Forestry Department

Food and Agriculture Organization of the United Nations

FRA 2000

PAN-TROPICAL SURVEY OF FOREST COVER CHANGES 1980-2000

RESULTS AND FINDINGS

Forest Resources Assessment Programme

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The Forest Resources Assessment Programme

Forests are crucial for the well-being of humanity. They provide foundations for life on earth through ecological functions, by regulating the climate and water resources and by serving as habitats for plants and animals. Forests also furnish a wide range of essential goods such as wood, food, fodder and medicines, in addition to opportunities for recreation, spiritual renewal and other services.

Today, forests are under pressure from expanding human populations, which frequently leads to the conversion or degradation of forests into unsustainable forms of land use. When forests are lost or severely degraded, their capacity to function as regulators of the environment is also lost, increasing flood and erosion hazards, reducing soil fertility and contributing to the loss of plant and animal life. As a result, the sustainable provision of goods and services from forests is jeopardized.

FAO, at the request of the member nations and the world community, regularly monitors the world's forests through the Forest Resources Assessment Programme. The next report, the Global Forest Resources Assessment 2000 (FRA 2000), will review the forest situation by the end of the millennium. FRA 2000 will include country-level information based on existing forest inventory data, regional investigations of land-cover change processes and a number of global studies focusing on the interaction between people and forests. The FRA 2000 report will be made public and distributed on the World Wide Web in the year 2000.

The Forest Resources Assessment Programme is organized under the Forest Resources Division (FOR) at FAO headquarters in Rome. Contact persons are:

Robert Davis	FRA Programme Coordinator	robert.davis@fao.org
Peter Holmgren	FRA Project Director	peter.holmgren@fao.org

or use the e-mail address: fra@fao.org

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Paper drafted by: Anne Branthomme, FAO-FRA Programme

Abbreviations

CATIE	Tropical Agricultural Research and Higher Education Centre
DCW	Digital Chart of the World
ENGREF	Nationale du génie rural des eaux et des forêts
FAO	Food and Agricultural Organization of the United Nations
FRA	Forest Resources Assessment Programme of FAO
FSI	Forest Survey of India
ha	hectare (s)
HRSD	high-resolution satellite data
IBAMA	Instituto Brasileiro do Meio Ambiente
ICIV	Institut pour la cartographie internationale de la végétation, Toulouse
IRS	Infra-red Scanner
JRC	Joint Research Centre
MSS	Multispectral Scanner
NASA	National Aeronautics and Space Administration
SE	standard error of the mean
SPOT	Satellite Pour l'Observation de la Terre
TIFF	Tagged Image File Format
TM	Thematic Mapper
TREES	Tropical Ecosystem Environment Observation by Satellite
WRS	World Reference System of Landsat

4. Results and findings

The results from the FRA 2000 Remote Sensing Survey cover most of pan-tropical forests under a wide range of ecological conditions, from tropical rainforests to dry forests. Estimates were calculated at different levels: at sampling unit, stratum, sub-regional, regional, pan-tropical levels and at ecological zones level. The reliability of the estimates differs according to the study level. The survey was mainly designed for generating information with an acceptable statistical precision at the regional and pan-tropical levels. Estimates at the subregional level have a relatively low precision but give valuable indications on forest changes processes.

For each level of analysis the major findings consist of transition matrices which summarize all change information registered during two consecutive periods. These matrices constitute an interesting source of information for studying land use dynamics and understanding the processes of changes involved. From them were derived forest area change and forest area change estimates for the reference years and periods. The survey is the first assessment tool to provide consistent and comparable information over two reporting periods (1980-1990 and 1990-2000), allowing the calculation of both changes and the change in changes between the two periods. Past assessments have not been able to provide such information on trends owing to various inconsistencies in information between subsequent FRA reports.

Moreover, the consistency of the survey over the whole pan-tropical area makes it a good tool for comparing statistics between regions and calibrating results from national statistics on a regional basis.

4.1. Example of results at sampling unit level

Among the 117 sampling units selected for the survey, 113 were analysed and mapped at three points in time (T1, T2 and T3). The four remaining samples could not be completely studied due to a lack of suitable images available, and were only interpreted at two points in time. Two of them are located in the Congo Basin, one in Venezuela, the other one in Papua New Guinea.

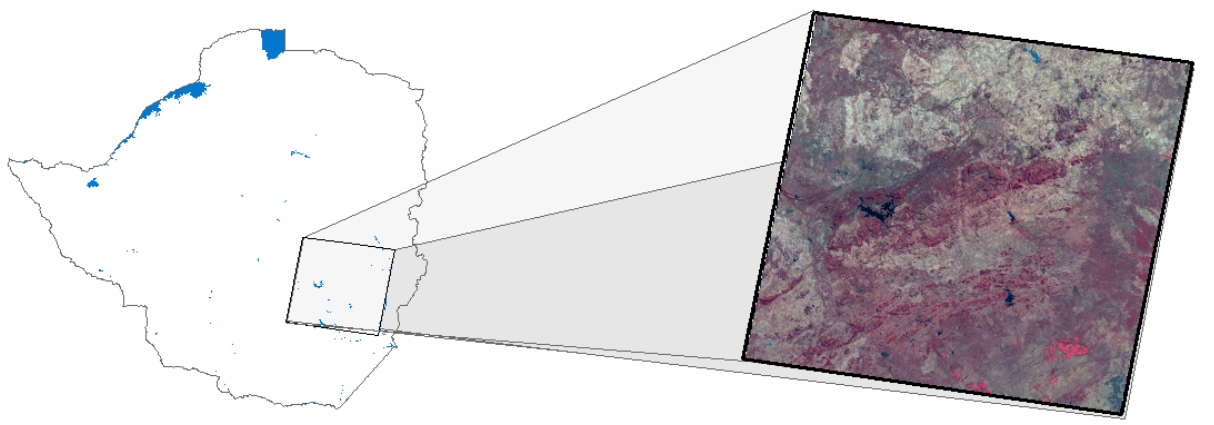
On average the visible area of the T2 image covered 3.1 million ha, which were integrally interpreted. As regards the T1 and T3 images, only the common area with the T2 image was analysed. The size of these common areas varies among the sampling units, mainly due to cloud coverage and shifts in the satellite track. The interpreted visible common area between the T1 and T2 images represented a mean of 2.2 million ha, while the common area between the T2 and T3 images amounted about 2.6 million ha. The common visible part to all three images of the time series measured on average 2 million ha. In total, the visible area interpreted covered 982 million hectares (T1, T2 and T3 images). Excluding the permanent water the common area to all three dates represent a total land area of 225 millions over all the sampling units or 7.4 percent of the total surveyed area.

The resulting maps represent primary spatial information that could be used for a number of analyses in particular at local level, which pursue other objectives than the actual remote sensing survey. Geo-referenced maps derived from the import of the data grids into a Geographic Information System (GIS) as well as the maps derived from the scanning process of the interpretation overlays constitutes an important spatial data set.

For every sampling unit, estimates of the land cover state (area covered by each land cover classes) at the three times of observation and at the reference years, as well as area change matrices for the observed and reference periods were produced. Forest cover estimates and forest cover change estimates were also calculated for the different forest definitions adopted.

An example of results from the interpretation is given for a sampling unit located in Zimbabwe (sampling unit code 1613, WRS2 path/row 169/74, see Figure 1). The T1 image, a Landsat Multispectral scanner (MSS) scene, was acquired on May 1981; the T2 image, also a Landsat MSS image, was dated May 1989; the T3 image used was a Landsat Thematic Mapper (TM) scene from June 1998.

Figure 1. Location of the sampling unit 1613 in Zimbabwe and T3 satellite image

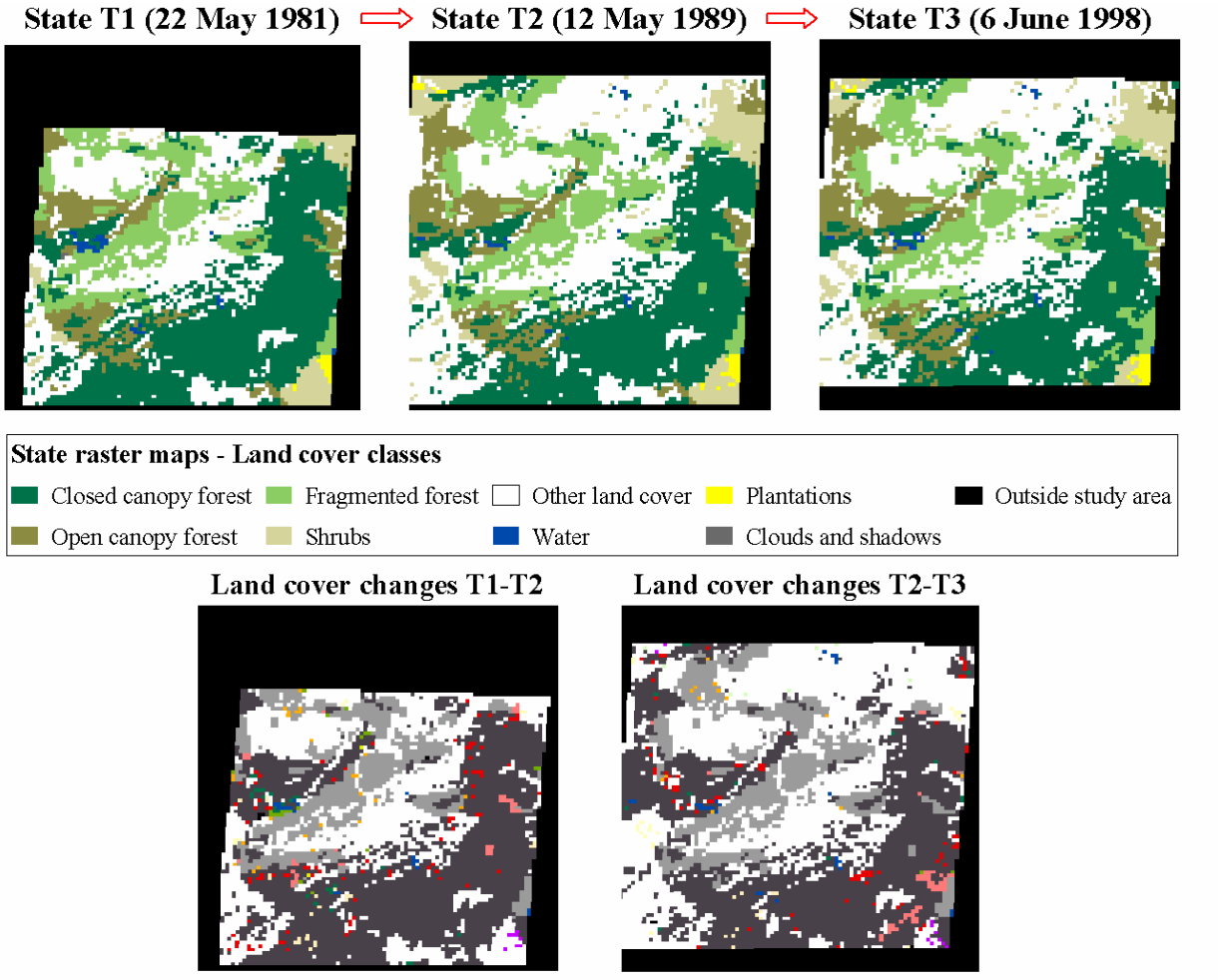


T3 image
Landsat TM 5 Path 169 Row 74
Acquisition date 6 June 1998

4.1.1. State and change raster maps based on dot grid registrations

The *raster* maps shown in the Figure 2 derive from the interpretation of the three date time series of images. They represent the states at the times T1, T2 and T3 (above) and the distribution of changes during the periods T1-T2 and T2-T3 (below). The pixel size (smallest unit of the map), in relationship with the dot grid specifications used for the data registration, is 2 x 2 km^2. The change maps presented are based on the common area between two consecutive images.

Figure 2. Results for a sampling unit (sampling unit code 1613, Zimbabwe). State and change raster maps based on dot grid registrations



4.1.2. Observed transition matrices and states

Transition matrices shown in Table 1 summarise all the changes in land cover classes observed and reported in the interpretation overlays of the sampling unit during the studied periods (T1-T2 and T2-T3).

The matrices presented refer only to the common part to all three images of the time series. This restriction of the studied area allows comparing matrices from both periods. Similar matrices describing the changes observed in the common area to two consecutive images were also produced.

The row and columns sums of the matrices give the area of each classes, or states, at the times T1, T2 and T3.

Table 1. Observed area transition matrices for the periods T1-T2 and T2-T3, for the sampling unit 1613, Zimbabwe (thousand ha).

Area transition matrix T1-T2 (1981-1989)

(Thousand hectares)

Land cover classes in T1	Land cover classes in 1990: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations	State T1	% of total land area
Closed canopy forest	842.4	8.8		6.8	0.8		22.0	0.4		**881.2**	*38.3*
Open canopy forest	0.8	202.8		9.6			10.4			**223.6**	*9.7*
Long fallow											
Fragmented forest	2.0	4.8		368.8			10.4			**386.0**	*16.8*
Shrubs					65.2		2.8		2.8	**70.8**	*3.1*
Short fallow											
Other land cover	0.8	4.4		0.8			708.0			**714.0**	*31.1*
Water	2.0	2.8		0.8			2.4	7.6		**15.6**	*0.7*
Plantations									8.0	**8.0**	*0.3*
State T2 →	**848.0**	**223.6**		**386.8**	**66.0**		**756.0**	**8.0**	**10.8**	2 299.2	
% of total land area →	*0.4*	*0.1*		*0.2*	*0.0*		*32.9*	*0.0*	*0.0*		

Area transition matrix T2-T3 (1989-1998)

(Thousand hectares)

Land cover classes in T2	Land cover classes in T3: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations	State T2	% of total land area
Closed canopy forest	807.2	4.4		21.2	0.8		13.2	1.2		**848.0**	*36.9*
Open canopy forest		212.8		0.4			10.0	0.4		**223.6**	*9.7*
Long fallow											
Fragmented forest				382.8			3.6	0.4		**386.8**	*16.8*
Shrubs					58.0		4.8		3.2	**66.0**	*2.9*
Short fallow											
Other land cover	2.4	0.8		0.8	0.8		750.0	1.2		**756.0**	*32.9*
Water								8.0		**8.0**	*0.3*
Plantations							0.4		10.4	**10.8**	*0.5*
State T3 →	**809.6**	**218.0**		**405.2**	**59.6**		**782.0**	**11.2**	**13.6**	2 299.2	
% of total land area →	*35.2*	*9.5*		*17.6*	*2.6*		*34.0*	*0.5*	*0.6*		

Notes: The diagonals of the matrices contain areas where no change was identified between two consecutive dates. The other elements represent areas that changed from a class (row class) to another (column class) during the studied period. The land cover classes are ordered according to decreasing indicative woody biomass content, with the exception of the plantation class, so negative changes (from higher to lower biomass) correspond to the values above the diagonal while positive changes are below.

Results can also be expressed as relative values, in percentage of the total area where changes were registered in the period (Table 2). The row and column totals give respectively the area changed by classes of origin and destination.

As an example, these matrices show that, in the studied area

- During the first period, the main transition was from the class closed canopy forest to the class other land cover representing 22.8 percent of the total changed area (22 thousand hectares).
- In the second period, this transition decreased to 13.2 thousand while most of the changes (30.3 percent or 21.2 thousand hectares) occurred from the closed canopy forest class to the fragmented forest class. This difference indicates a change in the change processes between the two observed periods.
- During both periods the closed canopy forest class was the most affected by changes (40 percent and 58.3 percent of total change respectively in the periods T1-T2 and T2-T3), while the other land cover class was the most common class of destination

(49.8 percent and 45.7 percent), followed by the fragmented forest class (18.7 percent and 32 percent).

Table 2. Analysis of change for the periods T1-T2 and T2-T3 in the sampling unit 1613, Zimbabwe (percentage of total change)

PERIOD 1: T1-T2 (1981-1989)

% of total change		Land cover classes in T2								Total change by class of origin	
Land cover classes in T1		Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations	ha	%
Closed canopy forest			9.1		7.1	0.8		22.8	0.4		**38.8**	*40.2*
Open canopy forest		0.8			10.0			10.8			**20.8**	*21.6*
Long fallow												
Fragmented forest		2.1	5.0					10.8			**17.2**	*17.8*
Shrubs								2.9		2.9	**5.6**	*5.8*
Short fallow												
Other land cover		0.8	4.6		0.8						**6.0**	*6.2*
Water		2.1	2.9		0.8			2.5			**8.0**	*8.3*
Plantations												
Total change by class of destination	ha	**5.6**	**20.8**		**18**	**0.8**		**48**	**0.4**	**2.8**	**96.4**	
	%	*5.8*	*21.6*		*18.7*	*0.8*		*49.8*	*0.4*	*2.9*		*100.0*

PERIOD 2: T2-T3 (1989-1998)

% of total change		Land cover classes in T3								Total change by class of origin	
Land cover classes in T2		Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations	ha	%
Closed canopy forest			6.3		30.3	1.1		18.9	1.7		**40.8**	*58.3*
Open canopy forest					0.6			14.3	0.6		**10.8**	*15.4*
Long fallow												
Fragmented forest								5.1	0.6		**4.0**	*5.7*
Shrubs								6.9		4.6	**8.0**	*11.4*
Short fallow												
Other land cover		3.4	1.1		1.1	1.1			1.7		**6.0**	*8.6*
Water												
Plantations								0.6			**0.4**	*0.6*
Total change by class of destination	ha	**2.4**	**5.2**		**22.4**	**1.6**		**32**	**3.2**	**3.2**	**70.0**	
	%	*3.4*	*7.4*		*32.0*	*2.3*		*45.7*	*4.6*	*4.6*		*100.0*

4.1.3. Forest cover and forest cover change estimates

Estimates of forest cover and forest area change were calculated by grouping different land cover classes according to the different definitions of forest adopted (Table 3). The definitions are presented in section 2.2.2.

Table 3. Forest area estimates for the sampling unit 1613 (Zimbabwe), according to different definitions of forest (thousand ha)

	Forest definition **f1**	Forest definition **f2**	Forest definition **f3**
T1	881.2	1 190.6	1 233.5
T2	848.0	1 157.6	1 200.5
T3	809.6	1 117.6	1 162.7

Table 4. Forest area change estimates for the sampling units 1613 (Zimbabwe), for the different forest definition (thousand ha)

		Annual deforestation *(thousand ha/year)*	**Net annual forest area change** *(thousand ha/year)*	**Deforestation rate** *(%/year)*
Forest definition f1	**Period T1-T2**	4.9	- 4.2	0.48
	Period T2-T3	4.5	- 4.2	0.51
Forest definition f2	**Period T1-T2**	6.1	- 4.1	0.35
	Period T2-T3	5.4	- 5.0	0.39
Forest definition f3	**Period T1-T2**	6.0	- 4.1	0.34
	Period T2-T3	5.2	-4.7	0.35

Notes: deforestation represents the gross forest loss (all transitions from forest to non-forest classes according to the selected definition); net forest area change is the net forest gain or loss (transitions from non-forest to forest classes minus deforestation).

4.1.4. Standardised transition matrices 1980-1990 and 1990-2000

The matrices presented in Table 5 show the results of the standardisation procedure to the reference years 1980,1990 and 2000 presented in section 2.4. The main interest of these matrices is the calculation of estimates at aggregated levels such as regional, pan-tropical or ecological levels. They can also be used for comparing the matrices between sampling units.

Diagrams of comparison of standardised vs. observed states, as presented in Figure 3, were used for verifying the solutions of the standardisation process. They also give a picture of the trend of each class inside the sampling unit.

Table 5. Standardised area transition matrices for the periods 1980-1990 and 1990-2000 for the sampling unit 1613, Zimbabwe (thousand ha)

Area transition matrix 1980-1990

(Thousand hectares)

Land cover classes in 1980	Land cover classes in 1990: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	State 1980	% of total land area
Closed canopy forest	838.4	10.8		9.0	1.0		27.3	0.5		**887.0**	*38.6*
Open canopy forest	1.0	198.1		11.5			12.8			**223.4**	*9.7*
Long fallow											
Fragmented forest	2.4	5.7		364.9			12.7			**385.7**	*16.8*
Shrubs					64.6		3.6		3.5	**71.7**	*3.1*
Short fallow											
Other land cover	1.0	5.3		1.0			699.0			**706.3**	*30.7*
Water	2.5	3.5		1.0			3.1	7.3		**17.4**	*0.8*
Plantations									7.5	**7.5**	*0.3*
State 1990 →	**845.3**	**223.4**		**387.4**	**65.6**		**758.5**	**7.8**	**11.0**	2 299	
% of total land area →	*36.8*	*9.7*		*16.9*	*2.9*		*33.0*	*0.3*	*0.5*		

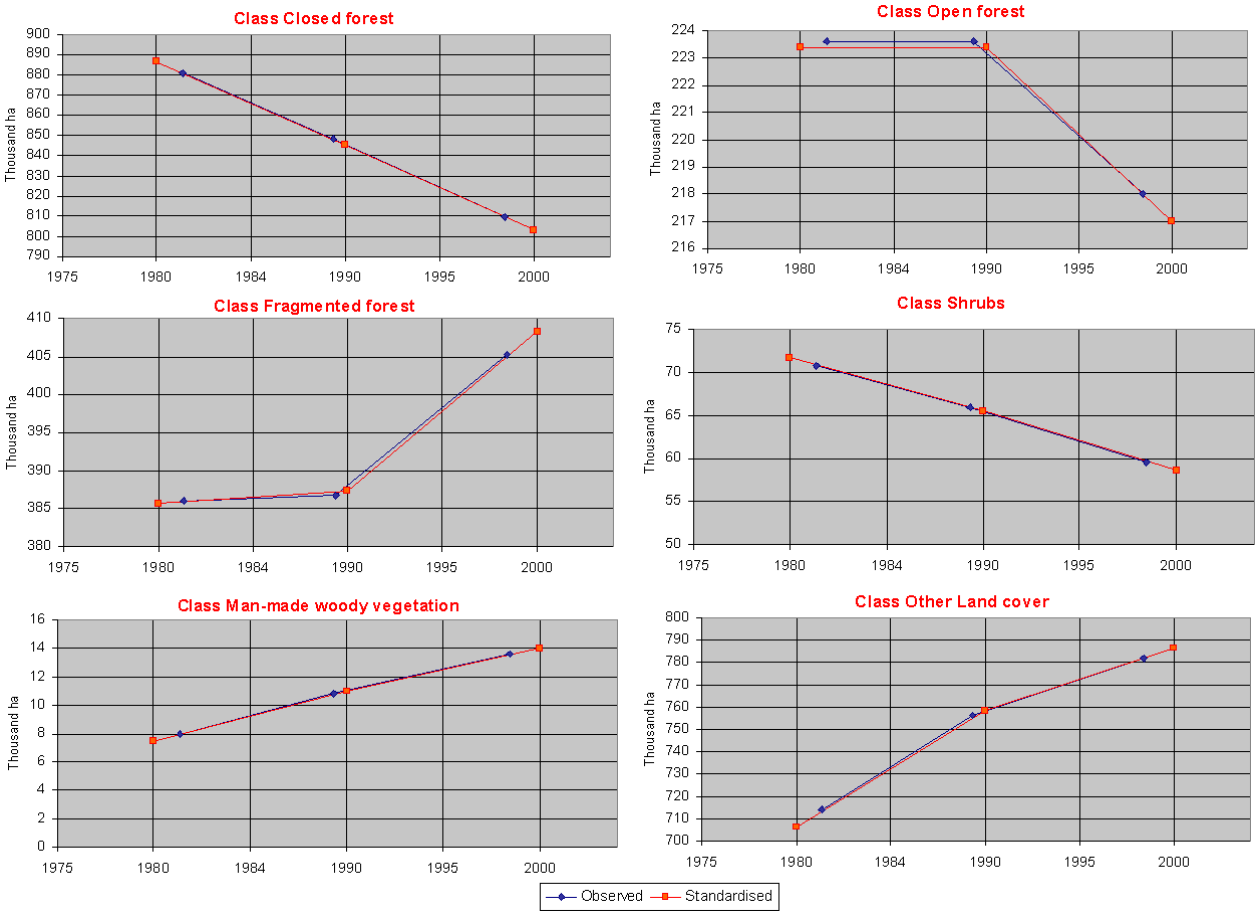
Area transition matrix 1990-2000

(Thousand hectares)

Land cover classes in 1990	Land cover classes in 2000: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	State 1990	% of total land area
Closed canopy forest	800.6	4.6		23.8	0.9		14.1	1.3		**845.3**	*36.8*
Open canopy forest		212.0					10.9	0.5		**223.4**	*9.7*
Long fallow											
Fragmented forest	- 0.1	- 0.2		383.6			3.7	0.5		**387.4**	*16.9*
Shrubs					56.8		5.3		3.5	**65.6**	*2.9*
Short fallow											
Other land cover	2.7	0.7		0.9	0.9		752.0	1.4		**758.5**	*33.0*
Water	- 0.1	- 0.1					- 0.1	8.1		**7.8**	*0.3*
Plantations							0.5		10.5	**11.0**	*0.5*
State 2000 →	**803.1**	**217.0**		**408.3**	**58.6**		**786.4**	**11.8**	**14.0**	2 299	
% of total land area →	*34.9*	*9.4*		*17.8*	*2.5*		*34.2*	*0.5*	*0.6*		

Notes: see Table 1. The small negative values produced by the mathematical routines, unrealistic, were removed before the aggregation process.

Figure 3. Diagrams of comparison between standardised and observed states. Sampling unit 1613, Zimbabwe. Thousand ha.



Notes: The observed dots (in blue) represent the area effectively measured at the time T1, T2 and T3, while the standardised dots (in red) are calculated area generated from the standardisation at the year 1980, 1990 and 2000 procedure through a number of assumptions. In the above case, the results were extrapolated to the years 1980 and 2000.

4.2. States and changes for the periods 1980-1990 and 1990-2000 at Pan-tropical, regional and ecological zones levels

The aggregated area transition matrices for the 1980-1990 and 1990-2000 periods, estimated for the two reference periods at pan-tropical and regional levels and for ecological zones, constitute the overall and more interesting results of the remote sensing survey. They are based on the standardized matrices of 113 of the 117 selected sampling units (see section 2.5.1 for statistical calculations). These matrices, presented in the following paragraphs, describe in details the land cover changes from 1980 (classes in row) to 1990 (classes in columns), and from 1990 (classes in row) to 2000 (classes in column) for the surveyed land area. Standard errors and confidence intervals of the elements of the matrices were also calculated and are given in Appendix 1.

To facilitate the analysis, different results directly generated from the area transition matrices are shown also in the below sections:

- Summaries of net changes by class for the two periods 1980-1990 and 1990-2000 were produced to describe the area lost and gained for each class during the two studied

periods. They were obtained directly from the matrices by calculating the difference between two consecutive states (row and column sums of the matrices).

- Elements of the transition matrices were also expressed as percentage of the total area change estimated for a given period. This presentation of the results focuses on the analysis of change and allows identifying the major transitions and the main classes of destination and of origin.

Although the results are presented hereby for the two periods, the analysis focuses on the period 1990-2000. The comparison with the decade 1980-1990 will be presented in the section 4.3 where the significance of the differences between the estimates from the two periods is studied.

4.2.1. Area transition matrices and net changes by land cover classes at pan-tropical and regional levels

4.2.1.1. Pan-tropical level

For the 1990-2000 reporting period, at the pan-tropical level, the survey revealed that closed canopy forest was the class most subject to loss (Figure 4 and Table 7): a mean of 70 million hectares disappeared (45 percent of the total area change). At the opposite, the other land cover class, which includes sparsely vegetated areas such as grassland, agriculture and urban areas, showed the greatest increase in area across the tropics (73 million hectares or 54 percent). The main area transition at the pan-tropical level, estimated at 43 million ha (26 percent of all changes), was the conversion of closed canopy forests to other land cover (Table 6). Also noticeable during that decade were the transitions from fragmented forest, shrubs and short fallow classes to the other land cover class, and from closed canopy forest to fragmented forest and short fallow classes.

4.2.1.2. Regional level

The summaries of net changes by region (Figure 5, Figure 6 and Figure 7) show also that in all the regions the closed canopy forest was the main class affected by loss in the period 1990-2000 while the “other land cover” class presented the major increase. However, results at regional level varied somewhat.

Forest change in Latin America (Table 12 and Figure 7), during the 1990s, was characterized by a marked large transition from closed canopy forests into other land cover (32 millions hectares or 41 percent of total change), which was about twice as great as the total area in the other two regions. Substantial areas of shrubs were also converted into other land cover class in Latin America, but not in Asia or Africa. The other land cover class expanded considerably and gained an estimated area covering almost 40 million ha (67 percent of total changes in the region).

While the findings were similar in Asia (Table 10 and Figure 6), showing that the greatest transition was from closed canopy forests class into “other land cover” (32 percent of total area change), that region also had large areas of closed canopy forest that were transformed into both long and short fallow. Changes from other land cover and closed canopy forests to plantations (human-made woody vegetation) were also notably observed in Asia. The

plantation area expanded notably. Meanwhile, the area covered by the long fallow class in Asia reduced.

In Africa (Table 8) the amount of closed canopy forest converted into other land cover was relatively low in comparison with other regions (only 5 percent of all the changes). Large portions of both closed and open canopy forests were converted into fragmented forest and short fallow classes in the region. Significant areas of fragmented forest were also converted into other land cover. The open canopy forest in Africa sustained greater losses than in the other regions (minus 10 million hectares or 25 percent of total area change).

Positive transitions are those in which the woody content of the area increased. While they were not common during the 1990s, some positive changes were observed when other land cover recuperated into short fallow and shrubs in Latin America. Shifts from other land cover to fragmented forest were more uniformly distributed throughout the tropics, while changes from short fallow to long fallow were observed mostly in Asia.

Table 6. Area transition matrices for the periods 1980-1990 and 1990-2000 at pan-tropical level (million ha)

Area transition matrix 1980-1990

(million ha)

Land cover classes in 1980	Land cover classes in 1990: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations	State 1980	% of total land area
Closed canopy forest	1 200.4	6.3	9.5	11.3	1.7	15.1	35.5	2.1	2.7	**1 284.6**	*41.9*
Open canopy forest	0.7	295.9	0.6	5.9	1.3	2.3	10.0	0.6	0.2	**317.4**	*10.3*
Long fallow	1.1	0.1	62.3	0.3	0.3	6.8	2.2	0.1	ε	**73.0**	*2.4*
Fragmented forest	0.7	0.8	0.2	197.5	0.8	3.9	14.8	0.4	0.2	**219.4**	*7.2*
Shrubs	0.2	0.1	0.2	0.1	149.9	0.3	19.2	0.6	0.3	**170.9**	*5.6*
Short fallow	1.1	0.4	1.3	0.7	0.3	109.2	7.2	0.2	0.2	**120.5**	*3.9*
Other land cover	0.8	1.0	0.3	1.6	1.6	1.2	853.6	1.4	0.9	**862.2**	*28.1*
Water	0.1	0.1	ε	0.1	ε	0.1	1.0	2.5	ε	**4.0**	*0.1*
Plantations	0.1	ε	ε	ε	ε	0.2	0.9	ε	14.8	**16.1**	*0.5*
State 1990 →	**1 205.1**	**304.5**	**74.4**	**217.5**	**155.9**	**139.0**	**944.4**	**7.8**	**19.3**	**3 068**	
% of total land area →	*39.3*	*9.9*	*2.4*	*7.1*	*5.1*	*4.5*	*30.8*	*0.3*	*0.6*		

Area transition matrix 1990-2000

(million ha)

Land cover classes in 1990	Land cover classes in 2000: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations	State 1990	% of total land area
Closed canopy forest	1131.6	1.2	5.7	9.4	1.3	9.8	43.1	1.1	1.9	**1 205.1**	*39.3*
Open canopy forest	0.2	287.3	0.5	6.8	0.7	2.2	6.6	0.1	ε	**304.5**	*9.9*
Long fallow	1.1	0.1	63.2	0.2	ε	4.8	4.7	ε	0.2	**74.4**	*2.4*
Fragmented forest	0.5	0.4	0.2	202.1	0.5	2.2	11.2	0.1	0.2	**217.5**	*7.1*
Shrubs	0.1	0.1	ε	0.1	143.5	0.6	9.7	1.8	0.1	**155.9**	*5.1*
Short fallow	1.0	0.3	1.2	1.5	0.2	122.7	11.6	0.2	0.4	**139.0**	*4.5*
Other land cover	0.6	0.5	0.5	2.3	3.7	4.9	928.4	1.3	2.3	**944.4**	*30.8*
Water	0.2	ε	ε	ε	0.8	ε	1.2	5.6		**7.8**	*0.3*
Plantations	ε			ε	ε	ε	1.1		18.0	**19.3**	*0.6*
State 2000 →	**1 135.2**	**290.0**	**71.5**	**222.5**	**150.6**	**147.3**	**1 017.6**	**10.2**	**23.2**	**3 068**	
% of total land area →	*37.0*	*9.5*	*2.3*	*7.3*	*4.9*	*4.8*	*33.2*	*0.3*	*0.8*		

Notes: See Table 1. The symbol ε indicates values below the displayed decimal point. The matrices are based on the common visible area between all the images of the three date time-series. Stable water was excluded from the matrices. For the comparison between periods see section 4.3.

