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**Changement climatique
et usage des terres.
Vers le modèle
Nexus Land Use.
Annexes.**



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ANNEXES

Revue de littérature des taux d'accumulation du carbone dans les sols suite à un changement d'usage des sols (Post et Kwon, 2000)

Table 1 Rates of soil carbon accumulating during forest establishment after agricultural use

Site history	Years since agriculture	Soil sample depth (cm)	Rate of C change ($\text{g m}^{-2} \text{y}^{-1}$)		Reference
			max.	avg	
Cool temperate moist forest					
Cultivated to pine plantation	42-88	0-10	-8.56	-4.44	Pregitzer & Palik (1996)
	42-88	30-40	-5.27	-2.78	
Old field succession to northern hardwoods	1-60	10	16.03	15.06	Zak <i>et al.</i> (1990)
Long-term agriculture to oak forest	83	68.6	61.7	59.60	Jenkinson (1971)
Long-term agriculture to oak forest (P amended)	82	68.6	33.3	28.0	Jenkinson (1971)
Old field succession to mixed oak stand	>250	15.0	28.3	9.4	Robertson & Vitousek (1981)
Old field succession to northern hardwoods	>100	10.0	17.3	11.6	Robertson & Tiedje (1984)
Old field to managed pine plantation	10-50	15.4		65.66	Wilde (1964)
Abandoned field to mixed forest	2-65.5	42.8	23.9	2.15	Hamburg (1984)
Constructed dike to forest	100	12		26.3	Beke (1990)
Mine spoil to forest					
Harrison #1	21	22.9		50.09	Leisman (1957)
Warren	32	22.9		19.9	Leisman (1957)
Silver	41	22.9		38.4	Leisman (1957)
Kinney	51	22.9		38.4	Leisman (1957)
Warm temperate thorn steppe					
Grazing exclusion - shrub live oak	18	3.8		-9.44	Brejda (1997)
Grazing exclusion - mountain mahogany	18	3.8		-6.11	Brejda (1997)
Grazing exclusion - shrubless openings	8	3.8		12.78	Brejda (1997)
Warm temperate dry forest					
New parent material to chaparral - oak	41	100		70.87	Ulery (1995)
New parent material to chaparral - pine	41	100		59.93	Ulery (1995)
New parent material to chaparral - chamise	41	100		25.43	Ulery (1995)
New parent material to chaparral - ceanothus	41	100		22.00	Ulery (1995)
Warm temperate moist forest					
Old field to pine to hardwood succession	200	3.0	11.2	2.4	Switzer <i>et al.</i> (1979)
	120-180	10.0	12.9	4.5	Montes & Christensen (1979)
Old field to pine-natural succession	40-60	5.0		2.94	Christensen & MacAller (1985)
				-4.41	Christensen & MacAller (1985)
				-14.12	Christensen & MacAller (1985)
	~ 50	33.0		28.4	Schiffman & Johnson (1989)
	50-70	17.8	22.6	11.81	Hosner & Gimney (1970)
	110	68.5-91.4	31.7	5.9	Billings (1938)
Old field to managed pine plantation	~ 50	33.0		24.8	Schiffman & Johnson (1989)
	70	12.7	52.85	25.56	Coile (1940)
	40	60		3.6	Richter <i>et al.</i> 1999
Subtropical dry forest					
Abandoned pasture	25	38.1	-20.36	-13.08	Smith <i>et al.</i> (1951)
Long-term agriculture to secondary forest	35	25.0		80.0	Brown & Lugo (1990)
Long-term agriculture to mahogany plantation	50	25.0		38.0	Brown & Lugo (1990)
Subtropical moist forest					
Long-term agriculture to secondary forest	35	23.0		28.0	Weaver <i>et al.</i> (1987)
Long-term agriculture to secondary forest	100	50.0	300.0	105.0	Brown & Lugo (1990)
Coffee plantation to abandoned coffee shade	20	23.0		99.0	Weaver <i>et al.</i> (1987)
Forest plantation with intensive site preparation	2-34	43.5	566.71	-51.49	Gholz & Fisher (1982)
Subtropical wet forest					
10-year-old crop fields to secondary forest	38-47	50.0	566.7	148.8	Brown & Lugo (1990)
Long-term agriculture to secondary forest	~ 35	23.0		98.7	Weaver <i>et al.</i> (1987)
10-y-old crop fields to mahogany plantation	51	50.0		310.0	Brown & Lugo (1990)
Coffee plantation to abandoned coffee shade	30	23.0		10.3	Weaver <i>et al.</i> (1987)
Tropical moist forest					
Cultivated field to Eucalyptus plantation	11.5	55		12.17	Bashkin <i>et al.</i> (1998)
1 year clearing to forest plantation	10.5	100	-1569.6	-47.13	Sanchez <i>et al.</i> 1985
Swidden agriculture (forest fallow period)	10	10	143.3	68.9	Aweto (1981)
Short-term cropping to forest fallow	50	40	740.0	61.2	Ramakrishnan & Toky (1981)
Tropical wet forest					
Primary succession (P1)	126	1.5	3.36	1.18	Vitousek <i>et al.</i> (1983)

taux d'accumulation du carbone dans les sols suite à une transition « agriculture vers forêt » (Source : Post et Kwon, 2000)

Table 2 Rates of soil carbon accumulating during pasture establishment

Site history	Years since agriculture	Soil sample depth (cm)	Rate of C change ($\text{g m}^{-2}\text{y}^{-1}$)		Reference
			max.	avg	
Cool temperate steppe					
Cultivated to perennial grass	12	300		110.0	Gebhart <i>et al.</i> (1994)
Cultivated to abandoned field	50	10		3.1	Burke <i>et al.</i> (1995)
Cultivated to seeded grass	6	5		0.0	Robles & Burke (1998)
Cultivated to improved pasture					
Russian wildrye	8	7		6.86	White <i>et al.</i> (1976)
crested wheatgrass	8	7		18.87	
B-I-ALF(full)	8	7		14.01	
B-I-ALF(short)	8	7		34.15	
Mine tailing to grass-forb meadow	5-80	10	60.0	4.01	Titlyanova <i>et al.</i> (1988)
Coal mine spoil to dry grassland	28-40	120		28.2	Anderson (1977)
Subtropical moist forest					
Cultivated to pasture					
Atlantic	37	18		-16.22	Lugo <i>et al.</i> (1986)
Caonilas	37	18		-48.65	
Culebrinas	37	18		100.0	
North-west	37	18		8.11	
West	37	18		37.84	
East	37	18		35.14	
South-east	37	18		10.81	
South-west	37	18		67.75	
South	37	18		113.51	
Turabo	37	18		24.32	
Tropical dry forest					
Forest to unimproved pasture	23	10		-17.4	Trumbore <i>et al.</i> (1995)
Forest to improved pasture	23	10		-13.0	Trumbore <i>et al.</i> (1995)
Tropical moist forest					
Native forest to pasture	10	40		-30.0	Desjardins <i>et al.</i> (1994)
Mature forest cleared to pasture					
Purto Velho	7	10		83.18	Neill <i>et al.</i> (1997)
Calcaulandia	8	10		-4.02	
Nova Vida-1	81	10	342.72	15.23	
Nova Vida-2	20	10	174.81	24.10	
Ouro Preto-Benjamin	20	10	115.54	39.27	
Ouro Preto-Ienk	20	10	-84.13	2.37	
Vilhena	12	10	114.83	91.91	
Purto Velho	7	30		-14.29	
Tropical wet forest					
Native forest cleared for pasture					
Eutric Hapludand	25	50		-87.2	Veldkamp (1995)
Oxic Humitropept	25	50		-6.0	
Native forest cleared for pasture					
Andic Humitropept	18	60	142.03	34.93	van Dam <i>et al.</i> (1997)

taux d'accumulation du carbone dans les sols suite à l'établissement d'une prairie (Source : Post et Kwon, 2000)

Accumulation de carbone dans la litière lors d'une afforestation

Climate	Forest Type							
	Broadleaf Deciduous	Needleleaf Evergreen	Broadleaf Deciduous	Needleleaf Evergreen	Broadleaf Deciduous	Needleleaf Evergreen	Broadleaf Deciduous	Needleleaf Evergreen
	Litter carbon stock of mature forests (tonnes C ha ⁻¹)		Length of transition period (years)		Net annual accumulation of litter C over length of transition period ^{bc} (tonnes C ha ⁻¹ yr ⁻¹)		Net annual accumulation of litter C, based on 20 year default (tonnes C ha ⁻¹ yr ⁻¹)	
Boreal, dry	25 (10-58)	31 (6-86)	50	80	0.5	0.4	1.2	1.6
Boreal, moist	39 (11-117)	55 (7-123)	50	80	0.8	0.7	2.0	2.8
Cold Temperate, dry	28 (23-33) ^a	27 (17-42) ^a	50	80	0.6	0.4	1.4	1.4
Cold temperate, moist	16 (5-31) ^a	26 (10-48) ^a	50	50	0.3	0.5	0.8	1.3
Warm Temperate, dry	28.2 (23.4-33.0) ^a	20.3 (17.3-21.1) ^a	75	75	0.4	0.3	1.4	1.0
Warm temperate, moist	13 (2-31) ^a	22 (6-42) ^a	50	30	0.3	0.7	0.6	1.1
Subtropical	2.8 (2-3)	4.1	20	20	0.1	0.2	0.1	0.2
Tropical	2.1 (1-3)	5.2	20	20	0.1	0.3	0.1	0.3

Source: Siltanen *et al.*, 1997; and Smith and Heath, 2002; Tremblay *et al.*, 2002; and Vogt *et al.*, 1996, converted from mass to carbon by multiplying by conversion factor of 0.37 (Smith and Heath, 2002).

Note: Ages follow Smith and Heath (2002).

^a Values in parentheses marked by superscript "a" are the 5th and 95th percentiles from simulations of inventory plots, while those without superscript "a" indicate the entire range.

