

R.J.B Flat-earth paper (2017- 11th November 2018). Supplementary file 1 of ter
Below is raw data file from Nunn & Puga (2010/2012) – <https://diegopuga.org/datasets>

isocode	isonum	country	rugged	[T rugged popw	rugged_slope]
ABW	533	Aruba	0.462	0.38	1.226
AFG	4	Afghanistan	2.518	1.469	7.414
AGO	24	Angola	0.858	0.714	2.274
AIA	660	Anguilla	0.013	0.01	0.026
ALB	8	Albania	3.427	1.597	10.451
AND	20	Andorra	5.717	6.722	17.774
ANT	530	Netherlands	0.255	0.039	0.68
ARE	784	United Arab	0.769	0.316	2.112
ARG	32	Argentina	0.775	0.22	2.268
ARM	51	Armenia	2.688	0.934	8.178
ASM	16	American Sam	2.647	1.63	7.032
ATG	28	Antigua and	0.006	0.003	0.012
AUS	36	Australia	0.143	0.183	0.405
AUT	40	Austria	3.513	1.152	11.095
AZE	31	Azerbaijan	1.672	0.534	5.08
BDI	108	Burundi	1.78	1.586	4.721
BEL	56	Belgium	0.388	0.261	1.239
BEN	204	Benin	0.141	0.099	0.377
BFA	854	Burkina Faso	0.236	0.214	0.638
BGD	50	Bangladesh	0.186	0.065	0.502
BGR	100	Bulgaria	1.479	0.711	4.498
BHR	48	Bahrain	0.231	0.163	0.627
BHS	44	Bahamas	0.055	0.1	0.144
BIH	70	Bosnia and H	2.311	1.288	7.075
BLR	112	Belarus	0.164	0.208	0.54
BLZ	84	Belize	0.607	0.226	1.616
BMU	60	Bermuda	0.015	0.014	0.03
BOL	68	Bolivia	0.853	0.911	2.343
BRA	76	Brazil	0.24	0.25	0.654
BRB	52	Barbados	0.963	0.695	2.581
BRN	96	Brunei Darus	0.52	0.134	1.366
BTN	64	Bhutan	6.74	4.913	19.325
BWA	72	Botswana	0.181	0.478	0.488
CAF	140	Central Afri	0.197	0.257	0.528
CAN	124	Canada	0.775	0.37	2.695
CCK	166	Cocos (Keeli	0.015	0.018	0.031
CHE	756	Switzerland	4.761	1.45	14.999
CHL	152	Chile	2.481	0.677	7.365
CHN	156	China	1.878	0.708	5.493
CIV	384	Côte d'Ivoir	0.224	0.159	0.594
CMR	120	Cameroon	0.515	0.545	1.374
COD	180	Democratic R	0.443	0.531	1.177
COG	178	Congo	0.152	0.411	0.406
COK	184	Cook Islands	0.96	0.594	2.641
COL	170	Colombia	0.885	0.89	2.376
COM	174	Comoros	3.328	2.172	9.049
CPV	132	Cape Verde	2.367	1.399	6.502
CRI	188	Costa Rica	2.112	1.044	5.708
CUB	192	Cuba	0.528	0.293	1.448
CXR	162	Christmas Is	1.321	1.422	3.477
CYM	136	Cayman Islan	0.096	0.085	0.237

CYP	196 Cyprus	2.718	0.909	7.867
CZE	203 Czech Republ	0.884	0.578	2.845
DEU	276 Germany	0.597	0.405	1.906
DJI	262 Djibouti	2.432	0.804	6.416
DMA	212 Dominica	0.003	0.008	0.005
DNK	208 Denmark	0.189	0.191	0.611
DOM	214 Dominican Re	1.641	0.519	4.495
DZA	12 Algeria	0.51	1.368	1.445
ECU	218 Ecuador	1.278	0.766	3.446
EGY	818 Egypt	0.723	0.274	2.001
ERI	232 Eritrea	2.481	1.911	6.663
ESH	732 Western Saha	0.203	0.301	0.565
ESP	724 Spain	1.689	0.81	5.062
EST	233 Estonia	0.123	0.188	0.414
ETH	231 Ethiopia	1.57	1.725	4.193
FIN	246 Finland	0.328	0.268	1.202
FJI	242 Fiji	1.396	0.582	3.723
FLK	238 Falkland Isl	0.264	0.214	0.859
FRA	250 France	1.098	0.496	3.406
FRO	234 Faeroe Islan	2.253	1.309	8.215
FSM	583 Micronesia,	1.353	0.919	3.61
GAB	266 Gabon	0.218	0.582	0.583
GBR	826 United Kingd	0.568	0.21	1.878
GEO	268 Georgia	3.659	0.859	11.258
GHA	288 Ghana	0.228	0.25	0.601
GIB	292 Gibraltar	7.811	5.542	21.453
GIN	324 Guinea	0.74	1.03	1.969
GLP	312 Guadeloupe	1.188	0.533	3.23
GMB	270 Gambia	0.353	0.384	0.915
GNB	624 Guinea-Bissa	0.491	0.534	1.302
GNQ	226 Equatorial G	0.559	1.405	1.449
GRC	300 Greece	3.103	1.295	9.166
GRD	308 Grenada	2.088	1.538	5.655
GRL	304 Greenland	0.41	0.914	1.548
GTM	320 Guatemala	1.807	1.369	4.893
GUF	254 French Guian	0.205	0.254	0.546
GUM	316 Guam	0.666	0.293	1.825
GUY	328 Guyana	0.273	0.052	0.744
HKG	344 Hong Kong Sp	2.501	1.558	6.692
HND	340 Honduras	2.15	1.207	5.824
HRV	191 Croatia	1.267	0.678	3.842
HTI	332 Haiti	2.362	1.318	6.448
HUN	348 Hungary	0.346	0.289	1.09
IDN	360 Indonesia	0.967	0.435	2.587
IND	356 India	1.013	0.237	2.842
IOT	86 British Indi	0.018	0.016	0.037
IRL	372 Ireland	0.513	0.28	1.676
IRN	364 Iran, Islami	2.445	0.929	6.962
IRQ	368 Iraq	0.67	0.36	1.919
ISL	352 Iceland	1.472	0.557	5.318
ISR	376 Israel	1.705	1.002	4.808
ITA	380 Italy	2.458	0.755	7.506
JAM	388 Jamaica	1.788	0.934	4.837
JOR	400 Jordan	1.097	1.648	3.115

JPN	392 Japan	2.132	0.463	6.275
KAZ	398 Kazakhstan	0.372	0.281	1.172
KEN	404 Kenya	0.669	0.559	1.781
KGZ	417 Kyrgyzstan	4.287	0.948	13.105
KHM	116 Cambodia	0.54	0.146	1.421
KIR	296 Kiribati	0.01	0.015	0.021
KNA	659 Saint Kitts	0.006	0.01	0.012
KOR	410 Republic of	1.96	0.747	5.807
KWT	414 Kuwait	0.245	0.271	0.691
LAO	418 Lao People's	2.553	1.218	6.976
LBN	422 Lebanon	4.197	2.17	12.042
LBR	430 Liberia	0.263	0.259	0.695
LBY	434 Libyan Arab	0.403	0.337	1.124
LCA	662 Saint Lucia	2.147	1.351	5.841
LIE	438 Liechtenstei	5.328	2.927	17.18
LKA	144 Sri Lanka	0.65	0.446	1.712
LSO	426 Lesotho	6.202	4.165	17.595
LTU	440 Lithuania	0.175	0.229	0.578
LUX	442 Luxembourg	0.881	0.581	2.844
LVA	428 Latvia	0.154	0.136	0.522
MAC	446 Macao Specia	0.732	0.527	1.921
MAR	504 Morocco	2.413	1.291	6.853
MCO	492 Monaco	6.612	6.043	20.834
MDA	498 Republic of	0.799	0.573	2.527
MDG	450 Madagascar	1.169	0.738	3.185
MDV	462 Maldives	0.012	0.012	0.024
MEX	484 Mexico	1.732	0.825	4.795
MHL	584 Marshall Isl	0.014	0.016	0.033
MKD	807 The former Y	2.665	0.885	8.19
MLI	466 Mali	0.147	0.305	0.393
MLT	470 Malta	1.527	1.171	4.292
MMR	104 Myanmar	1.988	0.332	5.517
MNG	496 Mongolia	1.057	0.765	3.352
MNP	580 Northern Mar	1.7	1.484	4.572
MOZ	508 Mozambique	0.612	0.438	1.653
MRT	478 Mauritania	0.115	0.147	0.308
MSR	500 Montserrat	3.395	2.824	9.256
MTQ	474 Martinique	1.206	0.659	3.311
MUS	480 Mauritius	0.949	0.788	2.436
MWI	454 Malawi	1.027	0.821	2.759
MYS	458 Malaysia	1.009	0.374	2.684
MYT	175 Mayotte	2.673	2.483	5.809
NAM	516 Namibia	0.913	0.423	2.489
NCL	540 New Caledoni	1.586	0.621	4.338
NER	562 Niger	0.178	0.222	0.481
NFK	574 Norfolk Isla	1.154	0.812	3.266
NGA	566 Nigeria	0.312	0.229	0.833
NIC	558 Nicaragua	0.992	0.768	2.671
NIU	570 Niue	0.177	0.205	0.472
NLD	528 Netherlands	0.037	0.042	0.108
NOR	578 Norway	2.409	1.245	8.516
NPL	524 Nepal	5.043	1.26	14.458
NRU	520 Nauru	0.311	0.527	0.781
NZL	554 New Zealand	2.038	0.451	6.233

OMN	512 Oman	1.109	0.896	3.012
PAK	586 Pakistan	1.949	0.341	5.665
PAN	591 Panama	1.54	0.546	4.128
PCN	612 Pitcairn	0.404	0.79	1.067
PER	604 Peru	1.347	0.991	3.653
PHL	608 Philippines	2.028	0.574	5.428
PLW	585 Palau	0.475	0.38	1.293
PNG	598 Papua New Gu	1.589	0.98	4.217
POL	616 Poland	0.297	0.259	0.951
PRI	630 Puerto Rico	1.447	0.699	3.928
PRK	408 Democratic P	2.521	0.884	7.681
PRT	620 Portugal	1.304	0.967	3.937
PRY	600 Paraguay	0.245	0.479	0.681
PSE	275 Occupied Pal	2.775	1.754	7.927
PYF	258 French Polyn	2.072	1.389	5.637
QAT	634 Qatar	0.181	0.156	0.493
REU	638 Réunion	3.873	0.962	10.657
ROU	642 Romania	1.267	0.555	4.005
RUS	643 Russian Fede	0.94	0.355	3.278
RWA	646 Rwanda	3.309	3.178	8.748
SAU	682 Saudi Arabia	0.914	0.688	2.514
SCG	891 Serbia and M	1.673	0.711	5.144
SDN	736 Sudan	0.442	0.292	1.186
SEN	686 Senegal	0.244	0.246	0.647
SGP	702 Singapore	0.016	0.004	0.036
SHN	654 Saint Helena	3.863	2.368	11.182
SJM	744 Svalbard and	1.623	1.278	6.575
SLB	90 Solomon Isla	1.54	1.109	4.111
SLE	694 Sierra Leone	0.498	0.574	1.317
SLV	222 El Salvador	1.75	1	4.746
SMR	674 San Marino	1.802	1.925	5.497
SOM	706 Somalia	0.65	0.45	1.711
SPM	666 Saint Pierre	0.833	1.054	2.467
STP	678 Sao Tome and	2.347	0.876	5.991
SUR	740 Suriname	0.307	0.034	0.815
SVK	703 Slovakia	1.56	0.672	5.043
SVN	705 Slovenia	2.496	0.746	7.713
SWE	752 Sweden	0.715	0.343	2.53
SWZ	748 Swaziland	3.063	2.301	8.574
SYC	690 Seychelles	4.885	1.802	11.129
SYR	760 Syrian Arab	0.756	0.741	2.174
TCA	796 Turks and Ca	0.007	0.01	0.013
TCD	148 Chad	0.419	0.197	1.135
TGO	768 Togo	0.28	0.247	0.745
THA	764 Thailand	1.051	0.189	2.826
TJK	762 Tajikistan	5.301	1.033	15.976
TKL	772 Tokelau	0	0	0
TKM	795 Turkmenistan	0.284	0.248	0.834
TLS	626 Timor-Leste	1.85	1.286	5.001
TON	776 Tonga	0.773	0.07	1.992
TTO	780 Trinidad and	0.603	0.521	1.611
TUN	788 Tunisia	0.726	0.585	2.079
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MDG	450 Madagascar	1.169	0.738	3.185
MDV	462 Maldives	0.012	0.012	0.024
MEX	484 Mexico	1.732	0.825	4.795
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MLT	470 Malta	1.527	1.171	4.292
MMR	104 Myanmar	1.988	0.332	5.517
MNG	496 Mongolia	1.057	0.765	3.352
MNP	580 Northern Mar	1.7	1.484	4.572
MOZ	508 Mozambique	0.612	0.438	1.653
MRT	478 Mauritania	0.115	0.147	0.308
MSR	500 Montserrat	3.395	2.824	9.256
MTQ	474 Martinique	1.206	0.659	3.311
MUS	480 Mauritius	0.949	0.788	2.436
MWI	454 Malawi	1.027	0.821	2.759
MYS	458 Malaysia	1.009	0.374	2.684
MYT	175 Mayotte	2.673	2.483	5.809
NAM	516 Namibia	0.913	0.423	2.489
NCL	540 New Caledoni	1.586	0.621	4.338
NER	562 Niger	0.178	0.222	0.481
NFK	574 Norfolk Isla	1.154	0.812	3.266
NGA	566 Nigeria	0.312	0.229	0.833
NIC	558 Nicaragua	0.992	0.768	2.671
NIU	570 Niue	0.177	0.205	0.472
NLD	528 Netherlands	0.037	0.042	0.108
NOR	578 Norway	2.409	1.245	8.516
NPL	524 Nepal	5.043	1.26	14.458
NRU	520 Nauru	0.311	0.527	0.781
NZL	554 New Zealand	2.038	0.451	6.233
OMN	512 Oman	1.109	0.896	3.012
PAK	586 Pakistan	1.949	0.341	5.665
PAN	591 Panama	1.54	0.546	4.128
PCN	612 Pitcairn	0.404	0.79	1.067
PER	604 Peru	1.347	0.991	3.653
PHL	608 Philippines	2.028	0.574	5.428
PLW	585 Palau	0.475	0.38	1.293
PNG	598 Papua New Gu	1.589	0.98	4.217
POL	616 Poland	0.297	0.259	0.951
PRI	630 Puerto Rico	1.447	0.699	3.928
PRK	408 Democratic P	2.521	0.884	7.681
PRT	620 Portugal	1.304	0.967	3.937
PRY	600 Paraguay	0.245	0.479	0.681
PSE	275 Occupied Pal	2.775	1.754	7.927
PYF	258 French Polyn	2.072	1.389	5.637
QAT	634 Qatar	0.181	0.156	0.493
REU	638 Réunion	3.873	0.962	10.657
ROU	642 Romania	1.267	0.555	4.005
RUS	643 Russian Fede	0.94	0.355	3.278
RWA	646 Rwanda	3.309	3.178	8.748

SAU	682 Saudi Arabia	0.914	0.688	2.514
SCG	891 Serbia and M	1.673	0.711	5.144
SDN	736 Sudan	0.442	0.292	1.186
SEN	686 Senegal	0.244	0.246	0.647
SGP	702 Singapore	0.016	0.004	0.036
SHN	654 Saint Helena	3.863	2.368	11.182
SJM	744 Svalbard and	1.623	1.278	6.575
SLB	90 Solomon Isla	1.54	1.109	4.111
SLE	694 Sierra Leone	0.498	0.574	1.317
SLV	222 El Salvador	1.75	1	4.746
SMR	674 San Marino	1.802	1.925	5.497
SOM	706 Somalia	0.65	0.45	1.711
SPM	666 Saint Pierre	0.833	1.054	2.467
STP	678 Sao Tome and	2.347	0.876	5.991
SUR	740 Suriname	0.307	0.034	0.815
SVK	703 Slovakia	1.56	0.672	5.043
SVN	705 Slovenia	2.496	0.746	7.713
SWE	752 Sweden	0.715	0.343	2.53
SWZ	748 Swaziland	3.063	2.301	8.574
SYC	690 Seychelles	4.885	1.802	11.129
SYR	760 Syrian Arab	0.756	0.741	2.174
TCA	796 Turks and Ca	0.007	0.01	0.013
TCD	148 Chad	0.419	0.197	1.135
TGO	768 Togo	0.28	0.247	0.745
THA	764 Thailand	1.051	0.189	2.826
TJK	762 Tajikistan	5.301	1.033	15.976
TKL	772 Tokelau	0	0	0
TKM	795 Turkmenistan	0.284	0.248	0.834
TLS	626 Timor-Leste	1.85	1.286	5.001
TON	776 Tonga	0.773	0.07	1.992
TTO	780 Trinidad and	0.603	0.521	1.611
TUN	788 Tunisia	0.726	0.585	2.079
TUR	792 Turkey	2.62	1.192	7.773
TUV	798 Tuvalu	0.025	0.02	0.055
TWN	158 Taiwan	3.49	0.429	9.785
TZA	834 United Repub	0.677	0.541	1.814
UGA	800 Uganda	0.913	0.779	2.424
UKR	804 Ukraine	0.416	0.359	1.317
UMI	581 United State	0.005	0.035	0.011
URY	858 Uruguay	0.435	0.391	1.283
USA	840 United State	1.073	0.333	3.384
UZB	860 Uzbekistan	0.526	0.243	1.589
VAT	336 Holy See	0.438	0.428	1.162
VCT	670 Saint Vincen	3.071	1.878	8.401
VEN	862 Venezuela (B	0.634	0.594	1.716
VGB	92 British Virg	1.257	1.873	3.131
VIR	850 United State	1.404	1.268	3.652
VNM	704 Viet Nam	2.054	0.439	5.603
VUT	548 Vanuatu	1.729	1.041	4.709
WLF	876 Wallis and F	1.306	0.977	3.505
WSM	882 Samoa	1.677	0.968	4.644
YEM	887 Yemen	2.323	2.197	6.155
ZAF	710 South Africa	1.761	1.318	4.942
ZMB	894 Zambia	0.533	0.506	1.422

ZWE	716 Zimbabwe	1.194	1.106	3.232
isocode	isonum	country	rugged	rugged_popw
	MEAN OR TOT		1.38	3.94
	SCALE OR TOT			2.26 degree
				With slope of
				ADD ANTARCTICA
				What is slope
Slope degree	Extra area			3.94% = 2.26 d

2.26 x 3 = 6.78

10	1.52
20	6.38
30	

CHINA Ying	2014 deg	%	Area	%Diff	%Diff check
	1.00	12	21	0.9574	2.23
	10.00	11.65	20.62	0.9562	2.10
	30.00	10.92	19.29	0.9538	1.85
	100.00	9	15.84	0.9482	1.25
Nunn & Pega	926	3.14	5.49	0.9378	0.14
	1000.00	3.53	6.19	0.9383	0.19
	10000.00	0	0	0.9365	0.00
diff 1 vs 1000 t		3.40	3.39	1.0204	
% Diff 1 vs 1,000		239.9	239.3	2.0	1,074 % inc in accur
% Diff 10 vs 1,000		230.0	233.1	1.9	

Ying et al. formula 1 is just for calculating hypotenuse length, not area

Area projected = slope deg pi/180 sum sec (= Ratio Area true = h)

400	8.8	0.01745	0.15356	1.0119073	404.7629
94 x 94					
8836					10000
94					163833.022

Square when sloped projects a rectangle if square on, or an irregular diamond

Area projected = slope deg	sqrt = base	pi/180	sum	sec
12	10	3.464	0.01745	0.1745
				1.015420717

Circle when sloped casts an ellipse - this is more constant thus is perhaps better

Area projected = slope deg	diameter	pi/180 (I sum	sec
400	8.8	22.56759287	0.01745
			0.15356
			1.011907302

Circle only is wrong!!!!!!!!!!!!!!!!!!!!