Figure 4. Summary of net changes during the periods 1980-1990 and 1990-2000 by land cover classes at pan-tropical level (million ha)

(million ha)	1980-1990	1990-2000
Closed canopy forest	- 79.5	- 69.9
Open canopy forest	- 12.9	- 14.6
Long fallow	1.4	- 2.9
Fragmented forest	- 1.9	5.0
Shrubs	- 15.0	- 5.3
Short fallow	18.6	8.2
Other land cover	82.2	73.2
Water	3.8	2.4
Plantations	3.2	3.9

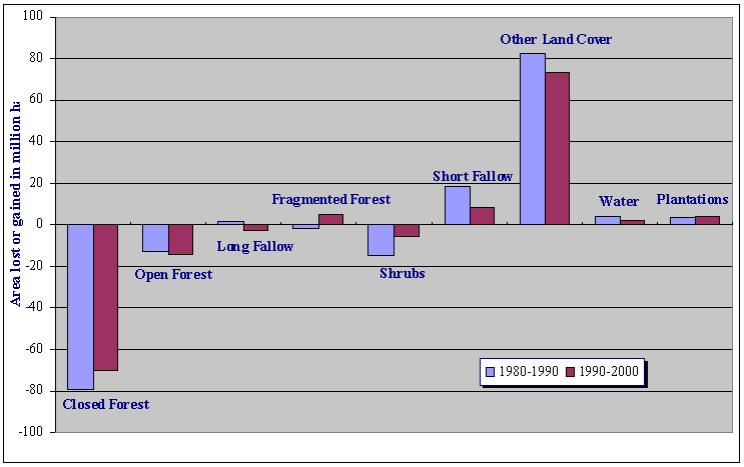


Table 7. Analysis of change for the periods 1980-1990 and 1990-2000 at pan-tropical level (percentages of the total area change)

Period 1: 1980-1990

% of total change

Land cover classes in 1980		Land cover classes in 1990									Total change by class of origin	
		Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations	ha	%
Closed canopy forest			3.4	5.2	6.2	0.9	8.3	19.5	1.2	1.5	**84.2**	*46.3*
Open canopy forest		0.4		0.3	3.3	0.7	1.3	5.5	0.3	0.1	**21.5**	*11.8*
Long fallow		0.6	ε		0.1	0.1	3.7	1.2	ε	ε	**10.7**	*5.8*
Fragmented forest		0.4	0.4	0.1		0.4	2.2	8.1	0.2	0.1	**21.9**	*12.0*
Shrubs		0.1	ε	0.1	0.1		0.2	10.6	0.3	0.1	**21.0**	*11.5*
Short fallow		0.6	0.2	0.7	0.4	0.2		4.0	0.1	0.1	**11.3**	*6.2*
Other land cover		0.4	0.5	0.2	0.9	0.9	0.7		0.8	0.5	**8.7**	*4.8*
Water		0.1	ε	ε	ε	ε	ε	0.6		ε	**1.4**	*0.6*
Plantations		0.1	ε	ε	ε	ε	0.1	0.5	ε		**1.3**	*0.7*
Total change by	ha	**4.7**	**8.7**	**12.2**	**19.9**	**6.0**	**29.9**	**90.9**	**5.3**	**4.5**	**181.9**	
class of destination	%	*2.6*	*4.6*	*6.7*	*10.9*	*3.3*	*16.4*	*49.9*	*2.9*	*2.4*		*100*

Period 2: 1990-2000

% of total change

Land cover classes in 1990		Land cover classes in 2000									Total change by class of origin	
		Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations	ha	%
Closed canopy forest			0.7	3.5	5.7	0.8	5.9	26.0	0.7	1.1	**73.6**	*44.4*
Open canopy forest		0.1		0.3	4.1	0.4	1.3	4.0	ε	ε	**17.2**	*10.3*
Long fallow		0.6	0.1		0.1	ε	2.9	2.8	ε	0.1	**11.2**	*6.7*
Fragmented forest		0.3	0.3	0.2		0.3	1.3	6.7	0.1	0.1	**15.3**	*9.3*
Shrubs		0.1	ε	ε	ε		0.3	5.9	1.1	ε	**12.4**	*7.4*
Short fallow		0.6	0.2	0.8	0.9	0.1		7.0	0.1	0.2	**16.3**	*9.9*
Other land cover		0.4	0.3	0.3	1.4	2.2	3.0		0.8	1.4	**16.0**	*9.7*
Water		0.1	ε	ε	ε	0.5	ε	0.7			**2.2**	*1.3*
Plantations		ε			ε	ε	ε	0.7			**1.2**	*0.7*
Total change by	ha	**3.7**	**2.6**	**8.3**	**20.3**	**7.1**	**24.5**	**89.3**	**4.6**	**5.1**	**165.5**	
class of destination	%	*2.2*	*1.5*	*5.0*	*12.2*	*4.3*	*14.8*	*53.9*	*2.7*	*3.0*		*100*

Notes: The elements of the above matrices represent the transition as percentages of the total area that underwent change (sum of all values of the area transition matrices above and below the diagonal). The row totals give the area and the percentage of total change by class of origin; the column totals give the area and percentages by class of destination.

Table 8. Area transition matrices for the periods 1980-1990 and 1990-2000 in Africa (million ha)

Area transition matrix 1980-1990

(million ha)

Land cover classes in 1980	Land cover classes in 1990: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations	State 1980	% of total land area
Closed canopy forest	273.9	2.7	0.9	4.6	0.1	7.2	2.5	ε	0.1	**292.0**	*23.9*
Open canopy forest	0.2	192.7	0.3	5.2	0.1	1.6	4.7	ε	ε	**204.9**	*16.7*
Long fallow	0.1	ε	15.8	0.2	ε	0.8	0.3			**17.2**	*1.4*
Fragmented forest	0.5	0.6	0.1	136.5	0.2	2.2	5.8	ε	ε	**145.8**	*11.9*
Shrubs	ε	ε	ε	0.1	44.2	0.2	1.2		ε	**45.8**	*3.7*
Short fallow	0.5	0.2	0.1	0.5	0.1	58.2	1.6	ε	0.1	**61.3**	*5.0*
Other land cover	0.3	0.7	ε	1.2	0.3	0.4	452.2	0.2	0.2	**455.5**	*37.2*
Water	ε	ε		ε	ε	0.1	0.4	0.1		**0.6**	*0.1*
Plantations	ε					ε	ε		0.8	**0.9**	*0.1*
State 1990 →	**275.6**	**197.0**	**17.2**	**148.2**	**44.9**	**70.7**	**468.7**	**0.4**	**1.3**	**1 224**	
% of total land area →	*22.5*	*16.1*	*1.4*	*12.1*	*3.7*	*5.8*	*38.3*	*0.0*	*0.1*		

Area transition matrix 1990-2000

(million ha)

Land cover classes in 1990	Land cover classes in 2000: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations	State 1990	% of total land area
Closed canopy forest	261.4	0.6	0.7	5.7	ε	5.0	2.0	ε	0.1	**275.6**	*22.5*
Open canopy forest	ε	186.1	0.2	5.8	0.1	1.8	2.9	ε	ε	**197.0**	*16.1*
Long fallow	ε	0.1	16.3	0.1	ε	0.5	0.2			**17.2**	*1.4*
Fragmented forest	0.2	0.2	ε	139.8	0.1	1.8	6.0	ε	ε	**148.2**	*12.1*
Shrubs	ε	ε	ε	ε	42.9	0.3	1.5		ε	**44.9**	*3.7*
Short fallow	0.8	0.2	0.3	0.9	0.2	65.3	2.9	0.1		**70.7**	*5.8*
Other land cover	0.1	0.2	ε	0.4	0.2	0.4	467.0	0.3	0.1	**468.7**	*38.3*
Water						ε	0.2	0.2		**0.4**	*0.0*
Plantations	ε			ε		ε	0.1		1.2	**1.3**	*0.1*
State 2000 →	**262.6**	**187.4**	**17.6**	**152.8**	**43.5**	**75.1**	**483.0**	**0.6**	**1.4**	**1 224**	
% of total land area →	*21.5*	*15.3*	*1.4*	*12.5*	*3.6*	*6.1*	*39.5*	*0.0*	*0.1*		

Notes: See notes Table 6

Figure 5. Summary of net changes during the periods 1980-1990 and 1990-2000 by land cover classes in Africa (million ha)

(million ha)	1980-1990	1990-2000
Closed canopy forest	- 16.5	- 13.0
Open canopy forest	- 7.9	- 9.6
Long fallow	0.1	0.3
Fragmented forest	2.4	4.7
Shrubs	- 0.9	- 1.4
Short fallow	9.4	4.4
Other land cover	13.2	14.3
Water	- 0.3	0.2
Plantations	0.5	0.1

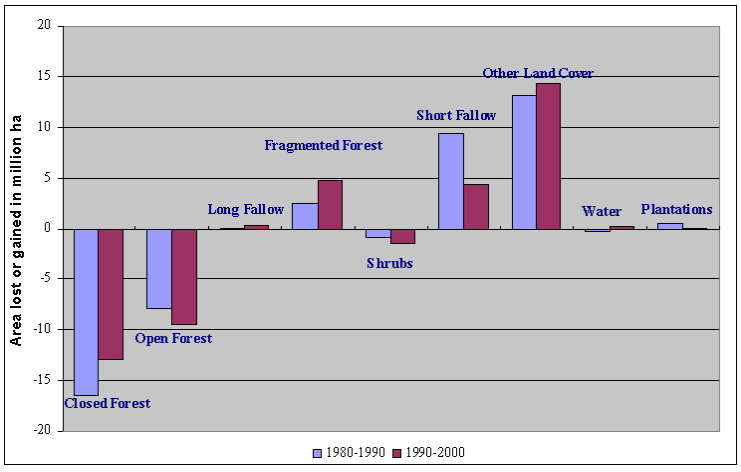


Table 9. Analysis of change for the periods 1980-1990 and 1990-2000 in Africa (percentage of total change)

Period 1: 1980-1990

% of total change

Land cover classes in 1980	Land cover classes in 1990: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations	Total change by class of origin: ha	%
Closed canopy forest		5.4	1.8	9.3	0.2	14.5	5.1	0.1	0.2	**18.2**	*36.5*
Open canopy forest	0.5		0.6	10.5	0.1	3.2	9.5	ε	0.1	**12.2**	*24.6*
Long fallow	0.2	ε		0.4	0.1	1.6	0.5			**1.4**	*2.7*
Fragmented forest	0.9	1.3	0.2		0.4	4.4	11.6	ε	ε	**9.3**	*18.7*
Shrubs	0.1	ε	ε	0.1		0.5	2.5		0.1	**1.6**	*3.2*
Short fallow	1.0	0.5	0.3	1.0	0.1		3.2	0.1	0.1	**3.1**	*6.2*
Other land cover	0.7	1.5	0.1	2.3	0.5	0.8		0.3	0.5	**3.4**	*6.7*
Water	0.1	0.1		ε	ε	0.1	0.7			**0.5**	*1.0*
Plantations	ε					ε	0.1			**0.1**	*0.1*
Total change by class of destination ha	**1.7**	**4.3**	**1.4**	**11.7**	**0.7**	**12.5**	**16.5**	**0.2**	**0.5**	**49.7**	
class of destination %	*3.4*	*8.7*	*2.9*	*23.6*	*1.4*	*25.1*	*33.3*	*0.5*	*1.1*		*100*

Period 2: 1990-2000

% of total change

Land cover classes in 1990	Land cover classes in 2000: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations	Total change by class of origin: ha	%
Closed canopy forest		1.4	1.6	12.9	0.1	11.4	4.6	0.1	0.2	**14.1**	*32.2*
Open canopy forest	0.1		0.5	13.3	0.3	4.0	6.6	ε	ε	**11.0**	*24.9*
Long fallow	0.1	0.1		0.3	ε	1.2	0.5			**1.0**	*2.2*
Fragmented forest	0.4	0.5	0.1		0.1	4.2	13.7	ε	ε	**8.4**	*19.0*
Shrubs	0.1	ε	ε	0.1		0.7	3.5		0.1	**2.0**	*4.5*
Short fallow	1.8	0.5	0.7	2.2	0.4		6.7	0.1		**5.4**	*12.3*
Other land cover	0.2	0.5	0.1	0.9	0.4	0.9		0.7	0.2	**1.7**	*3.9*
Water						ε	0.5			**0.2**	*0.5*
Plantations	ε			ε		ε	0.3			**0.2**	*0.3*
Total change by class of destination ha	**1.2**	**1.4**	**1.3**	**13.1**	**0.6**	**9.8**	**15.9**	**0.4**	**0.2**	**43.9**	
class of destination %	*2.6*	*3.1*	*3.0*	*29.7*	*1.3*	*22.3*	*36.3*	*0.9*	*0.5*		*100*

Notes: See notes Table 7.

Table 10. Area transition matrices for the periods 1980-1990 and 1990-2000 in Asia (million ha)

Area transition matrix 1980-1990

(million ha)

Land cover classes in 1980	Land cover classes in 1990: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	State 1980	% of total land area
Closed canopy forest	210.8	1.8	5.4	1.2	0.3	4.4	7.4	0.4	2.5	**234.3**	*38.4*
Open canopy forest	0.3	24.6	0.1	0.2	0.3	0.1	1.0	0.1	0.1	**26.8**	*4.4*
Long fallow	0.8	ε	42.4	0.1	0.2	5.5	1.9	0.1	ε	**50.9**	*8.3*
Fragmented forest	0.1	0.1	0.1	17.1	0.4	0.2	2.1	ε	0.1	**20.1**	*3.3*
Shrubs	0.1	0.1	0.1	0.1	8.0	ε	1.2	ε	0.1	**9.6**	*1.6*
Short fallow	0.5	0.1	1.0	0.1	0.2	38.4	3.8	ε	0.1	**44.3**	*7.3*
Other land cover	0.2	0.2	0.2	0.2	0.3	0.1	208.1	0.3	0.4	**210.0**	*34.4*
Water	ε	ε		ε	ε		0.1	0.5	ε	**0.7**	*0.1*
Plantations	0.1	ε	ε	ε	ε	0.1	0.8	ε	12.7	**13.8**	*2.3*
State 1990 →	**213.0**	**26.8**	**49.3**	**19.0**	**9.7**	**49.0**	**226.3**	**1.4**	**16.0**	**611**	
% of total land area →	*34.9*	*4.4*	*8.1*	*3.1*	*1.6*	*8.0*	*37.1*	*0.2*	*2.6*		

Area transition matrix 1990-2000

(million ha)

Land cover classes in 1990	Land cover classes in 2000: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	State 1990	% of total land area
Closed canopy forest	193.0	0.4	3.6	0.7	0.1	3.2	9.4	0.7	1.8	**213.0**	*34.9*
Open canopy forest	0.2	24.7	0.2	0.2	0.2	0.3	1.1	ε	ε	**26.8**	*4.4*
Long fallow	0.5	ε	41.7	ε	ε	3.9	2.8	ε	0.2	**49.3**	*8.1*
Fragmented forest	0.1	ε	0.2	16.8	0.2	0.2	1.3	ε	0.1	**19.0**	*3.1*
Shrubs	ε	ε	ε	ε	8.6	0.2	0.8	ε	ε	**9.7**	*1.6*
Short fallow	0.1	ε	0.7	ε	ε	41.3	6.3	0.1	0.4	**49.0**	*8.0*
Other land cover	0.2	0.2	0.2	0.4	0.2	0.3	222.7	0.3	2.0	**226.3**	*37.1*
Water	ε			ε	ε		0.1	1.2		**1.4**	*0.2*
Plantations	ε			ε		ε	0.7		15.3	**16.0**	*2.6*
State 2000 →	**194.2**	**25.3**	**46.6**	**18.3**	**9.3**	**49.5**	**245.1**	**2.5**	**19.8**	**611**	
% of total land area →	*31.8*	*4.2*	*7.6*	*3.0*	*1.5*	*8.1*	*40.1*	*0.4*	*3.2*		

Notes: See notes Table 6.

Figure 6. Summary of net changes during the periods 1980-1990 and 1990-2000 by land cover classes in Asia (million ha).

(million ha)	1980-1990	1990-2000
Closed canopy forest	- 21.3	- 18.8
Open canopy forest	0.0	- 1.5
Long fallow	- 1.6	- 2.7
Fragmented forest	- 1.2	- 0.7
Shrubs	0.2	- 0.4
Short fallow	4.7	0.5
Other land cover	16.3	18.8
Water	0.7	1.1
Plantations	2.2	3.8

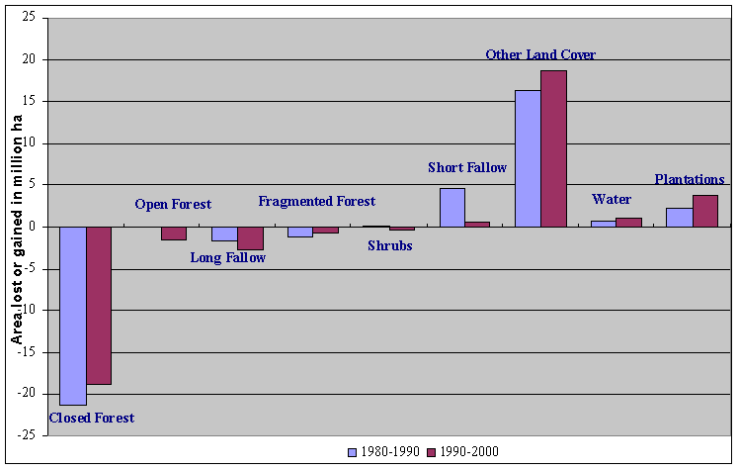


Table 11. Analysis of change for the periods 1980-1990 and 1990-2000 in Asia (percentage of total change)

Period 1: 1980-1990

% of total change

Land cover classes in 1980	Land cover classes in 1990: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	Total change by class of origin: ha	%
Closed canopy forest		3.7	11.2	2.6	0.6	9.3	15.5	0.8	5.3	**23.4**	*48.9*
Open canopy forest	0.6		0.3	0.4	0.6	0.2	2.2	0.1	0.1	**2.2**	*4.7*
Long fallow	1.8	ε		0.1	0.4	11.5	3.9	0.1	ε	**8.6**	*17.8*
Fragmented forest	0.2	0.2	0.3		0.7	0.4	4.3	0.1	0.2	**3.1**	*6.4*
Shrubs	0.1	0.1	0.1	0.1		ε	2.4	0.1	0.1	**1.5**	*3.2*
Short fallow	1.0	0.1	2.1	0.2	0.5		7.9	0.1	0.2	**5.8**	*12.2*
Other land cover	0.4	0.5	0.5	0.4	0.7	0.2		0.6	0.8	**1.9**	*4.0*
Water	0.1	ε		ε	ε		0.2		ε	**0.2**	*0.3*
Plantations	0.2	ε	ε	ε	ε	0.3	1.7	ε		**1.1**	*2.2*
Total change by ha	**2.1**	**2.3**	**7.0**	**1.9**	**1.7**	**10.5**	**18.2**	**0.9**	**3.3**	**47.9**	
class of destination %	*4.5*	*4.7*	*14.5*	*3.9*	*3.6*	*21.9*	*38.1*	*1.9*	*6.7*		*100*

Period 2: 1990-2000

% of total change

Land cover classes in 1990	Land cover classes in 2000: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	Total change by class of origin: ha	%
Closed canopy forest		0.9	8.0	1.6	0.3	7.0	20.8	1.7	4.0	**19.9**	*44.2*
Open canopy forest	0.4		0.4	0.5	0.4	0.6	2.4	0.1	ε	**2.1**	*4.7*
Long fallow	1.2	ε		0.1	ε	8.7	6.3	0.1	0.5	**7.6**	*16.9*
Fragmented forest	0.2	0.1	0.4		0.5	0.5	2.8	0.1	0.1	**2.1**	*4.7*
Shrubs	0.1	ε	ε	ε		0.5	1.7	0.1	ε	**1.1**	*2.4*
Short fallow	0.3	ε	1.6	0.1	ε		13.9	0.2	0.9	**7.6**	*16.9*
Other land cover	0.3	0.4	0.4	0.8	0.4	0.7		0.7	4.4	**3.7**	*8.1*
Water	ε			ε	ε		0.3			**0.2**	*0.3*
Plantations	0.0			0.0		0.1	1.5			**0.7**	*1.6*
Total change by ha	**1.1**	**0.6**	**4.9**	**1.4**	**0.7**	**8.1**	**22.4**	**1.3**	**4.5**	**45.1**	
class of destination %	*2.4*	*1.4*	*10.8*	*3.1*	*1.6*	*18.1*	*49.7*	*2.8*	*9.9*		*100*

Notes: See notes Table 7.

Table 12. Area transition matrices for the periods 1980-1990 and 1990-2000 in Latin America (million ha)

Area transition matrix 1980-1990

(million ha)

Land cover classes in 1980	Land cover classes in 1990: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	State 1980	% of total land area
Closed canopy forest	715.7	1.8	3.3	5.4	1.4	3.4	25.5	1.7	ε	**758.3**	*61.5*
Open canopy forest	0.1	78.6	0.1	0.5	1.0	0.6	4.2	0.5	0.1	**85.7**	*6.9*
Long fallow	0.1	ε	4.1	ε	ε	0.5	0.1	ε		**4.9**	*0.4*
Fragmented forest	0.1	ε	ε	44.0	0.3	1.6	7.0	0.3	0.1	**53.5**	*4.3*
Shrubs	0.1	ε	0.2	ε	97.7	0.1	16.8	0.5	0.2	**115.5**	*9.4*
Short fallow	0.1	0.1	0.2	0.1	ε	12.6	1.8	0.1		**14.9**	*1.2*
Other land cover	0.2	ε	ε	0.2	0.9	0.7	193.3	1.0	0.3	**196.7**	*15.9*
Water	0.1	ε	ε	0.1	ε	ε	0.6	1.9		**2.7**	*0.2*
Plantations				ε			0.1		1.3	**1.4**	*0.1*
State 1990 →	**716.6**	**80.7**	**7.9**	**50.3**	**101.3**	**19.4**	**249.3**	**6.0**	**1.9**	**1 234**	
% of total land area →	*58.1*	*6.5*	*0.6*	*4.1*	*8.2*	*1.6*	*20.2*	*0.5*	*0.2*		

Area transition matrix 1990-2000

(million ha)

Land cover classes in 1990	Land cover classes in 2000: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	State 1990	% of total land area
Closed canopy forest	677.1	0.2	1.4	3.0	1.1	1.7	31.7	0.3	ε	**716.6**	*58.1*
Open canopy forest	ε	76.6	0.1	0.8	0.3	0.1	2.7	ε	ε	**80.7**	*6.5*
Long fallow	0.5	0.1	5.3	0.1	ε	0.3	1.6	ε		**7.9**	*0.6*
Fragmented forest	0.2	0.2	ε	45.5	0.2	0.1	3.9	0.1	0.1	**50.3**	*4.1*
Shrubs	ε	0.1	ε	ε	92.0	ε	7.4	1.7	ε	**101.3**	*8.2*
Short fallow	0.1	0.1	0.2	0.5	ε	16.1	2.4	ε		**19.4**	*1.6*
Other land cover	0.4	0.1	0.3	1.5	3.3	4.2	238.7	0.7	0.2	**249.3**	*20.2*
Water	0.1	ε	ε	ε	0.8	ε	0.9	4.1		**6.0**	*0.5*
Plantations				ε	ε		0.3		1.6	**1.9**	*0.2*
State 2000 →	**678.5**	**77.2**	**7.4**	**51.4**	**97.7**	**22.7**	**289.6**	**7.0**	**2.0**	**1 234**	
% of total land area →	*55.0*	*6.3*	*0.6*	*4.2*	*7.9*	*1.8*	*23.5*	*0.6*	*0.2*		

Notes: See notes Table 6.

Figure 7. Summary of net changes during the periods 1980-1990 and 1990-2000 by land cover classes in Latin America (million ha)

(million ha)	1980-1990	1990-2000
Closed canopy forest	- 41.7	- 38.1
Open canopy forest	- 5.0	- 3.5
Long fallow	3.0	- 0.5
Fragmented forest	- 3.1	1.0
Shrubs	- 14.2	- 3.5
Short fallow	4.5	3.3
Other land cover	52.7	40.2
Water	3.4	1.0
Plantations	0.6	0.1

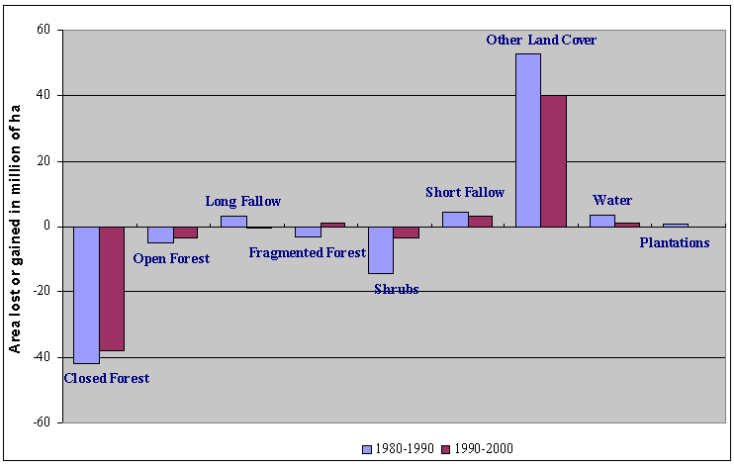


Table 13. Analysis of change for the periods 1980-1990 and 1990-2000 in Latin America (percentage of total change)

Period 1: 1980-1990

% of total change

Land cover classes in 1980		Land cover classes in 1990: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	Total change by class of origin: ha	%
Closed canopy forest			2.2	3.9	6.5	1.6	4.0	30.3	2.0	ε	**42.6**	*50.4*
Open canopy forest		0.1		0.1	0.6	1.1	0.7	5.0	0.6	0.1	**7.1**	*8.4*
Long fallow		0.2	ε		ε	ε	0.6	0.1	ε		**0.8**	*0.9*
Fragmented forest		0.2	0.1	ε		0.3	1.9	8.2	0.4	0.2	**9.5**	*11.2*
Shrubs		0.1	ε	0.2	ε		0.1	19.9	0.6	0.2	**17.8**	*21.1*
Short fallow		0.1	0.1	0.2	0.1	ε		2.2	0.1		**2.3**	*2.8*
Other land cover		0.3	ε	ε	0.3	1.1	0.9		1.1	0.3	**3.4**	*4.0*
Water		0.1	ε	ε	0.1	ε	ε	0.7			**0.8**	*0.8*
Plantations					ε			0.1			**0.1**	*0.1*
Total change by	ha	**0.9**	**2.0**	**3.8**	**6.3**	**3.6**	**6.9**	**56.1**	**4.1**	**0.7**	**84.3**	
class of destination	%	*1.0*	*2.3*	*4.4*	*7.5*	*4.2*	*8.1*	*66.5*	*4.9*	*0.8*		*100*

Period 2: 1990-2000

% of total change

Land cover classes in 1990		Land cover classes in 2000: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	Total change by class of origin: ha	%
Closed canopy forest			0.2	1.8	3.9	1.5	2.2	41.5	0.5	ε	**39.5**	*51.6*
Open canopy forest		ε		0.2	1.0	0.4	0.2	3.5	ε	ε	**4.1**	*5.3*
Long fallow		0.6	0.1		0.1	ε	0.4	2.1	ε		**2.6**	*3.4*
Fragmented forest		0.3	0.2	0.1		0.2	0.2	5.1	0.1	0.2	**4.8**	*6.3*
Shrubs		ε	0.1	ε	ε		ε	9.7	2.3	ε	**9.3**	*12.0*
Short fallow		0.1	0.1	0.3	0.6	ε		3.1	ε		**3.3**	*4.3*
Other land cover		0.5	0.1	0.4	1.9	4.4	5.5		0.9	0.2	**10.7**	*14.0*
Water		0.2	ε	ε	0.1	1.0	0.1	1.1			**1.9**	*2.4*
Plantations					ε	ε		0.4			**0.3**	*0.4*
Total change by	ha	**1.4**	**0.6**	**2.1**	**5.9**	**5.8**	**6.6**	**50.9**	**2.9**	**0.4**	**76.5**	
class of destination	%	*1.8*	*0.7*	*2.7*	*7.7*	*7.5*	*8.5*	*66.5*	*3.7*	*0.4*		*100*

Notes: See notes Table 7.

Area transition matrices at subregional level are also given as an indication in Appendix 3 with the corresponding standard errors. It is indeed important to analyse their contribution in the results at both regional and pan-tropical levels.

4.2.2. Forest area and forest area change at pan-tropical and regional level

4.2.2.1. Forest Area

Estimates of forest area and area change, including error estimates, were calculated by grouping the relevant classes constituting the forest definitions adopted (see section 2.2.2 for the forest definitions and section 2.5.2 for the formulae).

Table 14 reports the forest area estimates for the year 2000 according to all three definitions of forest adopted. Considering the forest definition f3, the forest area for the surveyed area in 2000 was estimated at 1.6 billion hectares, or about 50 percent of the surveyed land area. Half of this area was in Latin America.

Table 14. Estimates of forest area by region and at the pan-tropical level in 2000

	Forest definition f1				Forest definition f2				Forest definition f3			
	Absolute forest area *(million ha)*		Relative forest area *(percent)*		Absolute forest area *(million ha)*		Relative forest area *(percent)*		Relative forest area *(million ha)*		Relative forest area *(percent)*	
	Mean	*SE*	*Mean*	*SE*	*Mean*	*SE*	*Mean*	*SE*	*Mean*	*SE*	*Mean*	*SE*
Africa	263	39	21	3	484	38	40	3	519	37	42	3
Latin America	678	47	55	4	767	49	62	4	780	49	63	4
Asia	194	18	32	3	224	18	37	3	272	23	45	4
Pan-tropical	1135	63	37	2	1475	65	48	2	1571	66	51	2

Notes: The figures are related to the surveyed area, representing about 90 percent of the total forest land in the pan-tropical region. The estimates refer to the different definitions of forest f1, f2 and f3 (cf. part 1, section 2.2.2). SE=Standard error of the mean.

4.2.2.2. Forest area change

Deforestation was defined as the sum of all area transition from forest to non–forest classes. The net forest area change was estimated as the difference of the transitions resulting from non-forest into forest classes minus the deforestation. The deforestation rate was estimated at 0.52 percent per year, corresponding to an annual deforestation of 9.2 million hectares per year, for the pan-tropical zone for the time period 1990-2000 (f3 definition of forest). The net forest area change was of -8.6 million hectares per year during the period (Table 15). Standard errors at the regional levels were relatively high and differences of deforestation rates between geographical regions were not statistically significant at the 5 percent level.