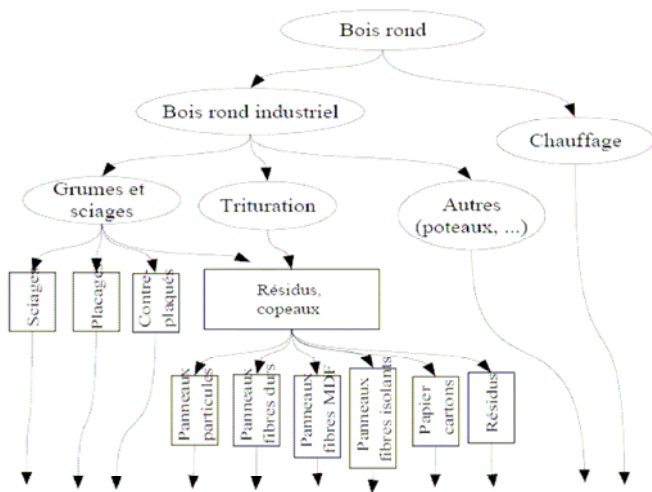
^b These columns indicates the annual increase in litter carbon when starting from bare ground in land converted forest land.

^c Note that the accumulation rates are for carbon being absorbed from the atmosphere. However, depending on the methodology, these may be transfers from other pools.

: Stock et accumulation de carbone dans la litière forestière lors d'une afforestation (Source : IPCC, 2003)

Le réservoir des produits bois

Le bois récolté peut être transformé en divers produits (0), auxquels est associée une durée de vie moyenne (0). Ceci permet d'estimer l'importance des flux entrants dans chaque réservoir (1, 10 ou 100 ans) durant une année pour chaque région (0)¹¹³.



: Schéma des différentes filières bois (Source : Dameron, 2004)

¹¹³ Les produits bois ont été ramenés à leur région d'origine et non à leur région de transformation dans l'étude de Dameron (2004)

Produits	Durée de vie moyenne basse			Durée de vie moyenne haute			Sensibilité	
	Réservoir 1 an	Réservoir 10 ans	Réservoir 100 ans	Réservoir 1 an	Réservoir 10 ans	Réservoir 100 ans	Une variation de 10 % de la production d'un type de produits (ou de sa durée de vie moyenne) entraîne une variation de x % du stock global total	
	Production mondiale 2000						En %	En valeurs absolues
Sciages	30 ans 0% 78% 22%			60 ans 0% 44% 56%			6%	0,5 ans 628 MtC
Panneaux Feuilles de Placages	10 ans 0% 100% 0%			15 ans 0% 94% 6%			0%	0,0 ans 3 MtC
Panneaux Contreplaqués	15 ans 0% 94% 6%			20 ans 0% 89% 11%			0%	0,0 ans 37 MtC
Autre Bois Ronds Industriels (poteaux, etc)	15 ans 0% 94% 6%			30 ans 0% 78% 22%			1%	0,1 ans 121 MtC
Panneaux de Particules	10 ans 0% 100% 0%			20 ans 0% 89% 11%			0%	0,0 ans 46 MtC
Panneaux de fibres Durs	10 ans 0% 100% 0%			15 ans 0% 94% 6%			0%	0,0 ans 4 MtC
Panneaux de fibres MDF	10 ans 0% 100% 0%			15 ans 0% 94% 6%			0%	0,0 ans 8 MtC
Panneaux de fibres Isolantes	15 ans 0% 94% 6%			30 ans 0% 78% 22%			0%	0,0 ans 5 MtC
Papier Cartons	2 ans 89% 11% 0%			4 ans 67% 33% 0%			1%	0,1 ans 71 MtC
Résidus de Bois	1 an 100% 0% 0%			1 an 100% 0% 0%			0%	0,0 ans 8 MtC
Bois de chauffage + charbon	1 an 100% 0% 0%			2 ans 89% 11% 0%			1%	0,1 ans 99 MtC

Durée de vie moyenne tous produits	5,6 ans	11,0 ans
Stock résultant	7 000 MtC	13 600 MtC
Durée de vie moyenne hors produits à durée de vie courte	22,3 ans	43,5 ans
Stock résultant	5 800 MtC	11 300 MtC

Tableau 15 : Estimations (haute et basse) des durées de vie moyennes des diverses catégories de produits proposées par la FAO. Clé de répartition résultant, entre les réservoirs 1, 10 et 100 ans. Flux globaux en 2000 [FAO2000]. Durées de vie moyennes et stock moyen résultants de l'ensemble des produits. Sensibilité de ces derniers par rapport aux durées de vie des divers produits.

: Estimation des durées de vie moyenne des produits bois (Source : Dameron, 2004)

Région	Sciages	Placages	Contre plaqués	Panneaux de particules	Panneaux de fibres durs	Panneaux de fibres MDF	Panneaux de fibres isolants	Papiers cartons	Résidus	Autre Bois Rnd Indus	Bois énergie	Total
Canada	23,8	0,45	3,6	3,6	0,39	0,76	0,24	27,7	9,6	1,4	1,1	73
USA	35,8	0,67	5,4	9,1	1,00	1,94	0,60	70,7	24,5	5,4	26,3	181
Amérique centrale	1,6	0,03	0,2	0,2	0,02	0,05	0,01	1,7	0,6	0,4	29,1	34
Amérique du Sud (N)	8,9	0,17	1,3	2,5	0,27	0,53	0,16	19,2	6,7	3,2	61,1	104
Nord de l'Afrique	0,1	0,00	0,0	0,0	0,00	0,00	0,00	0,2	0,1	0,2	9,6	10
Ouest de l'Afrique	2,5	0,05	0,4	0,3	0,03	0,06	0,02	2,3	0,8	4,3	84,5	95
Est de l'Afrique	0,3	0,01	0,0	0,0	0,01	0,01	0,00	0,4	0,1	3,0	69,6	73
Sud de l'Afrique	1,2	0,02	0,2	0,4	0,05	0,09	0,03	3,3	1,1	3,1	27,6	37
Europe (OCDE)	24,3	0,45	3,6	5,7	0,62	1,21	0,37	44,1	15,3	3,1	11,3	110
Est de l'Europe	5,6	0,10	0,8	1,4	0,15	0,29	0,09	10,6	3,7	2,5	5,8	31
Ex-URSS	10,2	0,19	1,5	2,9	0,32	0,62	0,19	22,7	7,9	4,6	22,5	74
Moyen Orient	0,8	0,02	0,1	0,2	0,02	0,04	0,01	1,6	0,6	0,8	2,6	7
Asie du Sud	3,3	0,06	0,5	0,4	0,04	0,08	0,03	3,0	1,0	1,0	130,6	140
Asie de l'Est	8,0	0,15	1,2	1,1	0,12	0,24	0,07	8,8	3,0	13,5	72,2	108
Asie Sud Est et Japon	8,8	0,17	1,3	1,3	0,15	0,29	0,09	10,4	3,6	4,4	83,8	114
Océanie	3,3	0,06	0,5	0,9	0,10	0,19	0,06	6,8	2,3	3,1	4,4	22
Amérique du Sud (S)	2,2	0,04	0,3	0,7	0,08	0,15	0,05	5,6	2,3	0,1	7,2	19
Total	140,7	2,64	21,1	30,6	3,37	6,57	2,03	239,1	83,2	54,1	649,1	1 233

: Production en MtC/an des diverses catégories de produits bois, par région et ramenée à la région d'origine du bois (Source : Dameron, 2004, à partir de données de la FAO)

Projections agricoles de la FAO à l'horizon 2030

Population (millions)	1979-81	1997-99	2015	2030	2050			
Monde	4 430	5 900	7 207	8 270	9 322			
Pays en développement	3 259	4 595	5 858	6 910	7 987			
Pays industrialisés	789	892	951	979	986			
Pays en transition	382	413	398	381	349			
Croissance démographique (%/an)	1979 à 1999	1989 à 1999	1997-99 à 2015	2015 à 2030	2030 à 2050			
Monde	1,6	1,5	1,2	0,9	0,6			
Pays en développement	1,9	1,7	1,4	1,1	0,7			
Pays industrialisés	0,7	0,7	0,4	0,2	0,0			
Pays en transition	0,5	0,1	- 0,2	- 0,3	- 0,4			
Croissance du PIB (%/an)	1997-99 à 2015 total	2015 à 2030 total	1997-99 à 2015 par habitant	2015 à 2030 par habitant				
Monde	3,5	3,8	2,3	2,9				
Pays en développement	5,1	5,5	3,7	4,4				
Pays industrialisés	3,0	3,0	2,6	2,8				
Pays en transition	3,7	4,0	4,0	4,3				
Croissance de la demande de produits agricoles (%/an)	1969 à 1999	1979 à 1999	1989 à 1999	1997-99 à 2015	2015 à 2030			
Monde	2,2	2,1	2,0	1,6	1,4			
Pays en développement	3,7	3,7	4,0	2,2	1,7			
Pays industrialisés	1,1	1,0	1,0	0,7	0,6			
Pays en transition	- 0,2	- 1,7	- 4,4	0,5	0,4			
Croissance de la production agricole (%/an)	1969 à 1999	1979 à 1999	1989 à 1999	1997-99 à 2015	2015 à 2030			
Monde	2,2	2,1	2,0	1,6	1,3			
Pays en développement	3,5	3,7	3,9	2,0	1,7			
Pays industrialisés	1,3	1,0	1,4	0,8	0,6			
Pays en transition	- 0,4	- 1,7	- 4,7	0,6	0,6			
Apport énergétique (calories/personne/jour)	1961-63	1979-81	1997-99	2015	2030			
Monde	2 283	2 552	2 803	2 940	3 050			
Pays en développement	1 960	2 312	2 681	2 850	2 980			
Pays industrialisés	2 891	3 135	3 380	3 440	3 500			
Pays en transition	3 154	3 389	2 906	3 060	3 180			
Sous-alimentation	1990-92	Millions de personnes			% de la population			
		1997-99	2015	2030	1990-92	1997-99	2015	2030
Monde		815				14		
Pays en développement	816	777	610	443	20	17	11	6
Pays industrialisés		11				1		
Pays en transition		27				6		

: Aperçu des projections de la FAO (Source : FAO, 2002)

