

Forests, Grasslands, and Drylands

Sources: Food and Agriculture Organization of the United Nations (FAO), Forest Stewardship Council (FSC), United Nations Environment Program-Global Resource Information Database, Global Land Cover Characteristics Database (GLCCD).

EarthTrends Data Tables:
Forests,
Grasslands, and
Drylands



	Forest Area												Drylands (a)		Grassland Area		
	Total Forest		Natural Forest				Plantations				Certified Forest Area		Average Area (1000 ha)	Percent of Total Land Area	Shrublands (1992-93)	Savannas (1000 km ²) (1992-93)	Herbaceous Grasslands (1992-93)
	Area (1000 ha)	Annual % Change	Area (1000 ha)	Annual % Change	Area (1000 ha)	Annual % Change	Area (1000 ha)	Annual % Change	FSC (b) Certified (1000 ha)	All Certified (1000 ha)							
	2000	1990-2000	2000	1990-2000	2000	1990-2000	2000	1990-2000	2002	1998-2002	2000	1950-1981	1992-93	1992-93	1992-93		
WORLD	3,869,455	(0.2)	3,682,722	..	186,733	..	27,227	30.9	80,717	5,060	..	23,343	16,013	10,542			
ASIA (EXCL. MIDDLE EAST)	504,180	(0.1)	375,824	(0.1)	110,953	5.3	245	29.9	..	1,078	..	4,003	1,061	4,054			
Armenia	351	1.3	338	..	13	..	0	..	0	3	98	1	4	2			
Azerbaijan	1,094	1.3	1,074	..	20	..	0	..	0	7	84	9	2	4			
Bangladesh	1,334	1.3	709	(0.8)	625	4.4	0	..	0	0	0	3	0	1			
Bhutan	3,016	..	2,995	(0.0)	21	4.7	0	..	0	0	0	3	0	4			
Cambodia	9,335	(0.6)	9,245	(0.6)	90	3.3	0	..	0	0	0	4	3	0			
China	163,480	1.2	118,397	0.6	45,083	3.0	0	..	0	318	34	1,829	415	1,815			
Georgia	2,988	..	2,788	..	200	..	0	..	0	2	34	5	2	1			
India	64,113	0.1	31,535	(3.8)	32,578	6.2	0	..	0	185	60	285	246	26			
Indonesia	104,986	(1.2)	95,116	(1.5)	9,871	3.2	152	..	72	5	3	1	111	48			
Japan	24,081	..	13,399	..	10,682	..	6	..	3	0	0	18	43	2			
Kazakhstan	12,148	2.2	12,143	..	5	..	0	..	0	269	99	479	8	1,180			
Korea, Dem People's Rep	8,210	..	..	..	..	..	0	..	0	0	0	0	45	1
Korea, Rep	6,248	(0.1)	..	..	..	..	0	..	0	0	0	1	37	0
Kyrgyzstan	1,003	2.6	946	..	57	..	0	..	0	11	55	53	4	53			
Lao People's Dem Rep	12,561	(0.4)	12,507	(0.5)	54	..	0	..	0	0	0	2	6	0			
