
401	Basalt porphyry	501	Lithic wackes and graywackes
402	Olivine basalt	502	Lithic arenite
403	Analcite basalt	503	Arkosic sandstone
404	Quartz basalt	504	Feldspathic sandstone
405	Oceanite	505	Quartz arenites
406	Basalt scoria	506	
407	Basalt glass (tachylite)	507	
408	Basalt tuff	508	
409	Basalt tuff-breccia	509	
41X	*Tephrites*	51X	*Argillaceous rocks*
410	Tephrite	510	Shale
411	Tephrite porphyry	511	Silty shale
412	Leucite tephrite	512	Clay shale
413	Basanite	513	Black pyritic shale
414	Leucite basanite	514	Red shale
415		515	Glauconitic shale
416		516	Siltstone
417		517	Claystone
418		518	Clay minerals
419		519	
42X	*Basaltic nephelinites*	52X	*Calcareous rock*
420	Nephelinite	520	Limestone
421	Leucitite	521	Organic limestone
422	Nepheline basalts	522	Clastic limestone
423	Leucite basalt	523	Aphaitic limestone
424	Melilitite	524	Dolomitic limestone
425		525	Dolomite
426		526	Autigenic silicates in organic limestone
427			
428		527	
429		528	
		529	
43X	*Limburgites*	53X	*Siliceous sediments*
430	Limburgite	530	Siliceous shale
431	Limburgite porphyry	531	Opal and chacedony
432		532	Chert
433		533	Porcellanite
434		534	Diatomite
435		535	Spiculites
436		536	
437		537	
438		538	
439		539	

Table D (continued)

Code	Rock
54X	*Iron-rich sediments*
540	Ironstones
541	Glauconitic rocks
542	Sideritic and chamositic ironstones
543	Hematitic ironstones
544	Pyritic strata
545	
546	
547	
548	
549	
55X	Phosphatic sediments (phosphorites)
550	Collophane
551	
552	
553	
554	
555	
556	
557	
558	
559	
56X	*Andydrite and gypsum*
560	
561	
562	
563	
564	
565	
566	
567	
568	
569	
57X	*Homogeneous conglomerates* (consolidated clastics)
570	Conglomerate
571	Quartz pebble conglomerate
572	Chert cobble conglomerate
573	Argillaceous conglomerate
574	Siliceous conglomerate
575	Calcareous conglomerate
576	Ferruginous (limonite or hematitic) conglomerate
577	Carbonaceous conglomerate
578	Phosphatic conglomerate
579	
58X	*Mixed conglomerates* (consolidated)
580	Mixed pebble conglomerate
581	Mixed cobble conglomerate
582	Argillaceous mixed conglomerate
583	Glacial till
584	Tillite (indurated till)
585	Fanglomerate
586	Siliceous mixed conglomerate
587	Clacareous mixed conglomerate
588	Ferruginous (limonite or hematitic) mixed conglomerate
589	Carbonaceous mixed conglomerate
59X	*Unconsolidated materials* (recent gravels, cobbles, sand, and silt; usually river bottoms, dunes, etc.)
590	Gravels
591	Cobbles
592	Gravels and cobbles
593	Gravels, cobbles, and sand mixtures
594	Gravels, cobbles, sand, and silt mixtures
595	Sand
596	Sand and silt
597	Sand, silt, and clay
598	Saliceous derived alluvial silt
599	
6XX	METAMORPHIC ROCK
60X	*Hornfelses*
600	Pelitic hornfelses
601	Quartzo-feldspathic hornfelses
602	Contact marbles
603	Calc-silicate marbles and sparns
604	Basic hornfelses
605	Magnesiam hornfelses
606	
607	
608	
609	

Table D (continued)

Code	Rock	Code	Rock
61X	*Slates and phyllites*	65X	*Granulites and ecologites*
610	Slate	650	Pyroxene granulite
611	Spotted slate	651	Olivinite
612	Phyllite	652	Ecologite
613		653	
614		654	
615		655	
616		656	
617		657	
618		658	
619		659	
62X	*Schists*	66X	*Cataclasites, mylonites, and phyllonites*
620	Mica schist and quartz-albite schist	660	Mylonites
621	Calc-schist (low grade)	661	Cataclasites
622	Greenschist	662	Phyllonites
623	Magnesian schist	663	Fault gouge; shear zone materials
624	Glaucophane schist	664	
625	Pelitic schist	665	
626	Quartzo-feldspathic schist	666	
627	Calc-schists (high grade)	667	
628	Foliated marble	668	
629	Chlorite schist	669	
63X	*Amphibolites* (hornflende schist)	67X	*Marbles*
630	Epidote amphibolite	670	Brucite
631	Garnet-pyroxene amphibolite	671	
632		672	
633		673	
634		674	
635		675	
636		676	
637		677	
638		678	
639		679	
64X	*Gneisses*	68X	*Quartzites*
640	Granite gneiss	680	Orthoquartzite
641	Mica gneiss	681	
642		682	
643		683	
644		684	
645		685	
646		686	
647		687	
648		688	
649		689	

Table D (continued)

Code	Rock
69X	*Autometamorphism* (list of processes forming secondary minerals by hydrothermal alteration and other metamorphic processes)
690	Propylization
691	Uralitization
692	Chlorization
693	Silification
694	Saussurization
695	Kaolinization of granites
696	Greenstone
697	
698	
699	
7XX	SEDIMENTARY ROCKS (weakly consolidated—terraces, dunes, etc.)
70X	*Sandstone materials*
701	
702	
703	
704	
705	
71X	*Argillaceous material*
710	
711	
712	
713	
714	
715	
72X	*Calcareous material*
720	Marl
721	
722	
723	
724	
725	
73X	*Siliceous material*
730	
731	
732	
733	
734	
735	
74X	*Conglomerate* (homogeneous)
740	
741	
742	
743	
744	
745	
75X	*Conglomerate* (mixed)
750	
751	
752	
753	
754	
755	
76X	*Air-deposited sediment*
761	Loess
762	Volcanic ash
763	Volcanic ash over loess
764	Micaceous loess
765	Calcareous loess
766	Sand dunes