Céréales	1979-81	Millions de tonnes			1979 à 1999	% / an			2015 à 2030
		1997-99	2015	2030		1989 à 1999	1997-99 à 2015	2015 à 2030	
Monde									
Production	1 442	1 889	2 387	2 838	1,4	1,0	1,4	1,2	
Alimentation humaine	706	1 003	1 227	1 406	1,9	1,4	1,2	0,9	
Alimentation animale	575	657	911	1 148	0,6	0,6	1,9	1,5	
Pays en développement									
Production	649	1 026	1 354	1 652	2,5	2,1	1,6	1,3	
Alimentation humaine	524	790	1 007	1 185	2,2	1,7	1,4	1,1	
Alimentation animale	113	222	397	573	3,8	4,4	3,5	2,5	
Echanges nets	- 66	- 103	- 190	- 265					
Viande									
	1979-81	Millions de tonnes			1979 à 1999	% / an			2015 à 2030
		1997-99	2015	2030		1989 à 1999	1997-99 à 2015		
Monde									
Production	132	218	300	376	2,8	2,7	1,9	1,5	
Alimentation humaine	130	214	297	373	2,8	2,7	1,9	1,5	
Pays en développement									
Production	45	116	181	247	5,5	5,9	2,7	2,1	
Alimentation humaine	44	116	184	252	5,6	6,1	2,7	2,1	
Echanges nets	- 0,2	- 1,2	- 3,9	- 5,9					
Huiles végétales et oléagineux (en équivalent d'huile)									
	1979-81	Millions de tonnes			1979 à 1999	% / an			2015 à 2030
		1997-99	2015	2030		1989 à 1999	1997-99 à 2015		
Monde									
Production	50	104	157	217	4,1	4,3	2,5	2,2	
Alimentation humaine	37	67	98	130	3,3	2,8	2,3	1,9	
Usage industriel	8	23	45	71	6,1	6,9	3,9	3,1	
Pays en développement									
Production	29	68	109	156	5,0	4,7	2,8	2,4	
Alimentation humaine	21	45	73	102	4,3	3,6	2,9	2,2	
Usage industriel	3	13	26	41	8,2	10,2	4,4	3,1	
Echanges nets	1,5	4,0	3,4	3,5					
Terres arables (millions d'ha)		Superficie totale			1979-81	Superficie irriguée			
		1997-99	2015	2030		1997-99	2015	2030	
Monde		1 608			210	271			
Pays en développement		956	1017	1076	151	202	221	242	
Pays industrialisés		387			37	42			
Pays en transition		265			22	25			
Superficies et rendements dans les pays en développement		Superficies récoltées (millions d'ha)				Rendement (tonnes/ha)			
	1979-81	1997-99	2015	2030	1979-81	1997-99	2015	2030	
Blé	96	111	113	118	1,6	2,5	3,1	3,5	
Riz (non décortiqué)	138	157	162	164	2,7	3,6	4,2	4,7	
Maïs	76	97	118	136	2,0	2,8	3,4	4,0	
Toutes céréales	408	465	497	528	1,9	2,6	3,2	3,6	
% du total	60	55	53	51					

: Aperçu des projections de la FAO, suite (Source : FAO, 2002)

Observations sur l'estimation du potentiel de terres disponibles pour l'agriculture sans irrigation

Box 4.2 Estimating the land potential for rainfed agriculture: some observations¹

The evaluation of land potential undertaken in the global agro-ecological zones (GAEZ) study starts by taking stock of (i) the biophysical characteristics of the resource (soil, terrain, climate); and (ii) the growing requirements of crops (solar radiation, temperature, humidity, etc.). The data in the former set are interfaced with those in the second set and conclusions are drawn on the amount of land that may be classified as suitable for producing each one of the crops tested (see Fischer, van Velthuis and Nachtergaele, 2000).

The two data sets mentioned above can change over time. Climate change, land degradation or, conversely, land improvements, together with the permanent conversion of land to non-agricultural uses, all contribute to change the extent and characteristics of the resource. This fact is of particular importance if the purpose of the study is to draw inferences about the adequacy of land resources in the longer term. In parallel, the growth of scientific knowledge and the development of technology modify the growing requirements of the different crops for achieving any given yield level. For example, in the present round of GAEZ work the maximum attainable yield for rainfed wheat in subtropical and temperate environments is put at about 12 tonnes/ha in high input farming and about 4.8 tonnes/ha in low input farming. Some 25 years ago, when the first FAO agro-ecological zone study was carried out (FAO, 1981b), these yields were put at only 4.9 and 1.2 tonnes/ha, respectively. Likewise, land suitable for growing wheat at, say, 5 tonnes/ha in 30 years time may be quite different from that prevailing today, if scientific advances make it possible to obtain such yields where only 2 tonnes/ha can be achieved today. A likely possibility would be through the development of varieties better able to withstand stresses such as drought, soil toxicity and pest attack. Scientific knowledge and its application will obviously have an impact on whether or not any given piece of land will be classified as suitable for producing a given crop. Land suitability is crop-specific. To take an extreme example, more than 50 percent of the land area in the Democratic Republic of the Congo is suitable for growing cassava but less than 3 percent is suitable for growing wheat. Therefore, before statements can be made about the adequacy or otherwise of land resources to grow food for an increasing population, the information about land suitability needs to be interfaced with information about expected demand patterns – volume and commodity composition of both domestic and foreign demand. For example, the Democratic Republic of the Congo's ample land resources suitable for growing cassava will be of little value unless there is sufficient domestic or foreign demand for the country's cassava, now or in the future.

Declaring a piece of land as suitable for producing a certain crop implicitly assumes that people find it

worthwhile to exploit the land for this purpose. In other words, land must not only possess minimum biophysical attributes in relation to the requirements of the crops for which there is, or will be, demand, but it must also be in a socio-economic environment in which people consider it an economic asset. For example, in low-income countries, people will exploit land even if the yields or, more precisely, the returns to their work, are low relative to the urgency to secure their access to food. This means that the price of food is high relative to their income and that the opportunities of earning higher returns from other activities are limited as well. Thus, what

qualifies as land with an acceptable production potential in a poor country may not be so in a high-income one. An exception would be if poor quality of land were compensated by a larger area per person with access to mechanization² so that returns to work in farming would generate income not far below earnings from other work. Obviously, the socio-economic context within which a piece of land exists and assumes a given value or utility, changes over time: what qualifies today as land suitable for farming may not be so tomorrow. It is no easy task to account fully for all these factors in arriving at conclusions concerning how much land with crop production potential there is. For example, if food became scarce and its real price rose, more land would be worth exploiting and hence be classified as agricultural than would otherwise be the case. Therefore, depending on how such information is to be used, one may want to adopt different criteria and hence generate alternative estimates.

1 Adapted from Alexandratos and Bruinsma (1999).

2 Relatively low-yield rainfed but internationally competitive agriculture (wheat yields of 2.0-2.5 tonnes/ha compared with double that in western Europe) is practised in such high-income countries as the United States, Canada and Australia. But this is in large and fully mechanized farms permitting the exploitation of extensive areas that generate sufficient income per holding even if earnings per ha are low.

: Observations sur l'estimation du potentiel de terres disponibles pour l'agriculture sans irrigation (Source : FAO, 2002)

Méthodologie GAEZ

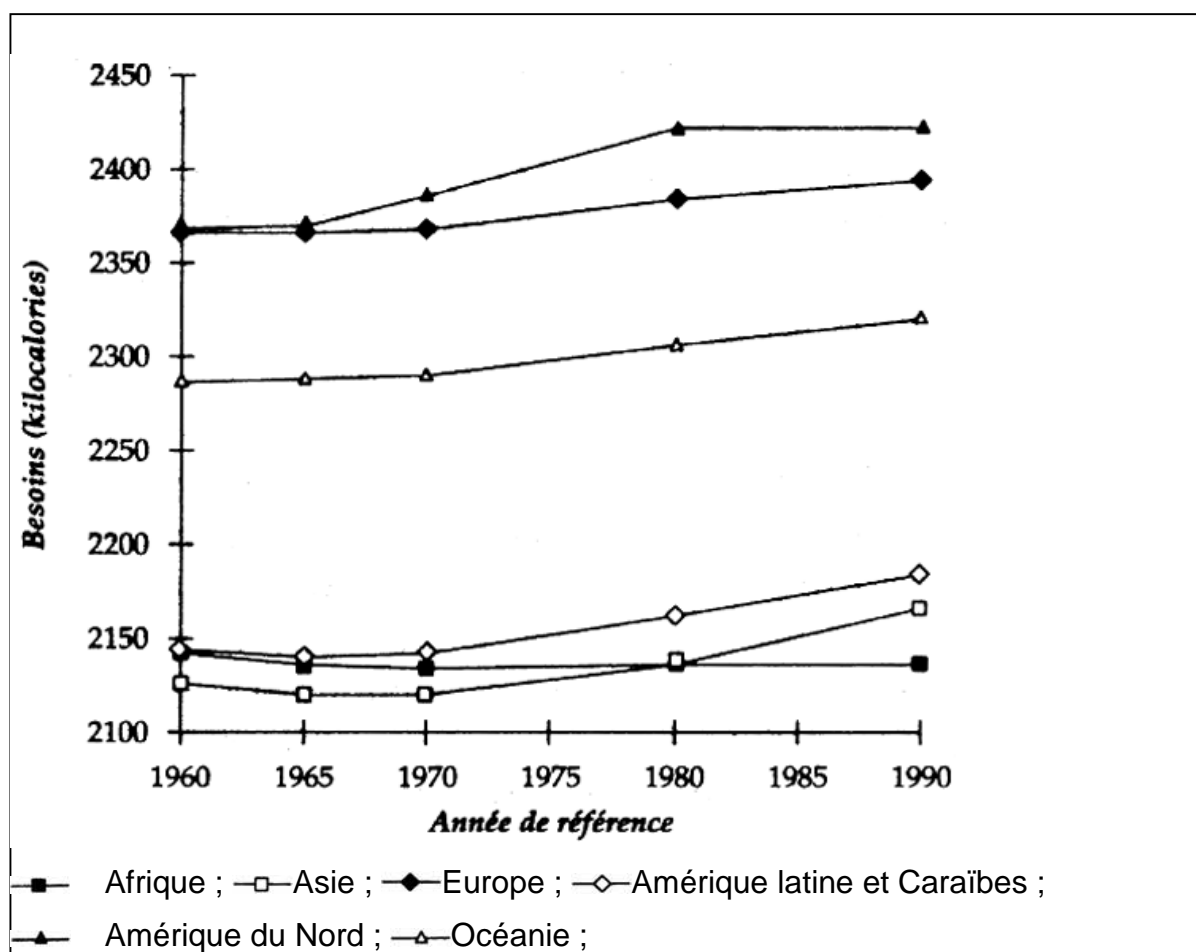
High level of inputs/advanced management : Production is based on improved high-yielding varieties and is mechanized with low labor intensity. It uses optimum applications of nutrients; chemical pest, disease, and weed control; and full conservation measures. The farming system is mainly market oriented.