Malaysia	19,292	(1.2)	17,543	(1.4)	1,750	2.2	68	4.1	55	0	0	3	0	1			
Mongolia	10,645	(0.5)	..	..	..	..	0	..	0	101	65	450	45	806
Myanmar	34,419	(1.4)	33,598	(1.5)	821	5.9	0	..	0	..	..	8	43	2	
Nepal	3,900	(1.8)	3,767	(2.0)	133	5.1	0	..	0	1	9	25	4	11			
Pakistan	2,361	(1.5)	1,381	(4.1)	980	3.7	0	..	0	73	83	300	1	19			
Philippines	5,789	(1.4)	5,036	(2.1)	753	5.1	15	..	15	0	0	0	0	0			
Singapore	2	..	..	..	..	..	0	..	0	0	0	0	0	0
Sri Lanka	1,940	(1.6)	1,625	(2.2)	316	1.5	5	..	13	2	24	1	0	0			
Tajikistan	400	0.5	390	..	10	..	0	..	0	6	40	50	1	18			
Thailand	14,762	(0.7)	9,842	(2.9)	4,920	6.1	0	..	0	3	7	12	33	0			
Turkmenistan	3,755	..	3,743	..	12	..	0	..	0	47	100	259	0	35			
Uzbekistan	1,969	0.2	1,669	..	300	..	0	..	0	44	99	187	0	22			
Viet Nam	9,819	0.5	8,108	(0.3)	1,711	6.3	0	..	0	0	0	15	7	2			
EUROPE (c)	1,035,344	0.0	1,007,236	0.1	32,015	0.0	16,255	31.6	46,703	488	..	3,650	686	715			
Albania	991	(0.8)	889	..	102	..	0	..	0	0	0	0	1	0			
Austria	3,886	0.2	..	..	..	..	0	..	550	0	0	3	0	1
Belarus	9,402	3.2	9,207	..	195	..	0	..	0	..	..	0	0	0	
Belgium (d)	728	(0.2)	..	..	..	..	4	..	..	0	0	0	0	0
Bosnia and Herzegovina	2,273	..	2,216	..	57	..	0	..	0	0	0	0	0	0			
Bulgaria	3,690	0.6	2,722	..	969	..	0	..	0	6	53	0	0	0			
Croatia	1,783	0.1	1,736	..	47	..	373	..	167	0	0	0	1	0			
Czech Rep	2,632	..	..	..	..	..	10	..	10	1	13	0	0	0
Denmark	455	0.2	114	..	341	..	0	..	0	0	0	0	0	0			
Estonia	2,060	0.6	1,755	..	305	..	0	..	0	0	0	0	0	0			
Finland	21,935	..	..	..	..	..	0	..	21,900	0	0	15	0	3
France	15,341	0.4	14,380	..	961	..	15	..	1	0	0	6	5	2			
Germany	10,740	..	..	..	..	..	418	55.2	3,242	2	5	0	0	1
Greece	3,599	0.9	3,479	..	120	..	0	..	0	6	45	15	8	1			
Hungary	1,840	0.4	1,704	..	136	..	0	..	0	4	46	0	0	0			
Iceland	31	2.2	19	..	12	..	0	..	0	..	..	23	0	2	
Ireland	659	3.0	69	..	590	..	0	..	0	0	0	0	0	0			
Italy	10,003	0.3	9,870	..	133	..	11	0.0	11	6	21	47	2	3			
Latvia	2,923	0.4	2,780	..	143	..	0	..	0	0	0	0	0	0			
Lithuania	1,994	0.2	1,710	..	284	..	0	..	0	0	0	0	0	0			
Macedonia, FYR	906	..	876	..	30	..	0	..	0	1	37	0	0	0			