Table 15. Annual deforestation and net forest area changes during the period 1990-2000 by region and at pan-tropical level

a) Forest definition f1

	Annual deforestation *(million ha/year)*	Annual net forest area change *(million ha/year)*		Deforestation rate *(percent/year)*	
	Mean	*Mean*	SE	*Mean*	*SE*
Africa	1.4	-1.3	0.4	0.47	0.11
Asia	2.0	-1.9	0.5	0.88	0.03
Latin America	3.9	-3.8	1.0	0.53	0.03
Pan-tropical	7.4	-7.0	1.2	0.58	0.10

b) Forest definition f2

	Annual deforestation *(million ha/year)*	Annual net forest area change *(million ha/year)*		Deforestation rate *(percent/year)*	
	Mean	*Mean*	SE	*Mean*	*SE*
Africa	2.4	-2.2	0.4	0.43	0.07
Asia	2.2	-2.0	0.5	0.84	0.14
Latin America	4.4	-4.1	1.0	0.51	0.04
Pan-tropical	8.9	-8.3	1.2	0.54	0.08

c) Forest definition f3

	Annual deforestation *(million ha/year)*	Annual net forest area change *(million ha/year)*		Forest area change rate *(percent/year)*	
	Mean	*Mean*	SE	*Mean*	*SE*
Africa	2.3	-2.1	0.4	0.38	0.06
Asia	2.5	-2.3	0.6	0.79	0.20
Latin America	4.4	-4.2	1.1	0.51	0.15
Pan-tropical	9.2	-8.6	1.3	0.52	0.08

4.2.3. Results at ecological level

In order to identify which types of forest were changing, reporting on forests through the remote sensing survey was classified according to ecological zones by grouping classes from the FRA 2000 global Ecological Zone map (FAO 2001) to obtain three aggregate zones:

- Tropical rain forest. Contains the global ecological zone *Tropical rain forest* (wet: high rainfall, no or short dry season).
- Tropical moist deciduous forest. Corresponds to the global ecological zone Tropical moist deciduous forest (subhumid, wet/dry: three to five months dry);
- Tropical dry forest and shrubland. Covers the global ecological zones tropical dry forest (dry/wet, five to height months dry) and tropical shrubland (semi-arid: evaporation > precipitation).

Only the tropical domain was considered (all months without frost: in marine areas over 18°C). The characteristics of the ecological zones considered in the survey are described in Appendix 6. The grouping of the ecological zones (tropical dry forest and tropical shrubland) was justified by the necessity of having a minimum number of sampling units in each zone.

To aggregate the statistics for the ecological zone of interest, the sampling units were classified according to their location relative to the ecological zone covering most of the sampling unit area, since zones transected some of the sampling units (Appendix 7). A GIS was used to overlay the common area to the T1, T2 and T3 data grids with the global ecological zone maps.

The sampling units mainly in the Tropical Mountain systems ecological zone (near > 1000 m altitude), were classified considering:

- the second major tropical ecological zone
- detailed local ecological maps used to build the global ecological zone map
- the spatial distribution of the forests since the forest was completely sometimes present in only one tropical ecological zone due to the altitude factor.

Then, one sampling unit belonging entirely to the temperate domain according to the global ecological zone map was excluded from the analysis (sampling unit 3105, Mexico North).

The ecological zone classification used in FRA 2000 differs from the one used in the FRA 1990 survey. It led to relatively high differences with the results at ecological zone level for the period 1980-1990 as reported in FRA 1990 (FAO 1996, pp 61-66).

The calculations of the estimates for ecological zones are explained in the section 2.5.1.4. Detailed results such as transition matrices and corresponding standard errors and confidence intervals, summary of net change by land cover classes by ecological zones are presented in Appendix 8.

The distribution of forests by ecological zones, as given in Figure 8 showed that the surveyed forests are mainly in the tropical rain forest ecological zone. Deforestation estimates by ecological zone (Table 16) show that the forest loss is also concentrated in the rain forest ecological zone.

Figure 8. Distribution of the forest by ecological zone in 2000 (f3 definition)

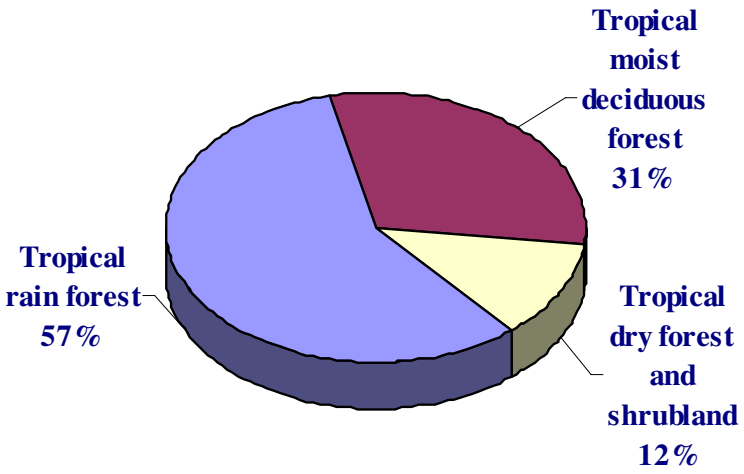


Table 16. Annual deforestation and net forest area change during the period 1990-2000 by ecological zone

	Annual deforestation *(million ha/year)*	Annual net forest area change *(million ha/year)*		Annual deforestation rate *(percent/year)*	
	Mean	*Mean*	SE	*Mean*	*SE*
Tropical rain forest	6.0	-5.7	1.2	0.59	0.14
Tropical moist deciduous forest	2.4	-2.2	0.4	0.43	0.07
Tropical dry forest and shrublands	0.8	-0.7	0.3	0.38	0.13

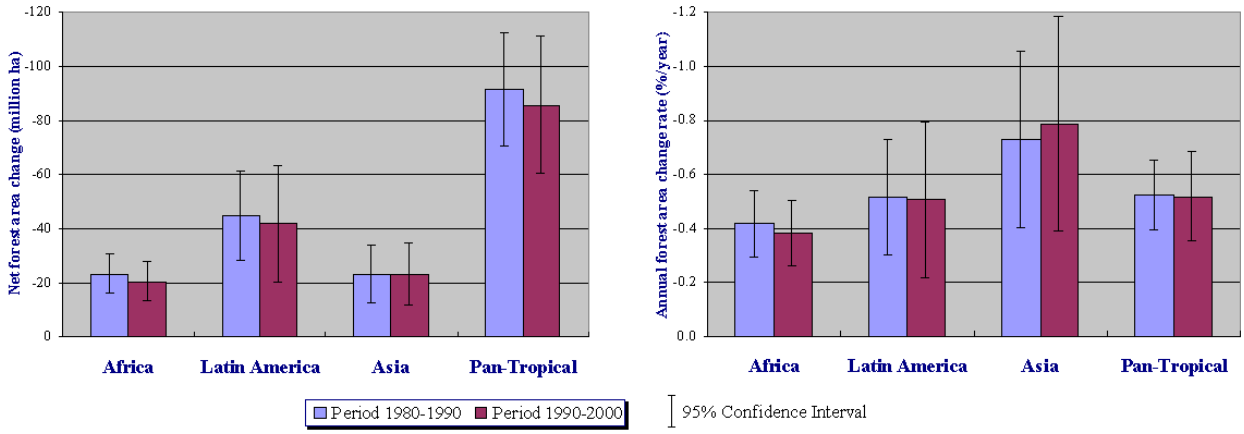
4.3. Trend analysis: comparison of the forest changes 1980-1990 and 1990-2000

4.3.1. Comparison of the forest area change estimates

Statistical tests were used to assess if the differences between estimates from the two studied periods were significant and thus to detect a possible break in the trend (see section 2.5.3).

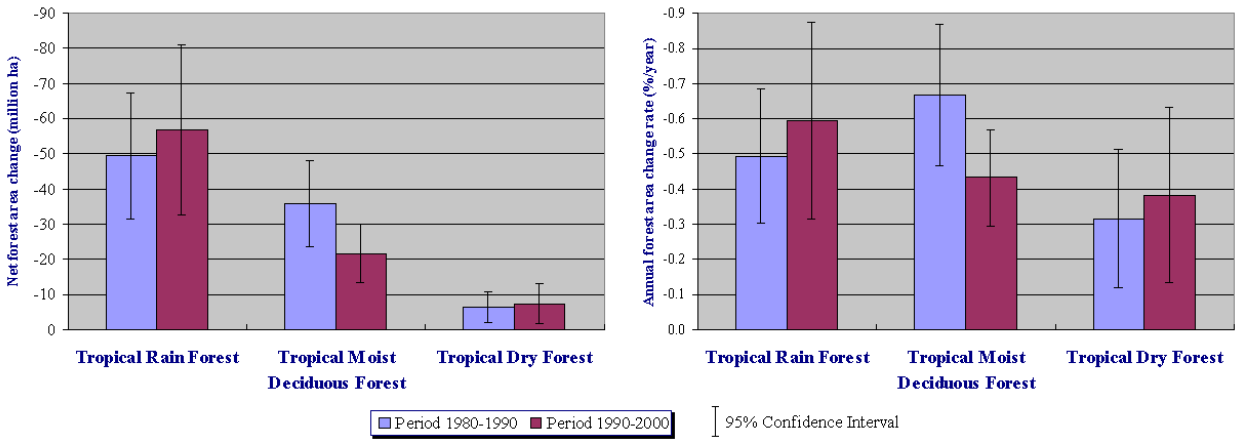
Figure 9 compares the absolute and relative changes of forest area between the two periods, with a 95 percent confidence interval indicated. Results showed that there was no significant difference in the estimates of deforestation at the 5 percent level of significance for the two study periods (1980-1990 and 1990-2000) at either regional or pan-tropical level.

Figure 9. Net forest area change by region and at pan-tropical level 1980-1990 and 1990-2000 (left); annual deforestation rate by region and at pan-tropical level 1980-1990 and 1990-2000 (right).



At ecological zone level, deforestation in the tropical moist deciduous forest zone was found to be significantly different between the two study periods (1980-1990 and 1990-2000). In this zone, both the net forest area change and the deforestation rate decreased significantly at the 5 percent level of significance (Figure 10). For the other ecological zones, differences in the net forest area change and annual deforestation rate was not significant.

Figure 10. Net forest area change by ecological zone, 1980-1990 and 1990-2000 (left); Annual deforestation rate by ecological zone, 1980-1990 and 1990-2000 (right).



4.3.2. Difference in the transition estimates

The following tables (Table 17 and Table 18) gives by geographical and ecological units the class-to-class transitions for which it was possible to detect a significant difference between the periods 1980-1990 and 1990-2000. This analysis considers the estimates of the proportion of one class going to another one (transition probability) during a period.

Table 17. Comparison of the transition probability estimates, 1980-1990 with 1990-2000 by region and at pan-tropical level

	Transitions with significant difference between the periods		Increase/ Decrease
Africa	Closed canopy forest	► Open canopy forest	Decrease
	Open canopy forest	► Other land cover	Decrease
Asia	Closed canopy forest	► Open canopy forest	Decrease
	Other land cover	► Plantations	Increase
Latin America	Closed canopy forest	► Open canopy forest	Decrease
Pan-tropical	Closed canopy forest	► Open canopy forest	Decrease
	Open canopy forest	► Other land cover	Decrease
	Closed canopy forest	► Long Fallow	Decrease
	Closed canopy forest	► Short fallow	Decrease
	Other land cover	► Open canopy forest	Decrease

Notes: The table shows the transition estimates statistically different between the periods 1980-1990 and 1990-200 at a 5 percent level of significance. Differences were calculated on the proportion estimates (probability of a class to change to another during the period). Only the transitions with an estimate above 1 million hectares for one of the two periods were considered. An increase indicates that the class-to-class transition was meaningfully superior during the period 1990-2000 than during the period 1980-1990.

Several conclusions can be underlined from the above table. There is a general decrease of the degradation of closed canopy forest into open canopy forest, observable in all the regions and at pan-tropical level. At pan-tropical level changes from closed canopy forest to

the shifting cultivation classes (long and short fallow) decreased in the second decade compare to the period 1980-1990. An increase of the conversion of the other land cover into plantation is also noticeable in Asia: while most of the plantations were in the first period mainly established to the detriment of forest area, the new planted area during the second period were both in previously forested and non-forested zones.

Table 18. Comparison of the transition probability estimates 1980-1990 with 1990-2000 by ecological zone

	Transitions with significant difference between the periods		Increase/ Decrease
Tropical rain forest	Closed canopy forest	► Open canopy forest	Decrease
	Closed canopy forest	► Short fallow	Decrease
	Closed canopy forest	► Other Land cover	Increase
	Long fallow	► Other Land cover	Increase
	Other land cover	► Plantations	Increase
Tropical moist deciduous forest	Closed canopy forest	► Open canopy forest	Decrease
	Closed canopy forest	► Long fallow	Decrease
	Open canopy forest	► Other Land cover	Decrease
	Short fallow	► Other Land cover	Decrease
	Other land cover	► Shrubs	Increase
Tropical dry forest and shrubland	None above 1 million hectares		

By ecological zone, the comparison between both periods (Table 18) shows that the decrease of the degradation of closed canopy forest into open canopy forest was also significant in all the ecological zones. Less pressure is observable on the forest classes in the Tropical moist deciduous forest ecological zone. At the opposite, direct conversion of the forests into other land cover increased significantly in the Tropical rain forest ecological zone. The changed area covered by the tropical dry forest and shrubland ecological zone was small and most of the transitions where significant difference could be detected are below 1 million ha.

4.4. Main forest change processes by region

Standardized transition matrices were used to depict major forest change processes and to quantify their relative importance at the pan-tropical and regional levels.

Change processes can be identified according to a selection of criteria adopted: extent and intensity of degradation of the forest cover, rapidity of the change process, the size of the activity contributing to the deforestation, main driving forces involved in the change process, type of land use involved...

In the study the main criteria selected were the scale of the change process and the rapidity of the processes.

According to these criteria four deforestation processes were differentiated:

- **Expansion of shifting cultivation into undisturbed areas.** This process occurred in forests where shifting cultivation or degradation began after 1980. The impact on the

forests was moderate and gradual, as the shifting cultivation incrementally expanded into them. This process was denoted by transitions from closed and open canopy forest classes to the long fallow class, and from closed canopy forest to open canopy forest.

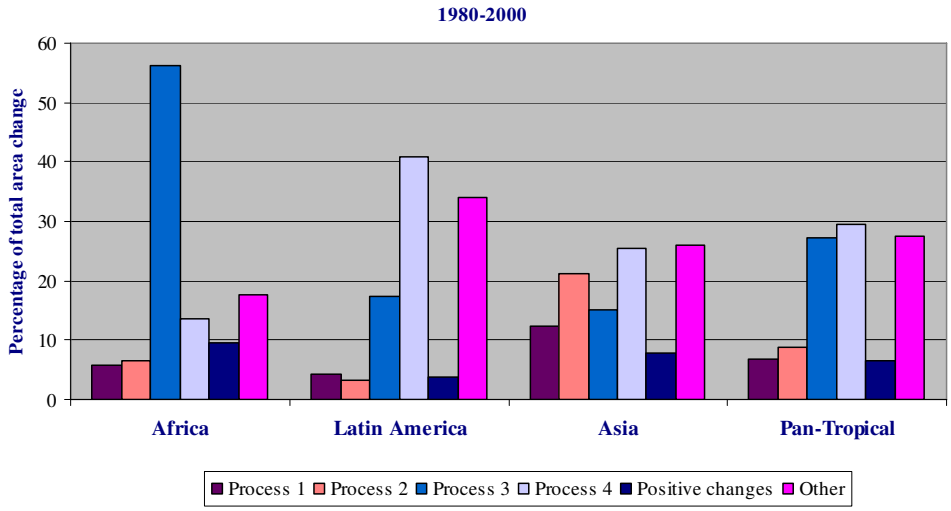
- **Intensification of agriculture in shifting cultivation areas.** This process occurred in forests already impacted by shifting agriculture practices in 1980. It also occurred where shifting cultivation had become more intense (where fallow period decreased) or where a complete transition from shifting to permanent agriculture had occurred from the 1980s to the 1990s. For this study, it included the transitions from the long fallow class to fragmented forest and short fallow, and from the short fallow class to other land cover.

- **Direct conversion of forests to small-scale permanent agriculture.** In this process, small areas of forest (less than 25 ha) were converted to agriculture. For this study, the transitions were represented in changes from closed and open forest to fragmented forest and short fallow, and from fragmented forest to either short fallow or other land cover.

- **Direct conversion of forest area to large-scale agriculture.** In this process, large areas (greater than 25 ha) of closed canopy forest, open canopy forest and long fallow were converted to other land cover. (This could also be represented by the more or less simultaneous conversion of smaller adjoining areas which, when aggregated, occupied an area of more than 25 ha. Such areas were indistinguishable in satellite imagery from large uniformly converted areas of forests.)

The elements of the matrices were grouped to estimate the area involved in each processes at the different levels.

Figure 11. Percentage of total area change by individual processes at regional and pan-tropical level for the period 1990-2000



Notes: The figure represents the proportion of the total area change during the period 1980-2000 divided by the identified processes. The positive changes includes comprises transitions from non-forest classes to forest classes and positive changes within forest classes).

At the pan-tropical level, deforestation in undisturbed forests was prevalent and evenly distributed between large- and small-scale conversions to agriculture. Regional variations in change processes are summarized as follows (Figure 11).

- ***Africa.*** The major process of deforestation was due to the conversion of forest for the establishment of small-scale permanent agriculture.

- ***Latin America*****.** Deforestation due to conversion to large-scale permanent agriculture was the predominant process.

- ***Asia.*** The major process was the direct conversion of forest to large-scale agriculture, with other processes contributing substantially to deforestation as well.

4.5. Comparison with FRA 2000 country statistics

FRA 2000 included a separate assessment of forest state and change using existing information from countries. The results of the two studies were compared to analyse the relationships between the two and to find ways of using the two data sets together to obtain an integrated estimate at the worldwide level.

It was observed that the two assessment components differed in the following respects.

- **Resolution.** The country statistics provided estimates at the national level, while the remote sensing survey was designed to provide information at the pan-tropical and regional levels.

- **Definitions**. The forest definitions used were close but did not correspond exactly between the two approaches. Country statistics were adjusted to a FRA 2000 global forest definition based on both use and cover, while the remote sensing survey used a uniform land cover definition based on photo-interpretation criteria.

- **Geographic coverage.** The areas surveyed were different. While the assessment based on country information was conducted worldwide, the remote sensing survey covered only 63 percent of the land area in the tropics,

- **Resolution.** The country statistics provided estimates at the national level, while the remote sensing survey was designed to provide information at the pan-tropical and regional levels.

- **Definitions**. The forest definitions used were close but did not correspond exactly between the two approaches. Country statistics were adjusted to a FRA 2000 global forest definition based on both use and cover, while the remote sensing survey used a uniform land cover definition based on photo-interpretation criteria.

- **Geographic coverage.** The areas surveyed were different. While the assessment based on country information was conducted worldwide, the remote sensing survey covered only 63 percent of the land area in the tropics, representing about 87 percent of the world's tropical forests. Within the land area of the survey, Landsat scenes with less than 10 percent forest were placed into a stratum that was not sampled. Landsat frames with land area of less than 1 million hectares were also not included, whereas information from countries theoretically covered the entire land area.

- **Measurement techniques**. Country statistics were based on a wide range of reference data derived from a number of methods (expert opinion, maps based on satellite

imagery, field surveys and sampling), while the remote sensing survey relied on interpreted satellite imagery and objective statistical sampling.

- **Currency of information.** The remote sensing survey was based on imagery acquired near the reference years 1980, 1990 and 2000 (with some variations), while the average date of the country information from developing countries was 1994, although some of the country data were older or more recent.

Variations between the two information sets could contribute to differences in the respective estimates; consequently a direct comparison between the two was impossible. However, because the remote sensing survey was conducted under relatively controlled conditions, using a consistent method among all subregions and regions, and employed the application of statistical sampling, it was used as a calibration tool at the regional level to improve some of the overall findings for the tropics.

Comparisons between the country-based findings and the remote sensing survey estimates were limited to the 73 countries that were covered by the remote sensing survey. Sixty of these countries were covered by at least a part of one sampling unit (Table 19). Only results at the subregional, regional and pan-tropical levels were examined (as the remote sensing survey was not used for generating national level results) using the f2 definition of forests (since it corresponds most closely to the definition used for the country statistical data).

Forest area estimates from the remote sensing survey were in general lower than estimates from the country data in the tropics, throughout the regions, and in most subregions. Nevertheless, there is a good correlation between the country data and the remote sensing estimates, observable at the subregional and regional levels (Figure 12.

The forest area change estimates from the two information sets were comparable for Asia and Latin America. However, the data for Africa were not comparable and consequently the correlation at the pan-tropical level was also low. The subregions contributing most to the disparity of the two data sets were East Africa and southern Africa. The disparity could be attributed primarily to two causes.

- **Seasonality and ecological conditions.** In dry areas, difficulties are commonly encountered in the use of satellite imagery to classify and interpret vegetation and to detect change. Leaf cover in such forests is low, exception during the short rainy season. When leaves are green the forests show up well in the imagery, but when they are absent it is difficult to detect and interpret the vegetation.

- **Inconsistencies in specific countries.** Country data from a few countries – the People's Democratic Republic of the Congo, the Sudan and Zambia – contributed to the high deforestation rate in Africa. Deforestation rates for the sampling units in the Sudan and Zambia were much lower than those calculated from the country data. This is not unexpected, as sampling units were not designed to provide representative national statistics and may have been located in areas that had lower deforestation rates within the countries. It is also possible that the country data from the Sudan and Zambia overestimated deforestation. For example, the baseline data for Zambia were from 1978, and the data for the Sudan from 1990 covered only one-third (the gum belt) of the country. Moreover, the change estimates were based on expert opinion or on estimates from surrounding countries owing to the absence of comparable time series of information for both countries.

Table 19. Comparison forest area and forest area change estimates from the Remote Sensing Survey with country data

	Forest Area 2000 *(million ha)*			Annual net forest area change *(million ha/year)*			Annual deforestation rate *(%/year)*		
	Country data	Remote sensing Survey	Significant difference	Country data	Remote sensing survey	Significant difference	Country data	Remote sensing Survey	Significant difference
Africa	622	484	**	-5.2	-2.2	***	0.77	0.43	***
Asia	289	224	**	-2.4	-2.0	n.s.	0.78	0.84	n.s.
Latin America	892	767	**	-4.4	-4.1	n.s	0.45	0.51	n.s.
Pan-tropical	1 803	1 475	***	-12.0	-8.3	**	0.62	0.54	n.s.

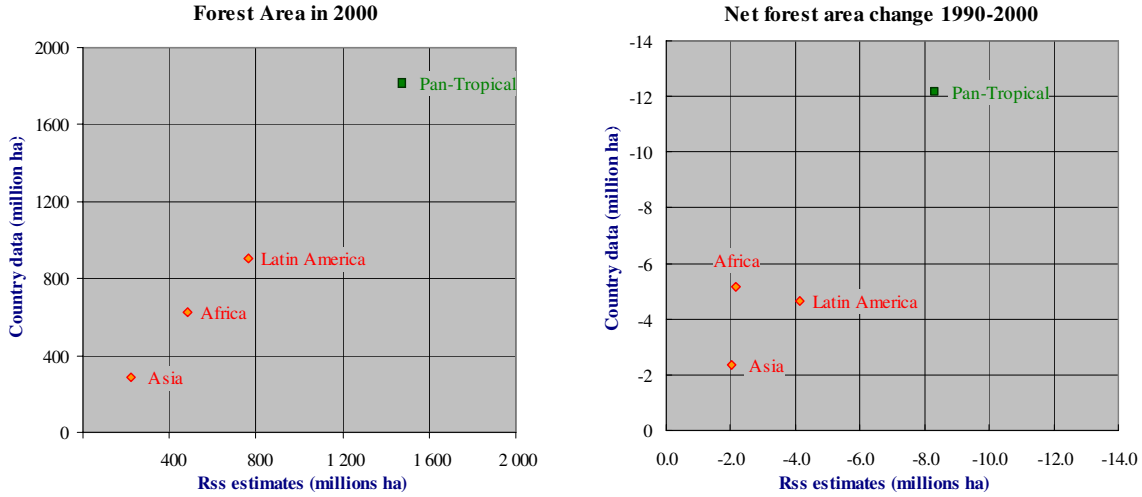
*Notes: Only the results from the countries included in the remote sensing survey were compiled to obtain the country data given in the table. The remote sensing estimates refer to the F2 definition of forest.The hypothesis tested in the table is that the country data value is the true value of the sampled population of the remote sensing survey. The level of significance of the difference between country data and remote sensing estimates: *** = 0.01 percent level of significance, ** = 1 percent level of significance, * = 5 percent level of significance, n.s = not significant at the 5 percent level.*

Table 20. Comparison forest area and forest area change estimates from the Remote Sensing Survey with country data

	Forest Area 2000 *(million ha)*					Annual net forest area change *(million ha/year)*					Annual deforestation rate *(%/year)*				
	Country data	RSS f2	Significant	RSS f3	Significant	Country data	RSS f2	Significant	RSS f3	Significant	Country data	RSS f2	Significant	RSS f3	Significant
SR 13	97	37	CD H **	39	CD H **	-1.3	-0.2	CD S ***	-0.2	CD S ***	1.16	0.42	CD H **	0.42	CD H **
SR 14	85	61	CD H *	74	n.s.	-1.4	-0.7	CD S *	-0.7	CD S **	1.37	1.06	n.s.	0.85	CD H *
SR 15	228	222	n.s.	229	n.s.	-0.8	-0.5	CD S *	-0.5	CD S *	0.35	0.22	CD H *	0.21	CD H*
SR 16	213	164	CD H **	177	CD H *	-1.7	-0.8	CD S ***	-0.7	CD S ***	0.76	0.44	CD H **	0.40	CD H **
Total surveyed Africa	**622**	**484**	**CD H ****	**519**	**CD H ****	**-5.2**	**-2.2**	**CD S *****	**-2.1**	**CD S *****	**0.77**	**0.43**	**CD H *****	**-0.38**	**CD H *****
SR 44	77	55	CD H **	65	n.s	-0.1	-0.1	n.s.	-0.1	n.s.	0.13	0.14	n.s.	0.21	n.s.
SR 45	81	71	n.s.	90	n.s.	-0.6	-0.4	n.s.	-0.4	n.s.	0.78	0.59	n.s.	0.46	CD H *
SR 46	131	98	CD H **	117	n.s.	-1.6	-1.5	n.s.	-1.8	n.s.	1.11	1.35	n.s.	1.30	n.s.
Total surveyed Asia	**289**	**224**	**CD H ****	**272**	n.s.	**-2.4**	**-2.0**	n.s.	**-2.3**	n.s.	**0.78**	**0.84**	n.s.	**0.79**	n.s.
SR 31	73	69	n.s.	73	n.s.	-1.0	-0.3	CD S ***	-0.2	CD S ***	1.17	0.41	CD H ***	0.31	CD H ***
SR 34	290	315	n.s.	317	n.s.	-1.1	-0.4	CD S ***	-0.4	CD S ***	0.38	0.12	CD H ***	0.11	CD H ***
SR 35	544	383	CD H ***	390	CD H **	-2.3	-3.4	n.s.	-3.6	n.s.	0.41	0.83	n.s.	0.84	n.s.
Total surveyed Latin America	**907**	**767**	**CD H ****	**780**	**CD H ****	**-4.6**	**-4.1**	n.s.	**-4.2**	n.s.	0.47	**0.51**	n.s.	**0.51**	n.s.
Total surveyed Pan-tropical	**1,818**	**1 475**	**CD H *****	**1 571**	**CD H ****	**-12.2**	**-8.3**	**CD S ****	**-8.6**	**CD S ****	**-0.62**	**-0.54**	**n.s.**	**-0.52**	**n.s.**

CD H = country data higher *CD S = country data smaller*

Figure 12. Forest area in 2000 (left) and net forest area change (right) - comparison between country data and remote sensing survey estimates (million hectares)



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Appendices

Appendix 1. Standard errors and confidence intervals of the elements of the area transition matrices at regional and pan-tropical levels

Notes:

- *A confidence interval might contain values outside the range of possible values (negative values). Nevertheless, complete formal intervals are presented to correspond to the standard error.*
- *The symbol ε indicates values below the displayed decimal point.*
- *The matrices are based on the common visible area between all the images of the three date time-series. Stable water was excluded from the matrices.*

Table 21. Standard errors and 95 percent confidence intervals of the area transition matrices - Pan-tropical level (million ha)

Standard errors - Area transition matrix 1980-1990

(million ha)

Land cover classes in 1980 \ Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	60.2	1.1	1.6	3.0	0.5	3.3	7.0	1.4	1.2
Open canopy forest	0.1	37.7	0.2	2.4	0.6	0.7	1.3	0.5	0.1
Long fallow	0.3	ε	11.8	0.1	0.2	2.0	0.5	ε	ε
Fragmented forest	0.3	0.2	0.1	31.1	0.2	2.2	4.3	0.2	0.2
Shrubs	0.1	ε	0.1	ε	28.0	0.2	7.8	0.5	0.1
Short fallow	0.3	0.1	0.3	0.3	0.2	17.7	1.8	0.1	0.1
Other land cover	0.2	0.2	0.1	0.5	0.6	0.7	57.3	0.9	0.3
Water	0.1	ε	ε	ε	ε	0.1	0.4	0.9	ε
Plantations	ε	ε	ε	ε	ε	0.1	0.4	ε	6.6

Standard errors - Area transition matrix 1990-2000

(million ha)

Land cover classes in 1990 \ Land cover classes in 2000	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	63.4	0.3	1.2	3.1	0.6	1.9	10.1	0.7	0.8
Open canopy forest	0.1	36.4	0.2	2.7	0.3	0.7	1.2	ε	ε
Long fallow	0.5	0.1	11.9	0.1	ε	1.2	1.3	ε	0.1
Fragmented forest	0.1	0.2	0.1	31.4	0.2	1.1	2.5	0.1	0.1
Shrubs	ε	0.1	ε	ε	26.6	0.3	2.8	1.7	ε
Short fallow	0.5	0.1	0.3	0.9	0.1	19.6	3.4	0.1	0.2
Other land cover	0.2	0.1	0.2	0.9	1.1	3.3	60.7	0.5	0.7
Water	0.1	ε	ε	ε	0.6	ε	0.5	3.0	
Plantations	ε			ε	ε	ε	0.5		7.7

95 % confidence intervals - Area transition matrix 1980-1990

(million ha)

Land cover classes in 1980 \ Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	082.4;1318.5]	[4.2;8.4]	[6.3;12.8]	[5.5;17.1]	[0.8;2.6]	[8.5;21.6]	[21.7;49.2]	[-0.7;4.9]	[0.3;5.1]
Open canopy forest	[0.4;0.9]	[222.0;369.7]	[0.1;1.0]	[1.2;10.7]	[0.1;2.6]	[0.9;3.7]	[7.4;12.5]	[-0.4;1.5]	[0.1;0.3]
Long fallow	[0.5;1.6]	[0.0;0.1]	[39.1;85.4]	[0.0;0.5]	[-0.1;0.6]	[2.8;10.7]	[1.2;3.3]	[0.0;0.1]	[0.0;0.0]
Fragmented forest	[0.1;1.3]	[0.5;1.1]	[0.0;0.5]	[136.6;258.4]	[0.3;1.3]	[-0.3;8.2]	[6.5;23.2]	[-0.1;0.8]	[-0.1;0.5]
Shrubs	[0.0;0.3]	[0.0;0.1]	[0.0;0.4]	[0.1;0.2]	[95.1;204.8]	[-0.1;0.7]	[4.0;34.5]	[-0.3;1.5]	[0.0;0.5]
Short fallow	[0.4;1.7]	[0.2;0.6]	[0.6;1.9]	[0.0;1.3]	[0.0;0.6]	[74.5;143.9]	[3.6;10.8]	[0.0;0.3]	[-0.1;0.4]
Other land cover	[0.4;1.2]	[0.6;1.4]	[0.1;0.5]	[0.5;2.6]	[0.5;2.6]	[-0.1;2.6]	[741.2;965.9]	[-0.4;3.2]	[0.3;1.5]
Water	[0.0;0.3]	[0.0;0.1]	[0.0;0.0]	[0.0;0.2]	[0.0;0.0]	[0.0;0.2]	[0.3;1.7]	[0.7;4.3]	[0.0;0.0]
Plantations	[0.0;0.2]	[0.0;0.0]	[0.0;0.0]	[0.0;0.0]	[0.0;0.0]	[0.0;0.3]	[0.2;1.7]	[0.0;0.0]	[1.9;27.7]