Intermediate level of inputs/improved management : Production is based on improved varieties and on manual labor and/or animal traction and some mechanization. It uses some fertilizer application and chemical pest, disease, and weed control, and employs adequate fallow periods and some conservation measures. The farming system is partly market oriented.

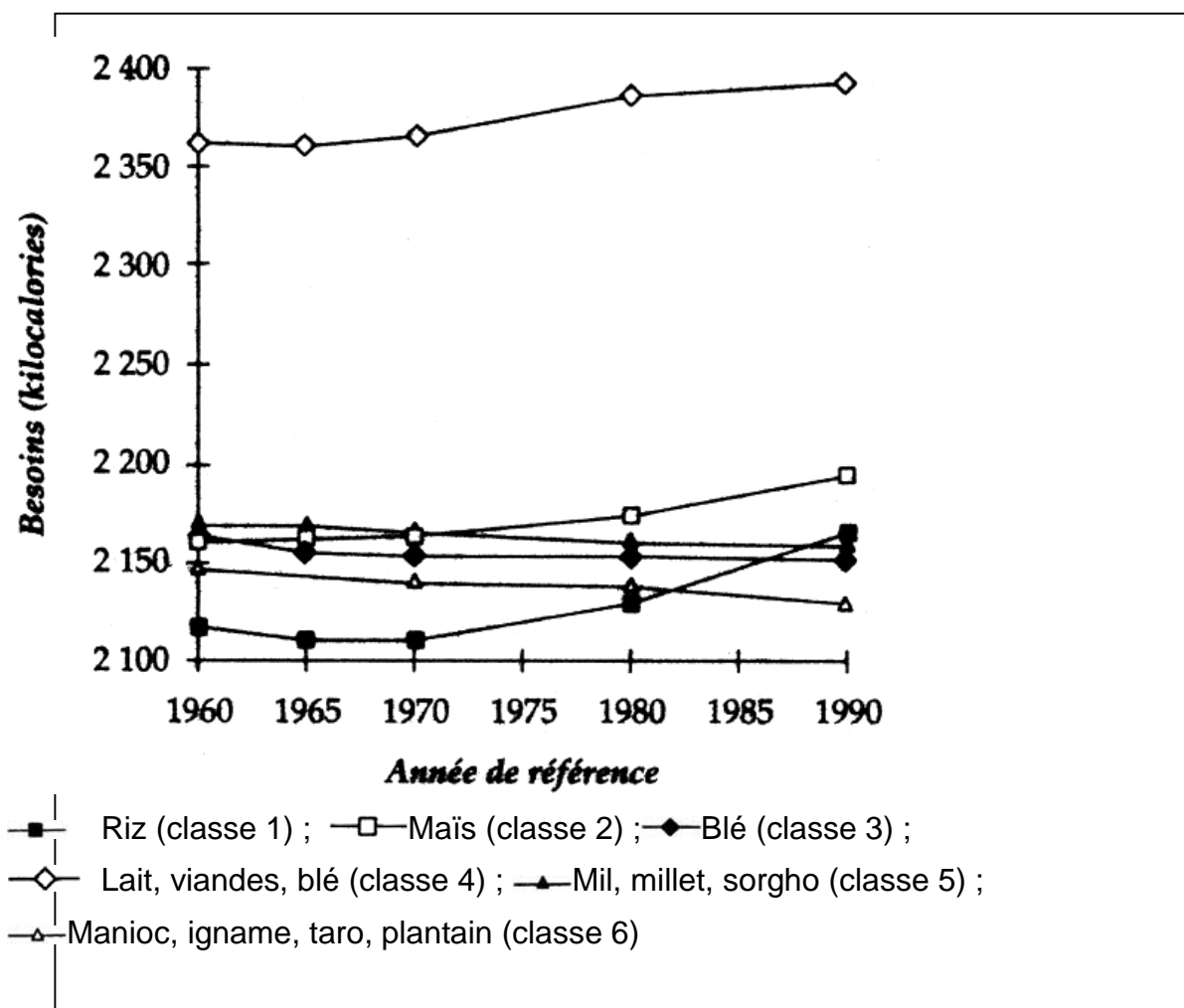
Low level of inputs/traditional management : Production is based on the use of traditional cultivars (if improved cultivars are used, they are treated in the same way as local cultivars) and labor-intensive techniques, with no application of nutrients. It uses no chemicals for pest and disease control and employs adequate fallow periods and minimum conservation measures. The farming system is largely subsistence based.

: Classification des technologies agricoles utilisées par GAEZ (Source : Fischer, 2002)

Régimes alimentaires et développement



Evolution des besoins en énergie alimentaire de 1960 à 1990 selon le continent (Source : Collomb, 1999)



: Évolution des besoins en énergie alimentaire de 1960 à 1990, selon le régime alimentaire désigné par ses composantes principales

Prévisions de Michel Griffon pour 2050

Nous présentons ici brièvement les résultats de quelques scénarios développés par Michel Griffon (2005). Nous rappelons que nous trouvons trop élevés ses valeurs de demande alimentaire. Un objectif est défini pour chaque scénario, Griffon calcule ensuite la production que ce scénario permet, et en déduit le surplus ou la pénurie.

Scénario 1 : L'objectif est la satisfaction des besoins alimentaires, il y a peu ou pas de changement technologique, le développement de l'agriculture est essentiellement pluvial.

(million tons)	Asia	Latin America	West Asia – North Africa	Sub-Saharan Africa
Assumptions of rainfed yields (increase if lack of land, in line with food requirements)	+ 50% (possible but difficult with current techniques); increase from \approx 4 t/ha to 6 t (average)	No change Average: 1.35 t/ha	It will be difficult to significantly increase yields because of lack of water	+ 40% Starting from low yields (1.15 t/ha), an average of 1.60 could easily be reached
Total expected production in 2050	3000	522 – 520	154	1350
2050 requirements	4150	520	390	1350
2050 shortfall ¹¹⁴	-1150	0	-236	0
Total area available with protected areas (10 ⁶ ha)	100	678	0	203

: Résultats du scénario 1 (Source : Griffon, 2005)

Scénario 2 : L'objectif est la satisfaction des besoins alimentaires, il y a peu ou pas de changement technologique, l'irrigation est développée au maximum.

(million tons)	Asia	Latin America	West Asia – North Africa	Sub-Saharan Africa
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¹¹⁴ Un chiffre négatif indique un manque à produire, un chiffre positif un surplus.

Total production in 2050	3100 to 3280	532 to 568	156 to 176	1370 to 1395
2050 shortfall	- 870 to - 1150	+ 12 to + 48	- 214 to - 234	+ 20 to + 55

: Résultats du scénario 2 (Source : Griffon, 2005)

Scénario 3 : L'objectif est la satisfaction des besoins alimentaires, il y a peu ou pas de changement technologique, l'Amérique latine fournit l'Asie pour compenser le manque à produire.

(million tons)	Asia	Latin America	West Asia – North Africa	Sub-Saharan Africa
Production obtained	3190 +/- 100	1704 +/- 100	166 +/- 10	1350
2050 shortfall	- 960 +/- 100	+ 1184 +/- 100	- 224 +/- 10	0

: Résultats du scénario 3 (Source : Griffon, 2005)

Revue des modèles d'usage des terres

Sur les trois pages suivantes :

: Principales caractéristiques de modèles d'usage des terres (Source : Heistermann, 2006)

Table 1
Land-use models covered in this review: overview

Model/modeling framework	Literature	Temporal resolution and coverage	Spatial resolution and coverage	Main mechanism	Motivation	Classification
CLUE-China	Verburg et al. (1999a,b)	1-year steps; 1990–2010	<i>Multi-scale</i> : (China); 96 km × 96 km grid; 32 km × 32 km grid; subgrid; National level (China)	Observed spatial relations are assumed to represent currently active processes; allocation of area demands based on preference maps (generated through regression analysis) See CLUE-China; additionally enhanced spectrum of location factors; using spatial sub-units for regression analysis based on Farming Systems Map	Assessing the spatial impact of national scale demand trends on the spatial distribution of land-use types	Geographic (empirical–statistical)
CLUE-Neotropics (based on CLUE-S)	Wassenaar et al. (submitted for publication) (based on Verburg et al. (2002))	1-year steps; 1990–2010	<i>Multi-scale</i> : (Neotropics); national level, farming systems sub-units, 3 km × 3 km; Sub-continental (Neotropics)	Rule-based representation of the causal chain typical for land-use change in the Sahel zone: transition from extensive to intensive use triggered by land scarcity thresholds	Identifying deforestation hotspots due to the expansion of pasture and cropland	Geographic (empirical–statistical)
SALU	Stephennie and Lambin (2001a,b)	1-year steps; 1961–1997	<i>Multi-scale</i> : (Sahel); country level; 2.5° latitude/3.75° longitude grid; sub-continental (Sahel zone)	Not a land-use model in a strict sense; rather maps present and future susceptibility towards specific land-use changes, in this case deforestation; based on fuzzy-logic	Reconstructing past land cover changes for Sudano-Sahelian countries as input for GCMs	Geographic (rule-/process-based)
Syndromes	Cassel-Gintz and Petschel-Held (2000)	<i>No explicit representation of time</i>	5 min longitude/latitude; Global	Identifying hotspots with high disposition for current and future deforestation	Identifying hotspots with high disposition for current and future deforestation	Geographic (rule-/process-based)
AgLU	Sands and Leimbach (2003)	15-year steps; 1990–2095	11 regions; Global	Partial equilibrium; land share proportional to economic return of the land; joint probability distribution function for yield	Simulate land-use changes and corresponding GHG emissions to feed into integrated modeling framework	Economic