Moldova, Rep	325	0.2	324	..	1	..	0	..	0	3	100	0	0	0			
Netherlands	375	0.3	275	..	100	..	103	..	69	0	0	0	0	0			
Norway	8,868	0.4	8,568	..	300	..	0	..	5,600	0	0	76	1	17			
Poland	9,047	0.2	9,008	..	39	..	3,592	16.1	2,743	6	19	0	0	0			
Portugal	3,666	1.7	2,832	..	834	..	0	..	0	3	29	18	5	0			
Romania	6,448	0.2	6,357	..	91	..	0	..	0	9	38	0	0	2			
Russian Federation	851,392	..	834,052	..	17,340	..	216	..	33	367	22	3,323	638	667			
Serbia and Montenegro	2,887	(0.1)	2,848	..	39	..	0	..	0	..	..	0	0	0	
Slovakia	2,177	0.9	2,162	..	15	..	0	..	0	0	0	0	0	0			
Slovenia	1,107	0.2	1,106	..	1	..	0	..	0	0	0	0	0	0			
Spain	14,370	0.6	12,466	..	1,904	..	0	..	0	35	69	85	23	2			
Sweden	27,134	..	26,565	..	569	..	10,130	35.8	11,167	0	0	34	0	4			
Switzerland	1,199	0.4	1,195	..	4	..	84	73.6	49	0	0	5	0	2			
Ukraine	9,584	0.3	5,159	..	4,425	..	238	..	203	39	65	0	0	6			
United Kingdom	2,794	0.6	866	1.5	1,928	0.3	1,061	93.4	958	0	0	0	0	0			
MIDDLE EAST & N. AFRICA	29,104	0.2	20,448	..	6,533	..	0	..	..	553	..	2,476	76	596	
Afghanistan	1,351	..	..	..	..	..	0	..	0	60	94	310	0	161
Algeria	2,145	1.3	1,427	(0.2)	718	5.3	0	..	0	49	21	192	2	10			
Egypt	72	3.3	0	0.0	72	3.3	0	..	0	8	8	6	3	4			
Iran, Islamic Rep	7,299	..	5,015	(1.2)	2,284	3.2	0	..	0	147	90	567	10	225			
Iraq	799	..	789	(0.0)	10	2.7	0	..	0	44	100	166	4	4			
Israel	132	4.9	41	..	91	..	0	..	0	1	69	7	0	0			
Jordan	86	..	41	(1.5)	45	1.6	0	..	0	6	72	46	0	0			
Kuwait	5	3.5	0	..	5	3.4	0	..	0	2	92	4	0	0			
Lebanon	36	(0.4)	34	..	2	..	0	..	0	1	59	2	0	2			
Libyan Arab Jamahiriya	358	1.4	190	0.0	168	3.3	0	..	0	37	23	34	0	2			
Morocco	3,025	..	2,491	(0.4)	534	2.0	0	..	0	37	92	155	1	15			
Oman	1	5.3	0	(17.3)	1	5.1	0	..	0	4	14	43	0	0			
Saudi Arabia	1,504	..	1,500	0.0	4	4.8	0	..	0	46	24	532	0	0			
Syrian Arab Rep	461	..	232	(6.9)	229	..	0	..	0	18	98	99	0	2			
Tunisia	510	0.2	308	(3.5)	202	11.7	0	..	0	15	94	38	1	9			
Turkey	10,225	0.2	8,371	..	1,854	..	0	..	0	60	77	46	55	160			
United Arab Emirates	321	2.8	7	..	314	0.0	0	..	0	0	0	6	0	0			
Yemen	449	(1.9)	..	..	..	..	0	..	0	13	30	216	0	2