Area projected = slope deg	diameter	pi/180	sum	sec
400	8.8	22.56759287	0.01745	0.15356
				1.011907302

If circular the above area diameter is

22.57	New area is
-------	-------------

Corrugated sheet analDiff %

1.50%	203.04
-------	--------

10.50%	224.315
--------	---------

Yang et al China area 1,000 ha	Gha	70%	381.34	90.67
China	932,748			

Taiwan	3,615	
HK	110	
Macao	3	
Total	936,476	936

Actual hypothenu:Projected base

As	Ap	
296,513	222,236	
-25.050	-25.050 % Diff	

Nunn & Puga, 2010 give examples of Terrain ruggedness index and these I compare

Country	TRI	Slope %	Ratio		
Netherland	0.037	0.12	3.24		
Mauritania	0.115	0.308	2.68		
Romania	1.267	4.005	3.16		
Zimbabwe	1.194	3.232	2.71		
Italy	2.458	7.506	3.05		
Djibouti	2.432	6.416	2.64	radians	
Nepal	5.043	14.458	2.87		
Lesotho	6.202	17.595	2.84	1	0.79
	MEAN		2.90		

CALCULATE GLOBAL AREA INCREASES

isocode	isonum	country	land_area	1,000 Ha %	rugged_slope	radians
ABW	533	Aruba	18	1.226		0.01
AFG	4	Afghanistan	65209	7.414		0.07
AGO	24	Angola	124670	2.274		0.02
AIA	660	Anguilla	9	0.026		0.00
ALB	8	Albania	2740	10.451		0.10
AND	20	Andorra	47	17.774		0.18
ANT	530	Netherlands	80	0.68		0.01
ARE	784	United Arab	8360	2.112		0.02
ARG	32	Argentina	273669	2.268		0.02
ARM	51	Armenia	2820	8.178		0.08
ASM	16	American Sam	20	7.032		0.07
ATG	28	Antigua and	44	0.012		0.00
AUS	36	Australia	768230	0.405		0.00
AUT	40	Austria	8245	11.095		0.11
AZE	31	Azerbaijan	8260.5	5.08		0.05
BDI	108	Burundi	2568	4.721		0.05
BEL	56	Belgium	3023	1.239		0.01
BEN	204	Benin	11062	0.377		0.00
BFA	854	Burkina Faso	27360	0.638		0.01
BGD	50	Bangladesh	13017	0.502		0.01
BGR	100	Bulgaria	11063	4.498		0.04
BHR	48	Bahrain	71	0.627		0.01
BHS	44	Bahamas	1001	0.144		0.00
BIH	70	Bosnia and H	5120	7.075		0.07
BLR	112	Belarus	20748	0.54		0.01
BLZ	84	Belize	2281	1.616		0.02
BMU	60	Bermuda	5	0.03		0.00
BOL	68	Bolivia	108438	2.343		0.02
BRA	76	Brazil	845942	0.654		0.01
BRB	52	Barbados	43	2.581		0.03

BRN	96 Brunei Darus	527	1.366	0.01
BTN	64 Bhutan	4700	19.325	0.19
BWA	72 Botswana	56673	0.488	0.00
CAF	140 Central Afri	62300	0.528	0.01
CAN	124 Canada	909351	2.695	0.03
CCK	166 Cocos (Keeli	1	0.031	0.00
CHE	756 Switzerland	4000	14.999	0.15
CHL	152 Chile	74880	7.365	0.07
CHN	156 China	932748	5.493	0.05
CIV	384 Côte d'Ivoir	31800	0.594	0.01
CMR	120 Cameroon	46540	1.374	0.01
COD	180 Democratic R	226705	1.177	0.01
COG	178 Congo	34150	0.406	0.00
COK	184 Cook Islands	24	2.641	0.03
COL	170 Colombia	110950	2.376	0.02
COM	174 Comoros	186.1	9.049	0.09
CPV	132 Cape Verde	403	6.502	0.06
CRI	188 Costa Rica	5106	5.708	0.06
CUB	192 Cuba	10982	1.448	0.01
CXR	162 Christmas Is	13.5	3.477	0.03
CYM	136 Cayman Islan	26	0.237	0.00
CYP	196 Cyprus	924	7.867	0.08
CZE	203 Czech Republ	7727	2.845	0.03
DEU	276 Germany	34877	1.906	0.02
DJI	262 Djibouti	2318	6.416	0.06
DMA	212 Dominica	75	0.005	0.00
DNK	208 Denmark	4243	0.611	0.01
DOM	214 Dominican Re	4838	4.495	0.04
DZA	12 Algeria	238174	1.445	0.01
ECU	218 Ecuador	27684	3.446	0.03
EGY	818 Egypt	99545	2.001	0.02
ERI	232 Eritrea	10100	6.663	0.07
ESH	732 Western Saha	26600	0.565	0.01
ESP	724 Spain	49900	5.062	0.05
EST	233 Estonia	4239	0.414	0.00
ETH	231 Ethiopia	100000	4.193	0.04
FIN	246 Finland	30459	1.202	0.01
FJI	242 Fiji	1827	3.723	0.04
FLK	238 Falkland Isl	1217	0.859	0.01
FRA	250 France	55010	3.406	0.03
FRO	234 Faeroe Islan	140	8.215	0.08
FSM	583 Micronesia,	70	3.61	0.04
GAB	266 Gabon	25767	0.583	0.01
GBR	826 United Kingd	24269	1.878	0.02
GEO	268 Georgia	6949	11.258	0.11
GHA	288 Ghana	22754	0.601	0.01
GIB	292 Gibraltar	1	21.453	0.21
GIN	324 Guinea	24572	1.969	0.02
GLP	312 Guadeloupe	169	3.23	0.03
GMB	270 Gambia	1000	0.915	0.01
GNB	624 Guinea-Bissa	2812	1.302	0.01
GNQ	226 Equatorial G	2805	1.449	0.01
GRC	300 Greece	12890	9.166	0.09
GRD	308 Grenada	34	5.655	0.06

GRL	304 Greenland	217500	1. 548	0. 02
GTM	320 Guatemala	10843	4. 893	0. 05
GUF	254 French Guian	8815	0. 546	0. 01
GUM	316 Guam	54	1. 825	0. 02
GUY	328 Guyana	19685	0. 744	0. 01
HKG	344 Hong Kong Sp	110	6. 692	0. 07
HND	340 Honduras	11189	5. 824	0. 06
HRV	191 Croatia	5592	3. 842	0. 04
HTI	332 Haiti	2756	6. 448	0. 06
HUN	348 Hungary	8962	1. 09	0. 01
IDN	360 Indonesia	181157	2. 587	0. 03
IND	356 India	297319	2. 842	0. 03
IOT	86 British Indi	8	0. 037	0. 00
IRL	372 Ireland	6889	1. 676	0. 02
IRN	364 Iran, Islami	162855	6. 962	0. 07
IRQ	368 Iraq	43737	1. 919	0. 02
ISL	352 Iceland	10025	5. 318	0. 05
ISR	376 Israel	2164	4. 808	0. 05
ITA	380 Italy	29411	7. 506	0. 07
JAM	388 Jamaica	1083	4. 837	0. 05
JOR	400 Jordan	8824	3. 115	0. 03
JPN	392 Japan	36450	6. 275	0. 06
KAZ	398 Kazakhstan	269970	1. 172	0. 01
KEN	404 Kenya	56914	1. 781	0. 02
KGZ	417 Kyrgyzstan	19180	13. 105	0. 13
KHM	116 Cambodia	17652	1. 421	0. 01
KIR	296 Kiribati	81	0. 021	0. 00
KNA	659 Saint Kitts	26	0. 012	0. 00
KOR	410 Republic of	9873	5. 807	0. 06
KWT	414 Kuwait	1782	0. 691	0. 01
LAO	418 Lao People's	23080	6. 976	0. 07
LBN	422 Lebanon	1023	12. 042	0. 12
LBR	430 Liberia	9632	0. 695	0. 01
LBY	434 Libyan Arab	175954	1. 124	0. 01
LCA	662 Saint Lucia	61	5. 841	0. 06
LIE	438 Liechtenstei	16	17. 18	0. 17
LKA	144 Sri Lanka	6463	1. 712	0. 02
LSO	426 Lesotho	3035	17. 595	0. 17
LTU	440 Lithuania	6268	0. 578	0. 01
LUX	442 Luxembourg	259	2. 844	0. 03
LVA	428 Latvia	6205	0. 522	0. 01
MAC	446 Macao Specia	3	1. 921	0. 02
MAR	504 Morocco	44630	6. 853	0. 07
MCO	492 Monaco	0	20. 834	0. 21
MDA	498 Republic of	3288	2. 527	0. 03
MDG	450 Madagascar	58154	3. 185	0. 03
MDV	462 Maldives	30	0. 024	0. 00
MEX	484 Mexico	194395	4. 795	0. 05
MHL	584 Marshall Isl	18	0. 033	0. 00
MKD	807 The former Y	2543	8. 19	0. 08
MLI	466 Mali	122019	0. 393	0. 00
MLT	470 Malta	32	4. 292	0. 04
MMR	104 Myanmar	65755	5. 517	0. 06
MNG	496 Mongolia	156650	3. 352	0. 03

MNP	580 Northern Mar	46	4. 572	0. 05
MOZ	508 Mozambique	78638	1. 653	0. 02
MRT	478 Mauritania	103070	0. 308	0. 00
MSR	500 Montserrat	10	9. 256	0. 09
MTQ	474 Martinique	106	3. 311	0. 03
MUS	480 Mauritius	203	2. 436	0. 02
MWI	454 Malawi	9408	2. 759	0. 03
MYS	458 Malaysia	32855	2. 684	0. 03
MYT	175 Mayotte	37. 4	5. 809	0. 06
NAM	516 Namibia	82329	2. 489	0. 02
NCL	540 New Caledoni	1828	4. 338	0. 04
NER	562 Niger	126670	0. 481	0. 00
NFK	574 Norfolk Isla	4	3. 266	0. 03
NGA	566 Nigeria	91077	0. 833	0. 01
NIC	558 Nicaragua	12140	2. 671	0. 03
NIU	570 Niue	26	0. 472	0. 00
NLD	528 Netherlands	3388	0. 108	0. 00
NOR	578 Norway	30428	8. 516	0. 08
NPL	524 Nepal	14300	14. 458	0. 14
NRU	520 Nauru	2	0. 781	0. 01
NZL	554 New Zealand	26771	6. 233	0. 06
OMN	512 Oman	30950	3. 012	0. 03
PAK	586 Pakistan	77088	5. 665	0. 06
PAN	591 Panama	7443	4. 128	0. 04
PCN	612 Pitcairn	4. 7	1. 067	0. 01
PER	604 Peru	128000	3. 653	0. 04
PHL	608 Philippines	29817	5. 428	0. 05
PLW	585 Palau	46	1. 293	0. 01
PNG	598 Papua New Gu	45286	4. 217	0. 04
POL	616 Poland	30436	0. 951	0. 01
PRI	630 Puerto Rico	887	3. 928	0. 04
PRK	408 Democratic P	12041	7. 681	0. 08
PRT	620 Portugal	9150	3. 937	0. 04
PRY	600 Paraguay	39730	0. 681	0. 01
PSE	275 Occupied Pal	602	7. 927	0. 08
PYF	258 French Polyn	366	5. 637	0. 06
QAT	634 Qatar	1100	0. 493	0. 00
REU	638 Réunion	250	10. 657	0. 11
ROU	642 Romania	22971	4. 005	0. 04
RUS	643 Russian Fede	1638134	3. 278	0. 03
RWA	646 Rwanda	2467	8. 748	0. 09
SAU	682 Saudi Arabia	214969	2. 514	0. 03
SCG	891 Serbia and M	10200	5. 144	0. 05
SDN	736 Sudan	237600	1. 186	0. 01
SEN	686 Senegal	19253	0. 647	0. 01
SGP	702 Singapore	67	0. 036	0. 00
SHN	654 Saint Helena	39	11. 182	0. 11
SJM	744 Svalbard and	0	6. 575	0. 07
SLB	90 Solomon Isla	2799	4. 111	0. 04
SLE	694 Sierra Leone	7162	1. 317	0. 01
SLV	222 El Salvador	2072	4. 746	0. 05
SMR	674 San Marino	6	5. 497	0. 05
SOM	706 Somalia	62734	1. 711	0. 02
SPM	666 Saint Pierre	23	2. 467	0. 02

STP	678 Sao Tome and	96	5.991	0.06
SUR	740 Suriname	15600	0.815	0.01
SVK	703 Slovakia	4810	5.043	0.05
SVN	705 Slovenia	2014	7.713	0.08
SWE	752 Sweden	41033	2.53	0.03
SWZ	748 Swaziland	1720	8.574	0.09
SYC	690 Seychelles	46	11.129	0.11
SYR	760 Syrian Arab	18378	2.174	0.02
TCA	796 Turks and Ca	43	0.013	0.00
TCD	148 Chad	125920	1.135	0.01
TGO	768 Togo	5439	0.745	0.01
THA	764 Thailand	51089	2.826	0.03
TJK	762 Tajikistan	13996	15.976	0.16
TKL	772 Tokelau	1	0	0.00
TKM	795 Turkmenistan	46993	0.834	0.01
TLS	626 Timor-Leste	1487	5.001	0.05
TON	776 Tonga	72	1.992	0.02
TTO	780 Trinidad and	513	1.611	0.02
TUN	788 Tunisia	15536	2.079	0.02
TUR	792 Turkey	76963	7.773	0.08
TUV	798 Tuvalu	3	0.055	0.00
TWN	158 Taiwan	3615	9.785	0.10
TZA	834 United Repub	88580	1.814	0.02
UGA	800 Uganda	19710	2.424	0.02
UKR	804 Ukraine	57935	1.317	0.01
UMI	581 United State	0	0.011	0.00
URY	858 Uruguay	17502	1.283	0.01
USA	840 United State	916192	3.384	0.03
UZB	860 Uzbekistan	42540	1.589	0.02
VAT	336 Holy See	0	1.162	0.01
VCT	670 Saint Vincen	39	8.401	0.08
VEN	862 Venezuela (B	88205	1.716	0.02
VGB	92 British Virg	15	3.131	0.03
VIR	850 United State	35	3.652	0.04
VNM	704 Viet Nam	31106	5.603	0.06
VUT	548 Vanuatu	1219	4.709	0.05
WLF	876 Wallis and F	14	3.505	0.04
WSM	882 Samoa	283	4.644	0.05
YEM	887 Yemen	52797	6.155	0.06
ZAF	710 South Africa	121447	4.942	0.05
ZMB	894 Zambia	74339	1.422	0.01
ZWE	716 Zimbabwe	38685	3.232	0.03

isocode isonum country 13193676 rugged_popw TOTs or MEANs
MEAN OR TOT 24897.11
SCALE OR TOT ADD ANTARCTICA

Duursman & Poisson O2 and CO2 To convert mols to g for O2 x 32; for C x 12 .

	Air	Sea	Land	Tot	% Air
mol O ₂	3.75	0.031		3.78	99.2
mol CO ₂ -C	0.053	2.9		2.953	1.8
O ₂ g (mol x 16 x	120	0.992 na		120.99	99.2
C g (mol x 12)	0.636	34.8		35.44	1.8
D & P data for C	0.64	0.35			35.64 This may be th
C in CO ₂ is x 0.1	44	12.012 QED			

Carbon Gt	Gt	%		stored C
air	640	0.00	tot	16,000,000
land	81000000	99.96		65,000,000
sea	35000	0.04		40,000
Tot	81035640	100		1,350

tot 81,041,350

	Area Gha	mean mol Org-C /m ² /yr	Total Org-C/yr	mol O ₂ /m ² /yr	Total O ₂ /yr (%)
Land	15	12	1.84 x 10 ¹⁵	12	1.84 x 10 ¹⁵ (44%)
Sea	36	6	2.16 x 10 ¹⁵	6.45	2.32 x 10 ¹⁵ (56%)
Total	51		4.00 x 10 ¹⁵		4.16 x 10 ¹⁵ (100%)

x 10 15

180 180.00 180.00
216.00 232.20
Tot 396.00 412.20

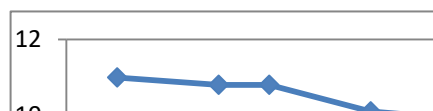
Oxygen imbalance

	mol x 10 15	Gt	%
humus + biomass	180	5,760	0.48 1.904258133
fossil fuel	1,520	48,640	4.02
atm	37,810	1,209,920	100
tot			

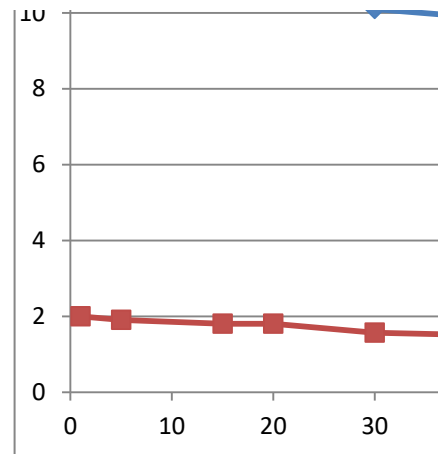
Gha	C NPP	Tot	Inc	% inc
15	1.44	21.6	22.725	5.2
13.2	1.44	19.008	20.133	5.9
				5.6

Flat areas Gha	CIA	FAO	%
Land	14.98	13.01	87.0
Antarctica Gha		1.40	9.4
Greenland glaciers		0.18	1.2
Rivers/lakes		0.37	2.5
TOTAL	14.98	14.96	100
Total less water		14.59	

Milevski & Milevsk 2015
res slope degree % inc base area



1		2
5	11	1.9
15	10.8	1.8
20	10.8	1.8
30	10.1	1.57
90	8.8	1.2
	0	0



MAIN GRAPH ON COARSE TOPOGRAPHY AND REFINED ROUGHNESS

Level of analysis	scale	Surface	+Hilly	Author(s)
1 km Astronomy	>1	0.0 n		NASA/NOAA
2 km	>1	0.0 n		Ying et al.
1 m		1	4.5 n	Ying et al. (f
2 m		1	2.0 ?	Milevski & Mil
3 m		1	0.6 n	Nunn & Puga (r
4 m		5	1.9 ?	Milevski & Mil
5 m		30	4.6 n	Ying et al.
6 m		24-71	56.1 y	Anon.
7 m		90	25.0 y	Rashid
8 m		90	12.0 y	Sutton & Lopez
9 m		90	7.7 y	Zhang et al.
10 m		90	1.2 ?	Milevski & Mil
11 m		100	180.0 y	Nogués-Bravo &
12 m		100	3.8 n	Ying et al.
13 m		500	30.0 y	Nogués-Bravo &
14 m		926	0.2 n	Nunn & Puga
15 m		1,000	10.0 y	Nogués-Bravo &
16 m		1,000	0.5 n	Ying et al.
0 dm	-	-	-	-
1 cm		1	26.0 -	Martin et al.
2 cm		1	33.0 -	Bramorski et a
3 cm		1	57.0 -	Bramorski et a
4 cm		1	260.0 -	Bramorski et a
1 mm		1	163.0 -	Grims
2 mm		1	60.0 -	Koiter
3 mm		3	23.0 -	Helming et al.
4 mm		4	35.0 -	Kamphorst et a
5 mm		90	100.0 -	Mirazai et al.
1 μm-nm Microbio		1 millions	-	various

84.11111111

BUT MANY CONTRIE	1 m scale mean (not mountai	2.57	% or	2.38
HAVE MOUNTS	1 cm scale	94.00	%	
	<1 mm >1μm scale	108.2		
	If have all rejm	21.25		18.2

cm	94.00	18.77
mm	108.2	42.08
	NEW LAND =	
	NEW WORLD =	78.08
NPP productivity	Mean land	39.0
If the land does go up then the productivity of 1.44 C /yr give		
Gha land or ocean	Productivity C Gt	%
39.0	1.44	56.2
36	0.72	25.9
75.0 Total	82.1	100.0
If the land does go up to 64 then the productivity of 1.44 C /yr		
Gha land or ocean	Productivity C Gt	%
64.0	1.44	92.2
36	0.72	25.9
100.0 Total	118.1	

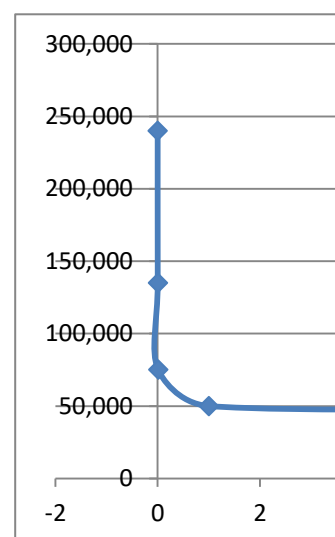
So... productivity on land is increased from 21.6 G to 82.6 Gt
Productivity overall goes from about 48 Gt to about 108 Gt or c

Missing sink and NPP method

If terrain 5.1%	15.8 Gha	
Then times 94%	30.6 Gha	
Then 76.2%	53.9 Gha	
Multiplication factor		3.42
If 3.5 x	55.2	

Coastline of Britain

Length of Ruler	Length of Coast km
10	48,000
1	50,000
0.01	75,000
0.001	135,000
0.0001	240,000
-1	



MODELLING MEANS

Land Gha	Model mean dm	New dm	Model mean cm	Model mean mm
15	1.8	27	1.8	48.6
				1.8
				sea
				Tot
				Ratio soil : s
				% soil : sea

Biome productivity from Campbell's Biology (2008) - <https://slideplayer.com/sli>

Biome	%	Global area	NPP (g/m2 % NPP	Gt/yr
Open ocean	65	33.15	125	24.4
Cont. shelf	5.2	2.65	360	5.6
Mangrove/Estuary	0.3	0.15	1,500	1.2
Algal bed/Coral r	0.1	0.05	2,500	0.9
Upwelling zone	0.1	0.05	500	0.1
Desert, rock, sa	4.7	2.40	3	0.04
Semi-desert	3.5	1.79	90	0.9
Tropical rainfor	3.3	1.68	2,200	22

Savannah	2.9	1.48	900	7.9	13.3
Cultivated land	2.7	1.38	650	9.1	9.0
Boreal forest (ta)	2.4	1.22	800	9.6	9.8
Temp. grassland	1.8	0.92	600	5.4	5.5
Wood and Shrub	1.7	0.87	700	3.5	6.1
Tundra/Alpine	1.6	0.82	140	0.6	1.1
Tropical decid fo	1.5	0.77	1,600	7.1	12.2
Temperate decid :	1.3	0.66	1,200	4.9	8.0
Temperate evergre	1	0.51	1,300	3.8	6.6
Swamp & marsh	0.4	0.20	2,000	2.3	4.1
Lake & stream	0.4	0.20	250	0.3	0.5
TOTAL	99.9	50.95	17,418	110	170

OUT BY +10!