Table 1 (Continued)

Model/modeling framework	Literature	Temporal resolution and coverage	Spatial resolution and coverage	Main mechanism	Motivation	Classification
EASOM ^a	McCarl (2004); Adams et al. (2005)	5-year steps; 2000–2100	Multi-scale: 11 US regions (broken down into 63 for agriculture) 28 international regions (for trade) National ^b (USA)	Partial equilibrium; non-linear mathematical programming; endogenous modeling of management; Competition of forestry and agricultural sector for land	Studying impacts of policies, technical change, global change on agricultural and forestry sector	Economic
IMPACT ^a	Rosegrant et al. (2002a)	Comparative static; 1997–2020	36 regions; Global	Partial equilibrium	Analyze the world food situation	Economic
G-cubed (Agriculture)	McKibbin and Wang (1998)	1-year step; 1993–2070	12 regions; Global	General equilibrium + macroeconomic behavior	Exploring the impact of international and domestic stocks like trade liberalization on US agriculture	Economic
GTAPE-L	Burniaux (2002)	Comparative static; baseyear 1997	5 regions; Global	General equilibrium + transition matrix, accounting for the history of land	Exemplify the incorporation of land/land use in GTAP; Assessing GHG mitigation policies with focus on land-use impacts	Economic
Global timber market model	Sobngen et al. (1999)	1-year steps; 1990–2140	10 regions; Global	Partial equilibrium; Welfare optimization with perfect foresight	Studying the impact of set-aside policies and future timber demand on forest structure and cover, timber markets and supply	Economic
GTAPEM	Hsin et al. (2004)	Comparative static; 2001–2020	7 regions; Global	General equilibrium + refined transformation structure for agricultural land + substitution possibility among primary and intermediate inputs	Improve the representation of the agricultural market	Economic
WATSIM	Kuhn (2003)	1-year steps; 2000–2010	9 regions; Global	Partial equilibrium + quasi dynamic price expectations	Study the influence of trade policy on agricultural sector	Economic
IMAGE land cover module	Alcamo et al. (1998)	1-year steps; 1970–2100	Multi-scale: 13 world regions, 0.5° grid, subgrid; Global	"Agricultural Economy Model" calculates demands for agricultural and forest products; land is allocated on a rule-based preference ranking	Integrated assessment of Global Change	Integrated

Table 1 (Continued)

Model/modeling framework	Literature	Temporal resolution and coverage	Spatial resolution and coverage	Main mechanism	Motivation	Classification
IFPSIM-EPIC	Tan and Shibasaki (2003); Tan et al. (2003)	not documented	<i>Multi-scale</i> : 32 world regions, 0.1° grid level; Global	Land productivity (based on EPIC) and crop prices (based on IFPSIM) are assumed to be major determinants of agricultural land-use change	Analyzing the relation between land-use patterns and global agricultural markets	Integrated
ACCELERATES	Rounsevell et al. (2003)	2000–2050; comparative static	<i>Multi-scale</i> : Countries; soil mapping units, NUTS2; Europe	Calculation of optimal crop combinations on spatial sub-units; assumes generic farmers who maximize their long-term profits	Assess the vulnerability of European managed ecosystems to environmental change	Integrated
GTAP-LEI/IMAGE coupling within EURALIS	Klijn et al. (2005); van Meijl et al. (submitted for publication)	10-year steps; 2001–2030	<i>Multi-scale</i> : national level, sub-national level (NUTS2), grid level; Global with focus on EU15	Coupling of a variant of GTAPEM (GTAP-LEI) and IMAGE Using management factor and food & feed production to update IMAGE and yield and livestock conversion factor to modify production in GTAP-LEI	Assessing impact of different policies on land use in Europe	Integrated
LUC China	Fischer and Sun (2001); Hubacek and Sun (2001)	So far quasi static; 1992–2025	<i>Multi-scale</i> : 8 economic regions, 5 km × 5 km grid; National (China)	Combining AEZ assessment, extended I/O analysis and scenario analysis to develop a spatially explicit production function for a CGE model	Assessing alternative policy scenarios	Integrated
FARM	Darwin et al. (1996)	Comparative static; 1990–2090	<i>Multi-scale</i> : 8 regions, 0.5° longitude/latitude; global	General equilibrium + land and water as primary inputs (imperfectly substitutable) in all sectors; AEZs defined by spatial explicit environmental data	Integrating explicit land and water assessment into CGE, environmental focus on climate change	Integrated

^a For FASOM and IMPACT a great variety of different model versions are around. The stated properties might vary between the different versions.

^b Global coverage for trade.

Table des régions GTAP 6 et autres découpages du monde utilisés dans Nexus

Le premier tableau¹¹⁵ (0) présente les différents découpages par ordre alphabétique des régions d'agrégation, et le second tableau (0) présente les mêmes découpages par ordre alphabétique des pays.

Afin de préserver la cohérence des régions GTAP, nous avons modifié de la façon suivante les régions décrites par Sohngen et Al. (1999) :

Le Boutan, les Maldives et le Népal sont classés dans Asie Centrale (ASC) et non plus en Asie du Sud-Est (ASE), pour préserver l'intégrité de la région xsa (rest of south Asia) ;

La Biélorussie, la Moldavie et l'Ukraine sont classés en Asie Centrale (ASC) et non plus en Europe (EUR), pour préserver l'intégrité de xsu (rest of former Soviet Union) ;

Sohngen distingue la Corée du Nord et la Corée du Sud, nous ne retenons que la Corée du Sud et incluons la Corée du Nord dans l'Asie du Sud Est (ASE).

¹¹⁵ Une case blanche dans le tableau signifie qu'il faut reprendre la même valeur qu'au dessus.

Régions GTAP 6	Régions Nexus	Régions Sohngen	Pays GTAP 6
Indonesia idn 10	EA	ASE	Indonesia
Malaysia mys 11			Malaysia
Philippines phl 12			Philippines
Thailand tha 14			Thailand
Viet Nam vnm 15			Viet Nam
Rest of east Asia xea 9			Korea, Democratic People's Republic of
			prk
			mng
			mac
			American Samoa
			asm
			Cook Islands
			cok
			Fiji
			fji
			French Polynesia
			pyf
			Guam
			gum
			Kiribati
			kir
			Marshall Islands
			mhl
			Micronesia, Federated States of
			fsm
			Nauru
			nru
			New Caledonia
			ncl
			Niue
			niu
			Norfolk Island
			nfk
			Northern Mariana Islands
			mnp
			Palau
			plw
			Papua New
			png

Régions GTAP 6	Régions Nexus	Régions Sohngen	Pays GTAP 6
			Guinea wsm Samoa slb Solomon Islands tkl Tokelau ton Tonga tuv Tuvalu vut Vanuatu wlf Wallis and Futuna
Rest of southeast Asia xse 16			brn Brunei Darussalam khm Cambodia
			lao Lao People's Democratic Republic mmr Myanmar tls Timor Leste
China chn 4		CHN China	chn China
Korea kor 7		KOR South Korea	kor Korea, Republic of
	IC Industrialized countries		
Australia aus 1		AUS Australia	aus Australia
Canada can 21		CAN Canada	can Canada
Japan jpn 6		JPN Japan	jpn Japan
New Zealand nzl 2		NZL New Zealand	nzl New Zealand
Hong Kong hkg 5		ASE South East Asia	hkg Hong Kong
Singapore sgp 13			sgp Singapore
Taiwan twn 8			twn Taiwan
austria aut 37		EUR Europe	aut Austria
Belgium bel 38			bel Belgium

Régions GTAP 6	Régions Nexus	Régions Sohngen	Pays GTAP 6
Switzerland che 52			Switzerland che
Cyprus cyp 58			Cyprus cyp
Germany deu 42			Germany deu
Denmark dnk 39			Denmark dnk
Spain esp 50			Spain esp
Finland fin 40			Finland fin
France fra 41			France fra
United Kingdom gbr 43			United Kingdom gbr
Greece grc 44			Greece grc
Croatia hrv 57			Croatia hrv
Ireland irl 45			Ireland irl
Italy ita 46			Italy ita
Luxembourg lux 47			Luxembourg lux
Malta mlt 61			Malta mlt
Netherlands nld 48			Netherlands nld
Portugal prt 49			Portugal prt
Sweden swe 51			Sweden swe
Rest of EFTA xef 53			Iceland isl Liechtenstein lie
			Norway nor
Rest of Europe xer 54			Andorra and Bosnia and Herzegovina bih Faroe Islands fro Gibraltar gib Macedonia, the former Yugoslav Republic of mkd

Régions GTAP 6	Régions Nexus	Régions Sohngen	Pays GTAP 6
			mco Monaco smr San Marino scg Serbia and Montenegro
United States of America usa 22		US United States	usa United States of America
Rest of north America xna 24			bmu Bermuda gri Greenland spm Saint Pierre and Miquelon
Argentina arg 29 Brazil bra 30 Chile chl 31 Colombia col 25 Mexico mex 23 Peru per 26 Uruguay ury 32 Venezuela ven 27	LAM Latin America	LAT South Central America	arg Argentina bra Brazil chl Chile col Colombia mex Mexico per Peru ury Uruguay ven Venezuela
Rest of andean Pact xap 28			bol Bolivia ecu Ecuador
Central America xca 34			blz Belize cri Costa Rica slv El Salvador gtm Guatemala hnd Honduras nic Nicaragua pan Panama
rest of the caribbean xcb 36			aia Anguilla

Régions GTAP 6	Régions Nexus	Régions Sohngen	Pays GTAP 6	
			abw	Aruba
			vgb	Virgin Islands, British
			cym	Cayman Islands
			cub	Cuba
			glp	Guadeloupe
			mtq	Martinique
			msr	Montserrat
			ant	Netherlands Antilles
			tca	Turks and Caicos
Rest of free trade areas of the americas xfa	35		atg	Antigua & Barbuda
			bhs	Bahamas
			brb	Barbados
			dma	Dominica
			dom	Dominican Republic
			grd	Grenada
			hti	Haiti
			jam	Jamaica
			pri	Puerto Rico
			kna	Saint Kitts and Nevis
			lca	Saint Lucia
			vct	Saint Vincent and the Grenadines
			tto	Trinidad and Tobago