	Forest Area						Certified Forest Area			Drylands (a)		Grassland Area		
	Total Forest		Natural Forest		Plantations		FSC (b) Certified		All Certi-	Average Area (1000 ha) 1950-1981	Percent of Total Land Area	Shrub-lands 1992-93	Savan- nas (1000 km ²) 1992-93	Herbaceous Grasslands 1992-93
	Area (1000 ha) 2000	Annual % Change 1990-2000	Area (1000 ha) 2000	Annual % Change 1990-2000	Area (1000 ha) 2000	Annual % Change 1998-2002	Area (1000 ha) 2002	Annual % Change 1990-2000	Schemes (1000 ha) 2000					
SUB-SAHARAN AFRICA	486,571	(0.9)	478,576	..	6,210	..	1,070	30.5	974	1,121	..	2,513	7,749	1,830
Angola	69,756	(0.2)	69,615	(0.2)	141	0.1	0	..	0	24	19	43	537	35
Benin	2,650	(2.3)	2,538	(2.5)	112	1.0	0	..	0	10	88	0	109	0
Botswana	12,427	(0.9)	12,426	(0.9)	1	4.1	0	..	0	58	100	127	97	226
Burkina Faso	7,089	(0.2)	7,023	(0.3)	67	11.3	0	..	0	27	100	2	199	31
Burundi	94	(9.0)	21	(21.9)	73	3.4	0	..	0	0	0	1	4	0
Cameroon	23,858	(0.9)	23,778	(0.9)	80	0.3	0	..	0	6	13	0	202	2
Central African Rep	22,907	(0.1)	22,903	..	4	..	0	..	0	12	20	0	473	0
Chad	12,692	(0.6)	12,678	(0.6)	14	2.5	0	..	0	87	68	68	445	120
Congo	22,060	(0.1)	21,977	(0.1)	83	11.5	0	..	0	0	0	0	91	2
Congo, Dem Rep	135,207	(0.4)	135,110	(0.4)	97	0.1	0	..	0	1	0	7	493	4
Côte d'Ivoire	7,117	(3.1)	6,933	(3.3)	184	2.9	0	..	0	..	..	0	201	0
Equatorial Guinea	1,752	(0.6)	..	..	..	..	0	..	0	0	0	0	3	0
Eritrea	1,585	(0.3)	1,563	(0.5)	22	..	0	..	0	10	83	25	29	15
Ethiopia	4,593	(0.8)	4,377	(0.9)	216	1.0	0	..	0	65	58	410	347	57
Gabon	21,826	..	21,790	..	36	..	0	..	0	0	0	1	48	2
Gambia	481	1.0	479	..	2	..	0	..	0	1	97	0	5	0
Ghana	6,335	(1.7)	6,259	(1.8)	76	2.5	0	..	0	16	66	0	154	0
Guinea	6,929	(0.5)	6,904	(0.5)	25	7.4	0	..	0	3	14	0	205	0
Guinea-Bissau	2,187	(0.9)	2,186	..	2	..	0	..	0	0	6	1	24	0
Kenya	17,096	(0.5)	16,865	(0.5)	232	0.9	0	..	0	40	68	221	152	19
Lesotho	14	..	0	..	14	..	0	..	0	0	0	0	13	9
Liberia	3,481	(2.0)	3,363	(2.0)	119	0.1	0	..	0	0	0	0	24	1
Madagascar	11,727	(0.9)	11,378	(1.0)	350	1.7	0	..	0	14	23	1	333	43
Malawi	2,562	(2.4)	2,450	(2.6)	112	1.5	0	..	0	0	0	1	43	0
Mali	13,186	(0.7)	13,172	(0.7)	15	6.6	0	..	0	101	80	138	304	126
Mauritania	317	(2.7)	293	(3.5)	25	..	0	..	0	47	46	56	10	71
Mozambique	30,601	(0.2)	30,551	(0.2)	50	1.5	0	..	0	30	38	4	283	3
Namibia	8,040	(0.9)	8,040	..	0	..	61	..	54	75	91	356	86	168
Niger	1,328	(3.7)	1,256	(4.1)	73	4.2	0	..	0	74	62	149	42	253
Nigeria	13,517	(2.6)	12,824	(2.8)	693	4.0	0	..	0	53	58	1	662	17
Rwanda	307	(3.9)	46	(15.2)	261	0.6	0	..	0	0	0	4	4	0
Senegal	6,205	(0.7)	5,942	(0.9)	263	5.3	0	..	0	19	94	17	97	31
Sierra Leone	1,055	(2.9)	1,049	..	6	..	0	..	0	0	0	0	27	0
Somalia	7,515	(1.0)	7,512	..	3	..	0	..	0	51	80	504	50	5
South Africa	8,917	(0.1)	7,363	(0.3)	1,554	0.8	898	29.2	828	81	66	240	138	290
Sudan	61,627	(1.4)	60,986	(1.5)	641	6.3	0	..	0	168	67	84	1,029	178
Tanzania, United Rep	38,811	(0.2)	38,676	..	135	..	0	..	0	..	..	26	168	65