Total Ocean	70.7	36.1	138.5	32.2	54.8
Total Land	28.4	14.5	678.9	74.8	110.3
Total water	0.8	0.4	900.0	2.6	4.6
TOTAL					169.7

The data in the table above is from R.H. Whittaker, quoted by Stiling (1996) "E
FINAL NPP TABLE

NPP Totals	C g/m2/yr	C g/m2/yr	C Gt/yr	C Gt/yr	TOTAL NPP Gt (
For 15 Gha land	Rate land	Rate sea	Tot land	Tot sea	
Duursma & Boisson	144	72	21.6	25.9	48
Whitman et al. 14	-	-	48	51	99
Stiling (1996)	773	152	115	55	170
UNEP (2002)	-	-	56.4	48.5	105
Campbell (2008) :	678.9	138.5	110.3	54.8	165
NASA (2011)	-	-	93	-	-
For 30 Gha land	725.95	145.25	218	52	270
For 60 Gha land	725.95	145.25	436	52	488
Mean of all rate:	532.0	120.8	74.1	47.0	121
Check rate by ar	C g/m2/yr	C g/m2/yr	C Gt/yr	C Gt/yr	These data are
D & B	144	72	21.6	25.9	
Stiling	773	152	116.0	54.7	
Campbell	678.9	138.5	101.8	49.9	OK this is a b
For 30 Gha land		mean x 2 -->	217.785	52.29 <--just mean	

Biome	Above C Gt	Below C GT	Sharlemann et al.14 - https://www.t
Tropical wet	140	128	
Tropical moist	152	150	
Tropical dry	42	137	
Tropical montane	40	55	
Warm temp moist	28	63	
Warm temp dry	23	78	
Cool temp moist	25	210	
Cool temp dry	9	100	
Boreal moist	23	366	
Boreal dry	5	68	
Polar moist	2	50	
Polar dry	0	10	
Total	489	1415	

Bar-On et al. 2018 global biomass estimates (corrected by RJB in red)
Biomass in Gt C Land Ocean
Trees 450

Bacteria			
Terr deep microb	60		
Mar deep microbes		7	
Soil	7		
Marine		1.3	
Fungi ???	12		
Archaea			
Terr deep microb	4		
Mar deep microbes		3	
Soil	0.5		
Marine		0.3	
Protists??	2	2	
Animals			
Fish		0.5	
Livestock	0.1		
Humans	0.06		
Wild mammals	0.007		
Wild birds	0.002		
Arthropods	0.2	1	
Annelids	0.82		
Molluscs		0.2	
Cnidarinas		0.1	
Nematodes	0.02		
Viruses ??	0.1	0.1	
Totals	536.8	15.5	552.3
%	97.2	2.8	
Tot all animals	1.309	1.4	

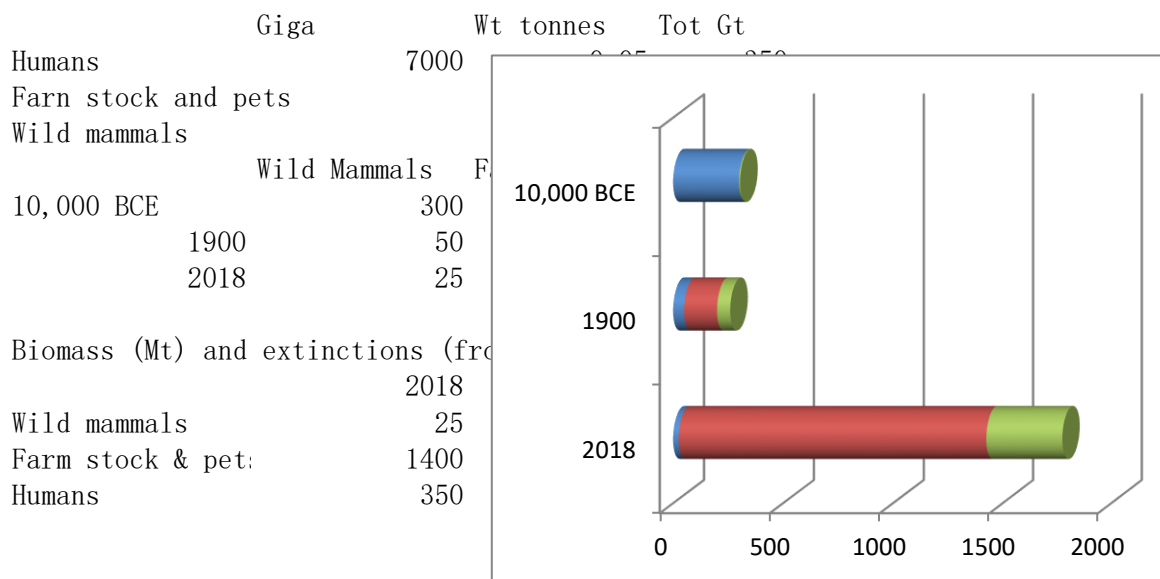
Life on Earth calculation in Gt carbon

			900
	Land	Sea	10000
Plants above groi	492		800
Roots	241		2000
Bacteria	241	6.3	15
VAM hyphae	15		
Earthworms	4		
Fish*		0.5	
Other organisms*	7.0	8.0	
Total	1,000	14.8	
Total x 2 for te	2,000	14.8	
Proportion %	99.3	0.7	
* From Bar-On (2018)			

NPP from UNEP - <https://archive.org/stream/worldatlasofbiod02groo#page/10/mode/>

	Terrestrial	Ocean	Total
	56.4	48.5	104.9
	83	90	173
trf	17.8		
	1.5		
	3.1		
	3.1		
	1.4		
	16.8		
	2.4		
	1		

0.8
0.5
8
Total 56.4



Lal 2008 fig. 1 – https://www.researchgate.net/publication/200736458_Sequestrat
Carbon cycles in detail.

Cf FAO for Grasslands... <http://www.fao.org/docrep/008/y8344e/y8344e05.htm>

%	Gha	%	FAO %	Diff
Desert, rock, sai	4.7	2.40	16.5	
Semi-desert	3.5	1.79	12.3	
Tropical rainfor	3.3	1.68	11.6	
Savannah	2.9	1.48	10.2	13.8
Cultivated land	2.7	1.38	9.5	26.1
Boreal forest (t	2.4	1.22	8.4	
Temp. grassland	1.8	0.92	6.3	
Wood and Shrub	1.7	0.87	6.0	
Tundra/Alpine	1.6	0.82	5.6	5.7
Tropical decid f	1.5	0.77	5.3	
Temperate decid :	1.3	0.66	4.6	
Tempeate evergre	1	0.51	3.5	
Tot	28.4	14.484	99.9	

R.J.B. Supplementary file 2 of soil carbon budgets from October, 2018, R.J.B –

Biome	A	B	A x B =	Total	SOC G % area
Boreal forest	1.2	12.5	15.00	150	9.9
Crops	1.4	17.7	24.78	248	11.6
Deserts	1.8	11.5	20.70	208	14.9
Dry shrubs	0.85	14.6	12.41	124	7.0
Temp decid fores	0.7	22.8	15.96	160	5.8

Temp everg fores	0.5	20.4	10.20	102	4.1
Temp grass	0.9	19.1	17.19	172	7.4
Trop decid fores	0.75	29.1	21.83	218	6.2
Trop everg fores	1.7	27.9	47.43	474	14.0
Trop savannah	1.5	23	34.50	345	12.4
Tundra	0.8	18	14.40	144	6.6
Total	12.1	216.6	234.40	2,345	100
MEAN TOTAL		19.7	238.26	2,383	SO THIS DOES W

Sorted by area

Biome	Area Gha	SOC 0-3m kg/tot	SOC 0-3 m Gt
Deserts	1.8	11.5	208
Trop everg fores	1.7	27.9	474
Trop savannah	1.5	23	345
Crops	1.4	17.7	248
Boreal forest	1.2	12.5	150
Temp grass	0.9	19.1	172
Dry shrubs	0.85	14.6	124
Tundra	0.8	18	144
Trop decid fores	0.75	29.1	218
Temp decid fores	0.7	22.8	160
Temp everg fores	0.5	20.4	102
Total	12.1	216.6	2345

Combined and SORTED BY AREA!!

Biome	Area Gha	SOC kg/m2	Index (Ar	Total SOC G	% area
Tropical forest	2.45	57.0	1.00	692	20.2
Deserts	1.8	11.5	0.15	208	14.9
Trop savannah	1.5	23.0	0.25	345	12.4
Crops	1.4	17.7	0.18	248	11.6
Temperate forest	1.2	43.2	0.37	262	9.9
Boreal forest	1.2	12.5	0.11	150	9.9
Temp grass	0.9	19.1	0.12	172	7.4
Dry shrubs	0.85	14.6	0.09	124	7.0
Tundra	0.8	18.0	0.10	144	6.6
Total	12.1			2345	100

From IPCC (2000: tab. 1) <https://www.ipcc.ch/pdf/special-reports/spm/srl-en.pdf>
Table of Global Carbon (Gt C) stocks in veggies and top 1 m soils (often double

Biome	Area Gha	Plants	Soils	Total C	Area %
Desert and arid	4.55	8	191	199	30.1
Tropical savannal	2.25	66	264	330	14.9
Tropical forest	1.76	212	216	428	11.6
Crops	1.60	3	128	131	10.6
Boreal forest	1.37	88	471	559	9.1
Temperate grassl:	1.25	9	295	304	8.3
Temperate forest	1.04	59	100	159	6.9
Tundra	0.95	6	121	127	6.3
Wetlands	0.35	15	225	240	2.3
Total	15.12	466.00	2011.00	2477.00	100.0

From Watson et al. (2000).
 Land Use, Land Use Change and Forestry.
 375pp.
 Cambridge University Press,
 Cambridge, UK
 on website
<https://www.cbd.int/doc/external/cop-09/fao-factsheet-https://www.ipcc.ch/pdf/special-reports/spm/srl-en.pdf>

Economic value from land and sea from Costanza et al 2014 - <http://wedocs.unep.org/handle/document/11311>

	2,011	
	1,368	
	660	
	8,944	
	28,916	
	352,249	
	2,222	
Total Ocean	396,370	
	4,901	
	3,800	
	5,382	
	3,137	
	4,166	
	140,174	
	193,843	
	25,681	
	12,512	
	5,567	
	6,661	
Total Land	405,824	
Diff	1.0	
land	15,323	
Lakes/rivers	200	
%	-	98.7
		1.3

Table of SOC deficits as revealed by BD shortfalls

SOC (1.3%) Depth m (Auth.) Soil Gt Volume Gm Density gm-3 For 1.35 gm-3

1,500 1 (IPCC, 4p1000	115,385	120,000	0.96	1.4
1,000 1 (Kochy et al.	76,923	120,000	0.64	2.1
2,300 3 (NASA)	176,923	360,000	0.49	2.7
3,000 >3 (Kochy et al.	230,769	360,000	0.64	2.1
			MEAN of 4	2.1
			MEAN 1st 3	2.1

Table of Terrain scenarios.

BD gm ⁻³	Area Gm ²	Terrain Fact	Soil Gt	Depth m	SOC @ 1.3%
1.35	120,000 x 1	1	162,000	1	2,106
1.35	240,000 x 2	2	324,000	1	4,212
1.35	480,000 x 4	4	648,000	1	8,424
1.35	720,000 x 6	2	972,000	3	12,636
1.35	720,000 x 6	4	#####	3	25,272

If soil weighs between 1.2- 1.7 tonnes per cubic m (<https://www.reference.com/s>

tonnes per m ³	area Gm ³	tot mass Gt	bd	SOC @ 1.3%	For 1,500 Gt
1.20	120,000	144,000	1.2	1,872	1.2
1.70	120,000	204,000	1.7	2,652	1.8

Or bcs bd is same as mass, then if BD is the required 1.35 get...

1.35 120,000 162,000 1.35 2,106 1.4

Q. E. D.

What happens if I put tm⁻³ as gcm⁻³ and then use 1 m depth i.e., 1 m vs. 100 cm
This is OK as 1 million g = 1 t and 1 million cm³ = 1 m³; but only 10,000 m² =

Julieta Bramowski file data and calculations of tortuosity using straight or cu

	1		Cateto (1 Cateto dife	Soma catetos
1	26	Diff		
2	29	3.00	1	9.00
3	29	0.00	1	0.00
4	28	1.00	1	1.00
5	28	0.00	1	0.00
6	28	0.00	1	0.00
7	28	0.00	1	0.00
8	27	1.00	1	1.00
9	27	0.00	1	0.00
10	28	1.00	1	1.00
11	28	0.00	1	0.00
12	26	2.00	1	4.00
13	26	0.00	1	0.00
14	27	1.00	1	1.00
15	27	0.00	1	0.00
16	24	3.00	1	9.00
17	24	0.00	1	0.00
18	23	1.00	1	1.00
19	23	0.00	1	0.00
20	23	0.00	1	0.00

21	23	0.00	1	0.00	1.00
22	23	0.00	1	0.00	1.00
23	23	0.00	1	0.00	1.00
24	25	2.00	1	4.00	5.00
25	25	0.00	1	0.00	1.00
26	27	2.00	1	4.00	5.00
27	27	0.00	1	0.00	1.00
28	26	1.00	1	1.00	2.00
29	26	0.00	1	0.00	1.00
30	25	1.00	1	1.00	2.00
31	25	0.00	1	0.00	1.00
32	24	1.00	1	1.00	2.00
33	24	0.00	1	0.00	1.00
34	23	1.00	1	1.00	2.00
35	23	0.00	1	0.00	1.00
36	25	2.00	1	4.00	5.00
37	25	0.00	1	0.00	1.00
38	24	1.00	1	1.00	2.00
39	24	0.00	1	0.00	1.00
40	23	1.00	1	1.00	2.00
41	23	0.00	1	0.00	1.00
42	25	2.00	1	4.00	5.00
43	25	0.00	1	0.00	1.00
44	29	4.00	1	16.00	17.00
45	29	0.00	1	0.00	1.00
46	33	4.00	1	16.00	17.00
47	33	0.00	1	0.00	1.00
48	33	0.00	1	0.00	1.00
49	33	0.00	1	0.00	1.00
50	34	1.00	1	1.00	2.00
51	34	0.00	1	0.00	1.00
52	35	1.00	1	1.00	2.00
53	35	0.00	1	0.00	1.00
54	35	0.00	1	0.00	1.00
55	35	0.00	1	0.00	1.00
56	33	2.00	1	4.00	5.00
57	33	0.00	1	0.00	1.00
58	32	1.00	1	1.00	2.00
59	32	0.00	1	0.00	1.00
60	32	0.00	1	0.00	1.00
61	32	0.00	1	0.00	1.00
62	32	0.00	1	0.00	1.00
63	32	0.00	1	0.00	1.00
64	32	0.00	1	0.00	1.00
65	32	0.00	1	0.00	1.00
66	28	4.00	1	16.00	17.00
67	28	0.00	1	0.00	1.00
68	28	0.00	1	0.00	1.00
69	28	0.00	1	0.00	1.00
70	26	2.00	1	4.00	5.00
71	26	0.00	1	0.00	1.00
72	28	2.00	1	4.00	5.00
73	28	0.00	1	0.00	1.00
74	30	2.00	1	4.00	5.00

75	30	0.00	1	0.00	1.00
76	30	0.00	1	0.00	1.00
77	30	0.00	1	0.00	1.00
78	29	1.00	1	1.00	2.00
79	29	0.00	1	0.00	1.00
80	25	4.00	1	16.00	17.00
81	25	0.00	1	0.00	1.00
82	24	1.00	1	1.00	2.00
83	24	0.00	1	0.00	1.00
84	24	0.00	1	0.00	1.00
85	24	0.00	1	0.00	1.00
86	24	0.00	1	0.00	1.00
87	24	0.00	1	0.00	1.00
88	22	2.00	1	4.00	5.00
89	22	0.00	1	0.00	1.00
90	20	2.00	1	4.00	5.00

T 1.416193

*OK, 28th July, 2017 I recalculated all Julieta's data and got these TIs for s

Reps	Straight	Curved	Ratio
1	4.146757548	6.513711517	1.570796
2	1.503317816	2.361406101	1.570796
3	5.95607406	9.355779245	1.570796
4	5.0978035	8.007611004	1.570796
5	2.724261132	4.279259375	1.570796
6	4.893820386	7.687195078	1.570796
7	8.478098704	13.31736629	1.570796
8	7.794378391	12.24338093	1.570796
9	3.498022711	5.49468122	1.570796
10	1.706685434	2.680855208	1.570796
11	4.350964155	6.834478504	1.570796

Tot	50.15018384	78.77572447	
Mean	4.559107622	7.161429497	1.570796

Mean mean 3.58

Reps Julieta's means 18th July

1	1.27
2	1.28
3	1.37
4	1.15
5	1.35
6	1.36
7	1.29
8	1.6

Tot	10.67
Mean	1.33375

rain data plus SOM calculations and Julieta data file appended at the bottom.

a/rugged/. Below that are my calculations and additions. RJB September, 2018. Zama, Ja

rugged	lsd	rugged_pc	land_area	[IClat	lon	soil [% Fertile	desert [%
0.144		0	18	12.508	-69.97	21.324	0
0.72	39.004		65209	33.833	66.026	27.849	4.356
0.228	4.906		124670	-12.299	17.551	26.676	0.425
0.006	0		9	18.231	-63.064	100	0
1.006	62.133		2740	41.143	20.07	68.088	0
1.616	99.064		47	42.551	1.576	0	0
0.08	0		80	12.725	-68.157	24.595	0
0.191	6.142		8360	23.913	54.331	0	77.28
0.226	9.407		273669	-35.396	-65.17	35.678	0
0.799	50.556		2820	40.294	44.938	30.148	0
0.792	44.303		20	-14.2	-170.388	100	0
0.003	0		44	17.271	-61.8	100	0
0.045	0.685		768230	-25.733	134.487	14.248	10.889
1.008	54.307		8245	47.589	14.14	55.098	0
0.49	27.713		8260.5	40.288	47.528	60.957	0
0.5	27.519		2568	-3.365	29.887	24.049	0
0.109	0.178		3023	50.642	4.661	48.967	0
0.045	0.014		11062	9.65	2.339	74.973	0
0.066	0.051		27360	12.274	-1.747	56.909	0
0.053	1.817		13017	23.848	90.27	41.883	0
0.427	20.196		11063	42.765	25.239	82.101	0
0.063	0		71	26.025	50.565	0	0
0.017	0		1001	24.255	-76.61	13.924	0
0.665	40.253		5120	44.175	17.784	76.888	0
0.046	0		20748	53.542	28.054	50.611	0
0.174	6.568		2281	17.205	-88.687	35.49	0
0.006	0		5	32.31	-64.772	20	0
0.258	13.57		108438	-16.71	-64.662	31.807	0
0.076	0.558		845942	-10.775	-53.085	18.783	0
0.289	3.823		43	13.167	-59.555	30.588	0
0.162	5.089		527	4.521	114.748	62.29	0
1.962	96.475		4700	27.417	90.435	66.365	0
0.048	0.301		56673	-22.189	23.814	15.249	1.455
0.06	0.033		62300	6.574	20.487	10.967	0
0.23	9.122		909351	61.495	-98.334	16.794	0
0.005	0		1	-12.122	96.867	0	0
1.388	66.06		4000	46.806	8.226	39.341	0
0.731	38.199		74880	-37.937	-71.384	22.158	15.489
0.537	28.648		932748	36.564	103.836	22.836	5.77
0.069	0.493		31800	7.623	-5.554	26.151	0
0.157	4.031		46540	5.697	12.743	27.829	0
0.126	2.763		226705	-2.879	23.658	16.001	0
0.049	0.243		34150	-0.831	15.246	4.063	0
0.3	14.999		24	-19.213	-158.978	25	0
0.277	14.366		110950	3.838	-72.866	30.444	0
1.063	64.479		186.1	-11.888	43.671	56.043	0
0.759	40.048		403	15.942	-23.981	11.663	0
0.623	36.61		5106	9.969	-84.199	52.082	0
0.153	6.129		10982	21.626	-79.018	45.947	0
0.403	14.025		13.5	-10.488	105.643	0	0
0.028	0		26	19.414	-80.926	100	0

0.706	44.072	924	35.049	33.235	26.866	0
0.252	4.154	7727	49.739	15.334	88.653	0
0.168	3.001	34877	51.11	10.392	61.338	0
0.627	39.024	2318	11.735	42.58	0	0
0.001	0	75	15.427	-61.356	36.405	0
0.054	0	4243	55.987	10.027	56.165	0
0.484	26.179	4838	18.895	-70.493	39.479	0
0.14	4.885	238174	28.168	2.647	9.59	23.277
0.405	20.09	27684	-1.434	-78.77	44.308	0
0.186	5.764	99545	26.562	29.782	0.007	16.498
0.658	37.141	10100	15.365	38.848	20.146	1.764
0.057	0.202	26600	24.674	-13.138	0	9.019
0.472	23.372	49900	40.231	-3.644	64.134	0
0.035	0	4239	58.673	25.549	62.517	0
0.443	20.128	100000	8.622	39.636	46.128	1.008
0.092	0.137	30459	64.481	26.24	2.097	0
0.421	14.011	1827	-17.447	161.988	98.293	0
0.083	0.786	1217	-51.745	-59.382	0	0
0.313	12.07	55010	46.56	2.551	59.939	0
0.665	39.927	140	62.073	-6.885	0	0
0.423	17.095	70	6.674	157.754	32.857	0
0.07	0.434	25767	-0.623	11.784	11.978	0
0.175	3.643	24269	54.15	-2.901	48.239	0
1.067	59.17	6949	42.179	43.513	34.021	0
0.071	0.371	22754	7.963	-1.208	65.738	0
1.728	100	1	36.139	-5.348	0	0
0.213	3.952	24572	10.435	-10.939	17.761	0
0.359	21.296	169	16.28	-61.601	76.5	0
0.091	0	1000	13.447	-15.388	81.699	0
0.123	0.098	2812	12.013	-14.987	43.253	0
0.177	5.54	2805	1.703	10.335	6.829	0
0.867	52.841	12890	39.043	22.989	48.588	0
0.606	39.913	34	12.157	-61.654	67.646	0
0.131	4.252	217500	74.728	-41.345	0	0
0.538	30.85	10843	15.697	-90.356	58.058	0
0.065	0.109	8815	3.93	-53.233	18.394	0
0.215	1.498	54	13.44	144.776	22.222	0
0.089	0.36	19685	4.794	-58.976	19.594	0
0.698	51.197	110	22.381	114.134	96.076	0
0.631	39.971	11189	14.822	-86.6	55.945	0
0.366	17.588	5592	45.026	16.419	48.395	0
0.697	42.462	2756	18.936	-72.686	42.05	0
0.098	0.921	8962	47.166	19.418	65.095	0
0.304	13.405	181157	-2.226	117.277	43.306	0
0.295	12.824	297319	22.876	79.627	51.042	4.495
0.006	0	8	-6.845	72.187	0	0
0.158	2.864	6889	53.181	-8.153	59.095	0
0.651	33.616	162855	32.56	54.305	21.824	0.543
0.175	5.572	43737	33.051	43.765	7.912	0.01
0.435	20.729	10025	64.99	-18.594	3.403	9.086
0.439	23.277	2164	31.353	34.967	27.477	0.709
0.711	38.884	29411	42.789	12.075	51.78	0
0.528	24.278	1083	18.156	-77.311	66.97	0
0.282	12.165	8824	31.25	36.788	15.479	15.332