95 % confidence intervals - Area transition matrix 1990-2000

(million ha)

Land cover classes in 1990 \ Land cover classes in 2000	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	1007.2;1255.9	[0.5;1.8]	[3.4;8.0]	[3.4;15.4]	[0.2;2.4]	[6.2;13.5]	[23.3;62.9]	[-0.2;2.5]	[0.4;3.4]
Open canopy forest	[0.0;0.4]	[216.0;358.7]	[0.2;0.9]	[1.5;12.2]	[0.1;1.2]	[0.9;3.4]	[4.4;8.9]	[0.0;0.1]	[0.0;0.1]
Long fallow	[0.1;2.0]	[0.0;0.3]	[40.0;86.5]	[0.1;0.4]	[0.0;0.1]	[2.4;7.2]	[2.1;7.3]	[0.0;0.1]	[0.0;0.5]
Fragmented forest	[0.2;0.8]	[0.1;0.8]	[0.0;0.5]	[140.5;263.7]	[0.1;0.8]	[0.0;4.4]	[6.3;16.0]	[0.0;0.3]	[-0.1;0.5]
Shrubs	[0.0;0.2]	[0.0;0.2]	[0.0;0.1]	[0.0;0.1]	[91.4;195.5]	[0.1;1.1]	[4.4;15.1]	[-1.6;5.2]	[0.0;0.2]
Short fallow	[0.0;2.0]	[0.1;0.5]	[0.6;1.9]	[-0.3;3.3]	[0.0;0.4]	[84.2;161.2]	[4.8;18.3]	[0.0;0.3]	[0.1;0.7]
Other land cover	[0.2;1.1]	[0.2;0.7]	[0.2;0.8]	[0.4;4.1]	[1.6;5.8]	[-1.6;11.4]	809.5;1047.3	[0.3;2.3]	[1.0;3.6]
Water	[-0.1;0.4]	[0.0;0.0]	[0.0;0.0]	[0.0;0.1]	[-0.4;2.0]	[0.0;0.1]	[0.2;2.2]	[-0.4;11.5]	[0.0;0.0]
Plantations	[0.0;0.0]	[0.0;0.0]	[0.0;0.0]	[0.0;0.1]	[0.0;0.0]	[0.0;0.1]	[0.2;2.0]	[0.0;0.0]	[2.9;33.2]

Table 22. Standard errors and 95 percent confidence intervals of the area transition matrices - Africa (million ha)

Standard errors - Area transition matrix 1980-1990

(million ha)

Land cover classes in 1980 \ Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	40.6	0.7	0.4	2.4	ε	3.0	0.7	ε	0.1
Open canopy forest	0.1	29.9	0.2	2.4	ε	0.6	1.0	ε	ε
Long fallow	ε	ε	6.9	0.1	ε	0.4	0.1		
Fragmented forest	0.3	0.2	0.1	28.9	0.1	1.9	2.0	ε	ε
Shrubs	ε	ε	ε	ε	15.6	0.2	0.6		ε
Short fallow	0.2	0.1	0.1	0.3	ε	11.3	0.4	ε	0.1
Other land cover	0.2	0.2	ε	0.5	0.1	0.1	45.1	0.1	0.2
Water	ε	ε		ε	ε	0.1	0.1	0.1	
Plantations	ε					ε	ε		0.4

Standard errors - Area transition matrix 1990-2000

(million ha)

Land cover classes in 1990 \ Land cover classes in 2000	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	38.7	0.3	0.3	2.6	ε	1.7	0.7	ε	ε
Open canopy forest	ε	28.5	0.1	2.7	0.1	0.6	0.7	ε	ε
Long fallow	ε	0.1	7.0	0.1	ε	0.2	0.1		
Fragmented forest	0.1	0.1	ε	29.2	ε	1.1	1.9	ε	ε
Shrubs	ε	ε	ε	ε	15.3	0.2	0.6		ε
Short fallow	0.5	0.1	0.2	0.8	0.1	13.7	1.6	ε	
Other land cover	ε	0.1	ε	0.1	0.1	0.2	45.8	0.1	0.1
Water						ε	0.1	0.1	
Plantations	ε			ε		ε	0.1		0.6

95 % confidence intervals - Area transition matrix 1980-1990

(million ha)

Land cover classes in 1980 \ Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	[194.3;353.4]	[1.4;4.0]	[0.2;1.6]	[0.0;9.3]	[0.0;0.2]	[1.4;13.0]	[1.2;3.9]	[0.0;0.1]	[0.0;0.3]
Open canopy forest	[0.1;0.4]	[134.1;251.2]	[-0.1;0.7]	[0.5;10.0]	[0.0;0.1]	[0.4;2.8]	[2.8;6.6]	[0.0;0.0]	[0.0;0.1]
Long fallow	[0.0;0.2]	[0.0;0.1]	[2.3;29.3]	[-0.1;0.4]	[0.0;0.1]	[0.0;1.6]	[0.1;0.5]	[0.0;0.0]	[0.0;0.0]
Fragmented forest	[-0.1;1.0]	[0.3;1.0]	[-0.1;0.2]	[79.7;193.2]	[0.0;0.3]	[-1.5;5.9]	[1.8;9.8]	[0.0;0.0]	[0.0;0.0]
Shrubs	[0.0;0.1]	[0.0;0.0]	[0.0;0.0]	[0.0;0.1]	[13.7;74.8]	[-0.2;0.6]	[0.0;2.4]	[0.0;0.0]	[0.0;0.1]
Short fallow	[0.1;0.9]	[0.1;0.4]	[0.0;0.3]	[-0.1;1.1]	[0.0;0.1]	[36.1;80.3]	[0.9;2.3]	[0.0;0.1]	[0.0;0.2]
Other land cover	[0.0;0.6]	[0.4;1.1]	[0.0;0.1]	[0.1;2.2]	[0.0;0.5]	[0.1;0.6]	[363.8;540.6]	[0.1;0.3]	[-0.1;0.6]
Water	[0.0;0.1]	[0.0;0.1]	[0.0;0.0]	[0.0;0.0]	[0.0;0.0]	[-0.1;0.2]	[0.1;0.6]	[0.0;0.3]	[0.0;0.0]
Plantations	[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;1.6]

95 % confidence intervals - Area transition matrix 1990-2000

(million ha)

Land cover classes in 1990 \ Land cover classes in 2000	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	[185.6;337.2]	[0.0;1.2]	[0.1;1.4]	[0.6;10.7]	[0.0;0.1]	[1.7;8.3]	[0.6;3.4]	[0.0;0.1]	[0.0;0.2]
Open canopy forest	[0.0;0.1]	[130.1;242.0]	[0.0;0.5]	[0.6;11.1]	[-0.1;0.4]	[0.5;3.0]	[1.4;4.4]	[0.0;0.0]	[0.0;0.0]
Long fallow	[0.0;0.1]	[-0.1;0.2]	[2.6;29.9]	[0.0;0.3]	[0.0;0.0]	[0.1;0.9]	[0.0;0.4]	[0.0;0.0]	[0.0;0.0]
Fragmented forest	[0.0;0.4]	[0.0;0.4]	[0.0;0.1]	[82.6;197.0]	[0.0;0.1]	[-0.4;4.0]	[2.3;9.7]	[0.0;0.0]	[0.0;0.0]
Shrubs	[0.0;0.1]	[0.0;0.0]	[0.0;0.0]	[0.0;0.1]	[12.8;73.0]	[-0.1;0.7]	[0.3;2.8]	[0.0;0.0]	[0.0;0.1]
Short fallow	[-0.2;1.7]	[0.1;0.4]	[0.0;0.6]	[-0.7;2.6]	[-0.1;0.4]	[38.4;92.2]	[-0.3;6.1]	[0.0;0.2]	[0.0;0.0]
Other land cover	[0.0;0.2]	[0.1;0.4]	[0.0;0.1]	[0.1;0.7]	[0.0;0.3]	[0.1;0.7]	[377.2;556.8]	[0.1;0.5]	[0.0;0.2]
Water	[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;0.4]	[0.0;0.3]	[0.0;0.0]
Plantations	[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;0.4]	[0.0;0.0]	[0.0;2.3]

Table 23. Standard errors and 95 percent confidence intervals of the area transition matrices - Asia (million ha)

Standard errors - Area transition matrix 1980-1990

(million ha)

Land cover classes in 1980 \ Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	17.2	0.6	1.2	0.4	0.1	1.2	2.8	0.2	1.2
Open canopy forest	0.1	7.0	0.1	0.1	0.1	ε	0.3	ε	ε
Long fallow	0.3	ε	9.5	ε	0.2	2.0	0.5	ε	ε
Fragmented forest	ε	ε	0.1	3.2	0.2	0.1	0.6	ε	ε
Shrubs	0.1	ε	ε	ε	2.2	ε	0.4	ε	ε
Short fallow	0.2	ε	0.3	0.1	0.2	12.6	1.2	ε	0.1
Other land cover	0.1	0.1	0.1	ε	0.1	ε	21.8	0.1	0.2
Water	ε	ε		ε	ε		ε	0.3	ε
Plantations	ε	ε	ε	ε	ε	0.1	0.4	ε	6.6

Standard errors - Area transition matrix 1990-2000

(million ha)

Land cover classes in 1990 \ Land cover classes in 2000	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	17.5	0.1	1.0	0.3	0.1	0.6	3.4	0.6	0.8
Open canopy forest	0.1	6.9	0.1	0.1	0.1	0.1	0.6	ε	ε
Long fallow	0.2	ε	9.5	ε	ε	1.2	0.9	ε	0.1
Fragmented forest	ε	ε	0.1	3.1	0.2	0.1	0.5	ε	ε
Shrubs	ε	ε	ε	ε	2.3	0.1	0.4	ε	ε
Short fallow	ε	ε	0.3	ε	ε	12.7	2.9	0.1	0.2
Other land cover	0.1	0.1	0.1	0.3	0.1	0.1	21.1	0.1	0.6
Water	ε			ε	ε		ε	0.5	
Plantations	ε			ε		ε	0.4		7.7

95 % confidence intervals - Area transition matrix 1980-1990

(million ha)

Land cover classes in 1980 \ Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	[177.1;244.6]	[0.6;2.9]	[3.0;7.7]	[0.4;2.1]	[0.1;0.4]	[2.1;6.7]	[2.0;12.8]	[0.0;0.7]	[0.1;4.9]
Open canopy forest	[0.1;0.5]	[10.8;38.3]	[0.0;0.3]	[0.0;0.4]	[0.1;0.5]	[0.0;0.2]	[0.4;1.6]	[0.0;0.2]	[0.0;0.1]
Long fallow	[0.3;1.4]	[0.0;0.0]	[23.7;61.0]	[0.0;0.1]	[-0.1;0.6]	[1.6;9.4]	[0.8;2.9]	[0.0;0.1]	[0.0;0.0]
Fragmented forest	[0.1;0.1]	[0.0;0.2]	[0.0;0.3]	[10.9;23.3]	[0.0;0.8]	[0.0;0.4]	[0.9;3.2]	[0.0;0.1]	[0.0;0.2]
Shrubs	[0.0;0.2]	[0.0;0.1]	[0.0;0.2]	[0.0;0.1]	[3.7;12.3]	[0.0;0.1]	[0.4;1.9]	[0.0;0.1]	[0.0;0.2]
Short fallow	[0.0;1.0]	[0.0;0.1]	[0.4;1.6]	[0.0;0.3]	[-0.1;0.5]	[13.7;63.1]	[1.4;6.2]	[0.0;0.1]	[-0.1;0.3]
Other land cover	[0.1;0.3]	[0.1;0.4]	[0.1;0.4]	[0.1;0.3]	[0.1;0.6]	[0.0;0.2]	[165.3;250.9]	[0.1;0.4]	[0.0;0.7]
Water	[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;0.2]	[-0.1;1.1]	[0.0;0.0]
Plantations	[0.0;0.2]	[0.0;0.0]	[0.0;0.0]	[0.0;0.0]	[0.0;0.0]	[0.0;0.3]	[0.1;1.5]	[0.0;0.0]	[-0.1;25.6]

95 % confidence intervals - Area transition matrix 1990-2000

(million ha)

Land cover classes in 1990 \ Land cover classes in 2000	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	[158.7;227.4]	[0.2;0.6]	[1.7;5.5]	[0.1;1.4]	[0.0;0.3]	[2.0;4.3]	[2.6;16.1]	[-0.5;2.0]	[0.3;3.3]
Open canopy forest	[0.0;0.3]	[11.2;38.2]	[0.0;0.4]	[0.0;0.4]	[0.0;0.3]	[0.0;0.5]	[-0.1;2.2]	[0.0;0.1]	[0.0;0.0]
Long fallow	[0.1;0.9]	[0.0;0.0]	[23.1;60.3]	[0.0;0.1]	[0.0;0.0]	[1.6;6.3]	[1.1;4.5]	[0.0;0.1]	[0.0;0.5]
Fragmented forest	[0.0;0.2]	[0.0;0.1]	[-0.1;0.4]	[10.7;23.0]	[-0.1;0.5]	[0.0;0.5]	[0.2;2.3]	[-0.1;0.1]	[0.0;0.1]
Shrubs	[0.0;0.1]	[0.0;0.0]	[0.0;0.0]	[0.0;0.0]	[4.2;13.0]	[0.0;0.5]	[0.1;1.5]	[0.0;0.1]	[0.0;0.0]
Short fallow	[0.0;0.2]	[0.0;0.0]	[0.1;1.3]	[0.0;0.1]	[0.0;0.0]	[16.3;66.3]	[0.7;11.9]	[0.0;0.2]	[0.1;0.7]
Other land cover	[0.0;0.4]	[0.0;0.4]	[0.0;0.3]	[-0.2;0.9]	[0.0;0.3]	[0.1;0.6]	[181.2;264.1]	[0.1;0.6]	[0.7;3.2]
Water	[0.0;0.1]	[0.0;0.0]	[0.0;0.0]	[0.0;0.0]	[0.0;0.0]	[0.0;0.0]	[0.1;0.2]	[0.2;2.3]	[0.0;0.0]
Plantations	[0.0;0.0]	[0.0;0.0]	[0.0;0.0]	[0.0;0.0]	[0.0;0.0]	[0.0;0.1]	[-0.1;1.5]	[0.0;0.0]	[0.3;30.3]

Table 24. Standard errors and 95 percent confidence intervals of the area transition matrices - Latin America (million ha)

Standard errors - Area transition matrix 1980-1990

(million ha)

Land cover classes in 1980 \ Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	41.1	0.6	1.1	1.7	0.4	0.9	6.4	1.4	ε
Open canopy forest	ε	21.9	ε	0.2	0.6	0.4	0.8	0.5	ε
Long fallow	0.1	ε	1.3	ε	ε	0.2	0.1	ε	
Fragmented forest	0.1	ε	ε	10.8	0.1	1.0	3.7	0.2	0.2
Shrubs	ε	ε	0.1	ε	23.1	0.1	7.8	0.5	0.1
Short fallow	0.1	ε	0.1	0.1	ε	5.3	1.3	0.1	
Other land cover	0.1	ε	ε	0.2	0.5	0.7	27.9	0.9	0.1
Water	0.1	ε	ε	ε	ε	ε	0.3	0.9	
Plantations				ε			0.1		0.7

Standard errors - Area transition matrix 1990-2000

(million ha)

Land cover classes in 1990 \ Land cover classes in 2000	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	47.2	0.1	0.5	1.6	0.6	0.6	9.5	0.3	ε
Open canopy forest	ε	21.5	0.1	0.6	0.2	0.1	0.7	ε	ε
Long fallow	0.4	0.1	1.6	ε	ε	0.2	1.0	ε	
Fragmented forest	0.1	0.1	ε	11.2	0.1	0.1	1.5	0.1	0.1
Shrubs	ε	ε	ε	ε	21.6	ε	2.7	1.7	ε
Short fallow	0.1	ε	0.1	0.4	ε	5.9	1.0	ε	
Other land cover	0.2	ε	0.1	0.9	1.1	3.3	33.7	0.5	0.1
Water	0.1	ε	ε	ε	0.6	ε	0.5	3.0	
Plantations				ε	ε		0.2		0.9

95 % confidence intervals - Area transition matrix 1980-1990

(million ha)

Land cover classes in 1980 \ Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	[635.3;796.2]	[0.6;3.0]	[1.2;5.3]	[2.1;8.8]	[0.5;2.2]	[1.6;5.2]	[12.9;38.1]	[-1.1;4.5]	[0.0;0.1]
Open canopy forest	[0.0;0.2]	[35.8;121.5]	[0.0;0.2]	[0.1;0.9]	[-0.2;2.2]	[-0.2;1.3]	[2.7;5.7]	[-0.4;1.4]	[0.0;0.1]
Long fallow	[0.0;0.3]	[0.0;0.1]	[1.6;6.7]	[0.0;0.1]	[0.0;0.0]	[0.1;0.9]	[0.0;0.2]	[0.0;0.0]	[0.0;0.0]
Fragmented forest	[0.0;0.3]	[0.0;0.1]	[0.0;0.1]	[22.8;65.2]	[0.0;0.5]	[-0.5;3.6]	[-0.3;14.2]	[-0.1;0.8]	[-0.1;0.4]
Shrubs	[0.0;0.1]	[0.0;0.0]	[0.0;0.3]	[0.0;0.0]	[52.3;143.0]	[-0.1;0.2]	[1.6;32.0]	[-0.4;1.4]	[-0.1;0.4]
Short fallow	[0.0;0.2]	[0.0;0.2]	[0.0;0.3]	[0.0;0.2]	[0.0;0.0]	[2.3;22.9]	[-0.8;4.4]	[0.0;0.2]	[0.0;0.0]
Other land cover	[0.0;0.4]	[0.0;0.0]	[0.0;0.0]	[-0.1;0.5]	[-0.1;2.0]	[-0.6;2.1]	[138.6;248.0]	[-0.8;2.7]	[0.0;0.6]
Water	[-0.1;0.2]	[0.0;0.1]	[0.0;0.0]	[0.0;0.1]	[0.0;0.0]	[0.0;0.1]	[-0.1;1.2]	[0.2;3.6]	[0.0;0.0]
Plantations	[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;0.3]	[0.0;0.0]	[-0.1;2.7]

95 % confidence intervals - Area transition matrix 1990-2000

(million ha)

Land cover classes in 1990 \ Land cover classes in 2000	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	[584.7;769.5]	[0.0;0.3]	[0.3;2.5]	[-0.1;6.2]	[0.0;2.2]	[0.6;2.8]	[13.2;50.3]	[-0.3;1.0]	[0.0;0.1]
Open canopy forest	[0.0;0.0]	[34.4;118.7]	[-0.1;0.3]	[-0.3;1.9]	[-0.1;0.8]	[0.0;0.2]	[1.4;4.0]	[0.0;0.1]	[0.0;0.1]
Long fallow	[-0.4;1.3]	[0.0;0.2]	[2.1;8.4]	[0.0;0.1]	[0.0;0.0]	[0.0;0.7]	[-0.3;3.6]	[0.0;0.0]	[0.0;0.0]
Fragmented forest	[0.0;0.4]	[-0.1;0.4]	[0.0;0.1]	[23.5;67.5]	[0.1;0.3]	[0.0;0.3]	[0.9;6.9]	[0.0;0.2]	[-0.1;0.4]
Shrubs	[0.0;0.1]	[0.0;0.2]	[0.0;0.0]	[0.0;0.0]	[49.7;134.2]	[0.0;0.1]	[2.2;12.6]	[-1.6;5.1]	[0.0;0.1]
Short fallow	[0.0;0.3]	[0.0;0.1]	[0.0;0.5]	[-0.3;1.2]	[0.0;0.0]	[4.5;27.7]	[0.4;4.4]	[0.0;0.0]	[0.0;0.0]
Other land cover	[0.0;0.8]	[0.0;0.1]	[0.0;0.5]	[-0.2;3.2]	[1.3;5.4]	[-2.3;10.7]	[172.6;304.7]	[-0.2;1.6]	[0.0;0.4]
Water	[-0.1;0.4]	[0.0;0.0]	[0.0;0.0]	[0.0;0.1]	[-0.5;2.0]	[0.0;0.1]	[-0.1;1.8]	[-1.7;10.0]	[0.0;0.0]
Plantations	[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;0.6]	[0.0;0.0]	[-0.3;3.5]

Appendix 2. Forest area and forest area change estimates at regional and pan-tropical level

Table 25. Forest area and area change estimates - pan-tropical level

Forest area

	Forest definition f1				Forest definition f2				Forest definition f3				
	Absolute forest cover *(million hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(million hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(million hectares)*		**Relative forest cover** *(%)*		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980	1 285	59	41.9	1.9	1 651	59	53.8	1.9	1 748	60	57.0	2.0	[53;61]
1990	1 205	60	39.3	2.0	1 558	62	50.8	2.0	1 657	62	54.0	2.0	[50;58]
2000	1 135	63	37.0	2.1	1 475	65	48.1	2.1	1 571	66	51.2	2.1	[47;55]

Forest area change (10-years periods)

(million hectares)	Forest definition f1			Forest definition f2			Forest definition f3			
	Deforestation	**Net forest area change**		**Deforestation**	**Net forest area change**		**Deforestation**	**Net forest area change**		
	Mean	Mean	SE	Mean	Mean	SE	Mean	Mean	SE	95%CI
1980-1990	84.2	-79.5	11.2	99.4	-92.8	11.3	99.1	-91.6	10.7	[-112;-71]
1990-2000	73.6	-69.9	11.5	88.9	-83.4	11.9	92.2	-85.7	13.0	[-111;-60]

Annual forest change (net area change and deforestation rate)

	Forest definition f1				Forest definition f2				Forest definition f3				
	Annual forest area change *(million hectares)*		**Deforestation rate r** *(%)*		**Annual net forest area change** *(million hectares)*		**Deforestation rate r** *(%)*		**Annual net forest area change** *(million hectares)*		**Deforestation rate r** *(%)*		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980-1990	-7.9	1.1	0.62	0.09	-9.3	1.1	0.56	0.07	-9.2	1.1	0.52	0.07	[0.40;0.65]
1990-2000	-7.0	1.2	0.58	0.10	-8.3	1.2	0.54	0.08	-8.6	1.3	0.52	0.08	[0.35;0.68]

Table 26. Forest area and area change estimates - Africa

Forest area

	Forest definition f1				Forest definition f2				Forest definition f3				
	Absolute forest cover *(million hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(million hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(million hectares)*		**Relative forest cover** *(%)*		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980	292.0	43.2	23.9	3.5	529	41.1	43.2	3.4	563	40	46.0	3.2	[40;52]
1990	275.6	40.8	22.5	3.3	506	39.8	41.3	3.3	539	38	44.1	3.1	[38;50]
2000	262.6	39.0	21.5	3.2	484	38.4	39.5	3.1	519	37	42.4	3.0	[36;48]

Forest area change (10-years periods)

(million hectares)	Forest definition f1			Forest definition f2			Forest definition f3			
	Deforestation	**Net forest area change**		**Deforestation**	**Net forest area change**		**Deforestation**	**Net forest area change**		
	Mean	Mean	SE	Mean	Mean	SE	Mean	Mean	SE	95%CI
1980-1990	18.2	-16.5	4.2	27.1	-23.8	3.9	26.9	-23.5	3.8	[-31;-16]
1990-2000	14.1	-13.0	3.5	23.6	-21.5	3.8	23.1	-20.7	3.6	[-28;-14]

Annual forest change (net area change and deforestation rate)

	Forest definition f1				Forest definition f2						Forest definition f3		
	Annual forest area change *(million hectares)*		**Deforestation rate r** *(%)*		**Annual net forest area change** *(million hectares)*		**Deforestation rate r** *(%)*				**Annual net forest area change** *(million hectares)*		**Deforestation rate r** *(%)*
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980-1990	-1.6	0.4	0.56	0.11	-2.4	0.4	0.45	0.07	-2.3	0.4	0.42	0.06	[0.29;0.54]
1990-2000	-1.3	0.4	0.47	0.11	-2.2	0.4	0.43	0.07	-2.1	0.4	0.38	0.06	[0.26;0.50]

Table 27. Forest area and area change estimates - Asia

Forest area

	Forest definition f1				Forest definition f2						Forest definition f3		
	Absolute forest cover *(million hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(million hectares)*		**Relative forest cover** *(%)*				**Absolute forest cover** *(million hectares)*		**Relative forest cover** *(%)*
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980	234.3	17.1	38.4	2.8	265.5	17.5	43.5	2.9	319	23	52.2	3.8	[45;60]
1990	213.0	17.3	34.9	2.8	244.0	17.7	40.0	2.9	295	23	48.4	3.7	[41;56]
2000	194.2	17.6	31.8	2.9	223.6	18.0	36.6	2.9	272	23	44.6	3.7	[37;52]

Forest area change (10-years periods)

(million hectares)	Forest definition f1			Forest definition f2			Forest definition f3			
	Deforestation	**Net forest area change**		**Deforestation**	**Net forest area change**		**Deforestation**	**Net forest area change**		
	Mean	Mean	SE	Mean	Mean	SE	Mean	Mean	SE	95%CI
1980-1990	23.4	-21.3	5.6	23.9	-21.5	5.6	26.1	-23.3	5.4	[-34;-13]
1990-2000	19.9	-18.8	5.0	21.7	-20.5	5.2	25.0	-23.3	6.0	[-35;-12]

Annual forest change (net area change and deforestation rate)

	Forest definition f1				Forest definition f2						Forest definition f3		
	Annual forest area change *(million hectares)*		**Deforestation rate r** *(%)*		**Annual net forest area change** *(million hectares)*		**Deforestation rate r** *(%)*		**Annual net forest area change** *(million hectares)*		**Deforestation rate r** *(%)*		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980-1990	-2.1	0.6	0.91	0.04	-2.2	0.6	0.81	0.14	-2.3	0.5	0.73	0.17	[0.41;1.05]
1990-2000	-1.9	0.5	0.88	0.03	-2.0	0.5	0.84	0.14	-2.3	0.6	0.79	0.20	[0.39;1.19]

Table 28. Forest area and area change estimates - Latin America

Forest area

	Forest definition f1				Forest definition f2				Forest definition f3				
	Absolute forest cover *(million hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(million hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(million hectares)*		**Relative forest cover** *(%)*		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980	758.3	36.4	61.5	3.0	855.9	39.1	69.4	3.2	866.8	39.1	70.3	3.2	[64;76]
1990	716.6	41.0	58.1	3.3	808.5	43.9	65.5	3.6	822.0	43.3	66.6	3.5	[60;74]
2000	678.5	46.8	55.0	3.8	767.1	49.3	62.2	4.0	780.2	49.2	63.2	4.0	[55;71]

Forest area change (10-years periods)

(million hectares)	Forest definition f1			Forest definition f2			Forest definition f3			
	Deforestation	**Net forest area change**		**Deforestation**	**Net forest area change**		**Deforestation**	**Net forest area change**		
	Mean	Mean	SE	Mean	Mean	SE	Mean	Mean	SE	95%CI
1980-1990	42.6	-41.7	8.7	48.4	-47.4	9.1	46.0	-44.8	8.4	[-61;-28]
1990-2000	39.5	-38.1	9.7	43.6	-41.4	10.0	44.2	-41.8	10.9	[-63;-20]

Annual forest change (net area change and deforestation rate)

	Forest definition f1				Forest definition f2				Forest definition f3				
	Annual forest area change *(million hectares)*		**Deforestation rate r** *(%)*		**Annual net forest area change** *(million hectares)*		**Deforestation rate r** *(%)*		**Annual net forest area change** *(million hectares)*		**Deforestation rate r** *(%)*		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980-1990	-4.2	0.9	0.55	0.04	-4.7	0.9	0.55	0.04	-4.5	0.8	0.52	0.11	[0.30;0.73]
1990-2000	-3.8	1.0	0.53	0.03	-4.1	1.0	0.51	0.04	-4.2	1.1	0.51	0.15	[0.22;0.80]

Notes: SE = standard error of the mean; 95%CI = 95% confidence interval; absolute forest cover = forest area; relative forest cover = percentage of total land area; deforestation = gross forest loss; Net forest area change = net forest loss/gain

Appendix 3. Results at subregional level – Africa

Notes: SE = standard error of the mean; 95%CI = 95% confidence interval; absolute forest cover = forest area; relative forest cover = percentage of total land area; deforestation = gross forest loss; Net forest area change = net forest loss/gain

Table 29. Area transition matrices for the periods 1980-1990 and 1990-2000 - East Sahelian Africa (subregion code 13, thousand ha)

Area transition matrix 1980-1990

('000 ha)	Land cover classes in 1990										
Land cover classes in 1980	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	**State 1980**	*% of total land area*
Closed canopy forest	16 781	62	213	440	9	117	353			**17 974**	*7.9*
Open canopy forest	5	18 172		137	18		542			**18 875**	*8.3*
Long fallow		ε	110	99		42	9			**260**	*0.1*
Fragmented forest	22	68		13 086	85	10	1 470	4		**14 746**	*6.5*
Shrubs	1			36	18 675		874			**19 586**	*8.6*
Short fallow						38	79			**118**	*0.1*
Other land cover	16	146		124	230	4	156 139	73		**156 732**	*68.6*
Water							99	- 1		**98**	*0.0*
Plantations									11	**11**	*0.0*
State 1990 →	**16 825**	**18 449**	**323**	**13 922**	**19 016**	**211**	**159 566**	**77**	**11**	**228 400**	
% of total land area →	*7.4*	*8.1*	*0.1*	*6.1*	*8.3*	*0.1*	*69.9*	*0.0*	*0.0*		

Area transition matrix 1990-2000

('000 ha)	Land cover classes in 2000										
Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	**State 1990**	*% of total land area*
Closed canopy forest	15 812	29	172	434	7	212	159			**16 825**	*7.4*
Open canopy forest	13	17 788		142	28		478	ε		**18 449**	*8.1*
Long fallow			114	54		113	43			**323**	*0.1*
Fragmented forest	19			12 699	38	81	1 080	6		**13 922**	*6.1*
Shrubs	6			7	18 170		833			**19 016**	*8.3*
Short fallow						93	117			**211**	*0.1*
Other land cover	27	38		201	136		158 988	176		**159 566**	*69.9*
Water							16	61		**77**	*0.0*
Plantations									11	**11**	*0.0*
State 2000 →	**15 878**	**17 854**	**286**	**13 536**	**18 379**	**499**	**161 714**	**243**	**11**	**228 400**	
% of total land area →	*7.0*	*7.8*	*0.1*	*5.9*	*8.0*	*0.2*	*70.8*	*0.1*	*0.0*		

Notes: see Table 6.