Togo	510	(3.4)	472	(3.8)	38	1.7	0	..	0	2	34	0	50	0
Uganda	4,190	(2.0)	4,147	(2.0)	43	3.6	0	..	0	4	16	11	92	3
Zambia	31,246	(2.4)	31,171	(2.4)	75	2.9	0	..	0	12	16	3	355	9
Zimbabwe	19,040	(1.5)	18,899	(1.6)	141	1.7	111	29.9	92	26	67	3	122	41
NORTH AMERICA	470,564	0.1	209,755	0.1	16,238	0.8	5,860	27.4	30,489	547	..	4,531	415	1,334
Canada	244,571	..	..	..	..	..	1,972	76.1	4,360	157	16	2,385	8	55
United States	225,993	0.2	209,755	0.1	16,238	0.8	3,888	19.8	26,129	390	41	2,132	407	1,279
C. AMERICA & CARIBBEAN	78,737	(1.1)	76,556	(1.2)	1,295	(0.5)	1,033	31.7	427	138	..	437	348	333
Belize	1,348	(2.3)	1,345	(2.4)	3	3.6	96	0.0	96	0	0	0	0	1
Costa Rica	1,968	(0.8)	1,790	(1.4)	178	9.6	86	38.8	41	0	0	0	3	0
Cuba	2,348	1.3	1,867	0.1	482	7.6	0	..	0	1	11	0	19	8
Dominican Rep	1,376	..	1,346	(0.3)	30	..	0	..	0	0	5	0	6	6
El Salvador	121	(4.6)	107	(6.1)	14	..	0	..	0	0	0	0	0	0
Guatemala	2,850	(1.7)	2,717	(2.2)	133	..	312	64.8	100	0	0	0	3	6
Haiti	88	(5.7)	68	(7.6)	20	5.1	0	..	0	0	3	0	3	5
Honduras	5,383	(1.0)	5,335	(1.1)	48	..	14	11.1	20	0	0	0	5	2
Jamaica	325	(1.5)	317	..	9	..	0	..	0	0	31	0	1	1
Mexico	55,205	(1.1)	54,938	(1.1)	267	..	516	36.6	169	136	69	436	293	301
Nicaragua	3,278	(3.0)	3,232	(3.2)	46	14.3	0	..	0	0	0	0	4	0
Panama	2,876	(1.6)	2,836	(1.8)	40	17.3	8	87.2	1	0	0	0	6	1
Trinidad and Tobago	259	(0.8)	244	..	15	..	0	..	0	0	4	0	0	0
SOUTH AMERICA (c)	885,618	(0.4)	875,163	(0.5)	10,455	6.7	2,110	30.3	1,551	444	..	1,674	3,168	1,101
Argentina	34,648	(0.8)	33,722	(1.1)	926	..	0	..	0	147	53	746	324	541
Bolivia	53,068	(0.3)	53,022	(0.3)	46	3.7	927	35.7	885	..	..	219	279	66
Brazil	543,905	(0.4)	538,924	(0.4)	4,982	3.2	1,183	26.9	666	131	15	251	1,751	116
Chile	15,536	(0.1)	13,519	(0.8)	2,017	5.5	0	..	0	16	21	105	23	87
Colombia	49,601	(0.4)	49,460	(0.4)	141	6.2	0	..	0	20	17	47	182	45
Ecuador	10,557	(1.2)	10,390	(1.3)	167	2.4	0	..	0	16	63	43	29	17
Guyana	16,879	(0.3)	16,867	..	12	..	0	..	0	0	0	2	13	2
Paraguay	23,372	(0.5)	23,345	(0.5)	27	11.3	0	..	0	22	55	0	247	11
Peru	65,215	(0.4)	64,575	(0.5)	640	15.2	0	..	0	48	37	240	44	134
Suriname	14,113	..	14,100	0.0	13	0.8	0	..	0	0	0	0	2	0
Uruguay	1,292	5.0	670	0.0	622	16.3	0	..	0	0	0	0	4	66
Venezuela	49,506	(0.4)	48,643	(0.5)	863	8.7	0	..	0	45	49	21	267	18
OCEANIA	201,271	(0.2)	194,718	(0.2)	2,848	0.6	654	91.9	410	661	..	4,023	2,505	567
Australia	154,539	(0.2)	153,496	..	1,043	..	0	..	0	661	86	4,007	2,397	411
Fiji	815	(0.2)	718	(1.4)	97	29.3	..	..	0	0	0	0	0	0
New Zealand	7,946	0.5	6,404	..	1,542	..	610	111.6	363	0	0	0	44	122
Papua New Guinea	30,601	(0.4)	30,511	(0.4)	90	5.9	4	0.0	4	0	1	13	56	32
Solomon Islands	2,536	(0.2)	2,486	(0.2)	50	2.2	39	..	43	0	0	2	5	0
DEVELOPED	1,725,231	0.1	1,377,765	..	63,695	..	23,630	30.9	78,386	2,168	..	13,483	3,745	4,190
DEVELOPING	1,962,481	(0.5)	1,817,491	(0.2)	122,764	4.4	3,597	31.1	2,326	2,862	..	9,825	12,263	6,341