0.604	37.173	36450	37.54	137.963	42.879	0
0.108	2.913	269970	48.18	67.313	9.877	9.747
0.195	5.427	56914	0.534	37.861	33.657	11.629
1.246	69.767	19180	41.464	74.556	12.534	0
0.154	6.094	17652	12.707	104.921	22.213	0
0.003	0	81	0.699	-46.958	45.679	0
0.003	0	26	17.274	-62.704	100	0
0.546	33.976	9873	36.356	127.806	43.556	0
0.063	0	1782	29.354	47.613	0	0
0.723	49.807	23080	18.495	103.774	12.068	0
1.103	71.642	1023	33.922	35.897	72.415	0
0.083	0.459	9632	6.448	-9.307	15.82	0
0.105	1.535	175954	27.041	18.029	2.756	48.242
0.59	35.476	61	13.894	-60.965	32.527	0
1.554	76.379	16	47.145	9.554	0	0
0.197	7.786	6463	7.63	80.701	51.595	0
1.559	90.249	3035	-29.58	28.254	54.695	0
0.049	0	6268	55.336	23.905	62.064	0
0.242	1.654	259	49.778	6.095	25.662	0
0.044	0	6205	56.854	24.931	77.568	0
0.185	4.168	3	22.169	113.555	0	0
0.629	36.083	44630	31.882	-6.302	43.968	0.614
2.106	100	0	43.753	7.422	0	0
0.222	0.403	3288	47.205	28.468	62.015	0
0.328	12.672	58154	-19.379	46.7	50.804	0
0.004	0	30	3.566	73.215	30	0
0.491	27.341	194395	23.941	-102.536	31.934	1.704
0.004	0	18	8.027	169.168	50	0
0.783	49.405	2543	41.6	21.701	52.895	0
0.042	0.228	122019	17.355	-3.524	18.562	26.132
0.381	14.699	32	35.925	14.407	100	0
0.577	34.731	65755	21.123	96.514	25.529	0
0.309	12.623	156650	46.836	103.07	44.883	1.49
0.504	25.44	46	15.8	145.63	4.13	0
0.17	4.54	78638	-17.264	35.549	55.384	0
0.034	0.278	103070	20.264	-10.336	2.042	74.857
1.027	69.921	10	16.736	-62.193	0	0
0.378	11.619	106	14.649	-61.021	61.658	0
0.283	9.101	203	-20.131	57.879	52.217	0
0.3	10.542	9408	-13.216	34.301	32.281	0
0.316	12.87	32855	3.791	109.709	49.196	0
0.72	42.602	37.4	-12.82	45.143	50.771	0
0.235	9.723	82329	-22.14	17.219	25.173	13.861
0.492	24.913	1828	-21.299	165.663	54.444	0
0.051	0.245	126670	17.424	9.401	8.236	39.21
0.351	12.248	4	-29.027	167.956	0	0
0.093	1.563	91077	9.585	8.092	56.263	0
0.286	11.923	12140	12.841	-85.033	33.249	0
0.055	0	26	-19.05	-169.86	26.923	0
0.012	0	3388	52.25	5.621	41.165	0
0.692	37.013	30428	64.467	14.082	0.073	0
1.493	75.265	14300	28.264	83.931	41.622	0
0.089	0	2	-0.641	167.801	0	0
0.606	31.49	26771	-41.806	171.478	44.643	0

0.283	12.216	30950	20.595	56.104	0	19.027
0.559	25.078	77088	29.97	69.395	6.988	11.184
0.457	22.956	7443	8.513	-80.109	42.843	0
0.104	7.424	4.7	-24.431	-128.445	0	0
0.427	20.01	128000	-9.173	-74.361	21.743	0.54
0.583	34.183	29817	11.739	122.868	80.137	0
0.148	0	46	7.801	135.16	13.043	0
0.491	25.222	45286	-6.476	145.252	46.833	0
0.084	1.2	30436	52.124	19.401	48.41	0
0.416	19.25	887	18.225	-66.464	59.186	0
0.71	52.428	12041	40.143	127.174	24.281	0
0.369	15.522	9150	39.593	-8.531	34.264	0
0.067	0.224	39730	-23.245	-58.393	28.751	0
0.706	54.906	602	31.914	35.207	62.369	0
0.645	40.29	366	-15.346	-145.232	6.284	0
0.047	0	1100	25.293	51.199	0	1.782
1.208	67.425	250	-21.121	55.54	16.4	0
0.357	16.71	22971	45.843	24.986	69.642	0
0.267	11.412	1638134	61.99	96.711	17.718	0.056
0.855	64.627	2467	-2.003	29.923	42.97	0
0.231	8.891	214969	24.097	44.562	0	37.258
0.48	27.128	10200	43.866	20.599	67.976	0
0.116	2.891	237600	13.887	30.09	19.8	2.16
0.065	0.168	19253	14.361	-14.474	60.496	0
0.005	0	67	1.361	103.82	3.488	0
1.205	72.252	39	-25.656	-10.466	10.256	0
0.464	24.247	0	78.845	18.31	0	0
0.476	21.213	2799	-8.895	159.601	80.002	0
0.144	1.943	7162	8.561	-11.791	7.546	0
0.518	26.108	2072	13.724	-88.869	65.938	0
0.522	14.144	6	43.944	12.459	0	0
0.17	6.914	62734	6.061	45.867	7.535	3.358
0.247	2.892	23	46.936	-56.323	0	0
0.71	42.127	96	0.446	6.727	88.013	0
0.096	0.743	15600	4.133	-55.911	22.425	0
0.442	23.419	4810	48.707	19.487	60.924	0
0.711	39.108	2014	46.112	14.823	67.604	0
0.207	3.868	41033	62.777	16.759	15.853	0
0.775	54.481	1720	-26.565	31.501	54.413	0
1.278	54.101	46	-6.723	51.924	13.043	0
0.198	6.63	18378	35.014	38.498	52.909	3.445
0.003	0	43	21.75	-71.856	0	0
0.112	3.605	125920	15.365	18.667	19.262	21.72
0.088	0.981	5439	8.528	0.977	56.646	0
0.302	16.408	51089	15.107	101.018	20.144	0
1.54	75.473	13996	38.527	71.038	17.449	0.025
0	0	1	-9.088	-171.83	0	0
0.082	1.426	46993	39.194	59.178	3.97	55.087
0.584	28.298	1487	-8.827	125.858	64.979	0
0.224	9.737	72	-19.859	-174.847	100	0
0.184	5.099	513	10.469	-61.257	50.384	0
0.198	7.434	15536	34.12	9.579	31.727	20.664
0.732	40.909	76963	39.061	35.174	65.295	0
0.008	0	3	-7.414	178.052	66.667	0

1.032	56.543	3615	23.752	120.953	9.843	0
0.201	5.346	88580	-6.266	34.826	39.711	0
0.251	8.765	19710	1.282	32.388	13.095	0.02
0.117	1.988	57935	49.009	31.411	69.003	0
0.001	0	0	7.141	-153.655	0	0
0.114	0.136	17502	-32.802	-56.013	68.979	0
0.304	14.317	916192	45.718	-112.982	41.6	0.278
0.154	5.782	42540	41.633	63.341	11.72	32.152
0.126	0	0	41.904	12.451	100	0
0.892	61.286	39	13.185	-61.205	38.818	0
0.202	5.994	88205	7.132	-66.153	21.567	0
0.34	19.147	15	18.511	-64.518	100	0
0.395	17.088	35	17.985	-64.805	100	0
0.583	36.775	31106	16.643	106.306	12.15	0
0.545	24.993	1219	-16.196	167.703	79.892	0
0.4	24.238	14	-13.829	-177.194	42.857	0
0.549	22.244	283	-13.738	-172.168	100	0
0.591	33.06	52797	15.863	47.58	0	10.75
0.45	23.957	121447	-29.004	25.094	27.647	4.386
0.145	2.455	74339	-13.458	27.794	23.114	0
0.306	13.837	38685	-19	29.869	54.877	0

rugged_lsd rugged_pc land_area lat lon soil desert
% 13,193,676 36.70 2.77
1,000 ha Tot area 4,842,079 1,000 ha

ge slope (%). As another alternative ruggedness measure, using the same GTOP030 elevation
) x rise (height)/run (base)

% Fertile soil. On the basis of

: 0.04m per meter or rise of 4 cm giving extra hypotenuse (area) by about 0.08%

of 4% has 4 cm rise per metre and the hypotenuse is just extra 0.08 cm, or the extra 0.0
ould add to the land area is 0.08%!!!

only 30 arc-seconds = ca. 1 km so is probably underestimation of undulations in each km.

: about 6.3%

just 6.3 cm per metre with hypotenuse just an extra 0.2 cm or 0.2%.

ly all countries area by their % slope as it is expressed in the actual increase in hypc
rugged_lsd rugged_pc land_area area x (slope/Tot area % Diff

0.144	0	18	0.22068	18.22068	1.211151285
0.72	39.004	65209	4834.59526	70043.59526	6.902265999
0.228	4.906	124670	2834.9958	127504.9958	2.223438997
0.006	0	9	0.00234	9.00234	0.025993242
1.006	62.133	2740	286.3574	3026.3574	9.462114422
1.616	99.064	47	8.35378	55.35378	15.09161615
0.08	0	80	0.544	80.544	0.675407231
0.191	6.142	8360	176.5632	8536.5632	2.068317142
0.226	9.407	273669	6206.81292	279875.8129	2.217702507
0.799	50.556	2820	230.6196	3050.6196	7.559762613
0.792	44.303	20	1.4064	21.4064	6.569997758
0.003	0	44	0.00528	44.00528	0.01199856
0.045	0.685	768230	3111.3315	771341.3315	0.403366366
1.008	54.307	8245	914.78275	9159.78275	9.986948107
0.49	27.713	8260.5	419.6334	8680.1334	4.834411877
0.5	27.519	2568	121.23528	2689.23528	4.508169326
0.109	0.178	3023	37.45497	3060.45497	1.223836664

0.045	0.014	11062	41.70374	11103.70374	0.375584048
0.066	0.051	27360	174.5568	27534.5568	0.633955365
0.053	1.817	13017	65.34534	13082.34534	0.499492547
0.427	20.196	11063	497.61374	11560.61374	4.304388601
0.063	0	71	0.44517	71.44517	0.623093206
0.017	0	1001	1.44144	1002.44144	0.143792938
0.665	40.253	5120	362.24	5482.24	6.607518095
0.046	0	20748	112.0392	20860.0392	0.537099662
0.174	6.568	2281	36.86096	2317.86096	1.59030074
0.006	0	5	0.0015	5.0015	0.029991003
0.258	13.57	108438	2540.70234	110978.7023	2.289360288
0.076	0.558	845942	5532.46068	851474.4607	0.649750631
0.289	3.823	43	1.10983	44.10983	2.516060479
0.162	5.089	527	7.19882	534.19882	1.347591895
1.962	96.475	4700	908.275	5608.275	16.19526503
0.048	0.301	56673	276.56424	56949.56424	0.485630125
0.06	0.033	62300	328.944	62628.944	0.525226802
0.23	9.122	909351	24507.00945	933858.0095	2.624275768
0.005	0	1	0.00031	1.00031	0.030990393
1.388	66.06	4000	599.96	4599.96	13.04272211
0.731	38.199	74880	5514.912	80394.912	6.859777395
0.537	28.648	932748	51235.84764	983983.8476	5.206980558
0.069	0.493	31800	188.892	31988.892	0.590492475
0.157	4.031	46540	639.4596	47179.4596	1.355377118
0.126	2.763	226705	2668.31785	229373.3179	1.163307866
0.049	0.243	34150	138.649	34288.649	0.404358305
0.3	14.999	24	0.63384	24.63384	2.573045859
0.277	14.366	110950	2636.172	113586.172	2.320856451
1.063	64.479	186.1	16.840189	202.940189	8.298104522
0.759	40.048	403	26.20306	429.20306	6.10504967
0.623	36.61	5106	291.45048	5397.45048	5.399780527
0.153	6.129	10982	159.01936	11141.01936	1.427332229
0.403	14.025	13.5	0.469395	13.969395	3.360166994
0.028	0	26	0.06162	26.06162	0.236439638
0.706	44.072	924	72.69108	996.69108	7.29324075
0.252	4.154	7727	219.83315	7946.83315	2.766298799
0.168	3.001	34877	664.75562	35541.75562	1.870351108
0.627	39.024	2318	148.72288	2466.72288	6.029168546
0.001	0	75	0.00375	75.00375	0.00499975
0.054	0	4243	25.92473	4268.92473	0.607289461
0.484	26.179	4838	217.4681	5055.4681	4.301641227
0.14	4.885	238174	3441.6143	241615.6143	1.424417172
0.405	20.09	27684	953.99064	28637.99064	3.33120662
0.186	5.764	99545	1991.89545	101536.8955	1.961745473
0.658	37.141	10100	672.963	10772.963	6.246777233
0.057	0.202	26600	150.29	26750.29	0.561825685
0.472	23.372	49900	2525.938	52425.938	4.818107403
0.035	0	4239	17.54946	4256.54946	0.412293107
0.443	20.128	100000	4193	104193	4.024262666
0.092	0.137	30459	366.11718	30825.11718	1.187723563
0.421	14.011	1827	68.01921	1895.01921	3.589367835
0.083	0.786	1217	10.45403	1227.45403	0.851684034
0.313	12.07	55010	1873.6406	56883.6406	3.293812738
0.665	39.927	140	11.501	151.501	7.591369034

0.423	17.095	70	2.527	72.527	3.48421967
0.07	0.434	25767	150.22161	25917.22161	0.579620811
0.175	3.643	24269	455.77182	24724.77182	1.843381299
1.067	59.17	6949	782.31842	7731.31842	10.11882292
0.071	0.371	22754	136.75154	22890.75154	0.597409568
1.728	100	1	0.21453	1.21453	17.66362297
0.213	3.952	24572	483.82268	25055.82268	1.930979023
0.359	21.296	169	5.4587	174.4587	3.128935387
0.091	0	1000	9.15	1009.15	0.906703661
0.123	0.098	2812	36.61224	2848.61224	1.285265839
0.177	5.54	2805	40.64445	2845.64445	1.428303877
0.867	52.841	12890	1181.4974	14071.4974	8.396387154
0.606	39.913	34	1.9227	35.9227	5.352325967
0.131	4.252	217500	3366.9	220866.9	1.524402253
0.538	30.85	10843	530.54799	11373.54799	4.664753606
0.065	0.109	8815	48.1299	8863.1299	0.543035029
0.215	1.498	54	0.9855	54.9855	1.792290695
0.089	0.36	19685	146.4564	19831.4564	0.738505519
0.698	51.197	110	7.3612	117.3612	6.272260338
0.631	39.971	11189	651.64736	11840.64736	5.503477472
0.366	17.588	5592	214.84464	5806.84464	3.699851698
0.697	42.462	2756	177.70688	2933.70688	6.057417706
0.098	0.921	8962	97.6858	9059.6858	1.078247107
0.304	13.405	181157	4686.53159	185843.5316	2.521762017
0.295	12.824	297319	8449.80598	305768.806	2.763462399
0.006	0	8	0.00296	8.00296	0.036986315
0.158	2.864	6889	115.45964	7004.45964	1.648373264
0.651	33.616	162855	11337.9651	174192.9651	6.508853612
0.175	5.572	43737	839.31303	44576.31303	1.882867768
0.435	20.729	10025	533.1295	10558.1295	5.049469227
0.439	23.277	2164	104.04512	2268.04512	4.587436074
0.711	38.884	29411	2207.58966	31618.58966	6.981935892
0.528	24.278	1083	52.38471	1135.38471	4.613829087
0.282	12.165	8824	274.8676	9098.8676	3.020898996
0.604	37.173	36450	2287.2375	38737.2375	5.90449306
0.108	2.913	269970	3164.0484	273134.0484	1.158423279
0.195	5.427	56914	1013.63834	57927.63834	1.749835431
1.246	69.767	19180	2513.539	21693.539	11.58657884
0.154	6.094	17652	250.83492	17902.83492	1.401090504
0.003	0	81	0.01701	81.01701	0.020995591
0.003	0	26	0.00312	26.00312	0.01199856
0.546	33.976	9873	573.32511	10446.32511	5.488294725
0.063	0	1782	12.31362	1794.31362	0.686257958
0.723	49.807	23080	1610.0608	24690.0608	6.521088842
1.103	71.642	1023	123.18966	1146.18966	10.74775531
0.083	0.459	9632	66.9424	9698.9424	0.690203089
0.105	1.535	175954	1977.72296	177931.723	1.111506665
0.59	35.476	61	3.56301	64.56301	5.518655342
1.554	76.379	16	2.7488	18.7488	14.66120498
0.197	7.786	6463	110.64656	6573.64656	1.683183892
1.559	90.249	3035	534.00825	3569.00825	14.96237085
0.049	0	6268	36.22904	6304.22904	0.574678359
0.242	1.654	259	7.36596	266.36596	2.765353351
0.044	0	6205	32.3901	6237.3901	0.51928931

36,885

0.185	4.168	3	0.05763	3.05763	1.884793124
0.629	36.083	44630	3058.4939	47688.4939	6.413483945
2.106	100	0	0	0	0
0.222	0.403	3288	83.08776	3371.08776	2.464716611
0.328	12.672	58154	1852.2049	60006.2049	3.086688957
0.004	0	30	0.0072	30.0072	0.023994241
0.491	27.341	194395	9321.24025	203716.2403	4.575599981
0.004	0	18	0.00594	18.00594	0.032989114
0.783	49.405	2543	208.2717	2751.2717	7.570015713
0.042	0.228	122019	479.53467	122498.5347	0.391461556
0.381	14.699	32	1.37344	33.37344	4.115368389
0.577	34.731	65755	3627.70335	69382.70335	5.228541372
0.309	12.623	156650	5250.908	161900.908	3.243285084
0.504	25.44	46	2.10312	48.10312	4.372107256
0.17	4.54	78638	1299.88614	79937.88614	1.626120233
0.034	0.278	103070	317.4556	103387.4556	0.307054273
1.027	69.921	10	0.9256	10.9256	8.47184594
0.378	11.619	106	3.50966	109.50966	3.204886217
0.283	9.101	203	4.94508	207.94508	2.37807021
0.3	10.542	9408	259.56672	9667.56672	2.684922975
0.316	12.87	32855	881.8282	33736.8282	2.613844416
0.72	42.602	37.4	2.172566	39.572566	5.490081184
0.235	9.723	82329	2049.16881	84378.16881	2.428553308
0.492	24.913	1828	79.29864	1907.29864	4.157641511
0.051	0.245	126670	609.2827	127279.2827	0.478697465
0.351	12.248	4	0.13064	4.13064	3.162706021
0.093	1.563	91077	758.67141	91835.67141	0.826118433
0.286	11.923	12140	324.2594	12464.2594	2.601513572
0.055	0	26	0.12272	26.12272	0.469782626
0.012	0	3388	3.65904	3391.65904	0.107883486
0.692	37.013	30428	2591.24848	33019.24848	7.847690663
1.493	75.265	14300	2067.494	16367.494	12.6317077
0.089	0	2	0.01562	2.01562	0.774947659
0.606	31.49	26771	1668.63643	28439.63643	5.867291708
0.283	12.216	30950	932.214	31882.214	2.923931192
0.559	25.078	77088	4367.0352	81455.0352	5.361283301
0.457	22.956	7443	307.24704	7750.24704	3.964351567
0.104	7.424	4.7	0.050149	4.750149	1.055735304
0.427	20.01	128000	4675.84	132675.84	3.524258825
0.583	34.183	29817	1618.46676	31435.46676	5.14853739
0.148	0	46	0.59478	46.59478	1.276494921
0.491	25.222	45286	1909.71062	47195.71062	4.046364797
0.084	1.2	30436	289.44636	30725.44636	0.942041188
0.416	19.25	887	34.84136	921.84136	3.779539681
0.71	52.428	12041	924.86921	12965.86921	7.133106119
0.369	15.522	9150	360.2355	9510.2355	3.787871499
0.067	0.224	39730	270.5613	40000.5613	0.676393759
0.706	54.906	602	47.72054	649.72054	7.344779342
0.645	40.29	366	20.63142	386.63142	5.336198491
0.047	0	1100	5.423	1105.423	0.490581434
1.208	67.425	250	26.6425	276.6425	9.63066051
0.357	16.71	22971	919.98855	23890.98855	3.850776405
0.267	11.412	1638134	53698.03252	1691832.033	3.173957668
0.855	64.627	2467	215.81316	2682.81316	8.044285872

0.231	8.891	214969	5404.32066	220373.3207	2.452347972
0.48	27.128	10200	524.688	10724.688	4.892338127
0.116	2.891	237600	2817.936	240417.936	1.172098907
0.065	0.168	19253	124.56691	19377.56691	0.64284082
0.005	0	67	0.02412	67.02412	0.035987045
1.205	72.252	39	4.36098	43.36098	10.05738339
0.464	24.247	0	0	0	0
0.476	21.213	2799	115.06689	2914.06689	3.948670169
0.144	1.943	7162	94.32354	7256.32354	1.299880573
0.518	26.108	2072	98.33712	2170.33712	4.530960609
0.522	14.144	6	0.32982	6.32982	5.210574708
0.17	6.914	62734	1073.37874	63807.37874	1.682217263
0.247	2.892	23	0.56741	23.56741	2.407604399
0.71	42.127	96	5.75136	101.75136	5.65236671
0.096	0.743	15600	127.14	15727.14	0.808411447
0.442	23.419	4810	242.5683	5052.5683	4.800891064
0.711	39.108	2014	155.33982	2169.33982	7.160695552
0.207	3.868	41033	1038.1349	42071.1349	2.467570467
0.775	54.481	1720	147.4728	1867.4728	7.896918231
1.278	54.101	46	5.11934	51.11934	10.01448767
0.198	6.63	18378	399.53772	18777.53772	2.12774287
0.003	0	43	0.00559	43.00559	0.01299831
0.112	3.605	125920	1429.192	127349.192	1.122262323
0.088	0.981	5439	40.52055	5479.52055	0.739490794
0.302	16.408	51089	1443.77514	52532.77514	2.748332134
1.54	75.473	13996	2236.00096	16232.00096	13.77526385
0	0	1	0	1	0
0.082	1.426	46993	391.92162	47384.92162	0.82710197
0.584	28.298	1487	74.36487	1561.36487	4.762811783
0.224	9.737	72	1.43424	73.43424	1.95309436
0.184	5.099	513	8.26443	521.26443	1.585458267
0.198	7.434	15536	322.99344	15858.99344	2.036657883
0.732	40.909	76963	5982.33399	82945.33399	7.21238158
0.008	0	3	0.00165	3.00165	0.054969767
1.032	56.543	3615	353.72775	3968.72775	8.912875165
0.201	5.346	88580	1606.8412	90186.8412	1.781680319
0.251	8.765	19710	477.7704	20187.7704	2.36663282
0.117	1.988	57935	763.00395	58698.00395	1.299880573
0.001	0	0	0	0	0
0.114	0.136	17502	224.55066	17726.55066	1.266747628
0.304	14.317	916192	31003.93728	947195.9373	3.273233769
0.154	5.782	42540	675.9606	43215.9606	1.564145724
0.126	0	0	0	0	0
0.892	61.286	39	3.27639	42.27639	7.749928506
0.202	5.994	88205	1513.5978	89718.5978	1.687050218
0.34	19.147	15	0.46965	15.46965	3.035944575
0.395	17.088	35	1.2782	36.2782	3.523328059
0.583	36.775	31106	1742.86918	32848.86918	5.305720481
0.545	24.993	1219	57.40271	1276.40271	4.497225644
0.4	24.238	14	0.4907	14.4907	3.38630984
0.549	22.244	283	13.14252	296.14252	4.43790375
0.591	33.06	52797	3249.65535	56046.65535	5.798125383
0.45	23.957	121447	6001.91074	127448.9107	4.709267977
0.145	2.455	74339	1057.10058	75396.10058	1.402062669

0.306	13.837	38685	1250.2992	39935.2992	3.130812151
rugged_lsd	rugged_pc	land_area		Tot area	Mean
%		13,193,676	369,512	13,563,189	3.55 % doesnt
		1,000 ha		2.72	Diff %

3.94 and total land a circle, what is extra land?