Régions GTAP 6	Régions Nexus	Régions Sohngen	Pays GTAP 6
			vir Virgin Islands, U.S.
Rest of south America xsm 33			flk Falkland Islands (Malvinas)
			guf French Guiana
			guy Guyana
			pry Paraguay
			sur Suriname
morocco mar 73	NAF North Africa	AFR Africa	mar Morocco
Tunisia tun 74			tun Tunisia
Rest of North Africa xnf 75			dza Algeria
			egy Egypt
			lby Libyan Arab Jamahiriya
Turkey tur 71		ASC Central Asia	tur Turkey
Rest of middle east xme 72			bhr Bahrain
			irn Iran, Islamic Republic of
			irq Iraq
			isr Israel
			jor Jordan
			kwt Kuwait
			lbn Lebanon
			omn Oman
			qat Qatar
			sau Saudi Arabia
			syr Syrian Arab Republic

Régions GTAP 6	Régions Nexus	Régions Sohngen	Pays GTAP 6
			United Arab Emirates are yem Palestinian Territory, Occupied pse Afghanistan afg Pakistan pak Bhutan btn Maldives mdv Nepal npl
Rest of south Asia xsa 20	SA South Asia		
Bangladesh bgd 17		ASE South East Asia	Bangladesh bgd
Sri Lanka lka 19			Sri Lanka lka
India ind 18		IND India	India ind
Botswana bwa 76	SSA Sub-Saharan Africa	AFR Africa	Botswana bwa
Madagascar mdg 85			Madagascar mdg
Mozambique moz 80			Mozambique moz
Malawi mwi 79			Malawi mwi
Tanzania tza 81			Tanzania, United Republic of tza
Uganda uga 86			Uganda uga
South Africa zaf 77			South Africa zaf
Zambia zmb 82			Zambia zmb
Rest of south Africa customs union xsc 78			Lesotho lso
			Namibia nam
			Swaziland swz

Régions GTAP 6	Régions Nexus	Régions Sohngen	Pays GTAP 6
rest of southern African development communityxsd 84			ago Angola Congo, the Democratic Republic of the cod mus Mauritius syc Seychelles
rest of sub Saharan Africa xss 87			ben Benin bfa Burkina Faso bdi Burundi cmr Cameroon cpv Cape Verde caf Central African Republic tcd Chad com Comoros cog Congo civ Cote d'Ivoire dji Djibouti gnq Equatorial Guinea eri Eritrea eth Ethiopia gab Gabon gmb Gambia gha Ghana gin Guinea gnb Guinea-Bissau ken Kenya

Régions GTAP 6	Régions Nexus	Régions Sohngen	Pays GTAP 6
			lbr Liberia mli Mali mrt Mauritania ner Niger nga Nigeria reu Reunion
			rwa Rwanda shn Saint Helena stp Sao Tome and Principe sen Senegal sle Sierra Leone som Somalia sdn Sudan tgo Togo myt Mayotte
Rest of Former soviet union xsu 70	TC	ASC	Central Asia arm Armenia aze Azerbaijan geo Georgia kaz Kazakhstan kgz Kyrgyzstan tjk Tajikistan tkm Turkmenistan uzb Uzbekistan blr Belarus mda Moldova, Republic of ukr Ukraine
Albania alb 55		EUR	Europe alb Albania

Régions GTAP 6			Régions Nexus	Régions Sohngen	Pays GTAP 6	
Bulgaria	bgr	56			bgr	Bulgaria
Czech Republic	cze	59			cze	Czech Republic
Estonia	est	66			est	Estonia
Hungary	hun	60			hun	Hungary
Lithuania	ltu	68			ltu	Lithuania
Latvia	lva	67			lva	Latvia
Poland	pol	62			pol	Poland
Romania	rom	63			rom	Romania
Slovakia	svk	64			svk	Slovakia
Slovenia	svn	65			svn	Slovenia
Russian Federation	rus	69		RUS Russia	rus	Russian Federation

Table des régions et pays utilisés par le modèle Nexus

Pays GTAP 6	Régions GTAP 6	Régions Nexus	Régions Sohngen
Afghanistan afg	xsa 20	Rest of South Asia SA	South Asia ASC Central Asia
Albania alb	alb 55	Albania TC	Transition countries EUR Europe
Algeria dza	xnf 75	Rest of North Africa NAF	North Africa AFR Africa
American Samoa asm	xoc 3	Rest of Oceania EA	East Asia ASE South East Asia
Andorra and	xer 54	Rest of Europe IC	Industrialized countries EUR Europe
Angola ago	xsd 84	rest of southern African development community SSA	Sub-Saharan Africa AFR Africa
Anguilla aia	xcb 36	rest of the caribbean LAM	Latin America LAT South Central America
Antigua & Barbuda atg	xfa 35	Rest of free trade areas of the americas LAM	Latin America LAT South Central America
Argentina arg	arg 29	Argentina LAM	Latin America LAT South Central America
Armenia arm	xsu 70	Rest of Former soviet union TC	Transition countries ASC Central Asia
Aruba abw	xcb 36	rest of the caribbean LAM	Latin America LAT South Central America
Australia aus	aus 1	Australia IC	Industrialized countries AUS Australia
Austria aut	aut 37	austria IC	Industrialized countries EUR Europe

Pays GTAP 6	Régions GTAP 6	Régions Nexus	Régions Sohngen
Azerbaijan aze	xsu 70	Rest of Former soviet union TC	Transition countries ASC Central Asia
Bahamas bhs	xfa 35	Rest of free trade areas of the americas LAM	Latin America LAT South Central America
Bahrain bhr	xme 72	Rest of middle east NAF	North Africa ASC Central Asia
Bangladesh bgd	bgd 17	Bangladesh SA	South Asia ASE South East Asia
Barbados brb	xfa 35	Rest of free trade areas of the americas LAM	Latin America LAT South Central America
Belarus blr	xsu 70	Rest of Former soviet union TC	Transition countries ASC Central Asia
Belgium bel	bel 38	Belgium IC	Industrialized countries EUR Europe
Belize blz	xca 34	Central America LAM	Latin America LAT South Central America
Benin ben	xss 87	rest of sub Saharan Africa SSA	Sub-Saharan Africa AFR Africa
Bermuda bmu	xna 24	Rest of north America IC	Industrialized countries US United States
Bhutan btn	xsa 20	Rest of south Asia SA	South Asia ASC Central Asia
Bolivia bol	xap 28	Rest of andean Pact LAM	Latin America LAT South Central America
Bosnia and Herzegovina bih	xer 54	Rest of Europe IC	Industrialized countries EUR Europe

Pays GTAP 6	Régions GTAP 6	Régions Nexus	Régions Sohngen
Botswana bwa	bwa 76	Botswana SSA	Sub-Saharan Africa AFR Africa
Brazil bra	bra 30	Brazil LAM	Latin America LAT South Central America
Brunei Darussalam brn	bxse 16	Rest of southeast Asia EA	East Asia ASE South East Asia
Bulgaria bgr	bgr 56	Bulgaria TC	Transition countries EUR Europe
Burkina Faso bfa	bxss 87	rest of sub Saharan Africa SSA	Sub-Saharan Africa AFR Africa
Burundi bdi	bxss 87	rest of sub Saharan Africa SSA	Sub-Saharan Africa AFR Africa
Cambodia khm	bxse 16	Rest of southeast Asia EA	East Asia ASE South East Asia
Cameroon cmr	bxss 87	rest of sub Saharan Africa SSA	Sub-Saharan Africa AFR Africa
Canada can	can 21	Canada IC	Industrialized countries CAN Canada
Cape Verde cpv	bxss 87	rest of sub Saharan Africa SSA	Sub-Saharan Africa AFR Africa
Cayman Islands cym	xcb 36	rest of the Caribbean LAM	Latin America LAT South Central America
Central African Republic caf	bxss 87	rest of sub Saharan Africa SSA	Sub-Saharan Africa AFR Africa
Chad tcd	bxss 87	rest of sub Saharan Africa SSA	Sub-Saharan Africa AFR Africa
Chile chl	chl 31	Chile LAM	Latin America LAT South Central

Pays GTAP 6		Régions GTAP 6			Régions Nexus		Régions Sohngen	
China	chn	chn	4	China	EA	East Asia	CHN	America China
Colombia	col	col	25	Colombia	LAM	Latin America	LAT	South Central America
Comoros	com	xss	87	rest of sub-Saharan Africa	SSA	Sub-Saharan Africa	AFR	Africa
Congo	cog	xss	87	rest of sub-Saharan Africa	SSA	Sub-Saharan Africa	AFR	Africa
Congo, the Democratic Republic of the	cod	xsd	84	rest of southern African development community	SSA	Sub-Saharan Africa	AFR	Africa
Cook Islands	cok	xoc	3	Rest of Oceania	EA	East Asia	ASE	South East Asia
Costa Rica	cri	xca	34	Central America	LAM	Latin America	LAT	South Central America
Cote d'Ivoire	civ	xss	87	rest of sub-Saharan Africa	SSA	Sub-Saharan Africa	AFR	Africa
Croatia	hrv	hrv	57	Croatia	IC	Industrialized countries	EUR	Europe
Cuba	cub	xcb	36	rest of the caribbean	LAM	Latin America	LAT	South Central America
Cyprus	cyp	cyp	58	Cyprus	IC	Industrialized countries	EUR	Europe
Czech Republic	cze	cze	59	Czech Republic	TC	Transition countries	EUR	Europe
Denmark	dnk	dnk	39	Denmark	IC	Industrialized countries	EUR	Europe
Djibouti	dji	xss	87	rest of sub-Saharan Africa	SSA	Sub-Saharan Africa	AFR	Africa