a. Drylands area is determined using aridity zones; arid, semi-arid and dry sub-humid zones are included. Hyper-arid (bare sand deserts) are excluded. b. Forest Stewardship Council. c. Regional totals are from the original source and are not calculated by WRI. d. Belgium includes Luxembourg.

VARIABLE DEFINITIONS AND METHODOLOGY

FAO Total Forest Area includes both natural forests and plantations, which are determined by the presence of trees and the absence of other predominant land uses, such as agroforestry. Data are presented in thousands of hectares. **Total Forests** are areas where tree crowns cover over 10 percent of the ground, and cover areas greater than 0.5 hectares. Tree height at maturity should exceed 5 meters. **Natural Forests** are forests composed primarily of indigenous tree species. **Plantations** are forest stands established artificially by afforestation and reforestation, and can include either non native or indigenous (native) trees. Reforestation does not include regeneration of old tree crops.

The Food and Agriculture Organization (FAO) published *Global Forest Resources Assessment 2000* (FRA 2000) in response to international interest in a global forest assessment with a single definition of forest cover. FAO compiles country information to create one internationally comparable database; national data gathering methodologies can be found at <http://www.fao.org/forestry/fo/fra/index.jsp>.

Forest statistics are based primarily on forest inventory information provided by national governments. FAO harmonized these national assessments with the 10-percent forest definition mentioned above. In tropical regions, national inventories are supplemented by a remote sensing survey. FAO analyzed high resolution Landsat satellite data from a number of sample sites covering a total of 10 percent of the tropical forest zone. Where only limited or outdated inventory data were available, FAO used linear projections and expert opinion to fill in data gaps. If no forest statistics existed for 1990 and 2000, FAO projected forward or backward in time to estimate forest area in the two reference years.

World Resources Institute (WRI) staff used data from the FRA 2000 to estimate natural forest and plantation area for 1990 and to calculate the rate of change from 1990 to 2000. FAO, assuming a fixed rate of tree planting for each country, compiled country data from various years and extrapolated forward to the year 2000. WRI reversed this approach and extrapolated backward from 2000 to 1990 by subtracting tree planting rates. Plantations area was then subtracted from total forest area to calculate natural forest area. Countries where this methodology resulted in a negative plantations area in 1990 were assigned a value of .. (no data available). Rates of change for the decade were calculated using an exponential growth rate equation.

Certified Forest Area, expressed in thousands of hectares, includes forests certified by major forest certification schemes. **Forest Stewardship Council (FSC) Certified Forests** include all natural forests, plantations, and mixed and semi-natural forests certified as managed in accordance with the ten FSC principles and criteria. The FSC certifies forests as natural forests when most of the principal characteristics and key elements of the native ecosystems, such as complexity, structure, and diversity are still present. Forests are certified as plantations when they are the result of human activities and lack most of the principal characteristics and key elements of native ecosystems. According to FSC, certified plantations should decrease the pressures on natural forests; represent diverse species and age classes; preferentially choose native over exotic species; improve soil function, fertility and structure; and have a portion of their area managed for the restoration of natural forest cover. Semi-natural and mixed forest area includes mixed areas of natural forest and plantations. Full FSC certification involves two steps. First, the site is assessed for sustainability. Second, a chain of custody is traced from forest, to processor, to distributors, to the final consumer to ensure that only wood from the certified forests are being sold and delivered as FSC-certified. For a complete list of the Principles and Criteria, please refer to *Document 1.2* at <http://www.fscoax.org/principal.htm>.

Forest Area Certified by All Certification Schemes aggregates the total area of forests certified by international, regional, and national forest certification schemes, and is reported in thousands of hectares. Certifications by ISO 14000 are not included. The only, or primary, certifier in most countries with active certification programs is the Forest Stewardship Council (FSC). Other certification bodies include the American Tree Farm Program (ATFP), Canadian Standards Association (CSA), Green Tag (GT), Pan-European Forest Certification (PEFC), and the Sustainable Forestry Initiative (SFI) of the American Forest and Paper Association (AFPA). Data are compiled by FAO.