! ? ##### ha

% in degree?

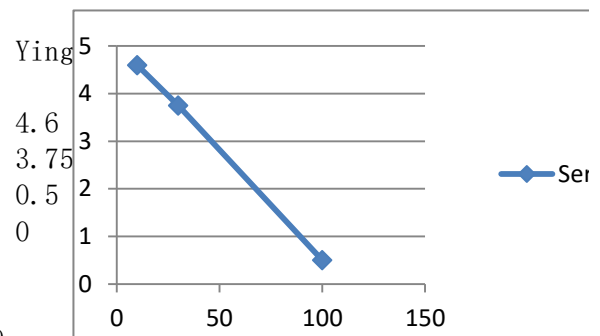
degrees

Africa 30 million km2 or 3,000,000,000

Total land 148,940,000 km2

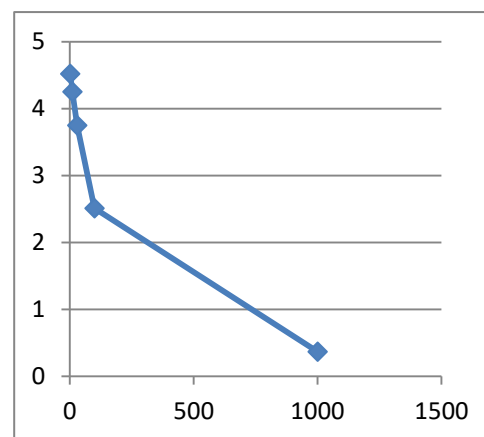
or 14,894,000,000 ha

		Res	
		1	
		10	
		30	
		100	
Ying say %	Resolution %	inc land su	1100
	1	4.52	Diff check
	10	4.25	
4.6	30	3.75	2.49
3.75	100	2.51	3.00
	1000	0.37	0.00
0.5	10000	0	2.60
0			



acy

diff % diff check
1.19
1.0119073 1.19073018



shape if angled. Relevant for quadrats.

Hypotenuse True area diff %

3.518 12.1850

1.54 At 0840 i calculate that country land area totals gi

12.1850

atter for large area calculations

Hypotenuse True area diff %

22.8363 404.763262

1.19

Hypotenuse True area diff %

22.8363 409.5829

2.40

409.570821

2.39 Ditto (-ish due to pi points..)

Diff %

340 70%

375.7 10.50%

381.41 1.50%

90.71

to their slope index in original table above

degree (180/pi)		sqrt = base	pi/180	sum
57.29578	15	2.23	3.872983346	0.01745 0.038914
45				

Area Gha	degree (180/pi)	sqrt = base	pi/180	sum	sec	Hypotenuse
0.000018	0.70241107	0.004242641	0.01745	0.012257073	1.000075123	0.00
0.065209	4.24015148	0.255360529	0.01745	0.073990643	1.002743566	0.26
0.12467	1.30268153	0.353086392	0.01745	0.022731793	1.000258423	0.35
0.000009	0.0148969	0.003	0.01745	0.000259951	1.000000034	0.00
0.00274	5.96632281	0.052345009	0.01745	0.104112333	1.005444275	0.05
0.000047	10.0784999	0.006855655	0.01745	0.175869823	1.015666944	0.01
0.00008	0.3896053	0.008944272	0.01745	0.006798612	1.000023111	0.01
0.00836	1.209907	0.091433036	0.01745	0.021112877	1.000222918	0.09
0.273669	1.29924555	0.523133826	0.01745	0.022671835	1.000257061	0.52
0.00282	4.67524478	0.053103672	0.01745	0.081583021	1.003337149	0.05
0.00002	4.02241782	0.004472136	0.01745	0.070191191	1.002468469	0.00
0.000044	0.00687549	0.00663325	0.01745	0.000119977	1.000000007	0.01
0.76823	0.23204664	0.876487307	0.01745	0.004049214	1.000008198	0.88
0.008245	6.33107322	0.090801982	0.01745	0.110477228	1.006133799	0.09
0.0082605	2.90812573	0.090887293	0.01745	0.050746794	1.001289002	0.09
0.002568	2.70292689	0.050675438	0.01745	0.047166074	1.001113351	0.05
0.003023	0.70985839	0.054981815	0.01745	0.012387029	1.000076724	0.05
0.011062	0.21600407	0.105176043	0.01745	0.003769271	1.000007104	0.11
0.02736	0.36554212	0.165408585	0.01745	0.00637871	1.000020344	0.17
0.013017	0.2876224	0.114092068	0.01745	0.005019011	1.000012595	0.11
0.011063	2.57542825	0.105180797	0.01745	0.044941223	1.001010707	0.11
0.000071	0.35923983	0.00842615	0.01745	0.006268735	1.000019649	0.01
0.001001	0.08250587	0.031638584	0.01745	0.001439727	1.000001036	0.03
0.00512	4.04693303	0.071554175	0.01745	0.070618981	1.002498712	0.07
0.020748	0.3093942	0.144041661	0.01745	0.005398929	1.000014574	0.14
0.002281	0.92581922	0.047759816	0.01745	0.016155545	1.000130515	0.05
0.000005	0.01718873	0.002236068	0.01745	0.000299943	1.000000045	0.00
0.108438	1.34219456	0.329299256	0.01745	0.023421295	1.000274341	0.33
0.845942	0.37470906	0.919751053	0.01745	0.006538673	1.000021378	0.92
0.000043	1.47847584	0.006557439	0.01745	0.025799403	1.000332897	0.01

0.000527	0.78261168	0.022956481	0.01745	0.013656574	1.000093258	0.02
0.0047	10.9375828	0.068556546	0.01745	0.19086082	1.018494539	0.07
0.056673	0.27960119	0.238060917	0.01745	0.004879041	1.000011903	0.24
0.0623	0.30251891	0.249599679	0.01745	0.005278955	1.000013934	0.25
0.909351	1.5437476	0.953598972	0.01745	0.026938396	1.000362948	0.95
0.000001	0.01776169	0.001	0.01745	0.000309942	1.000000048	0.00
0.004	8.53020533	0.063245553	0.01745	0.148852083	1.011181678	0.06
0.07488	4.21222902	0.273642102	0.01745	0.073503396	1.002707469	0.27
0.932748	3.1440975	0.965788797	0.01745	0.054864501	1.001506947	0.97
0.0318	0.34033293	0.178325545	0.01745	0.00593881	1.000017635	0.18
0.04654	0.78719448	0.215731314	0.01745	0.013736544	1.000094354	0.22
0.226705	0.67434019	0.476135485	0.01745	0.011767236	1.000069238	0.48
0.03415	0.23261959	0.184797186	0.01745	0.004059212	1.000008239	0.18
0.000024	1.51282989	0.004898979	0.01745	0.026398882	1.000348552	0.00
0.11095	1.36109164	0.333091579	0.01745	0.023751049	1.000282122	0.33
0.0001861	5.17061273	0.013641847	0.01745	0.090227192	1.004084326	0.01
0.000403	3.7201351	0.02007486	0.01745	0.064916357	1.002110773	0.02
0.005106	3.26689821	0.07145628	0.01745	0.057007374	1.001627124	0.07
0.010982	0.82958492	0.104795038	0.01745	0.014476257	1.00010479	0.10
0.0000135	1.99137204	0.003674235	0.01745	0.034749442	1.000604066	0.00
0.000026	0.13579074	0.00509902	0.01745	0.002369548	1.000002807	0.01
0.000924	4.49819455	0.030397368	0.01745	0.078493495	1.003088543	0.03
0.007727	1.62962536	0.087903356	0.01745	0.028436963	1.000404467	0.09
0.034877	1.09192535	0.186753849	0.01745	0.019054097	1.000181557	0.19
0.002318	3.67106544	0.048145612	0.01745	0.064060092	1.002055362	0.05
0.000075	0.00286479	0.008660254	0.01745	4.99906E-05	1.000000001	0.01
0.004243	0.35007286	0.065138314	0.01745	0.006108771	1.000018659	0.07
0.004838	2.57371285	0.069555733	0.01745	0.044911289	1.00100936	0.07
0.238174	0.8278664	0.488030737	0.01745	0.014446269	1.000104356	0.49
0.027684	1.9736316	0.166385095	0.01745	0.034439871	1.000593346	0.17
0.099545	1.14633558	0.315507528	0.01745	0.020003556	1.000200104	0.32
0.0101	3.81198331	0.100498756	0.01745	0.066519109	1.002216482	0.10
0.0266	0.32371771	0.163095064	0.01745	0.005648874	1.000015955	0.16
0.0499	2.89783895	0.223383079	0.01745	0.05056729	1.001279889	0.22
0.004239	0.23720317	0.065107603	0.01745	0.004139195	1.000008567	0.07
0.1	2.40100563	0.316227766	0.01745	0.041897548	1.000878345	0.32
0.030459	0.68866211	0.17452507	0.01745	0.012017154	1.00007221	0.17
0.001827	2.13213715	0.042743421	0.01745	0.037205793	1.000692535	0.04
0.001217	0.49215865	0.034885527	0.01745	0.008588168	1.000036879	0.03
0.05501	1.95074016	0.234542107	0.01745	0.034040416	1.000579655	0.23
0.00014	4.69630275	0.01183216	0.01745	0.081950483	1.003367363	0.01
0.00007	2.06747985	0.0083666	0.01745	0.036077523	1.000651147	0.01
0.025767	0.33403061	0.160521027	0.01745	0.005828834	1.000016988	0.16
0.024269	1.07588828	0.155785108	0.01745	0.01877425	1.000176262	0.16
0.006949	6.42331312	0.083360662	0.01745	0.112086814	1.006314779	0.08
0.022754	0.34434349	0.150844291	0.01745	0.006008794	1.000018053	0.15
0.000001	12.1081386	0.001	0.01745	0.211287018	1.022743972	0.00
0.024572	1.12800815	0.156754585	0.01745	0.019683742	1.000193756	0.16
0.000169	1.85001051	0.013	0.01745	0.032282683	1.000521312	0.01
0.001	0.52424176	0.031622777	0.01745	0.009148019	1.000041845	0.03
0.002812	0.74594891	0.053028294	0.01745	0.013016808	1.000084725	0.05
0.002805	0.83015776	0.052962251	0.01745	0.014486253	1.000104935	0.05
0.01289	5.23709732	0.113534136	0.01745	0.091387348	1.004190404	0.11
0.000034	3.23662915	0.005830952	0.01745	0.056479179	1.001597071	0.01

0.2175	0.88686784	0.466368953	0.01745	0.015475844	1.000119763	0.47
0.010843	2.80124841	0.104129727	0.01745	0.048881785	1.001195905	0.10
0.008815	0.31283185	0.093888231	0.01745	0.005458916	1.0000149	0.09
0.000054	1.04553192	0.007348469	0.01745	0.018244532	1.000166455	0.01
0.019685	0.42627274	0.140303243	0.01745	0.007438459	1.000027666	0.14
0.00011	3.82852533	0.010488088	0.01745	0.066807767	1.002235797	0.01
0.011189	3.33314107	0.10577807	0.01745	0.058163312	1.001693873	0.11
0.005592	2.20022171	0.074779676	0.01745	0.038393869	1.000737498	0.07
0.002756	3.68932455	0.052497619	0.01745	0.064378713	1.002075894	0.05
0.008962	0.62449927	0.09466784	0.01745	0.010897512	1.000059381	0.09
0.181157	1.48191129	0.425625422	0.01745	0.025859352	1.000334446	0.43
0.297319	1.62790788	0.545269658	0.01745	0.028406992	1.000403614	0.55
0.000008	0.02119944	0.002828427	0.01745	0.00036993	1.000000068	0.00
0.006889	0.96018737	0.083	0.01745	0.01675527	1.000140386	0.08
0.162855	3.98250617	0.403552971	0.01745	0.069494733	1.002419628	0.40
0.043737	1.09937108	0.209133928	0.01745	0.019184025	1.000184042	0.21
0.010025	3.04412204	0.100124922	0.01745	0.05311993	1.001412524	0.10
0.002164	2.75266131	0.046518813	0.01745	0.04803394	1.00115474	0.05
0.029411	4.29257187	0.171496356	0.01745	0.074905379	1.002811982	0.17
0.001083	2.76923854	0.032908965	0.01745	0.048323212	1.001168704	0.03
0.008824	1.78418662	0.093936149	0.01745	0.031134056	1.000484861	0.09
0.03645	3.59060239	0.190918831	0.01745	0.062656012	1.001966104	0.19
0.26997	0.6714758	0.519586374	0.01745	0.011717253	1.000068651	0.52
0.056914	1.02032997	0.238566553	0.01745	0.017804758	1.000158526	0.24
0.01918	7.46606498	0.138491877	0.01745	0.130282834	1.008547247	0.14
0.017652	0.81411824	0.132860829	0.01745	0.014206363	1.000100919	0.13
0.000081	0.01203211	0.009	0.01745	0.00020996	1.000000022	0.01
0.000026	0.00687549	0.00509902	0.01745	0.000119977	1.000000007	0.01
0.009873	3.32343362	0.099362971	0.01745	0.057993917	1.001684007	0.10
0.001782	0.39590754	0.042213742	0.01745	0.006908587	1.000023865	0.04
0.02308	3.99048881	0.151921032	0.01745	0.06963403	1.002429357	0.15
0.001023	6.86649491	0.031984371	0.01745	0.119820336	1.007221651	0.03
0.009632	0.39819926	0.098142753	0.01745	0.006948577	1.000024142	0.10
0.175954	0.64397745	0.419468712	0.01745	0.011237406	1.000063143	0.42
0.000061	3.34284833	0.00781025	0.01745	0.058332703	1.001703768	0.01
0.000016	9.74825109	0.004	0.01745	0.170106982	1.01464471	0.00
0.006463	0.98080794	0.080392786	0.01745	0.017115099	1.000146481	0.08
0.003035	9.97905063	0.055090834	0.01745	0.174134434	1.015355349	0.06
0.006268	0.33116592	0.079170702	0.01745	0.005778845	1.000016698	0.08
0.000259	1.62905287	0.016093477	0.01745	0.028426973	1.000404182	0.02
0.006205	0.29908126	0.078771822	0.01745	0.005218968	1.000013619	0.08
0.000003	1.10051657	0.001732051	0.01745	0.019204014	1.000184425	0.00
0.04463	3.92035034	0.211258136	0.01745	0.068410113	1.002344543	0.21
0	11.7686551	0	0.01745	0.205363032	1.021464004	0.00
0.003288	1.44755629	0.057341085	0.01745	0.025259857	1.000319115	0.06
0.058154	1.82425391	0.241151405	0.01745	0.031833231	1.000506891	0.24
0.00003	0.01375099	0.005477226	0.01745	0.000239955	1.000000029	0.01
0.194395	2.74522999	0.440902484	0.01745	0.047904263	1.001148507	0.44
0.000018	0.01890761	0.004242641	0.01745	0.000329938	1.000000054	0.00
0.002543	4.68207453	0.050428167	0.01745	0.081702201	1.003346933	0.05
0.122019	0.22517126	0.349312181	0.01745	0.003929238	1.00000772	0.35
0.000032	2.45762653	0.005656854	0.01745	0.042885583	1.000920292	0.01
0.065755	3.15780694	0.256427378	0.01745	0.055103731	1.001520134	0.26
0.15665	1.91983572	0.395790349	0.01745	0.033501133	1.000561426	0.40

0.000046	2.61774011	0.00678233	0.01745	0.045679565	1.001044219	0.01
0.078638	0.947013	0.280424678	0.01745	0.016525377	1.00013656	0.28
0.10307	0.17647044	0.321045168	0.01745	0.003079409	1.000004741	0.32
0.00001	5.2882297	0.003162278	0.01745	0.092279608	1.004272923	0.00
0.000106	1.8963705	0.01029563	0.01745	0.033091665	1.000547779	0.01
0.000203	1.39544922	0.014247807	0.01745	0.024350589	1.000296549	0.01
0.009408	1.58038965	0.096994845	0.01745	0.027577799	1.000380388	0.10
0.032855	1.53744962	0.181259483	0.01745	0.026828496	1.000359992	0.18
0.0000374	3.32457568	0.006115554	0.01745	0.058013846	1.001685166	0.01
0.082329	1.42579758	0.286930305	0.01745	0.024880168	1.000309591	0.29
0.001828	2.48393361	0.042755117	0.01745	0.043344641	1.000940115	0.04
0.12667	0.27559058	0.355907291	0.01745	0.004809056	1.000011564	0.36
0.000004	1.87061525	0.002	0.01745	0.032642236	1.000532994	0.00
0.091077	0.47726281	0.301789662	0.01745	0.008328236	1.000034681	0.30
0.01214	1.53000651	0.110181668	0.01745	0.026698614	1.000356514	0.11
0.000026	0.27043407	0.00509902	0.01745	0.004719075	1.000011135	0.01
0.003388	0.06187942	0.058206529	0.01745	0.001079796	1.000000583	0.06
0.030428	4.8675644	0.174436235	0.01745	0.084938999	1.003618193	0.18
0.0143	8.2268172	0.119582607	0.01745	0.14355796	1.010393676	0.12
0.000002	0.44747094	0.001414214	0.01745	0.007808368	1.000030486	0.00
0.026771	3.56663192	0.163618459	0.01745	0.062237727	1.001939898	0.16
0.03095	1.7252273	0.175926121	0.01745	0.030105216	1.000453333	0.18
0.077088	3.24234044	0.277647258	0.01745	0.056578841	1.00160272	0.28
0.007443	2.36382772	0.086272823	0.01745	0.041248794	1.000851335	0.09
0.0000047	0.61132277	0.002167948	0.01745	0.010667582	1.000056901	0.00
0.128	2.09208459	0.357770876	0.01745	0.036506876	1.000666746	0.36
0.029817	3.10696596	0.172675997	0.01745	0.054216556	1.00147152	0.17
0.000046	0.74079315	0.00678233	0.01745	0.012926841	1.000083557	0.01
0.045286	2.41473234	0.212805075	0.01745	0.042137079	1.000888424	0.21
0.030436	0.54486644	0.174459164	0.01745	0.009507919	1.000045202	0.17
0.000887	2.24942182	0.029782545	0.01745	0.039252411	1.000770871	0.03
0.012041	4.39226462	0.10973149	0.01745	0.076645018	1.002944436	0.11
0.00915	2.25457048	0.095655632	0.01745	0.039342255	1.000774406	0.10
0.03973	0.39017823	0.199323857	0.01745	0.00680861	1.000023179	0.20
0.000602	4.53235896	0.024535688	0.01745	0.079089664	1.00313576	0.02
0.000366	3.22634869	0.019131126	0.01745	0.056299785	1.001586929	0.02
0.0011	0.28246591	0.033166248	0.01745	0.00492903	1.000012148	0.03
0.00025	6.08305187	0.015811388	0.01745	0.106149255	1.005660404	0.02
0.022971	2.29347027	0.151561869	0.01745	0.040021056	1.000801377	0.15
1.638134	1.87748339	1.27989609	0.01745	0.032762085	1.000536917	1.28
0.002467	4.99950743	0.049668904	0.01745	0.087241405	1.003817637	0.05
0.214969	1.44011257	0.463647495	0.01745	0.025129964	1.000315841	0.46
0.0102	2.94469946	0.100995049	0.01745	0.051385006	1.001321663	0.10
0.2376	0.67949609	0.487442304	0.01745	0.011857207	1.000070301	0.49
0.019253	0.37069852	0.13875518	0.01745	0.006468689	1.000020922	0.14
0.000067	0.02062648	0.008185353	0.01745	0.000359932	1.000000065	0.01
0.000039	6.38030969	0.006244998	0.01745	0.111336404	1.006230071	0.01
0	3.76178296	0	0.01745	0.065643113	1.002158384	0.00
0.002799	2.35410394	0.052905576	0.01745	0.041079114	1.00084434	0.05
0.007162	0.7545418	0.0846286	0.01745	0.013166754	1.000086688	0.08
0.002072	2.71721881	0.045519227	0.01745	0.047415468	1.001125167	0.05
0.000006	3.14638243	0.00244949	0.01745	0.054904373	1.001509141	0.00
0.062734	0.98023515	0.250467563	0.01745	0.017105103	1.00014631	0.25
0.000023	1.41320024	0.004795832	0.01745	0.024660344	1.000304143	0.00