Pays GTAP 6	Régions GTAP 6	Régions Nexus	Régions Sohngen		
Dominica dma	xfaf	35	Africa Rest of free trade areas of the americas LAM	Latin America LAT	South Central America
Dominican Republic dom	xfaf	35	Rest of free trade areas of the americas LAM	Latin America LAT	South Central America
Ecuador ecu	xap	28	Rest of andean Pact LAM	Latin America LAT	South Central America
Egypt egy	xnf	75	Rest of North Africa NAF	North Africa AFR	Africa
El Salvador slv	xca	34	Central America LAM	Latin America LAT	South Central America
Equatorial Guinea gnq	xss	87	rest of sub Saharan Africa SSA	Sub- Saharan Africa AFR	Africa
Eritrea eri	xss	87	rest of sub Saharan Africa SSA	Sub- Saharan Africa AFR	Africa
Estonia est	est	66	Estonia TC	Transition countries EUR	Europe
Ethiopia eth	xss	87	rest of sub Saharan Africa SSA	Sub- Saharan Africa AFR	Africa
Falkland Islands (Malvinas) flk	xsm	33	Rest of south America LAM	Latin America LAT	South Central America
Faroe Islands fro	xer	54	Rest of Europe IC	Industriali zed countries EUR	Europe
Fiji fji	xoc	3	Rest of Oceania EA	East Asia ASE	South East Asia
Finland fin	fin	40	Finland IC	Industriali zed countries EUR	Europe
France fra	fra	41	France IC	Industriali EUR	Europe

Pays GTAP 6	Régions GTAP 6	Régions Nexus	Régions Sohngen				
French Guiana	guf	xsm 33	Rest of south America	LAM	zed countries Latin America	LAT	South Central America
French Polynesia	pyf	xoc 3	Rest of Oceania	EA	East Asia	ASE	South East Asia
Gabon	gab	xss 87	rest of sub Saharan Africa	SSA	Sub-Saharan Africa	AFR	Africa
Gambia	gmb	xss 87	rest of sub Saharan Africa	SSA	Sub-Saharan Africa	AFR	Africa
Georgia	geo	xsu 70	Rest of former soviet union	TC	Transition countries	ASC	Central Asia
Germany	deu	deu 42	Germany	IC	Industrialized countries	EUR	Europe
Ghana	gha	xss 87	rest of sub Saharan Africa	SSA	Sub-Saharan Africa	AFR	Africa
Gibraltar	gib	xer 54	Rest of Europe	IC	Industrialized countries	EUR	Europe
Greece	grc	grc 44	Greece	IC	Industrialized countries	EUR	Europe
Greenland	grl	xna 24	Rest of north America	IC	Industrialized countries	US	United States
Grenada	grd	xfa 35	Rest of free trade areas of the americas	LAM	Latin America	LAT	South Central America
Guadeloupe	glp	xcb 36	rest of the caribbean	LAM	Latin America	LAT	South Central America
Guam	gum	xoc 3	Rest of Oceania	EA	East Asia	ASE	South East Asia
Guatemala	gtm	xca 34	Central	LAM	Latin	LAT	South

Pays GTAP 6	Régions GTAP 6	Régions Nexus	Régions Sohngen
		America	Central America
Guinea	gin	rest of sub-Saharan Africa	Africa
Guinea-Bissau	gnb	rest of sub-Saharan Africa	Africa
Guyana	guy	Rest of south America	South Central America
Haiti	hti	Rest of free trade areas of the americas	South Central America
Honduras	hnd	Central America	South Central America
Hong Kong	hkg	Hong Kong	South East Asia
Hungary	hun	Hungary	Europe
Iceland	isl	Rest of EFTA	Europe
India	ind	India	India
Indonesia	idn	Indonesia	South East Asia
Iran, Islamic Republic of	irn	Rest of middle east	Central Asia
Iraq	irq	Rest of middle east	Central Asia
Ireland	irl	Ireland	Europe
Israel	isr	Rest of middle east	Central Asia

Pays GTAP 6		Régions GTAP 6		Régions Nexus		Régions Sohngen		
Italy	ita	ita	46	Italy	IC	Industrialized countries	EUR	Europe
Jamaica	jam	xfa	35	Rest of free trade areas of the americas	LAM	Latin America	LAT	South Central America
Japan	jpn	jpn	6	Japan	IC	Industrialized countries	JPN	Japan
Jordan	jor	xme	72	Rest of middle east	NAF	North Africa	ASC	Central Asia
Kazakhstan	kaz	xsu	70	Rest of Former soviet union	TC	Transition countries	ASC	Central Asia
Kenya	ken	xss	87	Rest of sub Saharan Africa	SSA	Sub-Saharan Africa	AFR	Africa
Kiribati	kir	xoc	3	Rest of Oceania	EA	East Asia	ASE	South East Asia
Korea, Democratic People's Republic of	prk	xea	9	Rest of east Asia	EA	East Asia	ASE	South East Asia
Korea, Republic of	kor	kor	7	Korea	EA	East Asia	KOR	North Korea
Kuwait	kwt	xme	72	Rest of middle east	NAF	North Africa	ASC	Central Asia
Kyrgyzstan	kgz	xsu	70	Rest of Former soviet union	TC	Transition countries	ASC	Central Asia
Lao People's Democratic Republic	lao	xse	16	Rest of southeast Asia	EA	East Asia	ASE	South East Asia
Latvia	lva	lva	67	Latvia	TC	Transition countries	EUR	Europe
Lebanon	lbn	xme	72	Rest of	NAF	North	ASC	Central

Pays GTAP 6	Régions GTAP 6	Régions Nexus	Régions Sohngen
		middle east	Africa
		Rest of south Africa	Asia
Lesotho Iso	xsc 78	customs union SSA	Sub-Saharan Africa AFR Africa
		rest of sub Saharan Africa	Sub-Saharan Africa AFR Africa
Liberia lbr	xss 87	Africa SSA	Sub-Saharan Africa AFR Africa
Libyan Arab Jamahiriya lby	xnf 75	Rest of North Africa NAF	North Africa AFR Africa
Liechtenstein lie	xef 53	Rest of EFTA IC	Industrialized countries EUR Europe
Lithuania litu	ltu 68	Lithuania TC	Transition countries EUR Europe
Luxembourg lux	lux 47	Luxembourg IC	Industrialized countries EUR Europe
Macau mac	xea 9	Rest of east Asia EA	East Asia ASE South East Asia
Macedonia, the former Yugoslav Republic of mkd	xer 54	Rest of Europe IC	Industrialized countries EUR Europe
Madagascar mdg	mdg 85	Madagascar SSA	Sub-Saharan Africa AFR Africa
Malawi mwi	mwi 79	Malawi SSA	Sub-Saharan Africa AFR Africa
Malaysia mys	mys 11	Malaysia EA	East Asia ASE South East Asia
Maldives mdv	xsa 20	Rest of south Asia SA	South Asia ASC Central Asia
		rest of sub Saharan Africa	Sub-Saharan Africa AFR Africa
Mali mli	xss 87	Africa SSA	Sub-Saharan Africa AFR Africa
Malta mlt	mlt 61	Malta IC	Industrialized countries EUR Europe

Pays GTAP 6	Régions GTAP 6	Régions Nexus	Régions Sohngen
Marshall Islands mhl	xoc 3	Rest of Oceania EA	zed countries East Asia ASE South East Asia
Martinique mtq	xcb 36	rest of the caribbean LAM	Latin America LAT South Central America
Mauritania mrt	xss 87	rest of sub Saharan Africa SSA	Sub-Saharan Africa AFR Africa
Mauritius mus	xsd 84	rest of southern African development community SSA	Sub-Saharan Africa AFR Africa
Mayotte myt	xss 87	rest of sub Saharan Africa SSA	Sub-Saharan Africa AFR Africa
Mexico mex	mex 23	Mexico LAM	Latin America LAT South Central America
Micronesia, Federated States of fsm	xoc 3	Rest of Oceania EA	East Asia ASE South East Asia
Moldova, Republic of mda	xsu 70	Rest of Former soviet union TC	Transition countries ASC Central Asia
Monaco mco	xer 54	Rest of Europe IC	Industrialized countries EUR Europe
Mongolia mng	xea 9	Rest of east Asia EA	East Asia ASE South East Asia
Montserrat msr	xcb 36	rest of the caribbean LAM	Latin America LAT South Central America
Morocco mar	mar 73	morocco NAF	North Africa AFR Africa
Mozambique moz	moz 80	Mozambique SSA	Sub-Saharan Africa AFR Africa

Pays GTAP 6	Régions GTAP 6	Régions Nexus	Régions Sohngen
Myanmar mmr	xse 16	Rest of southeast Asia EA East Asia	ASE South East Asia
Namibia nam	xsc 78	Rest of south Africa customs union SSA Sub-Saharan Africa	AFR Africa
Nauru nru	xoc 3	Rest of Oceania EA East Asia	ASE South East Asia
Nepal npl	xsa 20	Rest of south Asia SA South Asia	ASC Central Asia
Netherlands nld	nld 48	Netherlands IC Industrialized countries	EUR Europe
Netherlands Antilles ant	xcb 36	rest of the caribbean LAM Latin America	LAT South Central America
New Caledonia ncl	xoc 3	Rest of Oceania EA East Asia	ASE South East Asia
New Zealand nzl	nzl 2	New Zealand IC Industrialized countries	NZL New Zealand
Nicaragua nic	xca 34	Central America LAM Latin America	LAT South Central America
Niger ner	xss 87	rest of sub Saharan Africa SSA Sub-Saharan Africa	AFR Africa
Nigeria nga	xss 87	rest of sub Saharan Africa SSA Sub-Saharan Africa	AFR Africa
Niue niu	xoc 3	Rest of Oceania EA East Asia	ASE South East Asia
Norfolk Island nfk	xoc 3	Rest of Oceania EA East Asia	ASE South East Asia
Northern Mariana Islands mnp	xoc 3	Rest of Oceania EA East Asia	ASE South East Asia
Norway nor	xef 53	Rest of EFTA IC Industrialized countries	EUR Europe