Table 30. Standard errors of the area transition matrices - East Sahelian Africa (subregion code 13, thousand ha)

Standard errors - Area transition matrix 1980-1990

(thousand hectares)

Land cover classes in 1980 \ Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	5 850	44	214	282	6	118	205		
Open canopy forest	6	14 651		71	10		293		
Long fallow		ε	111	99		42	9		
Fragmented forest	16	48		4 931	48	10	598	4	
Shrubs	1			21	5 038		593		
Short fallow						39	80		
Other land cover	11	72		63	133	4	14 941	38	
Water							56	20	
Plantations									12

Standard errors - Area transition matrix 1990-2000

(thousand hectares)

Land cover classes in 1990 \ Land cover classes in 2000	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	5 474	30	173	288	7	214	70		
Open canopy forest	14	14 353		73	23		322	ε	
Long fallow			115	54		113	43		
Fragmented forest	20			4 767	32	81	599	6	
Shrubs	5			7	4 790		545		
Short fallow						94	118		
Other land cover	29	28		120	86		14 965	95	
Water							16	37	
Plantations									12

Table 31. Forest area and area change -East Sahelian Africa (subregion code 13)

Forest area

	Forest definition f1				Forest definition f2				Forest definition f3				
	Absolute forest cover *(thousand hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(thousand hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(thousand hectares)*		**Relative forest cover** *(%)*		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980	17 974	6 370	8	3	40 125	16 050	18	7	42 024	16 192	18	7	[5;32]
1990	16 825	5 854	7	3	38 368	15 752	17	7	40 237	15 893	18	7	[4;31]
2000	15 878	5 484	7	2	36 740	15 454	16	7	38 529	15 588	17	7	[3;30]

Forest area change (10-years periods)

(thousand hectares)	Forest definition f1			Forest definition f2			Forest definition f3			
	Deforestation	**Net forest area change**		**Deforestation**	**Net forest area change**		**Deforestation**	**Net forest area change**		
	Mean	Mean	SE	Mean	Mean	SE	Mean	Mean	SE	95%CI
1980-1990	1 193	-1 148	816	2 049	-1 758	760	2 063	-1 786	718	[-3,193;-379]
1990-2000	1 013	- 947	713	1 772	-1 628	742	1 861	-1 708	768	[-3,213;-203]

Annual forest change (net area change and deforestation rate)

	Forest definition f1				Forest definition f2						Forest definition f3		
	Annual forest area change *(thousand hectares)*		**Deforestation rate r** *(%)*		**Annual net forest area change** *(thousand hectares)*		**Deforestation rate r** *(%)*		**Annual net forest area change** *(thousand hectares)*		**Deforestation rate r** *(%)*		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980-1990	- 115	82	0.64	0.35	- 176	76	0.44	0.20	- 179	72	0.43	0.18	[0.08;0.77]
1990-2000	- 95	71	0.56	0.35	- 163	74	0.42	0.20	- 171	77	0.42	0.19	[0.04;0.81]

Table 32. Area transition matrices for the periods 1980-1990 and 1990-2000 - West Sahelian and West Africa (subregion code 14, thousand ha)

Area transition matrix 1980-1990

('000 ha)

Land cover classes in 1980	Land cover classes in 1990: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	**State 1980**	*% of total land area*
Closed canopy forest	23 708	267	140	2 594	46	1 422	473	3	10	**28 663**	*11.5*
Open canopy forest		32 267		3 154	38	19	607	3	13	**36 100**	*14.5*
Long fallow	8		7 078			507	77			**7 670**	*3.1*
Fragmented forest	35	211		44 578	3	6	1 482			**46 314**	*18.6*
Shrubs	12	7		7	18 994		89			**19 109**	*7.7*
Short fallow	19	21	53	144		29 416	691	12	62	**30 418**	*12.2*
Other land cover	2	78		183	7	50	79 382	45	7	**79 755**	*32.1*
Water							132	88		**219**	*0.1*
Plantations						1	2		248	**252**	*0.1*
State 1990 →	**23 785**	**32 851**	**7 270**	**50 660**	**19 088**	**31 421**	**82 934**	**151**	**340**	**248 500**	
% of total land area →	*9.6*	*13.2*	*2.9*	*20.4*	*7.7*	*12.6*	*33.4*	*0.1*	*0.1*		

Area transition matrix 1990-2000

('000 ha)

Land cover classes in 1990	Land cover classes in 2000: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	**State 1990**	*% of total land area*
Closed canopy forest	20 340	59	107	2 510	15	193	536	4	20	**23 785**	*9.6*
Open canopy forest		28 060		3 857	108	76	734	9	7	**32 851**	*13.2*
Long fallow			7 134			126	10			**7 270**	*2.9*
Fragmented forest	77	109		47 199	16	48	3 206	5		**50 660**	*20.4*
Shrubs	20	9		24	18 841		193			**19 088**	*7.7*
Short fallow	15	18	48	4		28 990	2 336	10		**31 421**	*12.6*
Other land cover	20	67		30		190	82 532	70	24	**82 934**	*33.4*
Water						*s*	91	60		**151**	*0.1*
Plantations						8	8		324	**340**	*0.1*
State 2000 →	**20 472**	**28 324**	**7 289**	**53 625**	**18 980**	**29 631**	**89 645**	**159**	**376**	**248 500**	
% of total land area →	*8.2*	*11.4*	*2.9*	*21.6*	*7.6*	*11.9*	*36.1*	*0.1*	*0.2*		

Notes: see Table 6.

Table 33. Standard errors of the area transition matrices - West Sahelian and West Africa (subregion code 14, thousand ha)

Standard errors - Area transition matrix 1980-1990

(thousand hectares)

Land cover classes in 1980	Land cover classes in 1990: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	12 709	52	932	81	58	322	3 405	625	756
Open canopy forest	10	527	22	79	49	10	40		2
Long fallow	154	1	3 303			1 042	855		115
Fragmented forest	26	ε	97	1 095	158	49	502	ε	20
Shrubs				1	1 002	90	133	ε	2
Short fallow	32		159	8		12 362	2 853	67	168
Other land cover	24		18	ε	14	85	6 246	124	634
Water							15	135	
Plantations	ε			ε		29	415		3 069

Standard errors - Area transition matrix 1990-2000

(thousand hectares)

Land cover classes in 1990	Land cover classes in 2000: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	9 913	59	92	1 923	15	105	422	5	16
Open canopy forest		8 014		2 565	108	70	286	10	5
Long fallow			5 420			78	7		
Fragmented forest	62	49		12 646	16	51	1 528	5	
Shrubs	20	9		24	14 247		172		
Short fallow	18	19	47	4		7 599	1 615	12	
Other land cover	18	55		30		136	26 980	43	26
Water						ε	61	37	
Plantations						5	6		153

Table 34. Forest area and area change - West Sahelian and West Africa (subregion code 14)

Forest area

	Forest definition f1				Forest definition f2				Forest definition f3				
	Absolute forest cover *(thousand hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(thousand hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(thousand hectares)*		**Relative forest cover** *(%)*		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980	28 663	14 416	12	6	75 055	15 650	30	6	87 871	16 286	35	7	[23;48]
1990	23 785	11 695	10	5	67 893	13 299	27	5	80 792	14 192	33	6	[21;44]
2000	20 472	9 940	8	4	60 713	11 290	24	5	73 960	12 568	30	5	[20;40]

Forest area change (10-years periods)

(thousand hectares)	Forest definition f1			Forest definition f2			Forest definition f3			
	Deforestation	**Net forest area change**		**Deforestation**	**Net forest area change**		**Deforestation**	**Net forest area change**		
	Mean	Mean	SE	Mean	Mean	SE	Mean	Mean	SE	95%CI
1980-1990	4 955	-4 878	3038	7 574	-7 161	2753	7 546	-7 079	2488	[-11,955; -2,202]
1990-2000	3 445	-3 313	2230	7 489	-7 181	2786	7 174	-6 833	2580	[-11,889; -1,776]

Annual forest change (net area change and deforestation rate)

	Forest definition f1				Forest definition f2				Forest definition f3				
	Annual forest area change *(thousand hectares)*		**Deforestation rate r** (%)		**Annual net forest area change** *(thousand hectares)*		**Deforestation rate r** (%)		**Annual net forest area change** *(thousand hectares)*		**Deforestation rate r** (%)		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980-1990	- 488	304	1.70	0.44	- 716	275	0.95	0.21	- 708	249	0.81	0.17	[0.47;1.14]
1990-2000	- 331	223	1.39	0.54	- 718	279	1.06	0.28	- 683	258	0.85	0.24	[0.37;1.32]

Table 35. Area transition matrices for the periods 1980-1990 and 1990-2000 - Central Africa (subregion code 15, thousand ha)

Area transition matrix 1980-1990

('000 ha)	Land cover classes in 1990										
Land cover classes in 1980	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	**State 1980**	*% of total land area*
Closed canopy forest	152 576	1 687	214	342		5 012	522	30	38	**160 421**	*40.7*
Open canopy forest	128	63 513	2	464		867	1 885			**66 858**	*16.9*
Long fallow			1 973			31				**2 004**	*0.5*
Fragmented forest	65	74		37 774		25	1 815			**39 754**	*10.1*
Shrubs											
Short fallow	348	105		6		18 723	282	18	10	**19 493**	*4.9*
Other land cover	119	228		496		237	104 820	13	36	**105 947**	*26.8*
Water						63	4	- 3		**64**	*0.0*
Plantations							2		56	**59**	*0.0*
State 1990 →	**153 235**	**65 606**	**2 189**	**39 082**		**24 958**	**109 331**	**58**	**141**	**394 600**	
% of total land area →	*38.8*	*16.6*	*0.6*	*9.9*		*6.3*	*27.7*	*0.0*	*0.0*		

Area transition matrix 1990-2000

('000 ha)	Land cover classes in 2000										
Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	**State 1990**	*% of total land area*
Closed canopy forest	148 027	461	260	260		3 947	220	19	40	**153 235**	*38.8*
Open canopy forest	8	64 593	76	311		376	243			**65 606**	*16.6*
Long fallow			2 162	19		8				**2 189**	*0.6*
Fragmented forest	31	8		37 696		800	546			**39 082**	*9.9*
Shrubs											
Short fallow	687	39		10		24 079	94	48		**24 958**	*6.3*
Other land cover		82		71		76	109 032	10	59	**109 331**	*27.7*
Water								58		**58**	*0.0*
Plantations									141	**141**	*0.0*
State 2000 →	**148 754**	**65 182**	**2 498**	**38 368**		**29 286**	**110 136**	**136**	**240**	**394 600**	
% of total land area →	*37.7*	*16.5*	*0.6*	*9.7*		*7.4*	*27.9*	*0.0*	*0.1*		

Notes: see Table 6.

Table 36. Standard errors of the area transition matrices - Central Africa (subregion code 15, thousand ha)

Standard errors - Area transition matrix 1980-1990

(thousand hectares)

Land cover classes in 1980 \ Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	34 049	560	202	230		2 793	116	18	28
Open canopy forest	69	11 524	2	337		503	683		
Long fallow			1 862			30			
Fragmented forest	62	50		20 795		22	1 760		
Shrubs									
Short fallow	195	50		6		7 985	181	18	11
Other land cover	75	148		461		114	27 173	9	29
Water						63	4	3	
Plantations							2		47

Standard errors - Area transition matrix 1990-2000

(thousand hectares)

Land cover classes in 1990 \ Land cover classes in 2000	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	32 875	288	246	171		1 648	86	19	41
Open canopy forest	8	11 909	71	181		161	133		
Long fallow			2 040	18		8			
Fragmented forest	31	8		20 770		660	490		
Shrubs									
Short fallow	482	20		10		10 496	36	48	
Other land cover		41		60		29	28 720	10	60
Water								43	
Plantations									114

Table 37. Forest area and area change - Central Africa (subregion code 15)

Forest area

	Forest definition f1				Forest definition f2						Forest definition f3		
	Absolute forest cover *(thousand hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(thousand hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(thousand hectares)*		**Relative forest cover** *(%)*		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980	160 421	35 611	41	9	236 113	30 257	60	8	242 535	28 483	61	7	[47;76]
1990	153 235	34 208	39	9	227 526	29 716	58	8	234 058	28 052	59	7	[45;73]
2000	148 754	33 255	38	8	222 463	29 193	56	7	229 223	27 595	58	7	[44;72]

Forest area change (10-years periods)

(thousand hectares)	Forest definition f1			Forest definition f2			Forest definition f3			
	Deforestation	**Net forest area change**		**Deforestation**	**Net forest area change**		**Deforestation**	**Net forest area change**		
	Mean	Mean	SE	Mean	Mean	SE	Mean	Mean	SE	95%CI
1980-1990	7 845	-7 185	2535	9 605	-8 587	2427	9 535	-8 477	2508	[-13,393;-3,560]
1990-2000	5 209	-4 481	1511	5 925	-5 064	1390	5 696	-4 835	1433	[-7,644;-2,025]

Annual forest change (net area change and deforestation rate)

	Forest definition f1				Forest definition f2				Forest definition f3				
	Annual forest area change *(thousand hectares)*		**Deforestation rate r** (%)		**Annual net forest area change** *(thousand hectares)*		**Deforestation rate r** (%)		**Annual net forest area change** *(thousand hectares)*		**Deforestation rate r** (%)		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980-1990	- 719	253	0.45	0.13	- 859	243	0.36	0.10	- 848	251	0.35	0.10	[0.15;0.55]
1990-2000	- 448	151	0.29	0.08	- 506	139	0.22	0.06	- 483	143	0.21	0.06	[0.09;0.32]

Table 38. Area transition matrices for the periods 1980-1990 and 1990-2000 - Tropical Southern Africa (subregion code 16, thousand ha)

Area transition matrix 1980-1990

('000 ha)	Land cover classes in 1990										
Land cover classes in 1980	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	**State 1980**	*% of total land area*
Closed canopy forest	80 805	643	333	1 231	26	667	1 190	5	72	**84 972**	*24.1*
Open canopy forest	116	78 715	297	1 468	11	720	1 697		34	**83 058**	*23.6*
Long fallow	75	24	6 626	77	45	205	187			**7 239**	*2.1*
Fragmented forest	334	295	77	41 014	87	2 136	1 009		7	**44 959**	*12.8*
Shrubs	20		6	19	6 550	224	273		37	**7 130**	*2.0*
Short fallow	133	99	72	329	58	10 007	545			**11 242**	*3.2*
Other land cover	197	295	35	355	32	106	111 837	34	204	**113 096**	*32.1*
Water	27	37		16	5		117	61		**263**	*0.1*
Plantations	14					4	33		489	**540**	*0.2*
State 1990 →	**81 721**	**80 108**	**7 447**	**44 510**	**6 814**	**14 069**	**116 886**	**101**	**844**	352 500	
% of total land area →	*23.2*	*22.7*	*2.1*	*12.6*	*1.9*	*4.0*	*33.2*	*0.0*	*0.2*		

Area transition matrix 1990-2000

('000 ha)	Land cover classes in 2000										
Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	**State 1990**	*% of total land area*
Closed canopy forest	77 250	78	179	2 456	10	636	1 086	14	13	**81 721**	*23.2*
Open canopy forest	19	75 614	157	1 539	11	1 320	1 439	5	3	**80 108**	*22.7*
Long fallow	25	62	6 841	76	5	275	164			**7 447**	*2.1*
Fragmented forest	67	113	27	42 201		911	1 175	5	10	**44 510**	*12.6*
Shrubs			12	14	5 919	310	521		37	**6 814**	*1.9*
Short fallow	70	163	241	929	164	12 114	387			**14 069**	*4.0*
Other land cover	45	52	33	87	37	111	116 475	29	18	**116 886**	*33.2*
Water							99	2		**101**	*0.0*
Plantations	9			19			136		680	**844**	*0.2*
State 2000 →	**77 485**	**76 082**	**7 490**	**47 320**	**6 146**	**15 678**	**121 481**	**56**	**761**	352 500	
% of total land area →	*22.0*	*21.6*	*2.1*	*13.4*	*1.7*	*4.4*	*34.5*	*0.0*	*0.2*		

Notes: see Table 6.

Table 39. Standard errors of the area transition matrices - Tropical Southern Africa (subregion code 16, thousand ha)

Standard errors - Area transition matrix 1980-1990

(thousand hectares)

Land cover classes in 1980 \ Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	17 797	240	184	673	17	248	556	5	68
Open canopy forest	45	21 186	203	703	11	378	574		33
Long fallow	47	21	3 929	63	44	87	93		
Fragmented forest	285	126	73	15 815	75	1 897	338		7
Shrubs	20		6	16	3 303	193	135		37
Short fallow	62	54	52	296	39	3 672	289		
Other land cover	139	89	22	206	17	49	18 141	21	197
Water	27	37		11	5		63	59	
Plantations	13					5	22		387

Standard errors - Area transition matrix 1990-2000

(thousand hectares)

Land cover classes in 1990 \ Land cover classes in 2000	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	16 934	48	78	1 676	10	258	566	14	9
Open canopy forest	17	20 076	105	757	11	612	593	5	3
Long fallow	22	66	3 861	59	4	150	86		
Fragmented forest	60	98	29	15 414		901	802	5	9
Shrubs			12	10	3 104	221	301		37
Short fallow	32	80	144	833	120	4 549	132		
Other land cover	31	30	21	29	21	64	17 938	17	10
Water							86	23	
Plantations	8			19			126		538

Table 40. Forest area and area - Tropical Southern Africa (subregion code 16)

Forest area

	Forest definition f1				Forest definition f2				Forest definition f3					
	Absolute forest cover *(thousand hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(thousand hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(thousand hectares)*		**Relative forest cover** *(%)*			
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI	
1980	84 972	18 804	24	5	178 021	16 404	51	5	190 256	15 044	54	4	[46;62]	
1990	81 721	18 047	23	5	171 720	16 582	49	5	184 113	15 156	52	4	[44;61]	
2000	77 485	16 955	22	5	164 083	15 971	47	5	176 831	14 518	50	4	[42;58]	

Forest area change (10-years periods)

(thousand hectares)	Forest definition f1			Forest definition f2			Forest definition f3			
	Deforestation	**Net forest area change**		**Deforestation**	**Net forest area change**		**Deforestation**	**Net forest area change**		
	Mean	Mean	SE	Mean	Mean	SE	Mean	Mean	SE	95%CI
1980-1990	4 167	-3 251	1075	7 888	-6 301	1151	7 790	-6 143	1090	[-8,280;-4,006]
1990-2000	4 472	-4 236	2184	8 454	-7 637	2058	8 395	-7 282	1954	[-11,111;-3,453]

Annual forest change (net area change and deforestation rate)

	Forest definition f1				Forest definition f2				Forest definition f3				
	Annual forest area change *(thousand hectares)*		**Deforestation rate r** (%)		**Annual net forest area change** *(thousand hectares)*		**Deforestation rate r** (%)		**Annual net forest area change** *(thousand hectares)*		**Deforestation rate r** (%)		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980-1990	- 325	108	0.38	0.09	- 630	115	0.35	0.08	- 614	109	0.32	0.06	[0.20;0.45]
1990-2000	- 424	218	0.52	0.23	- 764	206	0.44	0.11	- 728	195	0.40	0.10	[0.20;0.59]

Appendix 4. Results at subregional level – Asia

Notes: SE = standard error of the mean; 95%CI = 95% confidence interval; absolute forest cover = forest area; relative forest cover = percentage of total land area; deforestation = gross forest loss; Net forest area change = net forest loss/gain

Table 41. Area transition matrices for the periods 1980-1990 and 1990-2000 - South Asia (subregion code 44, thousand ha)

Area transition matrix 1980-1990

('000 ha)	Land cover classes in 1990										
Land cover classes in 1980	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	**State 1980**	*% of total land area*
Closed canopy forest	40 272	808	580	40	37	268	440	14	33	**42 493**	*21.1*
Open canopy forest	208	12 246	4	73	91	6	328	9	40	**13 006**	*6.5*
Long fallow	52		8 989	4	2	1 378	281		4	**10 710**	*5.3*
Fragmented forest	29	36	11	6 990	5	3	214	6	15	**7 309**	*3.6*
Shrubs		18			1 855	1	58	5	13	**1 950**	*1.0*
Short fallow	25		124	4	2	2 126	9			**2 290**	*1.1*
Other land cover	91	87	35	104	67	21	120 441	100	69	**121 015**	*60.2*
Water	7	3					40	57	9	**116**	*0.1*
Plantations	31	15	ε	6	5	ε	40		2 114	**2 210**	*1.1*
State 1990 →	**40 714**	**13 214**	**9 744**	**7 220**	**2 065**	**3 803**	**121 852**	**192**	**2 297**	**201 100**	
% of total land area →	*20.2*	*6.6*	*4.8*	*3.6*	*1.0*	*1.9*	*60.6*	*0.1*	*1.1*		

Area transition matrix 1990-2000

('000 ha)	Land cover classes in 2000										
Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	**State 1990**	*% of total land area*
Closed canopy forest	39 904	144	30	132	2	282	172	31	18	**40 714**	*20.2*
Open canopy forest	61	12 807		99	25	30	171	19	1	**13 214**	*6.6*
Long fallow	1		8 736	15	ε	881	111			**9 744**	*4.8*
Fragmented forest	6	17	ε	7 049	ε	4	107	31	7	**7 220**	*3.6*
Shrubs		1		4	2 020	15	22	4		**2 065**	*1.0*
Short fallow	ε		269	ε	ε	3 483	50			**3 803**	*1.9*
Other land cover	15	92	75	339	33	62	121 050	96	90	**121 852**	*60.6*
Water	6			4			33	149		**192**	*0.1*
Plantations							39		2 258	**2 297**	*1.1*
State 2000 →	**39 994**	**13 061**	**9 110**	**7 643**	**2 080**	**4 755**	**121 754**	**330**	**2 374**	**201 100**	
% of total land area →	*19.9*	*6.5*	*4.5*	*3.8*	*1.0*	*2.4*	*60.5*	*0.2*	*1.2*		

Notes: see Table 6.

Table 42. Standard errors of the area transition matrices - South Asia (subregion code 44, thousand ha)

Standard errors - Area transition matrix 1980-1990

(thousand hectares)

Land cover classes in 1980	Land cover classes in 1990: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	7 861	353	568	10	28	252	253	8	27
Open canopy forest	71	3 072	4	35	60	5	124	6	20
Long fallow	34		6 205	4	2	1 154	259		4
Fragmented forest	13	15	10	2 291	3	2	100	9	7
Shrubs		18			450	1	25	5	9
Short fallow	17		94	4	2	1 633	6		
Other land cover	34	28	30	44	47	21	13 939	61	36
Water	10	4					17	44	9
Plantations	15	8	ε	3	5	ε	14		929

Standard errors - Area transition matrix 1990-2000

(thousand hectares)

Land cover classes in 1990	Land cover classes in 2000: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	7 665	74	25	57	2	216	74	45	8
Open canopy forest	52	3 317		45	23	25	100	15	1
Long fallow	1		6 306	15	ε	591	81		
Fragmented forest	3	8	ε	2 357	ε	4	35	45	4
Shrubs		1		4	484	15	12	4	
Short fallow	ε		234	ε	ε	2 252	33		
Other land cover	8	74	74	271	30	57	13 365	40	41
Water	9			4			17	106	
Plantations							21		1 017

Table 43. Forest area and area change for the ecological zone - South Asia (subregion code 44)

Forest area

	Forest definition f1				Forest definition f2				Forest definition f3				
	Absolute forest cover *(thousand hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(thousand hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(thousand hectares)*		**Relative forest cover** *(%)*		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980	42 493	8 506	21	4	57 124	8 717	28	4	68 646	13 582	34	7	[21;47]
1990	40 714	7 836	20	4	55 533	8 195	28	4	66 079	12 122	33	6	[21;45]
2000	39 994	7 634	20	4	54 752	7 917	27	4	64 712	11 642	32	6	[21;44]

Forest area change (10-years periods)

(thousand hectares)	Forest definition f1			Forest definition f2			Forest definition f3			
	Deforestation	**Net forest area change**		**Deforestation**	**Net forest area change**		**Deforestation**	**Net forest area change**		
	Mean	Mean	SE	Mean	Mean	SE	Mean	Mean	SE	95%CI
1980-1990	2 221	-1 779	1087	1 996	-1 591	1093	3 091	-2 567	1819	[-6,132;997]
1990-2000	810	- 721	340	993	- 780	389	1 955	-1 367	797	[-2,930;196]

Annual forest change (net area change and deforestation rate)

	Forest definition f1				Forest definition f2				Forest definition f3				
	Annual forest area change *(thousand hectares)*		**Deforestation rate r** (%)		**Annual net forest area change** *(thousand hectares)*		**Deforestation rate r** (%)		**Annual net forest area change** *(thousand hectares)*		**Deforestation rate r** (%)		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980-1990	- 178	109	0.42	0.21	- 159	109	0.28	0.17	- 257	182	0.37	0.21	[-0.03;0.78]
1990-2000	- 72	34	0.18	0.07	- 78	39	0.14	0.06	- 137	80	0.21	0.10	[0.01;0.41]

Table 44. Area transition matrices for the periods 1980-1990 and 1990-2000 - Continental South-East Asia (subregion code 45, thousand ha)

Area transition matrix 1980-1990

('000 ha)	Land cover classes in 1990										
Land cover classes in 1980	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	**State 1980**	*% of total land area*
Closed canopy forest	60 576	656	1 957	428	126	778	2 369	224	930	**68 045**	*36.5*
Open canopy forest	89	11 528	96	64	207	49	632	53	2	**12 721**	*6.8*
Long fallow	375	18	16 205	31	56	581	999	56	2	**18 323**	*9.8*
Fragmented forest	69	30	60	5 928	153	87	881	26	39	**7 272**	*3.9*
Shrubs	24	42	21	46	4 899	17	767	32	15	**5 862**	*3.1*
Short fallow	151	40	128	13	53	5 115	1 020	27	2	**6 548**	*3.5*
Other land cover	94	142	83	58	178	23	60 407	97	43	**61 125**	*32.8*
Water	18			3	2		61	440	8	**531**	*0.3*
Plantations	2	2					12		5 757	**5 774**	*3.1*
State 1990 →	**61 399**	**12 459**	**18 550**	**6 571**	**5 674**	**6 650**	**67 148**	**953**	**6 797**	**186 200**	
% of total land area →	*33.0*	*6.7*	*10.0*	*3.5*	*3.0*	*3.6*	*36.1*	*0.5*	*3.7*		

Area transition matrix 1990-2000

('000 ha)	Land cover classes in 2000										
Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	**State 1990**	*% of total land area*
Closed canopy forest	57 572	142	1 027	475	41	1 061	952	107	22	**61 399**	*33.0*
Open canopy forest	80	10 994	150	37	112	215	863	7		**12 459**	*6.7*
Long fallow	272		17 193	18	9	677	346	34		**18 550**	*10.0*
Fragmented forest	49	28	88	5 766	1	173	448	8	18	**6 571**	*3.5*
Shrubs	39	17	16	10	4 906	94	552	26	14	**5 674**	*3.0*
Short fallow	43	1	108	28	11	5 895	550	15		**6 650**	*3.6*
Other land cover	114	84	61	40	114	94	66 435	61	145	**67 148**	*36.1*
Water	15			5	13		53	868		**953**	*0.5*
Plantations	4						31		6 762	**6 797**	*3.7*
State 2000 →	**58 188**	**11 266**	**18 642**	**6 380**	**5 208**	**8 208**	**70 230**	**1 118**	**6 961**	**186 200**	
% of total land area →	*31.3*	*6.1*	*10.0*	*3.4*	*2.8*	*4.4*	*37.7*	*0.6*	*3.7*		

Notes: see Table 6.

Table 45. Standard errors of the area transition matrices - Continental South-East Asia (subregion code 45, thousand ha)

Standard errors - Area transition matrix 1980-1990

(thousand hectares)

Land cover classes in 1980 \ Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	9 618	388	561	143	41	322	896	132	964
Open canopy forest	53	6 270	51	38	100	25	271	48	1
Long fallow	147	13	6 132	13	26	221	397	37	2
Fragmented forest	11	12	33	1 904	68	60	256	11	37
Shrubs	13	20	9	18	1 941	15	243	17	9
Short fallow	81	34	48	8	36	1 922	417	17	2
Other land cover	39	74	64	23	98	17	15 393	34	16
Water	14			3	2		34	284	8
Plantations	2	2					7		5 947

Standard errors - Area transition matrix 1990-2000

(thousand hectares)

Land cover classes in 1990 \ Land cover classes in 2000	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	5 158	35	298	321	20	455	391	74	23
Open canopy forest	65	6 033	85	15	54	143	579	7	
Long fallow	145		6 257	11	6	188	108	31	
Fragmented forest	24	18	69	1 741	1	138	178	ε	17
Shrubs	35	10	8	7	1 959	79	333	11	14
Short fallow	18	1	62	28	10	2 080	90	12	
Other land cover	99	61	33	17	67	77	15 151	28	112
Water	15			5	13		26	508	
Plantations	4						18		6 942

Table 46. Forest area and area change - Continental South-East Asia (subregion code 45)

Forest area

	Forest definition f1				Forest definition f2				Forest definition f3				
	Absolute forest cover *(thousand hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(thousand hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(thousand hectares)*		**Relative forest cover** *(%)*		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980	68 045	10 805	37	6	82 382	11 280	44	6	101 513	13 007	55	7	[41;68]
1990	61 399	9 732	33	5	75 317	10 384	40	6	94 598	12 660	51	7	[37;64]
2000	58 188	9 421	31	5	70 871	9 999	38	5	90 222	12 584	48	7	[35;62]

Forest area change (10-years periods)

(thousand hectares)	Forest definition f1			Forest definition f2			Forest definition f3			
	Deforestation	**Net forest area change**		**Deforestation**	**Net forest area change**		**Deforestation**	**Net forest area change**		
	Mean	Mean	SE	Mean	Mean	SE	Mean	Mean	SE	95%CI
1980-1990	7 469	-6 646	2356	8 083	-7 064	2205	7 807	-6 915	2011	[-10,856;-2,974]
1990-2000	3 826	-3 211	1037	5 117	-4 446	1371	5 014	-4 376	1435	[-7,190;-1,563]

Annual forest change (net area change and deforestation rate)

	Forest definition f1				Forest definition f2				Forest definition f3				
	Annual forest area change *(thousand hectares)*		**Deforestation rate r** *(%)*		**Annual net forest area change** *(thousand hectares)*		**Deforestation rate r** *(%)*		**Annual net forest area change** *(thousand hectares)*		**Deforestation rate r** *(%)*		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980-1990	- 665	236	0.98	0.29	- 706	221	0.86	0.23	- 691	201	0.68	0.20	[0.30;1.06]
1990-2000	- 321	104	0.52	0.16	- 445	137	0.59	0.17	- 438	144	0.46	0.16	[0.15;0.77]

Table 47. Area transition matrices for the periods 1980-1990 and 1990-2000 - Insular South-East Asia (subregion code 46, thousand ha)

Area transition matrix 1980-1990

('000 ha)	Land cover classes in 1990										
Land cover classes in 1980	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	**State 1980**	*% of total land area*
Closed canopy forest	109 994	320	2 828	776	107	3 393	4 586	149	1 575	**123 728**	*55.4*
Open canopy forest	13	776	46	75	2	50	81		26	**1 069**	*0.5*
Long fallow	419		17 161	24	155	3 550	578		8	**21 894**	*9.8*
Fragmented forest	7	34	71	4 163	197	91	984		20	**5 566**	*2.5*
Shrubs	44		44	16	1 264	5	342		40	**1 755**	*0.8*
Short fallow	306	23	742	95	169	31 205	2 768	19	114	**35 440**	*15.9*
Other land cover	21		123	12	94	59	27 262	77	252	**27 899**	*12.5*
Water							3	9		**12**	*0.0*
Plantations	66		6	5		149	740	8	4 864	**5 837**	*2.6*
State 1990 →	**110 870**	**1 153**	**21 020**	**5 166**	**1 987**	**38 501**	**37 343**	**262**	**6 899**	**223 200**	
% of total land area →	*49.7*	*0.5*	*9.4*	*2.3*	*0.9*	*17.2*	*16.7*	*0.1*	*3.1*		

Area transition matrix 1990-2000

('000 ha)	Land cover classes in 2000										
Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	**State 1990**	*% of total land area*
Closed canopy forest	95 569	105	2 557	122	90	1 821	8 246	608	1 751	**110 870**	*49.7*
Open canopy forest	17	911	33	80	49	10	52		2	**1 153**	*0.5*
Long fallow	257	1	15 774			2 372	2 380		236	**21 020**	*9.4*
Fragmented forest	33	ε	88	4 024	227	62	705	ε	26	**5 166**	*2.3*
Shrubs				1	1 655	116	213	ε	2	**1 987**	*0.9*
Short fallow	76		339	7		31 932	5 662	77	407	**38 501**	*17.2*
Other land cover	23		37	ε	14	154	35 206	160	1 748	**37 343**	*16.7*
Water							37	225		**262**	*0.1*
Plantations	ε			ε		28	609		6 262	**6 899**	*3.1*
State 2000 →	**95 976**	**1 017**	**18 828**	**4 234**	**2 036**	**36 494**	**53 110**	**1 071**	**10 435**	**223 200**	
% of total land area →	*43.0*	*0.5*	*8.4*	*1.9*	*0.9*	*16.4*	*23.8*	*0.5*	*4.7*		

Notes: see Table 6.