0.000096	3.42849224	0.009797959	0.01745	0.05982719	1.001792319	0.01
0.0156	0.46695027	0.12489996	0.01745	0.008148282	1.000033198	0.12
0.00481	2.88698047	0.069354164	0.01745	0.050377809	1.001270305	0.07
0.002014	4.41049128	0.044877611	0.01745	0.076963073	1.002968984	0.05
0.041033	1.44927406	0.202566039	0.01745	0.025289832	1.000319873	0.20
0.00172	4.90055507	0.041472883	0.01745	0.085514686	1.003667555	0.04
0.000046	6.35031618	0.00678233	0.01745	0.110813017	1.006171334	0.01
0.018378	1.24541408	0.135565482	0.01745	0.021732476	1.000236197	0.14
0.000043	0.00744845	0.006557439	0.01745	0.000129975	1.000000008	0.01
0.12592	0.65027918	0.354852082	0.01745	0.011347372	1.000064385	0.35
0.005439	0.42684566	0.073749576	0.01745	0.007448457	1.00002774	0.07
0.051089	1.61874791	0.226028759	0.01745	0.028247151	1.000399083	0.23
0.013996	9.07686875	0.118304691	0.01745	0.15839136	1.012676388	0.12
0.000001	0	0.001	0.01745	0	1	0.00
0.046993	0.47783573	0.216778689	0.01745	0.008338233	1.000034764	0.22
0.001487	2.86297678	0.038561639	0.01745	0.049958945	1.001249247	0.04
0.000072	1.14118101	0.008485281	0.01745	0.019913609	1.000198309	0.01
0.000513	0.92295518	0.022649503	0.01745	0.016105568	1.000129709	0.02
0.015536	1.19100769	0.124643492	0.01745	0.020783084	1.000216007	0.12
0.076963	4.44466387	0.277422061	0.01745	0.077559385	1.003015286	0.28
0.000003	0.03151268	0.001732051	0.01745	0.000549896	1.000000151	0.00
0.003615	5.58860114	0.06012487	0.01745	0.09752109	1.004774098	0.06
0.08858	1.03923147	0.297623924	0.01745	0.018134589	1.000164454	0.30
0.01971	1.38857778	0.140392307	0.01745	0.024230682	1.000293635	0.14
0.057935	0.7545418	0.240696905	0.01745	0.013166754	1.000086688	0.24
0	0.00630254	0	0.01745	0.000109979	1.000000006	0.00
0.017502	0.73506453	0.132295125	0.01745	0.012826876	1.00008227	0.13
0.916192	1.9381496	0.957179189	0.01745	0.033820711	1.000572193	0.96
0.04254	0.91035333	0.206252273	0.01745	0.015885666	1.00012619	0.21
0	0.665747	0	0.01745	0.011617285	1.000067484	0.00
0.000039	4.80214233	0.006244998	0.01745	0.083797384	1.003521303	0.01
0.088205	0.9830991	0.296993266	0.01745	0.017155079	1.000147166	0.30
0.000015	1.79334501	0.003872983	0.01745	0.03129387	1.000489853	0.00
0.000035	2.09151239	0.00591608	0.01745	0.036496891	1.000666381	0.01
0.031106	3.20692946	0.176368932	0.01745	0.055960919	1.001567858	0.18
0.001219	2.69606664	0.034914181	0.01745	0.047046363	1.001107702	0.03
0.000014	2.00739533	0.003741657	0.01745	0.035029048	1.000613831	0.00
0.000283	2.65890566	0.016822604	0.01745	0.046397904	1.001077349	0.02
0.052797	3.52211202	0.229775978	0.01745	0.061460855	1.001891696	0.23
0.121447	2.82925561	0.348492468	0.01745	0.04937051	1.001219963	0.35
0.074339	0.81469108	0.272651793	0.01745	0.014216359	1.000101061	0.27
0.038685	1.85115523	0.196685027	0.01745	0.032302659	1.000521958	0.20

13.194 2.25

Area Gha degree (180/pi) Hypotenuse
 ? ##### ha Plus Antarcti 1.61564082
 Land of 15 Gha x mean exta 0. 15.000

15.000

THIS IS VERY SMALL ADDITIONAL LAND, BUT
 AT 1m or even cm scale would expect exp

But... 0.

If it was for CO2 the value would be x 44; for c in CO2 is x 0.273!

% water
0.8
98.2
0.8
98.2

their mistake or accuracy error, eitherway the are not talking about CO2

reactive C
900
1,500
800
791
14.3
4,005.3

	Area Gha	mean Org-C /m ² /yr g	Org-C /ha/yr t	Total Org-C/yr Gt	O ₂ /m ² /yr t
Land	15	144	1.44	21.6	3.84
Sea	36	72	0.72	25.92	2.064
Total	51	0	0	47.52	

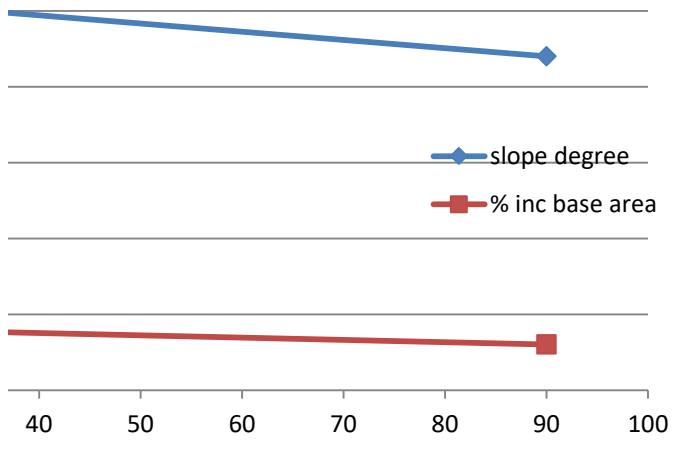
%
Land 45
Sea 55
Tot 100

NPP sea Whitman et al. 1989: tab. 6
g/m2/yr Tot 48.0

NPP sea from Duursma & Poisson
g/m2/yr Tot 72 25.9

NPP land Whitman et al. 1989: tab. 6
g/m2/yr Tot 51.0

NPP land from Duursma & Poisson
g/m2/yr Tot 144 21.6



Applications
Astronomy

Terrain, biomes, soil
evska (projected)
recalc.)
evska

evska
Araújo
Araújo
Araújo

Productivity
l.
l. (recalc.)
l. (recalc.)
Soil moisture, respiration

l.

SOM and colloid gas exchange

2.475 Median value %

% **15.36** terrain/slope
15.85 tortuosity/rugosity
NEW LAND = **36.00** micro-relief
NEW WORLD : **72.00** new global area including 3
terrain/slope

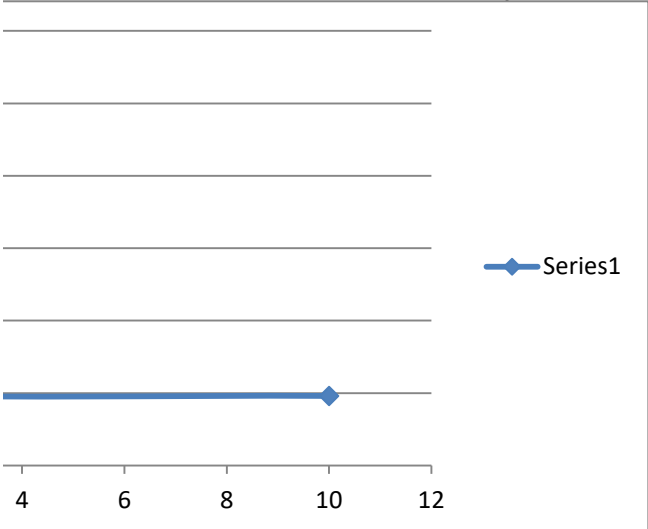
As terrain includes Antarctica, 15 Gha
Area increase for terrain
(A) mean m (n=3) (B) mean
(a) % increase 2.4 21.3
(b) Land 15 Gha 15.4 18.2
(c) Soil 12 Gha 12.3 14.6
(d) Difference 3.1 3.6
(e) Soil 12.3 Gha (c) x (C) then (D)
(f) Soil 14.6 Gha (c) x (C) then (D)
Total (e) + Difference (d) (A)
Total (f) + Difference (d) (B)

Total land is between 52-62 Gha + 36 Gha
Allowing for microscopic porosity this
OR TRY THE TOTAL AND JUST REDUCE BY 80%

Ratio = 2.0 to 1

tortuosity/rugosity 36x2 = 72 so
micro-relief
new global area including 36 Gha s Ratio = 2.2 to 1
75.0 1.5 times increas 47.1 % increase
as new total of ..

BIOMASS and PRODUCTIVITY ADJUSTMENTS (dependent upon original land area basis
Scale of rLand area bas% increase New land Gha Multiplication factor**
m2 (up to l 15 2.5 15.4 1.03
m2 (up to l 15 21.25 18.2 1.71
yr gives ne cm2* 15.4 94.0 23.9 1.59
cm2* 18.2 94.0 28.2 2.65
mm2 23.9 108.2 49.7 3.31
mm2 28.2 108.2 58.8 3.92
*80% of total flat land area is habitable with soil (15 x 0.8 = 12 Gha); but
**Most megafauna and trees are ha-1; mesofauna/flora m-2; microbes g-1 = cm-2
or fourfold Antarctic is included as it too has a fauna composed mainly of seabirds, peng
doubled. Biomass on land is increased by at least 3 times (tripled) and possibly up to
For energetics, the scale of measurment is the Joule (kg·m2·s-2), Gha
NOTE: much land is hilly so can keep the average terrrain hi 21.25%.



Or if arbitrary...

87.48 Gha		64 Gha	
36 Gha		36 Gha	
123.48 Gha		100 Gha	
2.43 : 1		1.8 :1	
71	29%	64	36%

de/6548420/23/images/18/Different+ecosystems+vary+considerably+in+their+net+primary+prod
%

- 24.5 OK
- 5.6 OK
- 1.4 OK
- 0.8 OK
- 0.2 OK
- 0.0 OK
- 1.0 OK
- 21.9 OK

7.9 OK
 5.3 **NOK needs correction**
 5.8 **NOK needs correction**
 3.3 **NOK needs correction**
 3.6 OK
 0.7 OK
 7.2 OK
 4.7 OK
 3.9 OK
 2.4 OK
 0.3 OK
 100
 OK
32.4
65.3
2.7

Gt C per year!!

cology: Theories and Applications” (Prentice Hall) – this from <https://en.wikipedia.org/>

%land	%sea	check	
	45	55	100.0
	48	52	100.0
	68	32	100.0
	54	46	100.0
	67	33	100.0
–	–		
	81	19	100.0
	89	11	100.0
	61	39	100.0

! apparently almost equivalent.

it different because they also have freshwater...

andfonline.com/doi/full/10.4155/cmt.13.77?scroll=top&needAccess=true

2up

- Wild mammals
- Farm stock & pets
- Humans

7/02/12/nature-article-to-commemorate-charles-darwins-birthday-on-12

ion_of_atmospheric_CO2_in_global_carbon_pools .

FAO	Gha	%
Total grass	5.25	40.5
composed of...		
woody savannah/savannah		13.8
open/closed shrub		12.7
non-woody grassland		8.3
tundra		5.7
TOT		40.5

Soil carbon budgets (0–3 m soil depth) from Jobaggy & Jackson (2000) upon which most NAS

%SOC	% sorted area	%sorted SOC
6.4	Boreal forest 1239.669421	Boreal forest 6.396588486
10.6	Crops 2049.586777	Crops 10.57569296
8.9	Deserts 1719.008264	Deserts 8.869936034
5.3	Dry shrubs 1024.793388	Dry shrubs 5.287846482
6.8	Temp decid fc 1322.31405	Temp decid fo1 6.823027719

4.3	Temp everg fc	842.9752066	Temp everg fo1	4.349680171
7.3	Temp grass	1421.487603	Temp grass	7.334754797
9.3	Trop decid fc	1801.652893	Trop decid fo1	9.296375267
20.2	Trop everg fc	3917.355372	Trop everg fo1	20.21321962
14.7	Trop savannah	2851.239669	Trop savannah	14.71215352
6.1	Tundra	1190.082645	Tundra	6.140724947
100	Total		Total	

WORK AS AN APPROX!!!

IF DOUBLE LAND AREA TO 24.2 get

Sorted by SOC

Biome	Area Gha	SOC 0-3m kg/m2		SOC 0-3 m Gt
Trop everg	1.7	27.9	47.43	474
Trop savan	1.5	23	34.5	345
Crops	1.4	17.7	24.78	248
Trop decid	0.75	29.1	21.825	218
Deserts	1.8	11.5	20.7	208
Temp grass	0.9	19.1	17.19	172
Temp decid	0.7	22.8	15.96	160
Boreal for	1.2	12.5	15	150
Tundra	0.8	18	14.4	144
Dry shrubs	0.85	14.6	12.41	124
Temp everg	0.5	20.4	10.2	102
Total	12.1	216.6	234.395	2345

%SOC

29.5			
8.9			
14.7			
10.6			
11.2			
6.4			
7.3	0.7	22.8	15.96
5.3	0.5	20.4	10.20
6.1	1.2	43.2	51.84
100			

also called Watson et al (2000)

d at 1-3 m)

C %

8.0
13.3
17.3
5.3
22.6
12.3
6.4
5.1
9.7
100.0

[org/bitstream/handle/20.500.11822/19113/Costanza_et_al_GEC_2014_%2b_SI.pdf?sequence=1&is](https://bitstream/handle/20.500.11822/19113/Costanza_et_al_GEC_2014_%2b_SI.pdf?sequence=1&is)

For 1.4 gm⁻³

For 1.5 gm⁻³

x	1.5	1.6
x	2.2	2.3
x	2.8	3.1
x	2.2	2.3
	2.2	2.3
	2.2	2.3

Cf. 1,500 Gt

1.4 x
2.8 x
5.6 x
4.2 <--cf. 3,000
8.4 <--cf. 3,000

science/much-cubic-meter-soil-weigh-e48660fa83d913ab), then 120,000 m3 will weigh

x
x

x

My calculations seem reasoned and reasonable based upon these presumptions.
?

1 ha and I measure in Gha, i.e., out by a factor of 100. Q.E.D. again.

rved hypotensuses. R. J. B. 2017- 11th November, 2018.

Hipotenusa (raiz da sDiff	Diff x diff	Diff + 1	Sqrt	Expect	
3.1622777	-3	9	10	3.16227766	1
1	0	0	1	1	1
1.4142136	1	1	2	1.414213562	1
1	0	0	1	1	1
1	0	0	1	1	1
1	0	0	1	1	1
1.4142136	1	1	2	1.414213562	1
1	0	0	1	1	1
1.4142136	-1	1	2	1.414213562	1
1	0	0	1	1	1
2.236068	2	4	5	2.236067977	1
1	0	0	1	1	1
1.4142136	-1	1	2	1.414213562	1
1	0	0	1	1	1
3.1622777	3	9	10	3.16227766	1
1	0	0	1	1	1
1.4142136	1	1	2	1.414213562	1
1	0	0	1	1	1
1	0	0	1	1	1

1	0	0	1	1	1
1	0	0	1	1	1
1	0	0	1	1	1
2. 236068	-2	4	5	2. 236067977	1
1	0	0	1	1	1
2. 236068	-2	4	5	2. 236067977	1
1	0	0	1	1	1
1. 4142136	1	1	2	1. 414213562	1
1	0	0	1	1	1
1. 4142136	1	1	2	1. 414213562	1
1	0	0	1	1	1
1. 4142136	1	1	2	1. 414213562	1
1	0	0	1	1	1
1. 4142136	1	1	2	1. 414213562	1
1	0	0	1	1	1
2. 236068	-2	4	5	2. 236067977	1
1	0	0	1	1	1
1. 4142136	1	1	2	1. 414213562	1
1	0	0	1	1	1
1. 4142136	1	1	2	1. 414213562	1
1	0	0	1	1	1
2. 236068	-2	4	5	2. 236067977	1
1	0	0	1	1	1
4. 1231056	-4	16	17	4. 123105626	1
1	0	0	1	1	1
4. 1231056	-4	16	17	4. 123105626	1
1	0	0	1	1	1
1	0	0	1	1	1
1	0	0	1	1	1
1. 4142136	-1	1	2	1. 414213562	1
1	0	0	1	1	1
1. 4142136	-1	1	2	1. 414213562	1
1	0	0	1	1	1
1	0	0	1	1	1
1	0	0	1	1	1
2. 236068	2	4	5	2. 236067977	1
1	0	0	1	1	1
1. 4142136	1	1	2	1. 414213562	1
1	0	0	1	1	1
1	0	0	1	1	1
1	0	0	1	1	1
1	0	0	1	1	1
1	0	0	1	1	1
1	0	0	1	1	1
1	0	0	1	1	1
4. 1231056	4	16	17	4. 123105626	1
1	0	0	1	1	1
1	0	0	1	1	1
1	0	0	1	1	1
2. 236068	2	4	5	2. 236067977	1
1	0	0	1	1	1
2. 236068	-2	4	5	2. 236067977	1
1	0	0	1	1	1
2. 236068	-2	4	5	2. 236067977	1

1	0	0	1	1	1
1	0	0	1	1	1
1	0	0	1	1	1
1. 4142136	1	1	2	1. 414213562	1
1	0	0	1	1	1
4. 1231056	4	16	17	4. 123105626	1
1	0	0	1	1	1
1. 4142136	1	1	2	1. 414213562	1
1	0	0	1	1	1
1	0	0	1	1	1
1	0	0	1	1	1
1	0	0	1	1	1
1	0	0	1	1	1
2. 236068	2	4	5	2. 236067977	1
1	0	0	1	1	1
2. 236068	2	4	5	2. 236067977	1
126. 04114					

Total

126. 0411426

expect

89

T = L1/Lo

1. 416192613

traight hypoteneuses and for curved hypoteneuses

pan.

tropical	dist	coas	near_coas	gemstones	rgdppc	2rgdppc	1rgdppc	1rgdppc	1rgdppc	2rgdppc	1rgdppc
100	0.001	100	0								
0	0.922	0	0		644.756	720.633	565.231	679.791			
44.346	0.428	13.1587	47756	1794.729	1051.822	1073.036	765.215	1106.763			
100	0	100	0								
0	0.048	94.6919	0	3703.113	1001.339	2289.472	2741.42	1931.784			
0	0.134	0	0								
74.555	0.001	100	0								
0	0.065	75.7464	0	20604.46	15797.56	25465	17567.88	20119.99			
0	0.352	13.0167	0	12173.68	4986.725	8122.497	8543.558	6926.81			
0	0.348	0	0	2421.985			4565.035				
100	0	100	0								
100	0.001	100	0	10022.03							
14.68	0.336	20.9399	264154	25417.44	7411.577	13169.83	21605.33	13184.23			
0	0.242	2.25634	0	28987.84	3706.075	11646.41	20691.42	11601.7			
0	0.584	0	0	2570.944			2538.14				
75.354	0.906	0	0	621.652	360.142	534.858	495.977	530.763			
0	0.113	45.9637	0	27302.99	5462.205	12440.79	20656.46	12223.31			
97.489	0.367	10.2806	0	959.222	1083.628	969.318	1282.898	1082.474			
49.82	0.735	0	0	998.416	474.313	669.515	921.09	719.511			
75.038	0.071	71.3844	0	1479.086	539.544	528.607	861.7	599.122			
0	0.149	31.4395	0	5979.171	1651.031	5830.809	5349.921	4567.501			
0	0.002	100	0	15928.09	2104.454	3922.257	5058.844	3776.897			
100	0.003	100	0	16977.2							
0	0.117	42.7623	0	5294.975			5572.282				
0	0.598	0	0	4802.11			6264.544				
100	0.026	100	0	5869.233							
0	0	100	0								
64.878	0.655	0	0	2398.855	1919.359	2515.915	2574.755	2153.277			
88.567	0.642	9.68309	12159	7300.865	1671.723	4189.509	5556.415	3761.573			
100	0.002	100	0	15290.58							
100	0.023	100	0								
0	0.389	0	0								
0	0.764	0	208687	7702.508	348.507	1223.49	4268.641	1631.317			
97.382	1.081	0	10802	1148.051	771.577	781.799	575.543	757.838			
0	1.43	4.4433	5166	27289.26	7291.48	14316.26	22360.12	14002.5			
100	0	100	0								
0	0.278	0	0	30161.29	9063.698	17224.02	22474.86	16696.84			
0	0.074	68.3825	0	9115.475	3669.742	4273.292	10310.83	5636.808			
0.301	0.987	5.76513	4410	3928.315	448.022	871.181	3420.866	1268.328			
100	0.284	16.359	3239	1575.628	1040.878	1800.013	1352.019	1536.27			
94.12	0.389	10.9018	0	1882.687	670.951	1051.615	1082.339	1036.539			
94.866	1.016	0.686405	87149	668.663	569.742	760.789	216.95	611.093			
100	0.457	4.83001	0	957.403	1198.207	2191.133	2005.219	1914.573			
100	0	100	0								
89.763	0.379	16.7275	0	6243.656	2152.841	3622.226	5095.796	3661.919			
100	0.003	100	0	1770.218	560.305	804.062	580.913	730.933			
0	0.004	100	0	4859.108	449.648	524.742	1776.535	809.993			
94.017	0.031	100	0	8621.291	1963.132	4396.007	6173.734	3955.164			
100	0.02	100	0		2046.226	2404.287	2415.604	2334.104			
100	0	100	0								
100	0.001	100	0								