Pays GTAP 6		Régions GTAP 6		Régions Nexus		Régions Sohngen		
Oman	omn	xme	72	Rest of middle east	NAF	North Africa	ASC	Central Asia
Pakistan	pak	xsa	20	Rest of south Asia	SA	South Asia	ASC	Central Asia
Palau	plw	xoc	3	Rest of Oceania	EA	East Asia	ASE	South East Asia
Palestinian Territory, Occupied	pse	xme	72	Rest of middle east	NAF	North Africa	ASC	Central Asia
Panama	pan	xca	34	Central America	LAM	Latin America	LAT	South Central America
Papua New Guinea	png	xoc	3	Rest of Oceania	EA	East Asia	ASE	South East Asia
Paraguay	pry	xsm	33	Rest of south America	LAM	Latin America	LAT	South Central America
Peru	per	per	26	Peru	LAM	Latin America	LAT	South Central America
Philippines	phl	phl	12	Philippines	EA	East Asia	ASE	South East Asia
Poland	pol	pol	62	Poland	TC	Transition countries	EUR	Europe
Portugal	prt	prt	49	Portugal	IC	Industrialized countries	EUR	Europe
Puerto Rico	pri	xfa	35	Rest of free trade areas of the americas	LAM	Latin America	LAT	South Central America
Qatar	qat	xme	72	Rest of middle east	NAF	North Africa	ASC	Central Asia
Reunion	reu	xss	87	rest of sub Saharan Africa	SSA	Sub-Saharan Africa	AFR	Africa
Romania	rom	rom	63	Romania	TC	Transition countries	EUR	Europe
Russian Federation	rus	rus	69	Russian Federatio	TC	Transition countries	RUS	Russia

Pays GTAP 6	Régions GTAP 6	Régions Nexus	Régions Sohngen
Rwanda rwa	xss 87	rest of sub-Saharan Africa SSA	Sub-Saharan Africa AFR Africa
Saint Helena shn	xss 87	rest of sub-Saharan Africa SSA	Sub-Saharan Africa AFR Africa
Saint Kitts and Nevis kna	xfa 35	Rest of free trade areas of the americas LAM	Latin America LAT South Central America
Saint Lucia lca	xfa 35	Rest of free trade areas of the americas LAM	Latin America LAT South Central America
Saint Pierre and Miquelon spm	xna 24	Rest of north America IC	Industrialized countries US United States
Saint Vincent and the Grenadines vct	xfa 35	Rest of free trade areas of the americas LAM	Latin America LAT South Central America
Samoa wsm	xoc 3	Rest of Oceania EA	East Asia ASE South East Asia
San Marino smr	xer 54	Rest of Europe IC	Industrialized countries EUR Europe
Sao Tome and Principe stp	xss 87	rest of sub-Saharan Africa SSA	Sub-Saharan Africa AFR Africa
Saudi Arabia sau	xme 72	Rest middle east NAF	North Africa ASC Central Asia
Senegal sen	xss 87	rest of sub-Saharan Africa SSA	Sub-Saharan Africa AFR Africa
Serbia and Montenegro scg	xer 54	Rest of Europe IC	Industrialized countries EUR Europe

Pays GTAP 6	Régions GTAP 6	Régions Nexus	Régions Sohngen
Seychelles syc	xsd 84	rest of southern African development community SSA	Sub-Saharan Africa AFR Africa
Sierra Leone sle	xss 87	rest of sub Saharan Africa SSA	Sub-Saharan Africa AFR Africa
Singapore sgp	sgp 13	Singapore IC	Industrialized countries ASE South East Asia
Slovakia svk	svk 64	Slovakia TC	Transition countries EUR Europe
Slovenia svn	svn 65	Slovenia TC	Transition countries EUR Europe
Solomon Islands slb	xoc 3	Rest of Oceania EA	East Asia ASE South East Asia
Somalia som	xss 87	rest of sub Saharan Africa SSA	Sub-Saharan Africa AFR Africa
South Africa zaf	zaf 77	South Africa SSA	Sub-Saharan Africa AFR Africa
Spain esp	esp 50	Spain IC	Industrialized countries EUR Europe
Sri Lanka lka	lka 19	Sri Lanka SA	South Asia ASE South East Asia
Sudan sdn	xss 87	rest of sub Saharan Africa SSA	Sub-Saharan Africa AFR Africa
Suriname sur	xsm 33	Rest of south America LAM	Latin America LAT South Central America
Swaziland swz	xsc 78	Rest of south Africa customs union SSA	Sub-Saharan Africa AFR Africa
Sweden swe	swe 51	Sweden IC	Industrialized EUR Europe

Pays GTAP 6	Régions GTAP 6	Régions Nexus	Régions Sohngen
Switzerland	che 52	IC	Industrialized countries EUR Europe
Syrian Arab Republic	xme 72	NAF	Rest of middle east North Africa ASC Central Asia
Taiwan	twm 8	IC	Industrialized countries ASE South East Asia
Tajikistan	xsu 70	TC	Rest of Former soviet union Transition countries ASC Central Asia
Tanzania, United Republic of	tza 81	SSA	Tanzania Sub-Saharan Africa AFR Africa
Thailand	tha 14	EA	Thailand East Asia ASE South East Asia
Timor Leste	xse 16	EA	Rest of southeast Asia East Asia ASE South East Asia
Togo	xss 87	SSA	rest of sub Saharan Africa Sub-Saharan Africa AFR Africa
Tokelau	xoc 3	EA	Rest of Oceania East Asia ASE South East Asia
Tonga	xoc 3	EA	Rest of Oceania East Asia ASE South East Asia
Trinidad and Tobago	xfa 35	LAM	Rest of free trade areas of the americas Latin America LAT South Central America
Tunisia	tun 74	NAF	Tunisia North Africa AFR Africa
Turkey	tur 71	NAF	Turkey North Africa ASC Central Asia
Turkmenistan	xsu 70	TC	Rest of Former soviet union Transition countries ASC Central Asia
Turks and Caicos	xcb 36	LAM	rest of the caribbean Latin America LAT South Central

Pays GTAP 6		Régions GTAP 6		Régions Nexus		Régions Sohngen		
Tuvalu	tuv	xoc	3	Rest of Oceania	EA	East Asia	ASE	America South East Asia
Uganda	uga	uga	86	Uganda	SSA	Sub-Saharan Africa	AFR	Africa
Ukraine	ukr	xsu	70	Rest of Former soviet union	TC	Transition countries	ASC	Central Asia
United Arab Emirates	are	xme	72	Rest of middle east	NAF	North Africa	ASC	Central Asia
United Kingdom	gbr	gbr	43	United Kingdom	IC	Industrialized countries	EUR	Europe
United States of America	usa	usa	22	United States of America	IC	Industrialized countries	US	United States
Uruguay	ury	ury	32	Uruguay	LAM	Latin America	LAT	South Central America
Uzbekistan	uzb	xsu	70	Rest of Former soviet union	TC	Transition countries	ASC	Central Asia
Vanuatu	vut	xoc	3	Rest of Oceania	EA	East Asia	ASE	South East Asia
Venezuela	ven	ven	27	Venezuela	LAM	Latin America	LAT	South Central America
Viet Nam	vnm	vnm	15	Viet Nam	EA	East Asia	ASE	South East Asia
Virgin Islands, British	vgb	xcb	36	rest of the caribbean	LAM	Latin America	LAT	South Central America
Virgin Islands, U.S.	vir	xfa	35	Rest of free trade areas of the americas	LAM	Latin America	LAT	South Central America
Wallis and Futuna	wlf	xoc	3	Rest of Oceania	EA	East Asia	ASE	South East Asia
Yemen	yem	xme	72	Rest of middle east	NAF	North Africa	ASC	Central Asia

Pays GTAP 6	Régions GTAP 6	Régions Nexus	Régions Sohngen
Zambia zmb	zmb 82 Zambia	SSA Sub-Saharan Africa	AFR Africa

Table des pays et régions utilisés par le modèle Nexus classés par ordre alphabétique des pays.

Types de forêts utilisés par Global Timber Market Model et GTAP Land-Use

région GTM	types de forêt						
	M1	M2	M3	M4	M5	M6	M7
Africa	SWP	HWP	DTR	-	TR		
Central Asia	P	MIXED					
South East Asia	P	-	DT	-	TR		
south and central America	SWP	HWP	MIXED	MIXED	TR		
Australia	SWP	HWP	MIXED	TR			
India	P	-	-	-	TR		
Japan	SWP	-	MIXED				
north Korea	MIXED						
New Zealand	SWP	HWP	-	-			
South Korea	MIXED						
Europe	BSW	CESW	CEHW	SSW	SHW	?	P
USA	PNWP	SP	SSW	NSW	INTSW	NSWL	INTSWL
Russia	TSW	BOR	TBHW	BORL			
Canada	PNW	-	-	NEMIX	-	?	INMIX
China	SWP	TMIX	NSW	STRL	SMIXL	NMIXL	BORL

région GTM	types de forêt (suite)													
	M8	M9	M10	M11	M12	M13	M14							
Africa														
Central Asia														
South East Asia														
south and central America														
Australia														
India														
Japan														
north Korea														
New Zealand														
South Korea														
Europe	BSWL	MIXED	-											
USA	PNWL	SHW	NHW	THW	SMIXED	TMIXED	NMIXL							
Russia														
Canada	PNWL	NML	BOR											
China														

: Table des types de forêts du modèle GTM par région, suite (Source : Sohngen et Al., 2004)

Abréviation	Description du type de forêt
BOR	Low access boreal except for Russia : boreal softwoods and hardwoods
BORL	low access boreal
BSW	boreal softwood type
BSWL	low access boreal softwoods
CEHW	central european hardwoods
CESW	central european softwoods
DT	high value dipterocarp forests
DTR	dry tropical forest
HWP	hardwood plantation type
INMIX	interior Canada mixed
INTSWL	low access interior softwood or interior/mountain softwood in the usa
MIXED	other species
NEMIX	northwestern mixed SW and HW
NHW	northern hardwood
NMIXL	low access northern mixed forest
NML	low access northern mixed forest
NSW	northern softwood
NSWL	low access northern softwood
P	general plantation type
PNW	pacific northwestern coastal rainforest
PNWL	low access PNW coastal rainforest or low access pacific northwestern softwood in the usa
PNWP	pacific northwestern west-side
SHW	southern european hardwoods or southern hardwoods in the usa
SMIXL	low access southern mixed forest
SP	southern pine plantations
SSW	southern european softwoods or southern softwoods in the usa
STRL	low access southern tropical
SWP	softwood plantation type
TBHW	temperate and boreal hardwoods
THW	temperate hardwood
TMIX	temperate mixed

TR	tropical forest
TSW	temperate softwood

: Liste des types de forêts utilisés par Sohngen et la base de données GTAP – landuse
(Source : Sohngen et Al., 2004)