Table 48. Standard errors of the area transition matrices - Insular South-East Asia (subregion code 46, thousand ha)

Standard errors - Area transition matrix 1980-1990

(thousand hectares)

Land cover classes in 1980 \ Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	11 924	252	895	424	73	1 100	2 614	127	752
Open canopy forest	9	445	30	74	2	28	50		26
Long fallow	220		3 763	16	171	1 592	225		4
Fragmented forest	4	26	79	1 100	190	83	511		20
Shrubs	48		48	16	884	5	302		40
Short fallow	230	14	298	73	160	12 348	1 160	17	107
Other land cover	10		52	5	76	34	6 761	45	156
Water							3	16	
Plantations	30		3	5		69	362	12	2 587

Standard errors - Area transition matrix 1990-2000

(thousand hectares)

Land cover classes in 1990 \ Land cover classes in 2000	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	32 875	52	932	81	58	322	3 405	625	756
Open canopy forest	10	527	22	79	49	10	40		2
Long fallow	154	1	3 303			1 042	855		115
Fragmented forest	26	ε	97	1 095	158	49	502	ε	20
Shrubs				1	1 002	90	133	ε	2
Short fallow	32		159	8		12 362	2 853	67	168
Other land cover	24		18	ε	14	85	6 246	124	634
Water							15	135	
Plantations	ε			ε		29	415		3 069

Table 49. Forest area and area change - Insular South-East Asia (subregion code 46)

Forest area

	Forest definition f1				Forest definition f2				Forest definition f3				
	Absolute forest cover *(thousand hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(thousand hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(thousand hectares)*		**Relative forest cover** *(%)*		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980	123 728	10 232	55	5	126 033	10 190	56	5	148 546	13 782	67	6	[54;79]
1990	110 870	11 936	50	5	113 171	11 754	51	5	134 765	14 587	60	7	[48;73]
2000	95 976	12 815	43	6	97 933	12 683	44	6	117 231	15 001	53	7	[39;66]

Forest area change (10-years periods)

(thousand hectares)	Forest definition f1			Forest definition f2			Forest definition f3			
	Deforestation	**Net forest area change**		**Deforestation**	**Net forest area change**		**Defores tation**	**Net forest area change**		
	Mean	Mean	SE	Mean	Mean	SE	Mean	Mean	SE	95%CI
1980-1990	13 734	-12 858	5013	13 807	-12 863	4985	15 272	-13 781	4616	[-22,827;-4,734]
1990-2000	15 301	-14 894	4914	15 623	-15 238	4992	18 092	-17 534	5760	[-28,823;-6,245]

Annual forest change (net area change and deforestation rate)

	Forest definition f1				Forest definition f2				Forest definition f3				
	Annual forest area change *(thousand hectares)*		**Deforestation rate r** (%)		**Annual net forest area change** *(thousand hectares)*		**Deforestation rate r** (%)		**Annual net forest area change** *(thousand hectares)*		**Deforestation rate r** (%)		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980-1990	-1 286	501	1.04	0.42	-1 286	499	1.02	0.41	-1 378	462	0.93	0.32	[0.29;1.56]
1990-2000	-1 489	491	1.34	0.46	-1 524	499	1.35	0.46	-1 753	576	1.30	0.43	[0.45;2.15]

Appendix 5. Results at subregional level - Latin America

Notes: SE = standard error of the mean; 95%CI = 95% confidence interval; absolute forest cover = forest area; relative forest cover = percentage of total land area; deforestation = gross forest loss; Net forest area change = net forest loss/gain

Table 50. Area transition matrices for the periods 1980-1990 and 1990-2000 - Mexico and Central America (subregion code 31, thousand ha)

Area transition matrix 1980-1990

('000 ha)	Land cover classes in 1990										
Land cover classes in 1980	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	**State 1980**	*% of total land area*
Closed canopy forest	37 825	801	1 063	760	86	623	517	19		**41 695**	*27.8*
Open canopy forest	68	31 889	75	251	125	455	845	25	7	**33 739**	*22.5*
Long fallow	70	32	1 393	14		271	61			**1 841**	*1.2*
Fragmented forest	31	1	16	5 406	3	1	284	11	5	**5 758**	*3.8*
Shrubs		3			20 547		202	25	3	**20 781**	*13.9*
Short fallow	37	62	35	1	9	4 009	178	31		**4 362**	*2.9*
Other land cover	37	7	7	12	25	16	40 873	40	160	**41 179**	*27.5*
Water	3					2	13	41		**60**	*0.0*
Plantations							82		404	**485**	*0.3*
State 1990 →	**38 072**	**32 795**	**2 589**	**6 444**	**20 795**	**5 379**	**43 055**	**192**	**580**	**149 900**	
% of total land area →	*25.4*	*21.9*	*1.7*	*4.3*	*13.9*	*3.6*	*28.7*	*0.1*	*0.4*		

Area transition matrix 1990-2000

('000 ha)	Land cover classes in 2000										
Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	**State 1990**	*% of total land area*
Closed canopy forest	35 572	50	565	1 230	3	244	403	6		**38 072**	*25.4*
Open canopy forest	9	31 843	119	256	11	105	432	7	14	**32 795**	*21.9*
Long fallow	53	15	2 267			230	24			**2 589**	*1.7*
Fragmented forest	9	10	26	6 199		4	176		20	**6 444**	*4.3*
Shrubs					20 718		77			**20 795**	*13.9*
Short fallow	11	43	62	16		5 173	73	2		**5 379**	*3.6*
Other land cover	8	17	5	10	1	3	42 904	6	100	**43 055**	*28.7*
Water					11	16		165		**192**	*0.1*
Plantations							94		485	**580**	*0.4*
State 2000 →	**35 662**	**31 978**	**3 043**	**7 711**	**20 744**	**5 775**	**44 183**	**185**	**619**	**149 900**	
% of total land area →	*23.8*	*21.3*	*2.0*	*5.1*	*13.8*	*3.9*	*29.5*	*0.1*	*0.4*		

Notes: see Table 6.

Table 51. Standard errors of the area transition matrices - Mexico and Central America (subregion code 31, thousand ha)

Standard errors - Area transition matrix 1980-1990

(thousand hectares)

Land cover classes in 1980 \ Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	6 005	516	581	579	62	281	240	15	
Open canopy forest	38	5 351	29	133	84	365	326	20	5
Long fallow	58	16	585	12		175	55		
Fragmented forest	21	1	14	2 650	2	1	260	11	5
Shrubs		2			8 417		122	14	3
Short fallow	21	38	20	1	8	2 167	110	30	
Other land cover	22	5	4	6	19	8	8 369	23	124
Water	4					3	7	37	
Plantations							67		273

Standard errors - Area transition matrix 1990-2000

(thousand hectares)

Land cover classes in 1990 \ Land cover classes in 2000	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	5 158	20	460	1 337	2	135	195	6	
Open canopy forest	5	5 533	117	232	10	51	171	4	12
Long fallow	34	15	959			158	13		
Fragmented forest	9	7	22	3 160		4	164		19
Shrubs					8 328		26		
Short fallow	9	22	34	13		2 284	58	2	
Other land cover	7	9	5	7	1	4	7 831	7	61
Water					8	19		138	
Plantations							87		363

Table 52. Forest area and area change - Mexico and Central America (subregion code 31)

Forest area

	Forest definition f1				Forest definition f2				Forest definition f3				
	Absolute forest cover *(thousand hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(thousand hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(thousand hectares)*		**Relative forest cover** *(%)*		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980	41 695	6 594	28	4	76 714	9 968	51	7	79 195	10 572	53	7	[39;67]
1990	38 072	6 027	25	4	72 298	8 716	48	6	75 603	9 395	50	6	[38;63]
2000	35 662	5 159	24	3	69 354	8 054	46	5	73 253	8 817	49	6	[37;60]

Forest area change (10-years periods)

(thousand hectares)	Forest definition f1			Forest definition f2			Forest definition f3			
	Deforestation	**Net forest area change**		**Deforestation**	**Net forest area change**		**Deforestation**	**Net forest area change**		
	Mean	Mean	SE	Mean	Mean	SE	Mean	Mean	SE	95%CI
1980-1990	3 870	-3 623	1230	4 698	-4 415	1496	3 820	-3 591	1336	[-6,211;-972]
1990-2000	2 500	-2 410	1413	3 113	-2 945	1492	2 534	-2 350	1290	[-4,878;178]

Annual forest change (net area change and deforestation rate)

	Forest definition f1				Forest definition f2				Forest definition f3				
	Annual forest area change *(thousand hectares)*		**Deforestation rate r** (%)		**Annual net forest area change** *(thousand hectares)*		**Deforestation rate r** (%)		**Annual net forest area change** *(thousand hectares)*		**Deforestation rate r** (%)		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980-1990	- 362	123	0.87	0.25	- 442	150	0.58	0.14	- 359	134	0.45	0.12	[0.22;0.68]
1990-2000	- 241	141	0.63	0.31	- 294	149	0.41	0.19	- 235	129	0.31	0.15	[0.01;0.61]

Table 53. Area transition matrices for the periods 1980-1990 and 1990-2000 - Tropical South America, excluded Brazil (subregion code 34, thousand ha)

Area transition matrix 1980-1990

('000 ha)	Land cover classes in 1990										
Land cover classes in 1980	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	**State 1980**	*% of total land area*
Closed canopy forest	296 900	42	457	695	223	850	3 032	1 218	ε	**303 418**	*67.0*
Open canopy forest	19	20 332					97			**20 448**	*4.5*
Long fallow	56		845			151	4	6		**1 063**	*0.2*
Fragmented forest	7			5 266	4	36	525	57		**5 896**	*1.3*
Shrubs	11				12 674		76			**12 761**	*2.8*
Short fallow	11		52			2 401	35	13		**2 512**	*0.6*
Other land cover	89	11	4	9	482	10	104 855	777	2	**106 239**	*23.4*
Water	2		9	39			103	609		**762**	*0.2*
Plantations											
State 1990 →	**297 096**	**20 385**	**1 367**	**6 010**	**13 383**	**3 449**	**108 729**	**2 679**	**2**	**453 100**	
% of total land area →	*65.6*	*4.5*	*0.3*	*1.3*	*3.0*	*0.8*	*24.0*	*0.6*	*0.0*		

Area transition matrix 1990-2000

('000 ha)	Land cover classes in 2000										
Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	**State 1990**	*% of total land area*
Closed canopy forest	292 914		412	175	ε	663	2 681	250		**297 096**	*65.6*
Open canopy forest		20 374					10			**20 385**	*4.5*
Long fallow	9		1 256			61	41			**1 367**	*0.3*
Fragmented forest	8		2	5 310	14		631	45		**6 010**	*1.3*
Shrubs					13 050		333			**13 383**	*3.0*
Short fallow	24		9			3 169	246	2		**3 449**	*0.8*
Other land cover	171		39	15	54	17	108 051	377	5	**108 729**	*24.0*
Water	138		11	32			499	2 000		**2 679**	*0.6*
Plantations									2	**2**	*0.0*
State 2000 →	**293 263**	**20 374**	**1 729**	**5 533**	**13 118**	**3 910**	**112 493**	**2 673**	**7**	**453 100**	
% of total land area →	*64.7*	*4.5*	*0.4*	*1.2*	*2.9*	*0.9*	*24.8*	*0.6*	*0.0*		

Notes: see Table 6.

Table 54. Standard errors of the area transition matrices - Tropical South America, excluded Brazil (subregion code 34, thousand ha)

Standard errors - Area transition matrix 1980-1990

(thousand hectares)

Land cover classes in 1980 \ Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	14 631	31	257	436	137	339	1 646	1 382	ε
Open canopy forest	14	18 339					69		
Long fallow	51		687			94	4	6	
Fragmented forest	7			1 465	4	37	386	58	
Shrubs	10				5 423		45		
Short fallow	11		52			1 189	32	12	
Other land cover	53	10	4	6	469	6	24 288	897	2
Water	2		9	33			64	410	
Plantations									

Standard errors - Area transition matrix 1990-2000

(thousand hectares)

Land cover classes in 1990 \ Land cover classes in 2000	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	14 453		184	66	ε	277	1 474	298	
Open canopy forest		18 373					7		
Long fallow	9		890			48	26		
Fragmented forest	6		2	1 506	14		522	46	
Shrubs					5 354		296		
Short fallow	23		9			1 421	206	2	
Other land cover	127		40	15	43	13	24 560	384	7
Water	124		11	33			422	2 415	
Plantations									2

Table 55. Forest area and area change - Tropical South America, excluded Brazil (subregion code 34)

Forest area

	Forest definition f1				Forest definition f2				Forest definition f3				
	Absolute forest cover *(thousand hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(thousand hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(thousand hectares)*		**Relative forest cover** *(%)*		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980	303 418	14 648	67	3	325 177	25 579	72	6	326 895	25 759	72	6	[61;83]
1990	297 096	14 639	66	3	318 816	26 165	70	6	320 851	26 383	71	6	[59;82]
2000	293 263	14 467	65	3	314 867	26 111	69	6	317 211	26 302	70	6	[59;81]

Forest area change (10-years periods)

(thousand hectares)	Forest definition f1			Forest definition f2			Forest definition f3			
	Deforestation	**Net forest area change**		**Deforestation**	**Net forest area change**		**Deforestation**	**Net forest area change**		
	Mean	Mean	SE	Mean	Mean	SE	Mean	Mean	SE	95%CI
1980-1990	6 518	-6 322	3133	6 557	-6 360	3089	6 254	-6 044	2966	[-11,857;-231]
1990-2000	4 182	-3 833	1462	4 307	-3 949	1520	4 054	-3 640	1432	[-6,447;-834]

Annual forest change (net area change and deforestation rate)

	Forest definition f1				Forest definition f2				Forest definition f3				
	Annual forest area change *(thousand hectares)*		**Deforestation rate r** *(%)*		**Annual net forest area change** *(thousand hectares)*		**Deforestation rate r** *(%)*		**Annual net forest area change** *(thousand hectares)*		**Deforestation rate r** *(%)*		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980-1990	- 632	313	0.21	0.10	- 636	309	0.20	0.10	- 604	297	0.18	0.09	[0.00;0.37]
1990-2000	- 383	146	0.13	0.05	- 395	152	0.12	0.05	- 364	143	0.11	0.04	[0.03;0.20]

Table 56. Area transition matrices for the periods 1980-1990 and 1990-2000 - Brazil (subregion code 35, thousand ha)

Area transition matrix 1980-1990

('000 ha)	Land cover classes in 1990										
Land cover classes in 1980	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	**State 1980**	*% of total land area*
Closed canopy forest	381 001	981	1 760	3 991	1 066	1 931	21 969	465	31	**413 195**	*65.5*
Open canopy forest	39	26 424	47	236	844	136	3 257	480	58	**31 521**	*5.0*
Long fallow	16		1 896	13	4	53	37	*ε*		**2 019**	*0.3*
Fragmented forest	94	41	11	33 321	252	1 532	6 146	262	143	**41 803**	*6.6*
Shrubs	39	10	156	15	64 472	67	16 540	505	149	**81 953**	*13.0*
Short fallow	49	22	64	82	3	6 152	1 608	55		**8 036**	*1.3*
Other land cover	101	2	4	198	443	712	47 536	142	116	**49 255**	*7.8*
Water	89	18	5	27	3	23	434	1 233		**1 832**	*0.3*
Plantations				1			36		851	**888**	*0.1*
State 1990 →	**381 430**	**27 499**	**3 943**	**37 884**	**67 087**	**10 606**	**97 561**	**3 143**	**1 348**	**630 500**	
% of total land area →	*60.5*	*4.4*	*0.6*	*6.0*	*10.6*	*1.7*	*15.5*	*0.5*	*0.2*		

Area transition matrix 1990-2000

('000 ha)	Land cover classes in 2000										
Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations	**State 1990**	*% of total land area*
Closed canopy forest	348 613	110	412	1 606	1 131	786	28 643	94	34	**381 430**	*60.5*
Open canopy forest	3	24 363	1	524	318	23	2 221	27	19	**27 499**	*4.4*
Long fallow	435	49	1 771	57	18	45	1 567	*ε*		**3 943**	*0.6*
Fragmented forest	181	157	17	33 986	156	125	3 096	35	129	**37 884**	*6.0*
Shrubs	19	54	18	3	58 192	38	7 005	1 739	19	**67 087**	*10.6*
Short fallow	78	27	170	460	16	7 783	2 071	1		**10 606**	*1.7*
Other land cover	222	37	246	1 467	3 295	4 193	87 709	311	81	**97 561**	*15.5*
Water	8	17		8	745	23	364	1 978		**3 143**	*0.5*
Plantations				12	8		214		1 115	**1 348**	*0.2*
State 2000 →	**349 560**	**24 816**	**2 636**	**38 122**	**63 879**	**13 016**	**132 889**	**4 185**	**1 397**	**630 500**	
% of total land area →	*55.4*	*3.9*	*0.4*	*6.0*	*10.1*	*2.1*	*21.1*	*0.7*	*0.2*		

Notes: see Table 6.

Table 57. Standard errors of the area transition matrices - Brazil (subregion code 35, thousand ha)

Standard errors - Area transition matrix 1980-1990

(thousand hectares)

Land cover classes in 1980 \ Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	37 883	308	839	1 543	412	830	6 195	317	21
Open canopy forest	16	10 625	39	157	605	109	716	471	30
Long fallow	18		916	14	3	50	30	ε	
Fragmented forest	65	33	12	10 383	108	1 033	3 667	208	151
Shrubs	27	7	92	8	20 857	71	7 750	451	138
Short fallow	49	24	71	65	2	4 643	1 310	57	
Other land cover	89	1	2	152	233	675	10 894	100	83
Water	79	18	5	17	2	18	339	760	
Plantations				1			26		659

Standard errors - Area transition matrix 1990-2000

(thousand hectares)

Land cover classes in 1990 \ Land cover classes in 2000	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	44 589	65	236	884	566	471	9 348	93	35
Open canopy forest	2	9 706	ε	503	238	18	638	27	15
Long fallow	433	49	938	42	12	37	990	ε	
Fragmented forest	109	139	15	10 685	55	91	1 416	24	136
Shrubs	18	50	11	2	19 149	38	2 635	1 728	20
Short fallow	69	30	105	387	10	5 272	996	1	
Other land cover	145	22	119	874	1 055	3 333	21 708	260	58
Water	5	15		6	619	19	244	1 752	
Plantations				13	6		123		875

Table 58. Forest area and area matrices - Brazil (subregion code 35)

Forest area

	Forest definition f1				Forest definition f2				Forest definition f3				
	Absolute forest cover *(thousand hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(thousand hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(thousand hectares)*		**Relative forest cover** *(%)*		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980	413 195	32 686	66	5	454 005	27 830	72	4	460 669	27 385	73	4	[65;82]
1990	381 430	37 819	60	6	417 347	34 185	66	5	425 499	33 047	67	5	[57;78]
2000	349 560	44 177	55	7	382 847	41 009	61	7	389 719	40 637	62	6	[49;74]

Forest area change (10-years periods)

(thousand hectares)	Forest definition f1			Forest definition f2			Forest definition f3			
	Deforestation	**Net forest area change**		**Deforestation**	**Net forest area change**		**Deforestation**	**Net forest area change**		
	Mean	Mean	SE	Mean	Mean	SE	Mean	Mean	SE	95%CI
1980-1990	32 194	-31 765	8000	37 185	-36 658	8402	35 935	-35 170	7778	[-50,416;-19,924]
1990-2000	32 817	-31 870	9501	36 156	-34 500	9767	37 564	-35 780	10756	[-56,862;-14,698]

Annual forest change (net area change and deforestation rate)

	Forest definition f1				Forest definition f2				Forest definition f3				
	Annual forest area change *(thousand hectares)*		**Deforestation rate r** (%)		**Annual net forest area change** *(thousand hectares)*		**Deforestation rate r** (%)		**Annual net forest area change** *(thousand hectares)*		**Deforestation rate r** (%)		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980-1990	-3 177	800	0.77	0.23	-3 666	840	0.81	0.22	-3 517	778	0.76	0.20	[0.37;1.16]
1990-2000	-3 187	950	0.84	0.31	-3 450	977	0.83	0.28	-3 578	1 076	0.84	0.30	[0.26;1.42]

Appendix 6. Characteristics of the global ecological zones of the tropical domain

(From FAO 2001)

The tropical domain has the following characteristics:

- Mean temperature of all months over 18°C.
- Approximate location between the Tropic of Cancer 23° N and the Tropic of Capricorn 23° S.
- Lowland zones are up to 1000 - 1500 m

Name	**Tropical rain forest**
Code	Tar
Climatic criteria	Uniformly high temperatures and heavy annual precipitation (at least 1500 mm, often > 2000 mm) distributed throughout the year. Either no dry season or at most 3 months during winter.
Vegetation	Tropical evergreen and semi-evergreen rainforest. The vegetation is lush, with tall, closely set trees that often form a continuous multi-layered canopy and emergent trees reaching a height of 50 to 60 meters. Most diverse terrestrial ecosystem, with a large number of tree species.
Distribution	Astride the equator and extending 5 to 10 degrees on either side. Main locations: Amazon basin, South America; Congo basin, Africa; Insular South East Asia.

Name	**Tropical moist deciduous forest**
Code	Tawa
Climatic criteria	Tropical climate with summer rain and a dry period of 3 to 5 months. Annual rainfall is generally in the range of 1000 to 2000 mm.
Vegetation	Moist semi-deciduous and deciduous forest types. Examples: monsoon forest in Asia, cerrado in South America and wet Miombo woodlands in Africa.
Distribution	Both north and southward of equator, approximately between 5 and 15 degrees. Most extensive areas are found in South America (cerrado) and Africa.

Name	**Tropical dry forest**
Code	Tawb
Climatic criteria	Tropical climate, with summer rains and a dry period of 5 to 8 months. Annual rainfall ranges from 500 to 1500 mm.
Vegetation	Dry tropical forest and woodland, including drier type of Miombo and Sudanian woodlands, savana (Africa), caatinga and chaco (South America), dry deciduous dipterocarp forest and woodlands (Asia).
Distribution	At both sides of equator, approximately between 15 and 20 degrees. This zone is most extensive in Africa.

Name	**Tropical shrubland**
Code	TBSh
Climatic criteria	Tropical temperature regime and evaporation > precipitation. Annual rainfall ranges between 200 and 500 mm.
Vegetation	Shrubs, xeromorphic woodlands, dry savana, thornbush.
Distribution	Most extensive in Africa and South Asia, where they form the equatorward margins of the tropical deserts.

Name	**Tropical mountain systems**
Code	TM
Climatic criteria	High variety of climatic conditions, varying with altitude.
Vegetation	Due to the variation in climatic conditions and altitude, there is a high variety of vegetation types along altitudinal belts, ranging from evergreen submontane rainforest, cloud forest up to alpine grassland.
Distribution	Main tropical mountain systems are the Andes in South America, mountains of the Rift Valley system in Eastern Africa and the Eastern Himalayas in Asia.

Appendix 7. Classification of the sampling units by ecological zones

Ecological zone code	Number of sampling units	Missing	Name	Land area *(million ha)*
Tar	43	3	Tropical rainforest	1389.5
Tawa	44	1	Tropical moist deciduous forest	1043.3
Tawb	25	0	Tropical dry forest and shrubland	602.4
Total	112	4		

TAR	TAWA	TAWB
1304	1310	1301
1308	1404	1302
1309	1405	1303
1401	1409	1305
1402	1410	1306
1403	1504	1307
1501	1506	1406
1502	1507	1407
1503	1508	1408
1505	1509	1602
3102	1510	1603
3103	1511	1604
3106	1512	1606
3401	1601	1608
3402	1607	1609
3403	1610	1613
3404	1611	3410
3405	1612	4403
3406	1614	4404
3407	1615	4407
3408	3101	4408
3413	3104	4410
3501	3107	4504
3502	3108	4506
3503	3109	4510
3504	3110	
3505	3409	
3506	3411	
3507	3412	
3509	3508	
3517	3510	
4405	3511	
4409	3512	
4501	3513	
4507	3514	
4508	3515	
4601	3516	
4602	4401	
4603	4402	
4604	4406	
4605	4502	
4606	4503	
4607	4505	
4608	4509	
4609		
4610		

Notes: The total surveyed land area oif the ecological zone was estimated from the aggregation process (see 2.5.1.4). One sampling unit, not tropical, was not included in the analysis (3105).

Appendix 8. Results by ecological zone

Table 59. Area transition matrices for the periods 1980-1990 and 1990-2000 - Ecological zone *Tropical rain forest* (million hectares)

Area transition matrix 1980-1990

(million ha)

Land cover classes in 1980	Land cover classes in 1990: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations	State 1980	% of total land area
Closed canopy forest	857.5	1.4	7.4	4.7	0.7	9.3	24.8	0.7	2.5	**909.0**	*65.4*
Open canopy forest	0.1	25.9	0.1	0.5	ε	0.1	1.5	0.5	ε	**28.7**	*2.1*
Long fallow	0.8	ε	39.2	0.2	0.2	6.0	1.0	ε	ε	**47.4**	*3.4*
Fragmented forest	0.1	0.1	0.1	45.3	0.3	0.8	3.7	0.1	0.2	**50.7**	*3.6*
Shrubs	0.1		0.2	ε	40.3	ε	11.9	0.5	ε	**52.9**	*3.8*
Short fallow	0.7	0.1	1.1	0.1	0.2	69.9	4.9	0.1	0.2	**77.3**	*5.6*
Other land cover	0.2	0.2	0.2	0.2	0.6	0.2	207.0	0.2	0.4	**209.2**	*15.1*
Water	0.1		ε	0.1	ε	ε	0.2	0.9	ε	**1.3**	*0.1*
Plantations	0.1	ε	ε	ε		0.1	0.8	ε	11.9	**12.9**	*0.9*
State 1990 →	**859.6**	**27.7**	**48.3**	**51.1**	**42.3**	**86.5**	**255.8**	**2.9**	**15.3**	**1 389**	
% of total land area →	*61.9*	*2.0*	*3.5*	*3.7*	*3.0*	*6.2*	*18.4*	*0.2*	*1.1*		

Area transition matrix 1990-2000

(million ha)

Land cover classes in 1990	Land cover classes in 2000: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations	State 1990	% of total land area
Closed canopy forest	805.6	0.4	4.8	3.4	1.1	5.4	36.4	0.7	1.9	**859.6**	*61.9*
Open canopy forest	ε	25.5	0.1	0.5	0.1	0.1	1.3	ε	ε	**27.7**	*2.0*
Long fallow	0.8	0.1	38.8	0.2	ε	3.9	4.2	ε	0.2	**48.3**	*3.5*
Fragmented forest	0.3	ε	0.1	45.1	0.3	0.4	4.6	0.1	0.2	**51.1**	*3.7*
Shrubs	ε	0.1	ε	ε	36.6	0.2	3.7	1.7	ε	**42.3**	*3.0*
Short fallow	0.7	0.1	1.0	0.1	ε	73.9	10.3	0.1	0.4	**86.5**	*6.2*
Other land cover	0.4	0.1	0.4	0.8	0.3	1.1	250.5	0.3	2.0	**255.8**	*18.4*
Water	ε	ε	ε	ε	0.1	ε	0.3	2.5		**2.9**	*0.2*
Plantations	ε			ε		ε	0.7		14.6	**15.3**	*1.1*
State 2000 →	**807.8**	**26.2**	**45.2**	**50.1**	**38.5**	**85.0**	**311.9**	**5.4**	**19.3**	**1 389**	
% of total land area →	*58.1*	*1.9*	*3.3*	*3.6*	*2.8*	*6.1*	*22.4*	*0.4*	*1.4*		

Notes: See Table 6.