0	0.012	100	0	20318				
0	0.426	0	0	15373.23			9155.582	
0	0.246	19.7358	0	25481.43	3880.887	12040.61	18943.52	11932.71
0	0.038	100	0	1881.967	1499.582	2065.445	1102.543	1647.355
100	0.003	100	0	5931.715				
0	0.019	100	0	28750.61	6943.104	13621.13	22975.16	13991.6
87.817	0.029	100	0	6410.803	1026.788	2111.321	3649.014	1989.486
0	0.752	4.17952	0	5417.91	1364.74	2521.953	2864.551	2389.185
73.165	0.157	37.3544	0	3373.415	1862.933	3459.407	3203.386	3209.836
0	0.325	22.7899	0	3598.329	909.903	1420.783	2936.674	1711.68
0	0.104	56.1576	0	911.884				
0	0.148	33.6288	0					
0	0.131	42.9055	0	21764.83	2188.97	8346.302	15621.72	7811.794
0	0.135	37.0373	0	9762.76			11710.01	
29.455	0.466	2.26331	0	635.794				
0	0.324	8.79128	0	25553.88	4253.287	11441.3	19770.36	11059.54
100	0.009	100	0	4949.898				
0	0.005	100	0					
0	0.172	34.6184	0	25698.01	5271.312	13251.08	21025.38	12907.1
0	0.001	100	0					
100	0	100	0					
100	0.195	28.1246	5200	6118.662	3108.377	9405.868	3847.075	5359.929
0	0.034	96.3607	0	26332.05	6939.374	11847.09	20352.87	12332.87
0	0.181	33.1835	0	1880.45			3243.627	
100	0.283	19.3048	13275	1892.808	1121.794	1246.881	1269.883	1217.556
0	0	100	0					
100	0.263	14.9423	4864	1975.794	303.321	512.136	571.719	469.724
100	0.003	100	0					
89.355	0.053	77.3706	0	1728.198	607.365	1049.606	894.813	866.362
100	0.045	87.3195	0	782.477	289.153	925.067	680.606	707.146
100	0.069	69.3531	0	15189.54	539.763	1294.001	7973.103	1623.25
0	0.029	96.2131	0	17391.74	1915.007	7721.514	12110.87	6959.675
100	0.001	100	0	7536.395				
0	0.867	3.50187	0					
78.376	0.099	48.2159	0	3974.407	2084.894	3683.875	4096.941	3228.048
100	0.125	43.0358	0					
100	0	100	0					
100	0.215	28.642	1023	4072.166				
0	0.002	100	0	25795.83	2218.149	6990.537	23328.39	9882.841
94.636	0.077	66.5159	0	2506.231	1313.356	1731.909	1911.571	1690.379
0	0.113	51.0571	0	9545.475			6438.607	
100	0.019	100	0	1798.406	1050.62	1034.517	796.162	1007.399
0	0.467	0	0	13223.63	2479.958	5804.766	7132.268	5178.71
99.835	0.062	77.0687	287	3028.274	839.518	1507.126	3258.498	1752.64
39.447	0.407	18.0434	489	2415.093	619.003	897.336	1885.008	1006.152
100	0	100	0					
0	0.035	95.8615	0	30532.31	3452.898	7316.275	21551.34	8281.263
0	0.461	11.4317	0	5826.672	1719.611	5862.488	4662.057	3593.365
0	0.456	2.58288	0		1363.606	4315.305	1221.224	2984.537
0	0.04	93.2095	0	28929.43				
0	0.052	90.3822	0	23857.94	2817.303	10147.87	16925.59	9250.91
0	0.058	80.9226	0	24994.66	3501.9	10741.87	18773.57	11048.93
100	0.012	100	0	3650.39	1326.785	3844.877	3598.21	3139.55
0	0.189	16.2407	0	3846.694	1663.149	2582.962	4088.574	3248.945

0.006	0.032	97.7372	0	26219.79	1920.721	11343.78	20742.39	11248.29
0	2.206	0	0	4594.435			5648.025	
51.028	0.409	9.38789	0	1018.731	650.601	941.848	1030.687	912.759
0	1.918	0	0	1560			2167.491	
100	0.17	25.378	0	1859.063	481.977	579.707	1141	766.583
100	0	100	0					
100	0.001	100	0	11224.7				
0	0.042	95.0484	0	16172.41	853.89	3161.702	14219.08	4725.635
0	0.04	98.6018	0	15958.92	28878.14	18161.66	10082.73	19359.77
54.794	0.267	6.8206	0	1569.901	612.943	783.584	1203.223	826.834
0	0.027	100	0	4216.305	2428.74	3461.337	3405.22	2881.809
100	0.096	54.5897	9901		1054.759	1247.827	990.059	1195.255
0	0.501	9.92269	0		857.168	5515.242	2312.993	3978.577
100	0.002	100	0	5620.647				
0	0.305	0	0					
100	0.035	100	0	3625.534	1252.871	1540.745	3633.984	1891.942
0	0.246	0	308	2122.544	355.366	714.936	1490.346	824.398
0	0.256	13.8029	0	8767.231			6346.336	
0	0.259	0	0	57792.09				
0	0.265	15.7566	0	7903.728			7693.585	
0	0	100	0	18581.94				
0	0.164	35.4198	0	3513.834	1455.361	1830.967	2657.562	1952.039
0	0	100	0					
0	0.197	11.0077	0	1331.461			2127.236	
65.224	0.087	61.0618	0	825.244	951.01	1126.29	705.899	966.595
100	0	100	0					
27.928	0.183	38.4165	0	9046.27	2365.019	5158.34	7274.678	4824.431
100	0	100	0					
0	0.135	14.0538	0	6059.698			3340.784	
11.688	1.014	0	0	779.597	456.875	612.963	891.656	638.532
0	0.002	100	0	18255.73				
50.245	0.287	30.3948	0		395.686	662.868	1376.179	725.201
0	1.694	0	0	1620.436	435.422	912.424	1084.652	891.187
100	0	100	0					
87.365	0.21	30.756	0	876.868	1133.42	1403.62	1364.891	1278.82
0	0.511	5.9946	0	1729.208	463.918	961.991	1016.92	856.331
100	0	100	0					
100	0.003	100	0					
100	0.006	100	0	9622.512	2489.759	3969.069	10652.32	4876.056
39.224	0.496	0	0	586.252	324.056	591.72	656.235	507.871
100	0.057	83.2625	0	8926.452	1559.265	2648.422	8165.59	3467.013
100	0.002	100	0					
0	0.305	17.6842	55728	6057.856	2159.705	3333.925	3637.062	3181.151
94.292	0.008	100	0	22140				
0.032	1.186	0	0	703.141	617.031	658.875	486.397	683.153
0	0	100	0					
73.44	0.491	9.17532	0	882.59	752.681	1416.623	1251.178	1109.575
100	0.077	65.2217	0	3277.64	1615.788	3128.881	1520.552	2131.895
100	0	100	0					
0	0.042	91.6192	0	28610.12	5996.128	13373.63	22161.45	12961.17
0	0.053	79.6415	0	34207.82	5429.51	12271.32	25101.95	13253.49
0	0.697	0	0	1322.873	496.334	641.508	999.145	691.527
100	0	100	0					
0	0.039	95.685	0	19614.94	8455.649	12488.61	16170.12	11982.21

0	0.113	47.7134	0	12729.71	623.095	4267.115	7115.765	3880.417
0	0.589	11.0758	0	1925.391	643.02	977.667	1815.145	1110.924
100	0.018	100	0	6164.348	1915.962	4198.462	5675.752	3954.735
100	0	100	0					
55.788	0.325	16.7165	0	4722.525	2307.632	4325.977	3832.72	3502.972
98.973	0.02	100	0	4027.548	1070.263	2033.298	2421.199	1893.012
100	0	100	0					
100	0.071	71.2843	0	2325.738				
0	0.283	14.8703	0	10401.36	2446.893	5807.87	7308.837	4706.412
100	0.012	100	0	22242.23	2143.823	6946.214	14105.68	7177.506
0	0.064	80.0171	0		853.857	2840.967	1169.178	1933.106
0	0.072	70.0621	0	18255.28	2086.406	6517.205	13813.43	6861.499
57.034	0.847	0	0	4553.069	1584.366	2220.024	3013.877	2405.144
0	0.046	100	0		949.299	2329.271	5124.096	2596.531
96.819	0.001	100	0	24538.31				
0	0.015	100	0		30387.13	35198.26	8290.317	23511.4
58.336	0.008	100	0		1989.306	3821.115	4588.492	3412.181
0	0.367	6.7651	0	5889.324	1181.952	3761.37	3005.54	2935.706
0	1.841	2.76605	205550	7095.689			5276.657	
68.88	0.946	0	0	1039.172	546.902	805.649	818.696	739.706
0	0.304	13.6641	0	12374.11	2230.766	11787.04	7647.705	7612.613
0	0.236	11.654	0				2313.608	
20.679	0.917	2.92113	0	1682.674	820.837	910.048	991.254	903.639
34.999	0.165	32.4713	0	1435.082	1258.898	1396.079	1358.175	1348.293
100	0.003	100	0	23611.61	2218.961	6430.213	22518.17	8339.448
0	0.001	100	0					
0	0.276	13.7615	0					
100	0.003	100	0	1862.47				
100	0.1	51.5546	16819	466.647	656.268	1125.709	409.872	904.314
100	0.039	99.6575	0	4594.274	1488.813	2503.697	2715.551	2147.779
0	0.025	100	0					
0	0.126	44.7664	0		1056.633	1201.617	863.075	1117.015
0	0.001	100	0					
100	0.004	100	0		820.358	1421.447	1225.896	1255.841
100	0.191	25.757	0					
0	0.554	0	0	11303.75			8219.698	
0	0.091	61.6056	0	16873.33			12876.63	
0	0.223	21.2438	0	25899.88	6739.231	14183.35	20709.99	13259.33
2.876	0.113	36.2172	426	4681.445	721.089	2461.908	2630.322	1902.181
100	0	100	0	17957.47	1912.258	3250.874	6353.528	3625.007
0	0.244	16.7091	0	3242.195	2408.502	5570.152	7368.301	4961.027
100	0.001	100	0					
13.413	1.254	0	0	821.15	475.502	550.5	428.787	472.883
100	0.263	16.778	0	1436.855	573.994	1055.553	614.222	833.23
99.546	0.193	29.3876	0	6279.51	817.049	1958.72	6397.871	2729.121
0	1.505	0	0	785.469			883.162	
100	0	100	0					
0	1.286	0	0	3667.555			2324.556	
100	0.013	100	0					
100	0	100	0	6568.724				
100	0.008	100	0	8969.766	3674.051	9117.805	13681.76	8591.538
0	0.114	48.8258	0	6251.551	1114.596	2446.059	4552.262	2441.64
0	0.152	38.9877	0	6510.354	1622.933	3894.789	6609.014	3821.776
100	0	100	0					

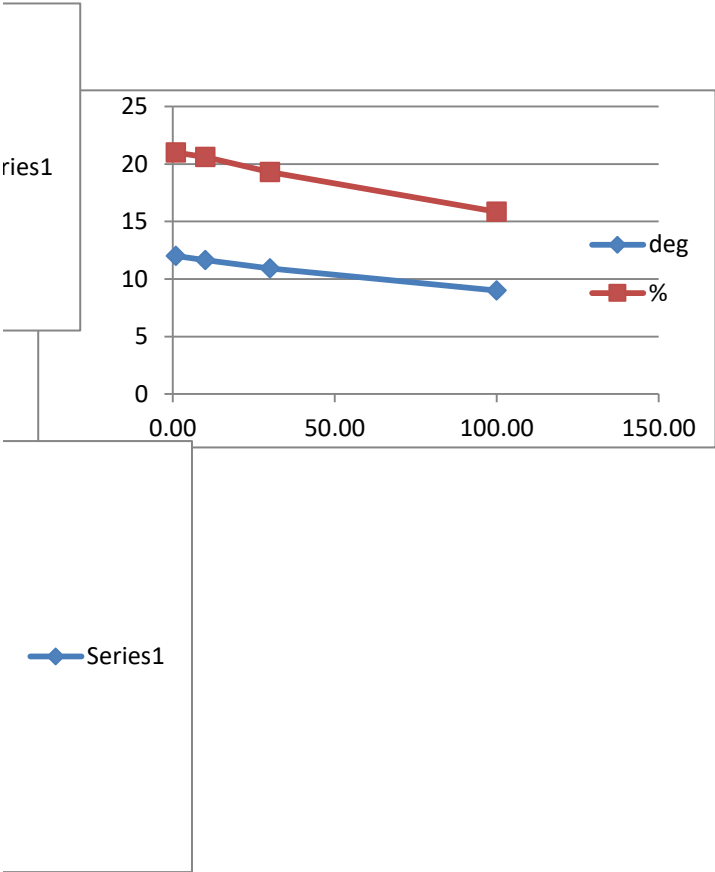
8.846	0.023	100	0	924.393	3958.396	16858.58	5906.895
88.294	0.42	10.2759	9035	521.827	423.714	600.268	535.125
97.783	0.909	0	0	1243.514	686.854	784.287	796.523
0	0.365	13.6144	0	4108.69			699.696
100	0	100	0				2745.334
0	0.142	37.4727	0	8781.518	4659.398	5421.178	7883.267
0.358	0.677	13.1656	0	33970.17	9561.348	16283.63	5841.658
0	1.645	0	0	1515.708			28448.85
0	0.02	100	0				17349.76
100	0.001	100	0	5334.509			3478.961
96.752	0.306	25.2528	5124	5685.12	7461.959	10471.65	8414.729
100	0	100	0				9366.497
100	0.001	100	0				
56.535	0.112	57.8169	0	2011.743	658.076	709.929	1808.773
100	0.002	100	0	3172.14			932.382
100	0	100	0				
100	0.003	100	0	4860.269			
0	0.148	38.1163	0	787.749	911.231	1783.548	2619.284
0.179	0.306	18.9404	144785	9419.122	2534.946	4270.851	3978.219
17.132	0.9	0	0	774.01	660.91	1040.744	645.375
8.401	0.499	0	898	2499.215	700.979	1401.811	863.642
							1163.542

tropical dist_coasnear_coasgemstonesrgdppc_2(rgdppc_1(rgdppc_1(rgdppc_2(rgdppc_1(

1 data, we calculate the average uphi
the FAO/UNESCO Digital Soil Map of the World and linked soil association composition table and cli
)8%.

oteneuse %....

really work as need better calc



ve 0.154% extra surface.

sec	Hypotenuse	True area	ϵ diff %
1.000758	3.88	15.0114	0.08

True area	ϵ diff %
0.0000	0.01
0.0654	0.27
0.1247	0.03
0.0000	0.00
0.0028	0.54
0.0000	1.57
0.0001	0.00
0.0084	0.02
0.2737	0.03
0.0028	0.33
0.0000	0.25
0.0000	0.00
0.7682	0.00
0.0083	0.61
0.0083	0.13
0.0026	0.11
0.0030	0.01
0.0111	0.00
0.0274	0.00
0.0130	0.00
0.0111	0.10
0.0001	0.00
0.0010	0.00
0.0051	0.25
0.0207	0.00
0.0023	0.01
0.0000	0.00
0.1085	0.03
0.8460	0.00
0.0000	0.03

0.0005	0.01
0.0048	1.85
0.0567	0.00
0.0623	0.00
0.9097	0.04
0.0000	0.00
0.0040	1.12
0.0751	0.27
0.9342	0.15
0.0318	0.00
0.0465	0.01
0.2267	0.01
0.0342	0.00
0.0000	0.03
0.1110	0.03
0.0002	0.41
0.0004	0.21
0.0051	0.16
0.0110	0.01
0.0000	0.06
0.0000	0.00
0.0009	0.31
0.0077	0.04
0.0349	0.02
0.0023	0.21
0.0001	0.00
0.0042	0.00
0.0048	0.10
0.2382	0.01
0.0277	0.06
0.0996	0.02
0.0101	0.22
0.0266	0.00
0.0500	0.13
0.0042	0.00
0.1001	0.09
0.0305	0.01
0.0018	0.07
0.0012	0.00
0.0550	0.06
0.0001	0.34
0.0001	0.07
0.0258	0.00
0.0243	0.02
0.0070	0.63
0.0228	0.00
0.0000	2.27
0.0246	0.02
0.0002	0.05
0.0010	0.00
0.0028	0.01
0.0028	0.01
0.0129	0.42
0.0000	0.16

0.2175	0.01
0.0109	0.12
0.0088	0.00
0.0001	0.02
0.0197	0.00
0.0001	0.22
0.0112	0.17
0.0056	0.07
0.0028	0.21
0.0090	0.01
0.1812	0.03
0.2974	0.04
0.0000	0.00
0.0069	0.01
0.1632	0.24
0.0437	0.02
0.0100	0.14
0.0022	0.12
0.0295	0.28
0.0011	0.12
0.0088	0.05
0.0365	0.20
0.2700	0.01
0.0569	0.02
0.0193	0.85
0.0177	0.01
0.0001	0.00
0.0000	0.00
0.0099	0.17
0.0018	0.00
0.0231	0.24
0.0010	0.72
0.0096	0.00
0.1760	0.01
0.0001	0.17
0.0000	1.46
0.0065	0.01
0.0031	1.54
0.0063	0.00
0.0003	0.04
0.0062	0.00
0.0000	0.02
0.0447	0.23
0.0000	0.00
0.0033	0.03
0.0582	0.05
0.0000	0.00
0.1946	0.11
0.0000	0.00
0.0026	0.33
0.1220	0.00
0.0000	0.09
0.0659	0.15
0.1567	0.06

0.0000	0.10
0.0786	0.01
0.1031	0.00
0.0000	0.43
0.0001	0.05
0.0002	0.03
0.0094	0.04
0.0329	0.04
0.0000	0.17
0.0824	0.03
0.0018	0.09
0.1267	0.00
0.0000	0.05
0.0911	0.00
0.0121	0.04
0.0000	0.00
0.0034	0.00
0.0305	0.36
0.0144	1.04
0.0000	0.00
0.0268	0.19
0.0310	0.05
0.0772	0.16
0.0074	0.09
0.0000	0.01
0.1281	0.07
0.0299	0.15
0.0000	0.01
0.0453	0.09
0.0304	0.00
0.0009	0.08
0.0121	0.29
0.0092	0.08
0.0397	0.00
0.0006	0.31
0.0004	0.16
0.0011	0.00
0.0003	0.57
0.0230	0.08
1.6390	0.05
0.0025	0.38
0.2150	0.03
0.0102	0.13
0.2376	0.01
0.0193	0.00
0.0001	0.00
0.0000	0.62
0.0000	0.00
0.0028	0.08
0.0072	0.01
0.0021	0.11
0.0000	0.15
0.0627	0.01
0.0000	0.03

0.0001	0.18
0.0156	0.00
0.0048	0.13
0.0020	0.30
0.0410	0.03
0.0017	0.37
0.0000	0.62
0.0184	0.02
0.0000	0.00
0.1259	0.01
0.0054	0.00
0.0511	0.04
0.0142	1.27
0.0000	0.00
0.0470	0.00
0.0015	0.12
0.0001	0.02
0.0005	0.01
0.0155	0.02
0.0772	0.30
0.0000	0.00
0.0036	0.48
0.0886	0.02
0.0197	0.03
0.0579	0.01
0.0000	0.00
0.0175	0.01
0.9167	0.06
0.0425	0.01
0.0000	0.00
0.0000	0.35
0.0882	0.01
0.0000	0.05
0.0000	0.07
0.0312	0.16
0.0012	0.11
0.0000	0.06
0.0003	0.11
0.0529	0.19
0.1216	0.12
0.0743	0.01
0.0387	0.05

13.202 0.154 %

True areadiff %

14.81718

15.000

0.023

15.023 0.154 %

THE SCALE IS ONLY 1KM!!!

onention inceases.

154 may be 4 times under sc 0.616 %

Total O ₂ /yr Gt
57.6
74.304
131.904

%

44
56
100

is reasonable; the tortuosity data are for soil only which is about 12 Gha or 80%
, tortuosity and r% difference x inc

(C) mean (D) mean mm (n=5) %
94.0 108.2

23.9 49.7
28.3 59.0

27.0	52.8	252	3.5
31.9	62.6	317	4.2

	soil	sea	tot
a ocean =	57.7	36	93.7
could be increased to 100 Gha.			
for soil	61.824	67.888	Doesnt work!

$$72:36 = 2:1$$

)

need to add 3 Gha to total for land area.

; however, aquatic productivity and biomass based on phytoplankton is often measured in terms of fish, birds, seals, all semi-terrestrial plus some plants and invertebrates.

3.9 times for microbes.

luction.jpg

'wiki/Primary_production

th-feb/.

NOAA data is based ([http://onlinelibrary.wiley.com/doi/10.1890/1051-0761\(2000\)0](http://onlinelibrary.wiley.com/doi/10.1890/1051-0761(2000)0)

Land	ocean	Total	% Land	% diff land
15	36	51	29.4	0.0
30	36	66	45.5	50.0
60	36	96	62.5	75.0
64	36	100	64.0	76.6

Land	ocean	Total	% Land	% diff	leRoughly
15	36	51	29.4	0.0	Flat
16.5	36	52.5	31.4	9.1	Macro 10%
33	36	69	47.8	54.5	Meso 100%
64	36	100	64.0	76.6	Micro 90%

4,690

4,765 Gt SOC or about double!!!