Drylands Area is the terrestrial area, in thousands of hectares, that falls within three of the world's six aridity zones—the arid, semi-arid, and dry sub-humid zones—as a percent of Earth's total terrestrial area. This definition of drylands has been adopted by the United Nations Convention to Combat Desertification

(UNCCD) to identify areas where efforts combating land degradation should be focused and where methods for attaining sustainable development should be promoted.

The world is divided into six aridity zones based on the aridity index--the ratio of mean annual precipitation (PPT) to mean annual potential evapotranspiration (PET). Drylands of concern to the CCD include those lands with an aridity index between .05 and .65 (excluding polar and sub-polar regions). Ratios of less than .05 indicate hyperarid zones, or true deserts. Ratios of 0.65 or greater identify humid zones. The areas with an aridity index between .05 and .65 encompasses the arid, semi-arid, and dry sub-humid areas. See the UNCCD's website at <http://www.unccd.int/main.php> for more information.

Climatic data from 1950 to 1981 were used to define aridity zone boundaries for the globe with a resolution of about 50 km. The amount of land within each aridity zone for individual countries was calculated by WRI.

Grasslands Area includes five categories under the International Geosphere- Biosphere Programme (IGBP) as classified by the Global Land Cover Classification Database (GLCCD). Data are reported in thousands of square kilometers. **Shrublands** is the combination of IGBP's closed and open shrublands categories; **Savannas** is IGBP's savannas and woody savannas; **Herbaceous Grasslands** is the IGBP grassland classification.

The Global Land Cover Classification team describes the method used to classify vegetation types as a "multitemporal unsupervised classification of NDVI data with post-classification refinement using multi-source earth science data." NDVI data are a measure of "greenness" derived from satellite data. The satellite data in this study were from the Advanced Very High Resolution Radiometer (AVHRR), and have a resolution of 1 X 1 km. Other data sets used were a digital elevation model to help define ecological factors that govern natural vegetation distribution, ecoregions data, and maps of soils, vegetation, and land cover. For a description of the five-step process used to arrive at the classifications, please see technical notes available at http://earthtrends.wri.org/searchable_db/variablenotes_static.cfm?varid=750&themeid=9.

FREQUENCY OF UPDATE BY DATA PROVIDERS

FAO forestry data is compiled each decade; data in this table are from the 2000 assessment. FRA 2000 uses different definitions for total forest area than FRA 1990; the data from these two volumes cannot be directly compared. **Certified Forest Area** data are updated periodically. WRI has compiled data from these periodic updates to cover a five-year time span. The most recent data are up-to-date as of June 30, 2002. Data from 1998 were captured on December 31 of that year. **Drylands** data were prepared in 1991. Raw data for **Grassland area** estimates were recorded from April 1992 to March 1993. Data were classified, refined, and released in a database version 2.0 in 2001.

DATA RELIABILITY AND CAUTIONARY NOTES:

FAO's FRA 2000 Forest Extent and Change Data: FAO acknowledges that the quality of primary data available on tropical forest resources remains very poor. The accuracy of national estimates provided to FAO is affected by two major sources of error. First, in most tropical countries, forests are not monitored comprehensively or frequently enough to map their extent accurately or to track their rate of change. In the absence of inventory data for specific dates (1990 and 2000), FAO's latest estimates of forest area and change over time are often based on projections and expert opinion and thus remain educated guesses. Just one or two satellite scenes appear to have been the prime source of new information for some countries with very poor inventory data. Second, estimates of open woodland areas are far less accurate than those of closed forest because it is difficult to monitor woodlands by remote sensing techniques, and government forestry agencies tend not to survey them as part of normal forest inventories. Differences in definitions used among countries further complicate this issue. The quality of data from developed countries is generally better than from developing countries, but problems still arise with estimates because of differences in national forestry definitions and systems of measurement, and the use of different reference periods. In Northern countries, the boundary between forest and tundra is vague, and the additional forest that should be counted under the new (globally harmonized) 10-percent crown cover threshold proved hard to quantify. Non-production forests are classified as "other wooded land" in FRA 2000, even though many of them appear to meet the FAO definition of forests. This results in significant underreporting in some countries. For a more complete discussion of some data reliability issues associated with the FRA 2000, please see: <http://www.wri.org/wri/forests/fra2000.html>.