Figure 13. Summary of net changes during the periods 1980-1990 and 1990-2000 by land cover classes - Ecological zone *Tropical rain forest* (million hectares)

(million ha)	1980-1990	1990-2000
Closed canopy forest	- 49.4	- 51.8
Open canopy forest	- 1.0	- 1.5
Long fallow	0.9	- 3.0
Fragmented forest	0.3	- 1.0
Shrubs	- 10.7	- 3.8
Short fallow	9.2	- 1.5
Other land cover	46.6	56.1
Water	1.6	2.4
Plantations	2.4	4.0

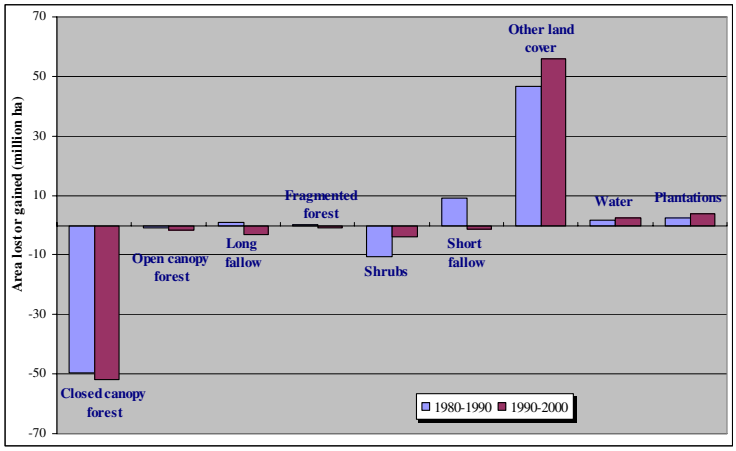

Table 60. Standard errors and 95 percent confidence intervals of the area transition matrices - Ecological zone *Tropical rain forest* (million hectares)

Standard errors - Area transition matrix 1980-1990

(million ha)

Land cover classes in 1980 \ Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	64.0	0.5	1.5	1.4	0.3	2.0	6.4	0.3	1.2
Open canopy forest	ε	7.0	0.1	0.2	ε	0.1	0.5	0.5	ε
Long fallow	0.3	ε	9.2	0.1	0.2	2.0	0.4	ε	ε
Fragmented forest	ε	0.1	0.1	21.5	0.2	0.7	1.0	0.1	0.2
Shrubs	0.1		0.1	ε	14.9	ε	7.4	0.4	ε
Short fallow	0.3	ε	0.3	0.1	0.2	14.4	1.8	0.1	0.1
Other land cover	0.1	0.1	0.1	0.1	0.5	0.1	42.9	0.1	0.2
Water	0.1		ε	ε	ε	ε	0.1	0.6	ε
Plantations	ε	ε	ε	ε		0.1	0.4	ε	6.6

Standard errors- Area transition matrix 1990-2000

(million ha)

Land cover classes in 1990 \ Land cover classes in 2000	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	67.2	0.2	1.2	1.6	0.6	1.3	9.9	0.6	0.8
Open canopy forest	ε	6.9	0.1	0.3	ε	0.1	0.4	ε	ε
Long fallow	0.5	ε	9.2	0.1	ε	1.2	1.3	ε	0.1
Fragmented forest	0.1	ε	0.1	21.5	0.2	0.2	1.7	ε	0.1
Shrubs	ε	ε	ε	ε	13.3	0.1	1.8	1.7	ε
Short fallow	0.5	ε	0.3	0.1	ε	15.0	3.4	0.1	0.2
Other land cover	0.2	ε	0.1	0.6	0.2	0.5	47.1	0.1	0.6
Water	ε	ε	ε	ε	ε	ε	0.1	1.8	
Plantations	ε			ε		ε	0.4		7.7

95 % Confidence Intervals - Area transition matrix 1980-1990

(million ha)

Land cover classes in 1980 \ Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	[732.2;982.9]	[0.4;2.4]	[4.3;10.4]	[1.9;7.5]	[0.2;1.3]	[5.4;13.2]	[12.2;37.4]	[0.0;1.4]	[0.1;4.9]
Open canopy forest	[0.0;0.1]	[12.1;39.6]	[0.0;0.2]	[0.1;0.8]	[0.0;0.0]	[0.0;0.3]	[0.5;2.4]	[-0.4;1.4]	[0.0;0.1]
Long fallow	[0.3;1.4]	[0.0;0.0]	[21.2;57.2]	[0.0;0.4]	[-0.2;0.5]	[2.0;9.9]	[0.3;1.7]	[0.0;0.0]	[0.0;0.0]
Fragmented forest	[0.0;0.1]	[0.0;0.2]	[0.0;0.3]	[3.3;87.4]	[-0.1;0.7]	[-0.6;2.2]	[1.8;5.7]	[0.0;0.2]	[-0.1;0.5]
Shrubs	[0.0;0.2]	[0.0;0.0]	[0.0;0.3]	[0.0;0.1]	[11.0;69.5]	[0.0;0.0]	[-2.6;26.5]	[-0.4;1.3]	[0.0;0.1]
Short fallow	[0.1;1.2]	[0.0;0.2]	[0.5;1.7]	[0.0;0.3]	[-0.1;0.5]	[41.6;98.2]	[1.4;8.3]	[0.0;0.2]	[-0.1;0.4]
Other land cover	[0.0;0.4]	[0.0;0.3]	[0.1;0.3]	[0.0;0.3]	[-0.3;1.6]	[0.1;0.3]	[122.9;291.1]	[0.1;0.3]	[0.0;0.9]
Water	[-0.1;0.2]	[0.0;0.0]	[0.0;0.0]	[0.0;0.1]	[0.0;0.0]	[0.0;0.1]	[0.0;0.4]	[-0.3;2.1]	[0.0;0.0]
Plantations	[0.0;0.1]	[0.0;0.0]	[0.0;0.0]	[0.0;0.0]	[0.0;0.0]	[0.0;0.3]	[0.1;1.5]	[0.0;0.0]	[-1.0;24.7]

95 % confidence intervals - Area transition matrix 1990-2000

(million ha)

Land cover classes in 1990 \ Land cover classes in 2000	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	[673.8;937.3]	[0.1;0.8]	[2.5;7.0]	[0.2;6.6]	[0.0;2.2]	[2.9;8.0]	[17.0;55.7]	[-0.5;2.0]	[0.4;3.4]
Open canopy forest	[0.0;0.1]	[12.0;38.9]	[0.0;0.3]	[0.0;1.1]	[0.0;0.2]	[0.0;0.3]	[0.4;2.1]	[0.0;0.1]	[0.0;0.0]
Long fallow	[-0.1;1.8]	[0.0;0.1]	[20.8;56.8]	[0.0;0.3]	[0.0;0.0]	[1.5;6.3]	[1.6;6.8]	[0.0;0.0]	[0.0;0.5]
Fragmented forest	[0.0;0.5]	[0.0;0.1]	[-0.1;0.3]	[3.0;87.2]	[0.0;0.7]	[0.1;0.6]	[1.4;7.9]	[0.0;0.1]	[-0.1;0.4]
Shrubs	[0.0;0.1]	[0.0;0.1]	[0.0;0.0]	[0.0;0.0]	[10.5;62.6]	[0.0;0.4]	[0.1;7.2]	[-1.6;5.1]	[0.0;0.0]
Short fallow	[-0.3;1.7]	[0.0;0.1]	[0.3;1.6]	[0.0;0.2]	[0.0;0.0]	[44.5;103.3]	[3.5;17.0]	[0.0;0.2]	[0.1;0.7]
Other land cover	[0.0;0.8]	[0.0;0.1]	[0.1;0.7]	[-0.3;1.9]	[0.0;0.7]	[0.0;2.1]	[158.2;342.9]	[0.0;0.6]	[0.7;3.3]
Water	[0.0;0.0]	[0.0;0.0]	[0.0;0.0]	[0.0;0.1]	[0.0;0.2]	[0.0;0.1]	[0.0;0.5]	[-1.0;5.9]	[0.0;0.0]
Plantations	[0.0;0.0]	[0.0;0.0]	[0.0;0.0]	[0.0;0.0]	[0.0;0.0]	[0.0;0.1]	[-0.2;1.5]	[0.0;0.0]	[-0.5;29.7]

Table 61. Analysis of change for the periods 1980-1990 and 1990-2000 - Ecological zone *Tropical rain forest* (percentage of total change)

Period 1: 1980-1990

% of total change

Land cover classes in 1980		Land cover classes in 1990: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations	Total change by class of origin: ha	%
Closed canopy forest			1.5	8.1	5.1	0.8	10.2	27.1	0.7	2.8	**51.5**	*56.2*
Open canopy forest		0.1		0.1	0.5	ε	0.2	1.6	0.5	0.1	**2.8**	*3.1*
Long fallow		0.9	ε		0.2	0.2	6.5	1.1	ε	ε	**8.2**	*8.9*
Fragmented forest		0.1	0.1	0.1		0.3	0.9	4.1	0.1	0.2	**5.4**	*5.9*
Shrubs		0.1		0.2	ε		ε	13.0	0.5	ε	**12.7**	*13.9*
Short fallow		0.7	0.1	1.2	0.2	0.2		5.3	0.1	0.2	**7.4**	*8.0*
Other land cover		0.3	0.2	0.2	0.2	0.7	0.2		0.2	0.5	**2.2**	*2.4*
Water		0.1		ε	0.1	ε	ε	0.2		ε	**0.4**	*0.4*
Plantations		0.1	ε	ε	ε		0.2	0.9	ε		**1.1**	*1.2*
Total change by	ha	**2.1**	**1.8**	**9.0**	**5.7**	**2.0**	**16.6**	**48.8**	**2.0**	**3.5**	**91.5**	
class of destination	%	*2.3*	*2.0*	*9.9*	*6.3*	*2.2*	*18.1*	*53.3*	*2.2*	*3.8*		*100*

Period 2: 1990-2000

% of total change

Land cover classes in 1990		Land cover classes in 2000: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations	Total change by class of origin: ha	%
Closed canopy forest			0.4	4.9	3.5	1.1	5.6	37.7	0.8	1.9	**54.1**	*56.0*
Open canopy forest		ε		0.1	0.5	0.1	0.1	1.3	ε	ε	**2.2**	*2.3*
Long fallow		0.9	0.1		0.2	ε	4.1	4.4	ε	0.2	**9.4**	*9.8*
Fragmented forest		0.3	ε	0.1		0.3	0.4	4.8	0.1	0.2	**6.0**	*6.2*
Shrubs		ε	0.1	ε	ε		0.2	3.8	1.8	ε	**5.7**	*5.9*
Short fallow		0.7	0.1	1.0	0.1	ε		10.7	0.1	0.4	**12.6**	*13.1*
Other land cover		0.4	0.1	0.4	0.8	0.4	1.1		0.3	2.1	**5.3**	*5.5*
Water		ε	ε	ε	ε	0.1	ε	0.3			**0.5**	*0.5*
Plantations		ε			ε		ε	0.7			**0.7**	*0.7*
Total change by	ha	**2.3**	**0.7**	**6.4**	**5.0**	**1.9**	**11.1**	**61.4**	**2.9**	**4.7**	**96.5**	
class of destination	%	*2.4*	*0.7*	*6.6*	*5.2*	*2.0*	*11.6*	*63.6*	*3.0*	*4.9*		*100*

Table 62. Forest area and area change - Ecological zone *Tropical rain forest*

Forest area

	Forest definition f1				Forest definition f2				Forest definition f3				
	Absolute forest cover *(million hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(million hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(million hectares)*		**Relative forest cover** *(%)*		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980	909.0	62.2	65.4	4.5	949.0	64.5	68.3	4.6	1002.0	69.1	72.1	5.0	[62;82]
1990	859.6	64.1	61.9	4.6	898.6	66.0	64.7	4.8	952.6	69.8	68.6	5.0	[59;78]
2000	807.8	67.2	58.1	4.8	845.2	68.7	60.8	4.9	895.9	72.6	64.5	5.2	[54;75]

Forest area change (10-years periods)

(million hectares)	Forest definition f1			Forest definition f2			Forest definition f3			
	Deforestation	**Net forest area change**		**Deforestation**	**Net forest area change**		**Deforestation**	**Net forest area change**		
	Mean	Mean	SE	Mean	Mean	SE	Mean	Mean	SE	95%CI
1980-1990	51.5	-49.4	9.6	52.8	-50.3	9.9	52.5	-49.4	9.1	[-67;-32]
1990-2000	54.1	-51.8	10.9	56.1	-53.5	11.2	59.9	-56.6	12.3	[-81;-32]

Annual forest change (net area change and deforestation rate)

(million hectares)	Forest definition f1				Forest definition f2				Forest definition f3				
	Annual forest area change		**Deforestation rate r** (%)		**Annual net forest area change**		**Deforestation rate r** (%)		**Annual net forest area change**		**Deforestation rate r** (%)		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980-1990	-4.9	1.0	0.54	0.12	-5.0	1.0	0.53	0.11	-4.9	0.9	0.49	0.10	[0.30;0.68]
1990-2000	-5.2	1.1	0.60	0.14	-5.3	1.1	0.60	0.14	-5.7	1.2	0.59	0.14	[0.32;0.87]

Notes: SE = standard error of the mean; 95%CI = 95% confidence interval; absolute forest cover = forest area; relative forest cover = percentage of total land area; deforestation = gross forest loss; Net forest area change = net forest loss/gain

Table 63. Area transition matrices for the periods 1980-1990 and 1990-2000 - Ecological zone *Tropical moist deciduous forest* (million hectares)

Area transition matrix 1980-1990

(million ha)

Land cover classes in 1980	Land cover classes in 1990: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations	State 1980	% of total land area
Closed canopy forest	262.9	4.0	1.9	5.9	0.9	5.6	9.6	1.3	0.1	**292.2**	*28.0*
Open canopy forest	0.4	168.8	0.4	1.6	1.2	2.0	7.1	ε	0.1	**181.7**	*17.4*
Long fallow	0.2	ε	19.0	0.1	ε	0.7	1.1	ε	ε	**21.2**	*2.0*
Fragmented forest	0.5	0.4	0.1	110.1	0.4	3.1	9.2	0.3	ε	**124.2**	*11.9*
Shrubs	0.1	ε	0.1	0.1	70.8	0.3	5.9	0.1	0.2	**77.4**	*7.4*
Short fallow	0.4	0.2	0.2	0.5	0.1	37.7	2.3	0.1	ε	**41.4**	*4.0*
Other land cover	0.4	0.5	0.1	1.1	0.6	1.1	296.2	1.0	0.4	**301.5**	*28.9*
Water	ε	ε		ε	ε	0.1	0.6	1.2		**2.0**	*0.2*
Plantations	ε	ε		ε		ε	0.1		1.6	**1.8**	*0.2*
State 1990 →	**265.1**	**174.1**	**21.7**	**119.4**	**74.1**	**50.5**	**332.1**	**4.1**	**2.4**	**1 043**	
% of total land area →	*25.4*	*16.7*	*2.1*	*11.4*	*7.1*	*4.8*	*31.8*	*0.4*	*0.2*		

Area transition matrix 1990-2000

(million ha)

Land cover classes in 1990	Land cover classes in 2000: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations	State 1990	% of total land area
Closed canopy forest	247.6	0.5	0.9	5.4	0.2	3.9	6.2	0.4	ε	**265.1**	*25.4*
Open canopy forest	0.1	166.2	0.3	2.0	0.5	1.2	3.7	ε	ε	**174.1**	*16.7*
Long fallow	0.2	0.1	20.3	ε	ε	0.6	0.4	ε		**21.7**	*2.1*
Fragmented forest	0.2	0.2	0.1	112.2	0.1	1.8	4.6	0.1	ε	**119.4**	*11.4*
Shrubs	0.1	ε	ε	ε	69.0	0.2	4.7	ε	ε	**74.1**	*7.1*
Short fallow	0.3	0.2	0.3	1.4	0.1	47.1	1.1	0.1		**50.5**	*4.8*
Other land cover	0.2	0.3	0.1	1.1	3.2	3.8	322.4	0.8	0.2	**332.1**	*31.8*
Water	0.1	ε		ε	0.7	ε	0.8	2.4		**4.1**	*0.4*
Plantations	ε			ε	ε		0.4		1.9	**2.4**	*0.2*
State 2000 →	**248.8**	**167.5**	**22.0**	**122.1**	**73.8**	**58.8**	**344.3**	**3.8**	**2.3**	**1 043**	
% of total land area →	*23.8*	*16.1*	*2.1*	*11.7*	*7.1*	*5.6*	*33.0*	*0.4*	*0.2*		

Notes: See Table 6.

Figure 14. Summary of net changes during the periods 1980-1990 and 1990-2000 by land cover classes - Ecological zone *Tropical moist deciduous forest* (million hectares)

(million ha)	1980-1990	1990-2000
Closed canopy forest	- 27.2	- 16.3
Open canopy forest	- 7.6	- 6.6
Long fallow	0.5	0.3
Fragmented forest	- 4.8	2.7
Shrubs	- 3.4	- 0.3
Short fallow	9.1	8.3
Other land cover	30.6	12.2
Water	2.1	- 0.3
Plantations	0.6	- 0.1

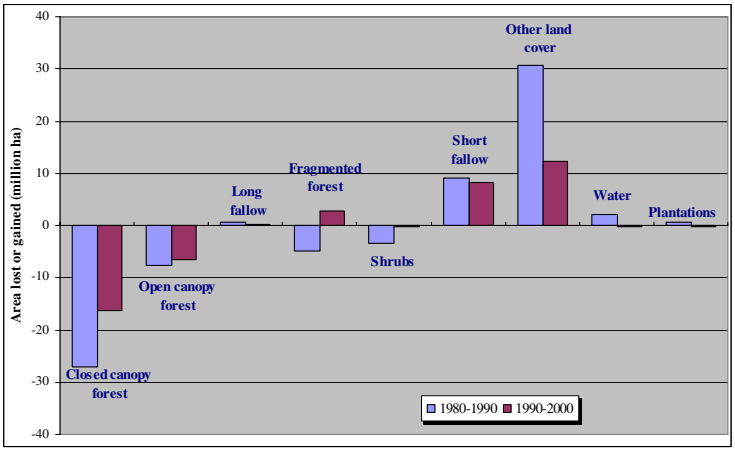

Table 64. Standard errors and 95 percent confidence intervals of the area transition matrices - Ecological zone *Tropical moist deciduous forest* (million hectares)

Standard errors - Area transition matrix 1980-1990

(million ha)	Land cover classes in 1990								
Land cover classes in 1980	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	45.8	1.0	0.6	2.6	0.4	2.8	2.9	1.4	0.1
Open canopy forest	0.1	30.4	0.2	0.5	0.6	0.7	1.2	ε	ε
Long fallow	0.1	ε	8.2	0.1	ε	0.3	0.4	ε	ε
Fragmented forest	0.3	0.1	0.1	25.3	0.1	2.1	4.1	0.2	ε
Shrubs	ε	ε	ε	ε	22.9	0.2	2.3	ε	0.1
Short fallow	0.1	0.1	0.1	0.3	0.1	10.8	0.7	ε	ε
Other land cover	0.2	0.2	0.1	0.5	0.3	0.7	44.9	0.9	0.2
Water	ε	ε		ε	ε	0.1	0.4	0.6	
Plantations	ε	ε		ε		ε	ε		0.5

Standard errors- Area transition matrix 1990-2000

(million ha)	Land cover classes in 2000								
Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	43.2	0.3	0.3	2.6	0.1	1.6	2.2	0.3	ε
Open canopy forest	0.1	29.7	0.2	0.8	0.3	0.5	0.9	ε	ε
Long fallow	0.1	0.1	8.4	ε	ε	0.2	0.1	ε	
Fragmented forest	0.1	0.1	0.1	25.7	0.1	1.1	1.4	0.1	ε
Shrubs	ε	ε	ε	ε	22.3	0.2	2.0	ε	ε
Short fallow	0.1	0.1	0.1	0.9	0.1	13.4	0.3	ε	
Other land cover	0.1	0.1	ε	0.7	1.1	3.4	47.3	0.5	0.1
Water	0.1	ε		ε	0.6	ε	0.5	2.4	
Plantations	ε			ε	ε		0.2		0.6

95 % Confidence Intervals - Area transition matrix 1980-1990

(million ha)	Land cover classes in 1990								
Land cover classes in 1980	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	[173.2;352.7]	[2.1;5.9]	[0.7;3.1]	[0.7;11.0]	[0.2;1.6]	[0.2;11.0]	[3.8;15.4]	[-1.4;4.1]	[0.0;0.3]
Open canopy forest	[0.2;0.7]	[109.3;228.4]	[0.0;0.8]	[0.6;2.6]	[0.0;2.4]	[0.6;3.4]	[4.7;9.5]	[0.0;0.1]	[0.0;0.2]
Long fallow	[0.0;0.4]	[0.0;0.1]	[3.0;34.9]	[-0.1;0.2]	[0.0;0.1]	[0.1;1.3]	[0.3;1.9]	[0.0;0.0]	[0.0;0.0]
Fragmented forest	[-0.1;1.1]	[0.1;0.6]	[0.0;0.3]	[60.6;159.7]	[0.2;0.7]	[-1.0;7.2]	[1.1;17.4]	[-0.1;0.7]	[0.0;0.0]
Shrubs	[0.0;0.1]	[0.0;0.1]	[0.0;0.2]	[0.0;0.1]	[26.0;115.7]	[-0.1;0.7]	[1.4;10.3]	[0.0;0.2]	[-0.1;0.4]
Short fallow	[0.1;0.6]	[0.1;0.4]	[0.0;0.3]	[-0.1;1.2]	[0.0;0.2]	[16.5;58.9]	[0.9;3.6]	[0.0;0.1]	[0.0;0.0]
Other land cover	[0.1;0.8]	[0.1;0.9]	[0.0;0.2]	[0.1;2.2]	[0.1;1.1]	[-0.3;2.4]	[208.3;384.2]	[-0.8;2.8]	[0.0;0.8]
Water	[0.0;0.1]	[0.0;0.1]	[0.0;0.0]	[0.0;0.0]	[0.0;0.0]	[-0.1;0.2]	[-0.1;1.3]	[0.0;2.5]	[0.0;0.0]
Plantations	[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;0.2]	[0.0;0.0]	[0.7;2.5]

95 % confidence intervals - Area transition matrix 1990-2000

(million ha)	Land cover classes in 2000								
Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	[162.9;332.3]	[0.0;1.1]	[0.3;1.4]	[0.2;10.5]	[0.1;0.4]	[0.8;7.0]	[1.9;10.4]	[-0.2;1.0]	[0.0;0.1]
Open canopy forest	[0.0;0.2]	[107.9;224.5]	[0.0;0.6]	[0.5;3.5]	[0.0;1.0]	[0.3;2.1]	[1.8;5.5]	[0.0;0.1]	[0.0;0.1]
Long fallow	[-0.1;0.5]	[-0.1;0.2]	[3.9;36.7]	[0.0;0.1]	[0.0;0.0]	[0.2;1.1]	[0.1;0.7]	[0.0;0.1]	[0.0;0.0]
Fragmented forest	[0.0;0.4]	[-0.1;0.5]	[0.0;0.3]	[61.8;162.5]	[0.0;0.2]	[-0.4;4.1]	[1.8;7.4]	[0.0;0.2]	[0.0;0.1]
Shrubs	[0.0;0.1]	[0.0;0.1]	[0.0;0.0]	[0.0;0.1]	[25.3;112.6]	[-0.1;0.6]	[0.7;8.6]	[0.0;0.0]	[0.0;0.1]
Short fallow	[0.0;0.5]	[0.0;0.3]	[0.0;0.6]	[-0.5;3.2]	[-0.1;0.3]	[20.9;73.3]	[0.6;1.6]	[0.0;0.2]	[0.0;0.0]
Other land cover	[0.0;0.4]	[0.1;0.5]	[0.0;0.2]	[-0.3;2.4]	[1.1;5.4]	[-2.8;10.4]	[229.7;415.0]	[-0.1;1.7]	[0.1;0.4]
Water	[-0.1;0.4]	[0.0;0.0]	[0.0;0.0]	[0.0;0.0]	[-0.5;1.9]	[0.0;0.0]	[-0.1;1.8]	[-2.3;7.2]	[0.0;0.0]
Plantations	[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;0.8]	[0.0;0.0]	[0.7;3.2]

Table 65. Analysis of change for the periods 1980-1990 and 1990-2000 - Ecological zone *Moist deciduous forest* (percentage of total change)

Period 1: 1980-1990

% of total change

Land cover classes in 1980	Land cover classes in 1990: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations	Total change by class of origin: ha	%
Closed canopy forest		5.4	2.5	7.8	1.2	7.5	12.8	1.8	0.2	**29.3**	*39.1*
Open canopy forest	0.6		0.5	2.1	1.6	2.6	9.5	ε	0.1	**12.8**	*17.1*
Long fallow	0.3	ε		0.1	0.1	0.9	1.4	ε	ε	**2.2**	*2.9*
Fragmented forest	0.7	0.5	0.2		0.6	4.2	12.3	0.4	ε	**14.1**	*18.8*
Shrubs	0.1	0.1	0.1	0.1		0.3	7.8	0.1	0.2	**6.6**	*8.8*
Short fallow	0.5	0.3	0.2	0.7	0.1		3.0	0.1	ε	**3.7**	*5.0*
Other land cover	0.6	0.7	0.1	1.5	0.8	1.4		1.4	0.5	**5.2**	*7.0*
Water	ε	ε		ε	ε	0.1	0.8			**0.8**	*1.0*
Plantations	0.1	ε		ε		ε	0.1			**0.2**	*0.2*
Total change by class of destination ha	**2.2**	**5.2**	**2.7**	**9.3**	**3.3**	**12.8**	**35.9**	**2.8**	**0.8**	**74.9**	
class of destination %	*2.9*	*7.0*	*3.6*	*12.4*	*4.3*	*17.1*	*47.9*	*3.8*	*1.1*		*100*

Period 2: 1990-2000

% of total change

Land cover classes in 1990	Land cover classes in 2000: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations	Total change by class of origin: ha	%
Closed canopy forest		1.0	1.6	9.9	0.4	7.2	11.4	0.7	0.1	**17.5**	*32.2*
Open canopy forest	0.2		0.6	3.7	0.9	2.2	6.8	0.1	ε	**7.9**	*14.5*
Long fallow	0.4	0.1		ε	ε	1.2	0.7	0.1		**1.4**	*2.6*
Fragmented forest	0.4	0.3	0.2		0.2	3.4	8.5	0.1	0.1	**7.2**	*13.3*
Shrubs	0.1	0.1	ε	0.1		0.5	8.6	ε	0.1	**5.1**	*9.4*
Short fallow	0.5	0.3	0.5	2.5	0.2		2.1	0.1		**3.4**	*6.2*
Other land cover	0.4	0.5	0.2	2.0	5.9	7.0		1.5	0.4	**9.7**	*18.0*
Water	0.2	ε		ε	1.2	ε	1.5			**1.6**	*3.0*
Plantations	ε			ε	ε		0.8			**0.5**	*0.9*
Total change by class of destination ha	**1.2**	**1.3**	**1.7**	**9.9**	**4.9**	**11.7**	**21.9**	**1.4**	**0.4**	**54.3**	
class of destination %	*2.2*	*2.4*	*3.1*	*18.2*	*8.9*	*21.5*	*40.4*	*2.5*	*0.7*		*100*

Table 66. Forest area and area change - Ecological zone *Tropical moist deciduous forest*

Forest area

	Forest definition f1				Forest definition f2				Forest definition f3				
	Absolute forest cover *(million hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(million hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(million hectares)*		**Relative forest cover** *(%)*		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980	292.2	49.9	28.0	4.8	501.5	64.0	48.1	6.1	536.5	66.0	51.4	6.3	[39;64]
1990	265.1	46.1	25.4	4.4	465.7	60.9	44.6	5.8	500.6	62.9	48.0	6.0	[36;60]
2000	248.8	43.4	23.8	4.2	443.5	58.4	42.5	5.6	479.0	60.6	45.9	5.8	[35;57]

Forest area change (10-years periods)

(million hectares)	Forest definition f1			Forest definition f2			Forest definition f3			
	Deforestation	**Net forest area change**		**Deforestation**	**Net forest area change**		**Deforestation**	**Net forest area change**		
	Mean	Mean	SE	Mean	Mean	SE	Mean	Mean	SE	95%CI
1980-1990	29.3	-27.2	6.2	39.0	-35.8	6.3	39.2	-35.8	6.3	[-48;-23]
1990-2000	17.5	-16.3	4.3	24.5	-22.2	4.4	24.4	-21.6	4.2	[-30;-13]

Annual forest change (net area change and deforestation rate)

	Forest definition f1				Forest definition f2				Forest definition f3				
	Annual forest area change *(million hectares)*		**Deforestation rate r** (%)		**Annual net forest area change** *(million hectares)*		**Deforestation rate r** (%)		**Annual net forest area change** *(million hectares)*		**Deforestation rate r** (%)		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980-1990	-2.7	0.6	0.93	0.16	-3.6	0.6	0.71	0.11	-3.6	0.6	0.67	0.10	[0.47;0.87]
1990-2000	-1.6	0.4	0.61	0.12	-2.2	0.4	0.48	0.08	-2.2	0.4	0.43	0.07	[0.30;0.57]

Notes: SE = standard error of the mean; 95%CI = 95% confidence interval; absolute forest cover = forest area; relative forest cover = percentage of total land area; deforestation = gross forest loss; Net forest area change = net forest loss/gain

Table 67. Area transition matrices for the periods 1980-1990 and 1990-2000 - Ecological zone *Tropical dry forest and shrubland* (million hectares)

Area transition matrix 1980-1990

(million ha)

Land cover classes in 1980	Land cover classes in 1990: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations	State 1980	% of total land area
Closed canopy forest	76.8	0.9	0.3	0.7	0.1	0.2	1.0	0.1	ε	**80.1**	*13.3*
Open canopy forest	0.1	94.1	0.1	3.9	0.1	0.2	1.4	0.1	ε	**99.9**	*16.6*
Long fallow	ε	ε	4.1	ε	ε	0.1	0.1	ε		**4.5**	*0.7*
Fragmented forest	0.1	0.3		42.0	0.1	ε	1.9	ε	ε	**44.4**	*7.4*
Shrubs	ε	ε	ε	0.1	27.8	ε	1.4	ε	0.1	**29.4**	*4.9*
Short fallow	0.1	ε	ε	ε	ε	1.6	0.1	ε		**1.8**	*0.3*
Other land cover	0.1	0.3	ε	0.2	0.3	ε	339.0	0.2	ε	**340.2**	*56.5*
Water	ε	ε		ε	ε		0.2	0.4	ε	**0.7**	*0.1*
Plantations		ε			ε		ε		1.3	**1.4**	*0.2*
State 1990 →	**77.2**	**95.7**	**4.5**	**47.0**	**28.5**	**2.1**	**345.1**	**0.8**	**1.5**	**602**	
% of total land area →	*12.8*	*15.9*	*0.7*	*7.8*	*4.7*	*0.3*	*57.3*	*0.1*	*0.3*		

Area transition matrix 1990-2000

(million ha)

Land cover classes in 1990	Land cover classes in 2000: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations	State 1990	% of total land area
Closed canopy forest	75.2	0.2	0.1	0.7	ε	0.5	0.5	ε	ε	**77.2**	*12.8*
Open canopy forest	0.1	88.6	0.1	4.3	0.1	0.8	1.7	ε	ε	**95.7**	*15.9*
Long fallow			4.1	0.1		0.2	0.1			**4.5**	*0.7*
Fragmented forest	ε	0.2		44.8		ε	1.9	ε		**47.0**	*7.8*
Shrubs	ε	ε	ε	ε	26.9	0.2	1.4	ε	ε	**28.5**	*4.7*
Short fallow	ε	0.1	ε		0.1	1.7	0.2			**2.1**	*0.3*
Other land cover	0.1	0.1	ε	0.4	0.1	ε	344.2	0.2	ε	**345.1**	*57.3*
Water	ε			ε	ε		0.1	0.7		**0.8**	*0.1*
Plantations							ε		1.5	**1.5**	*0.3*
State 2000 →	**75.3**	**89.2**	**4.4**	**50.2**	**27.2**	**3.4**	**350.0**	**1.0**	**1.6**	**602**	
% of total land area →	*12.5*	*14.8*	*0.7*	*8.3*	*4.5*	*0.6*	*58.1*	*0.2*	*0.3*		

Notes: See Table 6.