:Allowed=y

	0 plus 1	cos
-2.96998	-1.96998	-1.22152
0	1	1.698093
-0.5403	0.459698	2.816587
0	1	1.698093
0	1	1.698093
0	1	1.698093
0.414214	1.414214	0.490109
0	1	1.698093
0.414214	1.414214	0.490109
0	1	1.698093
1.236068	2.236068	-1.94
0	1	1.698093
0.414214	1.414214	0.490109
0	1	1.698093
2.162278	3.162278	-3.14218
0	1	1.698093
0.414214	1.414214	0.490109
0	1	1.698093
0	1	1.698093

3.142857

0 1 1.698093
0 1 1.698093
0 1 1.698093
1.236068 2.236068 -1.94
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1.236068 2.236068 -1.94
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1.236068 2.236068 -1.94
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1.236068 2.236068 -1.94
0 1 1.698093
3.123106 4.123106 -1.74669
0 1 1.698093
3.123106 4.123106 -1.74669
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0.414214 1.414214 0.490109
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1.236068 2.236068 -1.94
0 1 1.698093
0.414214 1.414214 0.490109
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0 1 1.698093
3.123106 4.123106 -1.74669
0 1 1.698093
0 1 1.698093
0 1 1.698093
1.236068 2.236068 -1.94
0 1 1.698093
1.236068 2.236068 -1.94
0 1 1.698093
1.236068 2.236068 -1.94

0	1	1.698093
0	1	1.698093
0	1	1.698093
0.414214	1.414214	0.490109
0	1	1.698093
3.123106	4.123106	-1.74669
0	1	1.698093
0.414214	1.414214	0.490109
0	1	1.698093
0	1	1.698093
0	1	1.698093
0	1	1.698093
0	1	1.698093
1.236068	2.236068	-1.94
0	1	1.698093
1.236068	2.236068	-1.94

Total length = hypoteneuse

30.95437	126.0411
----------	----------

Total base = base

89

Since $a^2 + b^2 = c^2$, then $b^2 = c^2 - a^2$

$c^2 - a^2$	
c2	15886.37
a2	7921
c2-a2	7965.37
sq rt =	89.24892
a + b =	178.2489
T index=	2.002797

q	rule	lacont	africont	asiacont	eurcont	ocecont	nortcont	soutlegor	gbilegor	fra
		0	0	0	0	1	0	0	1	
-1.687		0	1	0	0	0	0	0	1	
-1.567		1	0	0	0	0	0	0	1	
		0	0	0	0	1	0			
-0.82		0	0	1	0	0	0	0	0	
1.515		0	0	1	0	0	0	0	1	
		0	0	0	0	1	0	0	1	
0.913		0	1	0	0	0	0	1	0	
0.033		0	0	0	0	0	1	0	1	
-0.453		0	1	0	0	0	0	0	0	
		0	0	0	1	0	0	1	0	
0.99		0	0	0	0	1	0	1	0	
1.773		0	0	0	1	0	0	1	0	
1.853		0	0	1	0	0	0	0	0	
-1.007		0	1	0	0	0	0	0	0	
-1.25		1	0	0	0	0	0	0	1	
1.413		0	0	1	0	0	0	0	1	
-0.23		1	0	0	0	0	0	0	1	
-0.52		1	0	0	0	0	0	0	1	
-0.807		0	1	0	0	0	0	1	0	
-0.16		0	0	1	0	0	0	0	0	
0.457		0	1	0	0	0	0	1	0	
1.063		0	0	0	0	1	0	1	0	
-0.44		0	0	1	0	0	0	0	0	
-0.9		0	0	1	0	0	0	0	0	
0.257		0	0	0	0	1	0	1	0	
1.255		0	0	0	0	1	0	1	0	
-0.327		0	0	0	0	0	1	0	1	
-0.257		0	0	0	0	0	1	0	1	
0.76		0	0	0	0	1	0	1	0	
0.59		0	1	0	0	0	0	1	0	
-0.277		0	1	0	0	0	0	1	0	
0.58		1	0	0	0	0	0	1	0	
-1.07		1	0	0	0	0	0	0	1	
1.757		0	0	0	0	1	0	1	0	
		0	0	0	1	0	0			
2.023		0	0	1	0	0	0	0	0	
1.183		0	0	0	0	0	1	0	1	
-0.357		0	1	0	0	0	0	0	0	
-0.86		1	0	0	0	0	0	0	1	
-1.287		1	0	0	0	0	0	0	1	
-2.05		1	0	0	0	0	0	0	1	
-1.413		1	0	0	0	0	0	0	1	
0.86		0	0	0	1	0	0	1	0	
-0.767		0	0	0	0	0	1	0	1	
-1.28		1	0	0	0	0	0	0	1	
0.71		1	0	0	0	0	0	0	1	
0.637		0	0	0	0	1	0	0	1	
-0.877		0	0	0	0	1	0	0	0	
		0	1	0	0	0	0			
1.515		0	0	0	0	1	0	1	0	

0.817	0	1	0	0	0	0	1	0
0.793	0	0	1	0	0	0	0	0
1.71	0	0	1	0	0	0	0	0
-0.577	1	0	0	0	0	0	0	1
0.495	0	0	0	0	1	0	1	0
1.837	0	0	1	0	0	0	0	0
-0.52	0	0	0	0	1	0	0	1
-1.153	1	0	0	0	0	0	0	1
-0.587	0	0	0	0	0	1	0	1
-0.03	1	0	0	0	0	0	0	1
-0.307	1	0	0	0	0	0	0	1
	1	0	0	0	0	0		
1.333	0	0	1	0	0	0	0	1
0.527	0	0	1	0	0	0	0	0
-0.823	1	0	0	0	0	0	0	1
1.897	0	0	1	0	0	0	0	0
-0.093	0	0	0	1	0	0	1	0
	0	0	0	0	0	1		
1.397	0	0	1	0	0	0	0	1
	0	0	1	0	0	0	0	1
-0.365	0	0	0	1	0	0	1	0
-0.553	1	0	0	0	0	0	0	1
1.783	0	0	1	0	0	0	1	0
-1.033	0	1	0	0	0	0	0	0
-0.297	1	0	0	0	0	0	1	0
	0	0	1	0	0	0		
-1.32	1	0	0	0	0	0	0	1
	0	0	0	0	1	0	0	1
0.1	1	0	0	0	0	0	1	0
-1.65	1	0	0	0	0	0	0	1
-1.263	1	0	0	0	0	0	0	1
0.81	0	0	1	0	0	0	0	1
0.27	0	0	0	0	1	0	1	0
	0	0	0	0	1	0	0	1
-0.897	0	0	0	0	1	0	0	1
0.99	0	0	0	0	0	1		
	0	0	0	1	0	0	1	0
-0.23	0	0	0	0	0	1	1	0
1.037	0	1	0	0	0	0	1	0
-0.837	0	0	0	0	1	0	0	1
-0.203	0	0	1	0	0	0	0	0
-1.463	0	0	0	0	1	0	0	1
0.8	0	0	1	0	0	0	0	0
-0.653	0	1	0	0	0	0	0	1
0.213	0	1	0	0	0	0	1	0
	0	1	0	0	0	0		
1.643	0	0	1	0	0	0	1	0
-0.6	0	1	0	0	0	0	0	1
-1.507	0	1	0	0	0	0	0	1
1.753	0	0	1	0	0	0	0	0
1.07	0	1	0	0	0	0	1	0
0.893	0	0	1	0	0	0	0	1
-0.377	0	0	0	0	1	0	1	0
0.39	0	1	0	0	0	0	0	1

1.477	0	1	0	0	0	0	0	0
-0.877	0	1	0	0	0	0	0	0
-1.05	1	0	0	0	0	0	1	0
-0.74	0	1	0	0	0	0	0	0
-1.013	0	1	0	0	0	0	0	0
-0.145	0	0	0	1	0	0	1	0
0.06	0	0	0	0	1	0	1	0
0.717	0	1	0	0	0	0	0	0
0.77	0	1	0	0	0	0	0	1
-1.15	0	1	0	0	0	0	0	0
-0.177	0	1	0	0	0	0	0	1
-2.113	1	0	0	0	0	0	1	0
-1.01	1	0	0	0	0	0	0	1
0.06	0	0	0	0	1	0	1	0
1.515	0	0	1	0	0	0	0	0
-0.067	0	1	0	0	0	0	1	0
-0.083	1	0	0	0	0	0	1	0
0.33	0	0	1	0	0	0	0	0
1.767	0	0	1	0	0	0	0	1
0.177	0	0	1	0	0	0	0	0
0.195	0	1	0	0	0	0	0	1
0.133	1	0	0	0	0	0	0	1
	0	0	1	0	0	0	0	1
-0.317	0	0	1	0	0	0	0	0
-0.653	1	0	0	0	0	0	0	1
0.35	0	1	0	0	0	0	1	0
-0.473	0	0	0	0	1	0	0	1
-0.405	0	0	0	1	0	0	1	0
-0.433	0	0	1	0	0	0	0	0
-0.527	1	0	0	0	0	0	0	1
1.003	0	0	1	0	0	0	0	1
-1.3	0	1	0	0	0	0	0	0
0	0	1	0	0	0	0	0	0
	0	0	0	1	0	0		
-0.85	1	0	0	0	0	0	0	1
-0.523	1	0	0	0	0	0	0	1
	0	0	0	0	1	0		
1.255	0	0	0	0	1	0	0	1
0.793	1	0	0	0	0	0	0	1
-0.53	1	0	0	0	0	0	1	0
0.517	0	1	0	0	0	0	1	0
	1	0	0	0	0	0	0	1
0.293	1	0	0	0	0	0	1	0
-0.86	0	0	0	1	0	0	0	1
-0.837	1	0	0	0	0	0	0	1
	0	0	0	1	0	0		
-1.29	1	0	0	0	0	0	1	0
-0.657	0	0	0	0	1	0	0	1
	0	0	0	1	0	0	1	0
1.79	0	0	1	0	0	0	0	1
1.95	0	0	1	0	0	0	0	0
-0.177	0	1	0	0	0	0	1	0
	0	0	0	1	0	0	1	0
1.87	0	0	0	1	0	0	1	0

0.843	0	1	0	0	0	0	0	1
-0.727	0	1	0	0	0	0	1	0
-0.143	0	0	0	0	1	0	0	1
	0	0	0	1	0	0		
-0.633	0	0	0	0	0	1	0	1
-0.237	0	1	0	0	0	0	0	1
	0	0	0	1	0	0		
-0.68	0	0	0	1	0	0	1	0
0.643	0	0	1	0	0	0	0	0
0.917	0	0	0	0	1	0	0	1
-0.977	0	1	0	0	0	0	0	0
1.167	0	0	1	0	0	0	0	1
-0.817	0	0	0	0	0	1	0	1
-0.075	0	1	0	0	0	0		
	0	0	0	1	0	0	0	1
0.433	0	1	0	0	0	0	0	1
	1	0	0	0	0	0	0	1
-0.15	0	0	1	0	0	0	0	0
-0.873	0	0	1	0	0	0	0	0
-1.4	1	0	0	0	0	0	0	1
0.343	0	1	0	0	0	0	1	0
-1.16	0	0	1	0	0	0	0	0
-1.547	1	0	0	0	0	0	1	0
-0.207	1	0	0	0	0	0	0	1
1.577	0	1	0	0	0	0	1	0
	1	0	0	0	0	0		
	0	0	1	0	0	0		
-1.195	0	0	0	1	0	0	1	0
-1.29	1	0	0	0	0	0	1	0
-0.743	0	0	0	0	1	0	0	1
	0	0	1	0	0	0	0	1
-2.203	1	0	0	0	0	0	1	0
	0	0	0	0	1	0		
-0.205	1	0	0	0	0	0	0	1
-0.323	0	0	0	0	0	1	0	1
0.263	0	0	1	0	0	0	0	0
0.973	0	0	1	0	0	0	0	0
1.813	0	0	1	0	0	0	0	0
-0.16	1	0	0	0	0	0	1	0
0.58	1	0	0	0	0	0	0	1
-0.367	0	1	0	0	0	0	0	1
	0	0	0	0	1	0		
-0.92	1	0	0	0	0	0	0	1
-0.893	1	0	0	0	0	0	0	1
0.477	0	1	0	0	0	0	1	0
-1.61	0	1	0	0	0	0	0	0
	0	0	0	1	0	0	1	0
-1.18	0	1	0	0	0	0	0	0
	0	1	0	0	0	0		
-0.38	0	0	0	1	0	0	1	0
0.42	0	0	0	0	1	0	1	0
-0.083	1	0	0	0	0	0	0	1
-0.04	0	1	0	0	0	0	0	1
1.69	0	0	0	1	0	0	1	0

0.867	0	1	0	0	0	0	0	0
-0.43	1	0	0	0	0	0	1	0
-0.7	1	0	0	0	0	0	1	0
-0.823	0	0	1	0	0	0	0	0
	0	1	0	0	0	0		
0.55	0	0	0	0	0	1	0	1
1.697	0	0	0	0	1	0	1	0
-1.023	0	1	0	0	0	0	0	0
	0	0	1	0	0	0		
0.06	0	0	0	0	1	0	1	0
-0.73	0	0	0	0	0	1	0	1
	0	0	0	0	1	0		
	0	0	0	0	1	0	1	0
-0.553	0	1	0	0	0	0	0	0
-0.455	0	0	0	1	0	0	1	0
	0	0	0	1	0	0		
0.36	0	0	0	1	0	0	1	0
-1.127	0	1	0	0	0	0	0	1
0.207	1	0	0	0	0	0	1	0
-0.587	1	0	0	0	0	0	1	0
-0.813	1	0	0	0	0	0	1	0

q_rule_lacont_africont_asiacont_eurcont_ocecont_nortcont_soutlegor_gbilegor_fra

matic data compiled by the Climate Research Unit of the University of East Anglia, Fischer, van Velthu

red in $\mu\text{g}/\text{cm}^2$ and picometre scales.

10%5b0423:TVDOS0%5d2. 0. C0;2/full)

0	0	0	0	1	0	0	0	0
1	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0
0	0	0	0	1	0	0	0	0
0	0	1	0	0	0	0	0	0
0	0	0	1	0	0	0	0	0
0	0	0	0	0	1	0	0	1
0	0	0	1	0	0	0	0	0
0	0	0	0	1	0	0	0	1
0	0	0	0	1	0	0	0	0
			0	0	0	0	0	1
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0
			0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0
			0	0	0	0	0	0
0	0	0	0	0	1	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	1	0	0
0	0	0	1	0	0	0	0	0
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0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0	0
			0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	1	0	0	0	0	0
1	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0
1	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	0
0	0	0	0	1	0	0	0	0
			0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	1	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	1	0	0	0	0

0	1	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0
1	0	0	0	0	0	0	0	0
1	0	0	0	0	1	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	1	0	0	0	0
0	1	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0
1	0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	1
0	0	0	0	1	0	0	0	0
0	1	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	1	0	0	0	0
1	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	0	0
0	0	0	0	0	1	0	0	1
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	1	0	0	0	0	0
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0
0	0	0	0	0	0	0	0	0
1	0	0	0	1	0	0	0	0
1	0	0	0	0	0	0	0	0
			0	0	0	0	0	0
0	0	0	0	0	0	1	0	0
0	0	0	0	0	1	0	0	0
			0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	1	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	1	0	0	0	0

0	0	0	0	1	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	1	0	0	0	0	0
			0	0	0	0	0	0
0	0	0	1	0	0	0	0	0
0	0	0	1	0	0	0	0	0
			0	0	0	0	0	0
0	0	0	0	1	0	0	0	0
1	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0	0
1	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0	0
			0	0	0	0	0	0
0	0	0	0	0	1	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	0
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	0	1	0	0	0
0	0	0	0	1	0	0	0	0
			0	0	0	0	0	0
			0	0	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	1	0	0	0	0	0
0	0	0	0	0	0	0	1	0
			0	0	0	0	0	0
0	0	0	0	0	0	1	0	0
0	0	0	0	0	0	0	1	0
1	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	0	1	0	0	0
			0	0	0	0	0	0
0	0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0	0
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
			0	0	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	0	1	0	0	1
0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0

0	1	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	1	0	0	0	0
1	0	0	0	0	0	0	0	0
			0	0	0	0	0	0
0	0	0	1	0	0	0	0	0
0	0	0	0	1	0	0	0	0
1	0	0	0	0	0	0	0	0
			0	0	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	1	0	0	0	0	0
			0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
1	0	0	0	0	1	0	0	0
0	0	0	0	1	0	0	0	0
			0	0	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	1	0	0	0	0

legor_soclegor_detlegor_scaecolony_escolony_gtcolony_frcolony_prcolony_oafrica_re

izen, Shah, and Nachtergaele (2002) identify whether each cell on a 5-minute grid covering almost the

africa_re	africa_re	africa_re	africa_re	slave_exp	dist_slav	dist_slav	dist_slav	dist_slav
0	0	0	0	0				
0	0	0	0	0				
0	0	0	1	3.61E+06	5.669	6.981	4.926	3.872
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	1	0	86.997	10.626	2.57	3.719	2.215
0	0	0	0	0				
0	1	0	0	4.57E+05	5.121	9.234	2.835	3.902
0	1	0	0	1.67E+05	4.775	9.299	2.764	4.239
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
1	0	0	0	0	5.686	5.765	5.857	4.3
0	0	0	1	2009.941	5.642	8.772	2.84	2.293
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	1	0	0	52645.95	4.186	9.457	3.353	4.794
0	0	0	1	66718.81	5.642	8.772	3.003	3.051
0	0	0	1	7.67E+05	5.712	7.643	3.748	2.687
0	0	0	1	94662.92	5.527	7.924	3.697	3.227
0	0	0	0	0				
0	0	0	0	0				
0	0	1	0	0	10.131	1.754	4.846	2.61
0	1	0	0	0	3.647	11.6	3.482	6.465
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				

[illegible]

[illegible]

[illegible]

0	0	0	0	0				
0	0	1	0	5.35E+05	10.595	2.558	4.056	2.187
0	0	1	0	4553.603	10.996	2.699	3.204	1.65
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
0	0	0	0	0				
1	0	0	0	2030.663	6.766	3.457	6.584	4.895
1	0	0	0	27957.1	9.027	2.389	4.849	3.253
1	0	0	0	1088.177	9.027	2.389	5.454	3.696
africa_reafrica_reafrica_reafrica_reslave_expdist_slavdist_slavdist_slavdist_slav								

entire land area of the Earth is subject to various constraints for growing rainfed crops. Based on plat

pop_1400 european_descent

614	
1870829	0
1223208	2
200000	100
1802	
19200	0
276632	89.889
105743	0.5
747	
200000	89.954
1250000	98.4
226250	4
239693	0
773466	98
348867	0
692976	0
9103705	0
894427	98.85
31897	0
1276	
366341	100
487364	100
5326	39.91
601	
829897	26.732
931150	74.43
3403	
2328	
36082	0
80312	1.5
387580	0.6
174110	85.33
600000	98.5
553265	59.19
80943756	0
435857	0
1317285	0
3593277	0.46
238219	0
902880	45.6
0	0
0	41.4
74647	60.39
95479	63

150000	1
1801067	100
6500000	97.6
34822	
824	
600000	99.2
39145	52
1588836	0
553265	31.976
4182558	0
101512	1.9
2439	
5500000	99.24
69282	100
1639589	0
100000	100
139322	2.2
11000000	93.4
10000	
15427	
138320	1
3306643	94.6
275547	3
912300	0
455699	0
3387	
51104	0.5
87833	3
66516	5.75
1118034	100
1237	
10000	
243109	21.965
	1.3
42611	0
114924	46
530014	99.55
51954	2.5
1000000	99.3
6987225	0
77226807	0
193357	99.885
3741657	0
1000000	0
60000	
229955	30.698
7000000	99.8
22626	8
86370	1

12500000	0
1253389	41.9
1322790	0
325361	15
1383162	0
10513	
743	
2308243	0
42006	0
348220	0
313584	0.5
143361	0
500000	0
1335	
956352	0
26096	0
161557	100
26534	99.2
122643	100
13636	
1586397	8
147311	99.1
544859	0.6
4514402	30
6267	
169275	96.31
1063541	0
10000	99.5
3482202	0
578516	1
786003	0
221211	0
218	
3580	
0	16
348220	0
296322	0
0	
93798	10.85
31251	
705385	0
5909180	0
100069	51
600000	95.95
400000	100
1852093	0
15000	80.6

200000	0
7669487	0
66462	45.2
1888175	28.043
362390	0
866855	0
2750000	100
35772	66.3
1191757	0
900000	98.27
174110	52.85
183675	
24449	
6897	0.9
0	
1250000	99.43
6481410	99.5
211005	0
2000000	0
981591	98.68
3776350	0
442565	1.3
49570	0.5
0	
43289	
338261	0
150732	50
661618	0
0	
698933	99.61
202779	100
800000	99.3
9707	2.8
0	
1306601	0
776187	0
231251	0
1741101	0
286375	3.9
226444	5.5
36325	0
19021	
10258	7.1
836512	0
6438306	10

174110	0
1496403	0
1322790	0
2347003	100
	91.89
783496	76.02
1180650	7.5
1081	
377635	54.5
120	
432	
1665106	0
22994	
33072	
2250000	0
486527	18
348220	1
174110	1

pop_1400 european_descent

es 20 (soil moisture storage capacity constraints), 21 (soil depth constraints), 22 (soil fertility constrain



1ts), 23 (soil drainage constraints), 24 (soil texture constraints), and 25 (soil chemical constraints) in F



Fischer *et al.* (2002) and the country boundaries described above, we calculate the percentage of the la



and surface area of each country that has fertile soil (defined as soil that is not subject to severe constr



units for growing rainfed crops in terms of either soil fertility, depth, chemical and drainage properties,



, or moisture storage capacity). Cape Verde, French Polynesia, Mauritius and Seychelles are not covere



d by the Fischer *et al.* (2002) data, so for these countries we use instead the percentage of their land su



urface area that is classified by the Food and Agriculture Organization (2008) as arable land or permar



rent crop land.