WRI-calculated natural and plantation forest area: These data are based on the FRA 2000 and are subject to all the concerns those data raise. Moreover, the calculations are based on assumptions of linear change that are not supported by field research. WRI chose to make this calculation and present the data despite FAO's decision not to include them in the FRA 2000. We made this choice because these data represent the only available indicators of forest change based on consistent definitions. However, the data should be used as very rough approximations.

Certified Forest Area: The certification schemes are either performance-based or systems-based. Performance-based certification requires that landowners meet performance criteria set by the certification body. Systems-based schemes require that landowners manage the forest within broad system components. While there is some disagreement about which scheme best guarantees sustainable forestry, many groups feel that those using performance-based criteria carry the most weight. More information on certification is available at: <http://eesc.orst.edu/agcomwebfile/edmat/EC1518.pdf>. While the numbers reported are reliable, it is worth noting that certified forests do not represent the total area of well-managed forests. Many uncertified forests are under sound management. Increasing trends in forest certification indicate the importance that consumers attach to forest management issues rather than the total area of well-managed forests.

Drylands: The accuracy of land area totals is limited by the 50 kilometer resolution of the data set. The climate data set was derived from a limited number of field observations. Actual boundaries between aridity zones are neither abrupt nor static, making delineated borders somewhat artificial. The data should therefore, be considered useful as a general indicator of the extent of drylands within each country, rather than as an exact depiction of the climatic situation on the ground.

Alternative methods for measuring extent of drylands area include use of soil moisture and agricultural production systems, although these methods may also be subject to similar problems such as low resolution data, limited field observations, and subjectivity when delineating exact boundaries on the ground.

Grasslands area: Following publication of the GLCC database version 1, a number of scientific teams assessed its accuracy by comparing the results with higher-resolution satellite imagery. These teams found that the accuracy of the GLCC's approach was in a range from 60 to nearly 80 percent—meaning that the assessment teams' classification of a given area agreed with the GLCC's classification between 60 and 80 percent of the time. Given the relatively high level of potential for misclassification, the area of land in each classification should be treated as estimated rather than an exact interpretation of the earth's surface.

SOURCES:

FAO Forest Area Variables and All Certification Schemes: Food and Agriculture Organization of the United Nations (FAO). 2001. *Global Forest Resources Assessment 2000--Main Report*. FAO Forestry Paper No. 140. Rome: FAO. Data can also be obtained electronically at: <http://www.fao.org/forestry/fo/fra/index.jsp>.

FSC-certified Forests: WRI compilation of data from: Forest Stewardship Council (FSC). 1998, 2002. *Forests Certified by FSC-Accredited Certification Bodies. Document 5.3.3*. Oaxaca, Mexico, FSC. Available online at: <http://www.fscoax.org/principal.htm>.

Drylands: U. Deichmann and L. Eklundh. 1991. *Global digital data sets for land degradation studies: a GIS approach*. United Nations Environment Program/Global Resource Information Database (UNEP/GRID) GRID Case Study Series No. 4., Nairobi, Kenya.

Grasslands area: T.R. Loveland, B.C. Reed, J.F. Brown, D.O. Ohlen, Z. Zhu, L. Yang, J. Merchant. 2000. Global Land Cover Characteristics Database (GLCCD) Version 2.0. Available online at: http://edcdaac.usgs.gov/glcc/globdoc2_0.html.

Loveland, T.R., B.C. Reed, J.F. Brown, D.O. Ohlen, Z. Zhu, L. Yang, and J.W. Merchant. 2000. "Development of a global land cover characteristics database and IGBP DISCover from 1-km AVHRR data." *International Journal of Remote Sensing* 21: 1303-1330.