Figure 15. Summary of net changes during the periods 1980-1990 and 1990-2000 by land cover classes - Ecological zone *Tropical dry forest and shrubland* (million hectares)

(million ha)	1980-1990	1990-2000
Closed canopy forest	- 2.9	- 1.9
Open canopy forest	- 4.3	- 6.5
Long fallow	0.0	- 0.1
Fragmented forest	2.6	3.3
Shrubs	- 0.9	- 1.3
Short fallow	0.3	1.3
Other land cover	4.9	4.9
Water	0.1	0.2
Plantations	0.2	0.1

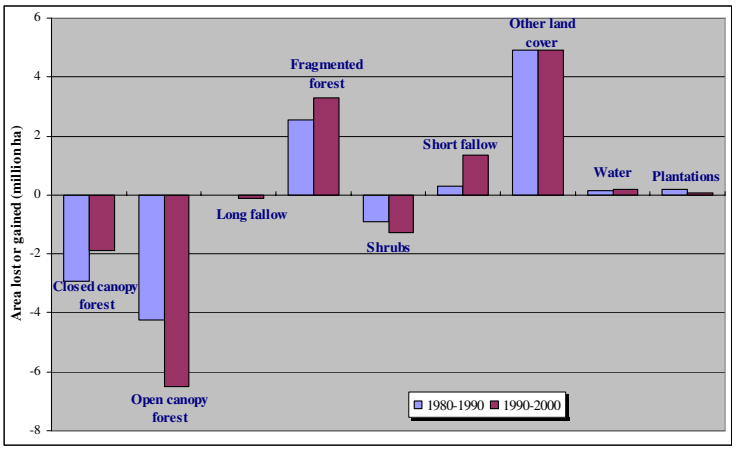

Table 68. Standard errors and 95 percent confidence intervals of the area transition matrices - Ecological zone *Tropical dry forest and shrubland* (million hectares)

Standard errors - Area transition matrix 1980-1990

(million ha)	Land cover classes in 1990								
Land cover classes in 1980	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	22.3	0.4	0.3	0.3	0.1	0.1	0.4	0.1	ε
Open canopy forest	ε	29.4	0.1	2.5	0.1	0.1	0.3	ε	ε
Long fallow	ε	ε	2.9	ε	ε	0.1	0.1	ε	
Fragmented forest	ε	0.1		13.5	ε	ε	0.8	ε	ε
Shrubs	ε	ε	ε	ε	6.4	ε	0.6	ε	ε
Short fallow	ε	ε	ε	ε	ε	0.9	ε	ε	
Other land cover	ε	0.1	ε	0.1	0.2	ε	53.8	0.1	ε
Water	ε	ε		ε	ε		0.1	0.3	ε
Plantations					ε		ε		0.9

Standard errors- Area transition matrix 1990-2000

(million ha)	Land cover classes in 2000								
Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	21.9	0.1	0.1	0.3	ε	0.3	0.2	ε	ε
Open canopy forest	0.1	27.9	0.1	2.8	0.1	0.5	0.7	ε	ε
Long fallow			2.8	0.1		0.1	0.1		
Fragmented forest	ε	0.1		14.7		ε	1.3	ε	
Shrubs	ε	ε	ε	ε	6.0	0.1	0.7	ε	ε
Short fallow	ε	ε	ε		0.1	0.9	0.1		
Other land cover	ε	0.1	ε	0.3	0.1	ε	54.1	0.1	ε
Water	ε			ε	ε		ε	0.5	
Plantations							ε		1.0

95 % Confidence Intervals - Area transition matrix 1980-1990

(million ha)	Land cover classes in 1990								
Land cover classes in 1980	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	[33.0;120.6]	[0.1;1.6]	[-0.2;0.8]	[0.2;1.3]	[0.0;0.2]	[0.0;0.4]	[0.2;1.9]	[0.0;0.2]	[0.0;0.1]
Open canopy forest	[0.0;0.2]	[36.5;151.6]	[-0.1;0.2]	[-1.0;8.7]	[0.0;0.3]	[0.0;0.4]	[0.7;2.0]	[0.0;0.2]	[0.0;0.1]
Long fallow	[0.0;0.1]	[0.0;0.0]	[-1.6;9.8]	[0.0;0.0]	[0.0;0.1]	[0.0;0.2]	[0.0;0.3]	[0.0;0.1]	[0.0;0.0]
Fragmented forest	[0.0;0.1]	[0.0;0.6]	[0.0;0.0]	[15.5;68.5]	[0.0;0.2]	[0.0;0.0]	[0.4;3.4]	[0.0;0.0]	[0.0;0.0]
Shrubs	[0.0;0.0]	[0.0;0.1]	[0.0;0.0]	[0.0;0.1]	[15.3;40.3]	[0.0;0.1]	[0.1;2.7]	[0.0;0.1]	[0.0;0.1]
Short fallow	[0.0;0.1]	[0.0;0.1]	[0.0;0.0]	[0.0;0.0]	[0.0;0.0]	[-0.2;3.4]	[0.0;0.2]	[0.0;0.0]	[0.0;0.0]
Other land cover	[0.0;0.2]	[0.1;0.6]	[0.0;0.1]	[0.0;0.5]	[0.0;0.7]	[0.0;0.0]	[233.6;444.3]	[0.0;0.3]	[0.0;0.1]
Water	[0.0;0.1]	[0.0;0.1]	[0.0;0.0]	[0.0;0.0]	[0.0;0.0]	[0.0;0.0]	[0.0;0.3]	[-0.2;0.9]	[0.0;0.0]
Plantations	[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]	[-0.5;3.2]

95 % confidence intervals - Area transition matrix 1990-2000

(million ha)	Land cover classes in 2000								
Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	[32.2;118.1]	[0.0;0.4]	[0.0;0.2]	[0.1;1.3]	[0.0;0.0]	[-0.1;1.0]	[0.1;1.0]	[0.0;0.1]	[0.0;0.0]
Open canopy forest	[0.0;0.2]	[34.0;143.2]	[-0.1;0.3]	[-1.2;9.9]	[0.0;0.2]	[-0.1;1.8]	[0.3;3.1]	[0.0;0.0]	[0.0;0.0]
Long fallow	[0.0;0.0]	[0.0;0.0]	[-1.4;9.7]	[-0.1;0.2]	[0.0;0.0]	[-0.1;0.5]	[0.0;0.2]	[0.0;0.0]	[0.0;0.0]
Fragmented forest	[0.0;0.0]	[0.0;0.4]	[0.0;0.0]	[16.0;73.7]	[0.0;0.0]	[0.0;0.1]	[-0.6;4.4]	[0.0;0.0]	[0.0;0.0]
Shrubs	[0.0;0.0]	[0.0;0.0]	[0.0;0.0]	[0.0;0.0]	[15.1;38.7]	[-0.1;0.4]	[0.1;2.7]	[0.0;0.0]	[0.0;0.1]
Short fallow	[0.0;0.1]	[0.0;0.2]	[0.0;0.1]	[0.0;0.0]	[-0.1;0.2]	[-0.1;3.5]	[-0.1;0.5]	[0.0;0.0]	[0.0;0.0]
Other land cover	[0.0;0.1]	[0.0;0.3]	[0.0;0.0]	[-0.2;0.9]	[0.0;0.3]	[0.0;0.1]	[238.2;450.1]	[0.0;0.4]	[0.0;0.1]
Water	[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]	[-0.3;1.6]	[0.0;0.0]
Plantations	[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]	[-0.5;3.6]

Table 69. Analysis of change for the periods 1980-1990 and 1990-2000 - Ecological zone *Tropical dry forest and shrubland* (percentage of total change)

Period 1: 1980-1990

% of total change

Land cover classes in 1980	Land cover classes in 1990: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations	Total change by class of origin: ha	%
Closed canopy forest		5.6	1.8	4.7	0.7	1.1	6.8	0.7	0.3	**3.4**	*21.8*
Open canopy forest	0.9		0.5	25.1	1.0	1.2	9.0	0.4	0.3	**5.9**	*38.3*
Long fallow	0.2	0.1		0.1	0.3	0.7	0.9	0.2		**0.4**	*2.5*
Fragmented forest	0.5	2.1			0.5	0.1	12.1	0.1	0.1	**2.4**	*15.3*
Shrubs	ε	0.2	ε	0.4		0.3	9.2	0.2	0.3	**1.6**	*10.7*
Short fallow	0.4	0.1	ε	ε	0.1		0.6	0.1		**0.2**	*1.3*
Other land cover	0.6	2.2	0.1	1.6	2.1	ε		1.1	0.3	**1.3**	*8.2*
Water	0.2	0.2		0.1	ε		1.2		0.1	**0.3**	*1.9*
Plantations		ε			ε		0.1			**0.0**	*0.1*
Total change by ha	**0.4**	**1.6**	**0.4**	**4.9**	**0.7**	**0.5**	**6.2**	**0.4**	**0.2**	**15.4**	
class of destination %	*2.8*	*10.6*	*2.5*	*32.0*	*4.7*	*3.3*	*40.0*	*2.7*	*1.3*		*100*

Period 2: 1990-2000

% of total change

Land cover classes in 1990	Land cover classes in 2000: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations	Total change by class of origin: ha	%
Closed canopy forest		1.3	0.7	4.6	0.2	3.3	3.6	0.3	ε	**2.0**	*13.8*
Open canopy forest	0.4		0.6	29.4	0.7	5.5	11.5	ε	ε	**7.1**	*48.2*
Long fallow				0.4		1.5	0.5			**0.4**	*2.4*
Fragmented forest	ε	1.5				0.1	12.9	ε		**2.1**	*14.6*
Shrubs	ε	ε	0.1	ε		1.0	9.4	0.1	0.3	**1.6**	*11.0*
Short fallow	0.2	0.5	0.1		0.4		1.3			**0.4**	*2.5*
Other land cover	0.4	0.8	0.1	2.4	0.8	0.2		1.5	0.3	**1.0**	*6.5*
Water	0.1			0.1	0.1		0.5			**0.1**	*0.7*
Plantations							0.2			**0.0**	*0.2*
Total change by ha	**0.2**	**0.6**	**0.2**	**5.4**	**0.3**	**1.7**	**5.9**	**0.3**	**0.1**	**14.7**	
class of destination %	*1.2*	*4.0*	*1.6*	*36.9*	*2.2*	*11.6*	*39.9*	*1.9*	*0.6*		*100*

Table 70. Forest area and area change - Ecological zone *Tropical dry forest and shrubland*

Forest area

	Forest definition f1				Forest definition f2				Forest definition f3				
	Absolute forest cover *(million hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(million hectares)*		**Relative forest cover** *(%)*		**Absolute forest cover** *(million hectares)*		**Relative forest cover** *(%)*		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980	80.1	23.2	13.3	3.8	189.9	47.5	31.5	7.9	199.4	48.5	33.1	8.0	[17;49]
1990	77.2	22.4	12.8	3.7	183.3	46.4	30.4	7.7	193.0	47.4	32.0	7.9	[17;47]
2000	75.3	21.9	12.5	3.6	175.7	44.8	29.2	7.4	185.6	45.8	30.8	7.6	[16;46]

Forest area change (10-years periods)

(million hectares)	Forest definition f1			Forest definition f2			Forest definition f3			
	Deforestation	**Net forest area change**		**Deforestation**	**Net forest area change**		**Deforestation**	**Net forest area change**		
	Mean	Mean	SE	Mean	Mean	SE	Mean	Mean	SE	95%CI
1980-1990	3.4	-2.9	1.2	7.7	-6.6	2.5	7.3	-6.3	2.3	[-11;-2]
1990-2000	2.0	-1.9	0.7	8.2	-7.6	3.0	8.0	-7.4	2.9	[-13;-2]

Annual forest change (net area change and deforestation rate)

	Forest definition f1				Forest definition f2				Forest definition f3				
	Annual forest area change *(million hectares)*		**Deforestation rate r** (%)		**Annual net forest area change** *(million hectares)*		**Deforestation rate r** (%)		**Annual net forest area change** *(million hectares)*		**Deforestation rate r** (%)		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	95%CI
1980-1990	-0.3	0.1	0.36	0.11	-0.7	0.2	0.35	0.12	-0.6	0.2	0.32	0.10	[0.12;0.51]
1990-2000	-0.2	0.1	0.24	0.07	-0.8	0.3	0.42	0.14	-0.7	0.3	0.38	0.13	[0.14;0.63]

Notes: SE = standard error of the mean; 95%CI = 95% confidence interval; absolute forest cover = forest area; relative forest cover = percentage of total land area; deforestation = gross forest loss; Net forest area change = net forest loss/gain

Appendix 9. Trends analysis – Difference in forest area change estimates between 1980-1990 and 1990-2000

- **Pan tropical level**

	Forest definition f1			Forest definition f2			Forest definition f3		
	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)
Difference Net forest area change estimates period2-period1 *(million hectares)*	1.0	0.6	No	0.9	0.7	No	0.6	0.8	No
Difference Deforestation rates r2-r1 (%/year)	-0.04	0.05	No	-0.03	0.04	No	-0.01	0.05	No

Notes: SE= standard error of the mean; test of significance at the 5% level.

- **Regional level**

Africa

	Forest definition f1			Forest definition f2			Forest definition f3		
	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)
Difference Net forest area change estimates period2-period1 *(million hectares)*	0.3	0.2	No	0.2	0.3	No	0.3	0.3	No
Difference Deforestation rates r2-r1 (%/year)	-0.09	0.07	No	-0.02	0.05	No	-0.03	0.05	No

Asia

	Forest definition f1			Forest definition f2			Forest definition f3		
	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)
Difference Net forest area change estimates period2-period1 *(million hectares)*	0.25	3.6	No	0.11	3.6	No	0.0	0.4	No
Difference Deforestation rates r2-r1 (%/year)	-0.02	0.06	No	0.03	0.07	No	0.06	0.14	No

Latin America

	Forest definition f1			Forest definition f2			Forest definition f3		
	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)
Difference Net forest area change estimates period2-period1 *(million hectares)*	0.4	0.5	No	0.6	0.5	No	0.3	0.7	No
Difference Deforestation rates r2-r1 (%/year)	-0.02	0.02	No	-0.04	0.02	No	-0.01	0.08	No

- **Subregional level**

East Sahelian Africa (subregion code 13)

	Forest definition f1			Forest definition f2			Forest definition f3		
	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)
Difference Net forest area change estimates period2-period1 *(million hectares)*	20	12	No	13	18	No	8	17	No
Difference Deforestation rates r2-r1 (%/year)	-0.08	0.03	**Yes**	-0.01	0.04	No	0.00	0.05	No

West Sahelian and West Africa (subregion code 14)

	Forest definition f1			Forest definition f2			Forest definition f3		
	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)
Difference Net forest area change estimates period2-period1 *(thousand hectares)*	157	89	No	- 2	88	No	25	101	No
Difference Deforestation rates r2-r1 (%/year)	-0.31	0.15	**Yes**	0.10	0.13	No	0.04	0.13	No

Central Africa (subregion code 15)

	Forest definition f1			Forest definition f2			Forest definition f3		
	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)
Difference Net forest area change estimates period2-period1 *(thousand hectares)*	270	14	**Yes**	352	171	**Yes**	364	167	**Yes**
Difference Deforestation rates r2-r1 (%/year)	-0.16	0.08	**Yes**	-0.14	0.07	No	-0.14	0.07	**Yes**

Tropical Southern Africa (subregion code 16)

	Forest definition f1			Forest definition f2			Forest definition f3		
	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)
Difference Net forest area change estimates period2-period1 *(thousand hectares)*	- 99	152	No	- 134	191	No	- 114	179	No
Difference Deforestation rates r2-r1 (%/year)	0.14	0.18	No	0.09	0.11	No	0.07	0.09	No

South Asia (subregion code 44)

	Forest definition f1			Forest definition f2			Forest definition f3		
	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)
Difference Net forest area change estimates period2-period1 *(thousand hectares)*	106	89	No	81	89	No	120	167	No
Difference Deforestation rates r2-r1 (%/year)	-0.24	0.18	No	-0.14	0.15	No	-0.17	0.22	No

Continental South-East Asia (subregion code 45)

	Forest definition f1			Forest definition f2			Forest definition f3		
	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)
Difference Net forest area change estimates period2-period1 *(thousand hectares)*	344	171	**Yes**	262	197	No	254	198	No
Difference Deforestation rates r2-r1 (%/year)	-0.45	0.21	**Yes**	-0.27	0.23	No	-0.22	0.19	No

Insular South-East Asia (subregion code 46)

	Forest definition f1			Forest definition f2			Forest definition f3		
	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)
Difference Net forest area change estimates period2-period1 *(thousand hectares)*	- 204	301	No	- 237	294	No	- 375	350	No
Difference Deforestation rates r2-r1 (%/year)	0.30	0.22	No	0.33	0.22	No	0.37	0.24	No

Mexico and Central America (subregion code 31)

	Forest definition f1			Forest definition f2			Forest definition f3		
	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)
Difference Net forest area change estimates period2-period1 *(thousand hectares)*	121	122	No	147	135	No	124	122	No
Difference Deforestation rates r2-r1 (%/year)	-0.24	0.32	No	-0.17	0.17	No	-0.14	0.15	No

Tropical South America, excluded Brazil (subregion code 34)

	Forest definition f1			Forest definition f2			Forest definition f3		
	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)
Difference Net forest area change estimates period2-period1 *(thousand hectares)*	249	231	No	241	226	No	240	230	No
Difference Deforestation rates r2-r1 (%/year)	-0.08	0.07	No	-0.07	0.07	No	-0.07	0.07	No

Brazil (subregion code 35)

	Forest definition f1			Forest definition f2			Forest definition f3		
	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)
Difference Net forest area change estimates period2-period1 *(thousand hectares)*	- 10	403	No	216	465	No	- 61	620	No
Difference Deforestation rates r2-r1 (%/year)	0.07	0.12	No	0.02	0.12	No	0.08	0.16	No

- **Ecological zone level**

Tropical rain forest

	Forest definition f1			Forest definition f2			Forest definition f3		
	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)
Difference Net forest area change estimates period2-period1 *(million hectares)*	-0.2	0.5	No	-0.3	0.5	No	-0.7	0.7	No
Difference Deforestation rates r2-r1 (%/year)	0.06	0.06	No	0.06	0.06	No	0.10	0.07	No

Tropical moist deciduous forest

	Forest definition f1			Forest definition f2			Forest definition f3		
	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)
Difference Net forest area change estimates period2-period1 *(million hectares)*	1.1	0.4	**Yes**	1.4	0.5	**Yes**	1.4	0.5	**Yes**
Difference Deforestation rates r2-r1 (%/year)	-0.32	0.12	**Yes**	-0.24	0.09	**Yes**	-0.24	0.09	**Yes**

Tropical dry forest and shrubland

	Forest definition f1			Forest definition f2			Forest definition f3		
	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)	Mean	SE	**Significant** (Yes/No)
Difference Net forest area change estimates period2-period1 *(million hectares)*	0.1	0.1	No	-0.1	0.2	No	-0.1	0.2	No
Difference Deforestation rates r2-r1 (%/year)	-0.12	0.12	No	0.07	0.10	No	0.07	0.09	No

Appendix 10. Probability transition matrices and their difference between the two reference periods.

- **Pan-tropical level**

Table 71. Mean transition probabilities 1980-1990 and 1990-2000 – Pan-tropical level

Probability matrix 1980-1990

Land cover classes in 1980	Land cover classes in 1990								
	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.934	0.005	0.007	0.009	0.001	0.012	0.028	0.002	0.002
Open canopy forest	0.002	0.932	0.002	0.019	0.004	0.007	0.031	0.002	0.001
Long fallow	0.015	0.001	0.853	0.004	0.004	0.093	0.031	0.001	ε
Fragmented forest	0.003	0.004	0.001	0.900	0.004	0.018	0.068	0.002	0.001
Shrubs	0.001	ε	0.001	0.001	0.877	0.002	0.112	0.003	0.002
Short fallow	0.009	0.003	0.011	0.006	0.002	0.906	0.060	0.001	0.002
Other Land Cover	0.001	0.001	ε	0.002	0.002	0.001	0.990	0.002	0.001
Water	0.037	0.015	0.003	0.021	0.003	0.022	0.254	0.640	0.004
Plantations	0.007	0.001	ε	0.001	ε	0.010	0.059	ε	0.921

Probability matrix 1990-2000

Land cover classes in 1990	Land cover classes in 2000								
	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.939	0.001	0.005	0.008	0.001	0.008	0.036	0.001	0.002
Open canopy forest	0.001	0.944	0.002	0.022	0.002	0.007	0.022	ε	ε
Long fallow	0.014	0.002	0.850	0.003	ε	0.064	0.063	ε	0.003
Fragmented forest	0.002	0.002	0.001	0.929	0.002	0.010	0.051	0.001	0.001
Shrubs	0.001	0.001	ε	ε	0.920	0.004	0.063	0.011	ε
Short fallow	0.007	0.002	0.009	0.010	0.001	0.883	0.083	0.001	0.003
Other Land Cover	0.001	ε	0.001	0.002	0.004	0.005	0.983	0.001	0.002
Water	0.021	0.002	0.001	0.006	0.099	0.005	0.152	0.713	
Plantations	0.001			0.002	ε	0.002	0.059		0.937

Table 72. Difference between mean transition probabilities from the two reference periods- Pan-tropical level

Difference between probability matrices (period 1990-2000 with period 1980-1990)

Classes of origin \ Classes of destination	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.004	-0.004	-0.003	-0.001	0.000	-0.004	0.008	-0.001	-0.001
Open canopy forest	-0.001	0.011	0.000	0.004	-0.002	0.000	-0.010	-0.002	0.000
Long fallow	-0.001	0.001	-0.003	0.000	-0.003	-0.028	0.032	0.000	0.003
Fragmented forest	-0.001	-0.002	0.000	0.029	-0.002	-0.008	-0.016	-0.001	0.000
Shrubs	0.000	0.000	-0.001	0.000	0.043	0.002	-0.050	0.008	-0.001
Short fallow	-0.002	-0.001	-0.002	0.005	-0.001	-0.024	0.023	0.000	0.001
Other Land Cover	0.000	-0.001	0.000	0.001	0.002	0.004	-0.007	0.000	0.001
Water	-0.016	-0.013	-0.002	-0.015	0.096	-0.017	-0.102	0.073	-0.004
Plantations	-0.006	-0.001	0.000	0.001	0.000	-0.008	0.000	0.000	0.015

Standard error of the difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin \ Classes of destination	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.005	0.001	0.001	0.002	0.001	0.002	0.005	0.001	0.001
Open canopy forest	0.000	0.008	0.001	0.004	0.002	0.002	0.004	0.001	0.000
Long fallow	0.006	0.001	0.029	0.002	0.002	0.016	0.018	0.001	0.002
Fragmented forest	0.001	0.001	0.000	0.020	0.001	0.007	0.017	0.001	0.000
Shrubs	0.000	0.000	0.001	0.000	0.033	0.001	0.029	0.008	0.001
Short fallow	0.003	0.001	0.003	0.004	0.001	0.019	0.021	0.001	0.002
Other Land Cover	0.000	0.000	0.000	0.001	0.001	0.003	0.004	0.001	0.001
Water	0.027	0.010	0.002	0.006	0.078	0.017	0.089	0.138	0.003
Plantations	0.003	0.001	0.000	0.001	0.000	0.006	0.024	0.001	0.027

Statistical test - Difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin \ Classes of destination	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	n.s.	DECREASE	DECREASE	n.s.	n.s.	DECREASE	n.s.	n.s.	n.s.
Open canopy forest	DECREASE	n.s.	n.s.	n.s.	n.s.	n.s.	DECREASE	n.s.	DECREASE
Long fallow	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	INCREASE
Fragmented forest	n.s.	n.s.	n.s.	n.s.	DECREASE	n.s.	n.s.	n.s.	n.s.
Shrubs	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Short fallow	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Other Land Cover	n.s.	DECREASE	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Water	n.s.	n.s.	n.s.	DECREASE	n.s.	n.s.	n.s.	n.s.	n.s.
Plantations	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

Notes: statistical test at the 5% level of significance; INCREASE = Significant difference, increase of the transition probability; DECREASE = Significant difference, decrease of the transition probability; n.s. = difference not significant.

- **Regional level**

Table 73. Mean transition probabilities 1980-1990 and 1990-2000 – Africa

Probability matrix 1980-1990

Land cover classes in 1980	Land cover classes in 1990								
	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.938	0.009	0.003	0.016	ε	0.025	0.009	ε	ε
Open canopy forest	0.001	0.940	0.001	0.025	ε	0.008	0.023	ε	ε
Long fallow	0.005	0.001	0.919	0.010	0.003	0.046	0.016		
Fragmented forest	0.003	0.004	0.001	0.936	0.001	0.015	0.040	ε	ε
Shrubs	0.001	ε	ε	0.001	0.965	0.005	0.027		0.001
Short fallow	0.008	0.004	0.002	0.008	0.001	0.950	0.026	0.001	0.001
Other Land Cover	0.001	0.002	ε	0.003	0.001	0.001	0.993	ε	0.001
Water	0.042	0.058		0.025	0.008	0.098	0.545	0.224	
Plantations	0.016					0.006	0.043		0.935

Probability matrix 1990-2000

Land cover classes in 1990	Land cover classes in 2000								
	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.949	0.002	0.003	0.021	ε	0.018	0.007	ε	ε
Open canopy forest	ε	0.944	0.001	0.030	0.001	0.009	0.015	ε	ε
Long fallow	0.001	0.004	0.943	0.009	ε	0.030	0.013		
Fragmented forest	0.001	0.002	ε	0.943	ε	0.012	0.041	ε	ε
Shrubs	0.001	ε	ε	0.001	0.956	0.007	0.034		0.001
Short fallow	0.011	0.003	0.004	0.013	0.002	0.924	0.042	0.001	
Other Land Cover	ε	0.001	ε	0.001	ε	0.001	0.996	0.001	ε
Water						0.001	0.531	0.468	
Plantations	0.006			0.014		0.006	0.108		0.865

Table 74. Difference between mean transition probabilities from the two reference periods – Africa

Difference between probability matrices (period 1990-2000 with period 1980-1990)

Classes of origin	Classes of destination: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.011	-0.007	0.000	0.005	0.000	-0.007	-0.001	0.000	0.000
Open canopy forest	-0.001	0.004	0.000	0.004	0.000	0.001	-0.008	0.000	0.000
Long fallow	-0.003	0.002	0.024	-0.002	-0.002	-0.015	-0.003		
Fragmented forest	-0.002	-0.003	0.000	0.007	-0.001	-0.003	0.001	0.000	0.000
Shrubs	0.000	0.000	0.000	0.000	-0.009	0.002	0.007		0.000
Short fallow	0.003	-0.001	0.002	0.006	0.001	-0.026	0.015	0.000	-0.001
Other Land Cover	-0.001	-0.001	0.000	-0.002	0.000	0.000	0.004	0.000	0.000
Water	-0.042	-0.058		-0.025	-0.008	-0.097	-0.014	0.244	
Plantations	-0.010			0.014		0.000	0.065		-0.069

Standard error of the difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin	Classes of destination: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.007	0.002	0.001	0.004	0.000	0.006	0.001	0.000	0.000
Open canopy forest	0.000	0.009	0.001	0.005	0.000	0.003	0.004	0.000	0.000
Long fallow	0.003	0.003	0.018	0.006	0.002	0.018	0.005		
Fragmented forest	0.002	0.001	0.001	0.009	0.000	0.008	0.011	0.000	0.000
Shrubs	0.000	0.000	0.000	0.001	0.006	0.002	0.006		0.000
Short fallow	0.004	0.001	0.001	0.007	0.001	0.024	0.023	0.000	0.001
Other Land Cover	0.000	0.000	0.000	0.001	0.000	0.000	0.002	0.000	0.000
Water	0.037	0.052		0.016	0.009	0.094	0.216	0.263	
Plantations	0.005			0.007		0.006	0.039		0.042

Statistical test - Difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin	Classes of destination: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	n.s.	DECREASE	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Open canopy forest	DECREASE	n.s.	n.s.	n.s.	n.s.	n.s.	DECREASE	n.s.	n.s.
Long fallow	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.		
Fragmented forest	n.s.	DECREASE	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Shrubs	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.		n.s.
Short fallow	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Other Land Cover	n.s.	DECREASE	n.s.	n.s.	n.s.	n.s.	INCREASE	n.s.	n.s.
Water	n.s.	n.s.		n.s.	n.s.	n.s.	n.s.	n.s.	
Plantations	n.s.			INCREASE		n.s.	n.s.		n.s.

Notes: see Table 72.

Table 75. Mean transition probabilities 1980-1990 and 1990-2000 – Asia

Probability matrix 1980-1990

Land cover classes in 1980	Land cover classes in 1990								
	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.900	0.008	0.023	0.005	0.001	0.019	0.032	0.002	0.011
Open canopy forest	0.012	0.916	0.005	0.008	0.011	0.004	0.039	0.002	0.003
Long fallow	0.017	ε	0.832	0.001	0.004	0.108	0.036	0.001	ε
Fragmented forest	0.005	0.005	0.007	0.848	0.018	0.009	0.103	0.002	0.004
Shrubs	0.007	0.006	0.007	0.007	0.838	0.002	0.122	0.004	0.007
Short fallow	0.011	0.001	0.022	0.003	0.005	0.868	0.086	0.001	0.003
Other Land Cover	0.001	0.001	0.001	0.001	0.002	ε	0.991	0.001	0.002
Water	0.039	0.004		0.004	0.003		0.157	0.769	0.025
Plantations	0.007	0.001	ε	0.001	ε	0.011	0.057	0.001	0.921

Probability matrix 1990-2000

Land cover classes in 1990	Land cover classes in 2000								
	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.906	0.002	0.017	0.003	0.001	0.015	0.044	0.004	0.008
Open canopy forest	0.006	0.921	0.007	0.008	0.007	0.009	0.040	0.001	ε
Long fallow	0.011	ε	0.846	0.001	ε	0.080	0.058	0.001	0.005
Fragmented forest	0.005	0.002	0.009	0.888	0.012	0.013	0.066	0.002	0.003
Shrubs	0.004	0.002	0.002	0.002	0.882	0.023	0.081	0.003	0.002
Short fallow	0.002	ε	0.015	0.001	ε	0.844	0.128	0.002	0.008
Other Land Cover	0.001	0.001	0.001	0.002	0.001	0.001	0.984	0.001	0.009
Water	0.015			0.006	0.009		0.087	0.883	
Plantations	ε			ε		0.002	0.042		0.956

Table 76. Difference between mean transition probabilities from the two reference periods- Asia

Difference between probability matrices (period 1990-2000 with period 1980-1990)

Classes of origin	Classes of destination: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.006	-0.006	-0.006	-0.002	-0.001	-0.004	0.012	0.002	-0.002
Open canopy forest	-0.006	0.005	0.001	0.000	-0.004	0.006	0.002	-0.001	-0.002
Long fallow	-0.006	0.000	0.014	0.000	-0.004	-0.028	0.021	0.000	0.005
Fragmented forest	-0.001	-0.003	0.002	0.041	-0.006	0.004	-0.037	0.000	-0.001
Shrubs	-0.003	-0.004	-0.005	-0.005	0.044	0.021	-0.041	-0.001	-0.005
Short fallow	-0.008	-0.001	-0.008	-0.002	-0.005	-0.024	0.042	0.001	0.006
Other Land Cover	0.000	0.000	0.000	0.001	-0.001	0.001	-0.007	0.000	0.007
Water	-0.024	-0.004		0.003	0.007		-0.071	0.114	-0.025
Plantations	-0.007	-0.001	0.000	-0.001	0.000	-0.009	-0.015	-0.001	0.034

Standard error of the difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin	Classes of destination: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.015	0.002	0.004	0.002	0.000	0.004	0.010	0.003	0.004
Open canopy forest	0.003	0.030	0.002	0.002	0.004	0.005	0.023	0.002	0.001
Long fallow	0.004	0.000	0.031	0.000	0.003	0.021	0.017	0.001	0.002
Fragmented forest	0.002	0.002	0.003	0.029	0.005	0.005	0.027	0.002	0.002
Shrubs	0.006	0.002	0.006	0.003	0.043	0.013	0.042	0.002	0.004
Short fallow	0.006	0.001	0.007	0.001	0.003	0.035	0.042	0.001	0.005
Other Land Cover	0.000	0.001	0.000	0.001	0.001	0.001	0.004	0.001	0.003
Water	0.023	0.007		0.003	0.007		0.066	0.089	0.022
Plantations	0.004	0.001	0.000	0.000	0.000	0.007	0.026	0.001	0.033

Statistical test - Difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin	Classes of destination: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	n.s.	DECREASE	n.s.	n.s.	DECREASE	n.s.	n.s.	n.s.	n.s.
Open canopy forest	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Long fallow	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	INCREASE
Fragmented forest	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Shrubs	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Short fallow	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Other Land Cover	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	INCREASE
Water	n.s.	n.s.		n.s.	n.s.		n.s.	n.s.	n.s.
Plantations	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

Notes: see Table 72.

Table 77. Mean transition probabilities 1980-1990 and 1990-2000 – Latin America

Probability matrix 1980-1990

Land cover classes in 1980	Land cover classes in 1990								
	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.944	0.002	0.004	0.007	0.002	0.004	0.034	0.002	ε
Open canopy forest	0.001	0.918	0.001	0.006	0.011	0.007	0.049	0.006	0.001
Long fallow	0.029	0.006	0.840	0.005	0.001	0.097	0.021	0.001	
Fragmented forest	0.002	0.001	0.001	0.823	0.005	0.029	0.130	0.006	0.003
Shrubs	ε	ε	0.001	ε	0.846	0.001	0.146	0.005	0.001
Short fallow	0.007	0.006	0.010	0.006	0.001	0.843	0.122	0.007	
Other Land Cover	0.001	ε	ε	0.001	0.005	0.004	0.983	0.005	0.001
Water	0.036	0.007	0.005	0.025	0.001	0.010	0.207	0.709	
Plantations				0.001			0.086		0.913

Probability matrix 1990-2000

Land cover classes in 1990	Land cover classes in 2000								
	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.945	ε	0.002	0.004	0.002	0.002	0.044	ε	ε
Open canopy forest	ε	0.949	0.001	0.010	0.004	0.002	0.033	ε	ε
Long fallow	0.063	0.008	0.670	0.007	0.002	0.043	0.207	ε	
Fragmented forest	0.004	0.003	0.001	0.904	0.003	0.003	0.078	0.002	0.003
Shrubs	ε	0.001	ε	ε	0.908	ε	0.073	0.017	ε
Short fallow	0.006	0.004	0.012	0.024	0.001	0.830	0.123	ε	
Other Land Cover	0.002	ε	0.001	0.006	0.013	0.017	0.957	0.003	0.001
Water	0.024	0.003	0.002	0.007	0.126	0.006	0.143	0.689	
Plantations				0.006	0.004		0.160		0.830

Table 78. Difference between mean transition probabilities from the two reference periods - Latin America

Difference between probability matrices (period 1990-2000 with period 1980-1990)

Classes of origin	Classes of destination: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.001	-0.002	-0.002	-0.003	0.000	-0.002	0.011	-0.002	0.000
Open canopy forest	-0.001	0.032	0.000	0.004	-0.007	-0.005	-0.016	-0.005	0.000
Long fallow	0.034	0.002	-0.169	0.002	0.001	-0.054	0.186	-0.001	
Fragmented forest	0.001	0.003	0.000	0.081	-0.001	-0.027	-0.053	-0.005	0.000
Shrubs	0.000	0.000	-0.001	0.000	0.062	0.000	-0.072	0.013	-0.001
Short fallow	-0.001	-0.002	0.002	0.019	0.000	-0.013	0.001	-0.006	
Other Land Cover	0.000	0.000	0.001	0.005	0.009	0.013	-0.026	-0.002	-0.001
Water	-0.011	-0.004	-0.003	-0.018	0.125	-0.003	-0.064	-0.020	
Plantations				0.006	0.004		0.074		-0.083

Standard error of the difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin	Classes of destination: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.007	0.001	0.001	0.002	0.001	0.001	0.008	0.001	0.000
Open canopy forest	0.001	0.020	0.001	0.005	0.008	0.004	0.010	0.005	0.000
Long fallow	0.050	0.006	0.156	0.005	0.001	0.037	0.100	0.001	
Fragmented forest	0.002	0.002	0.000	0.068	0.002	0.015	0.057	0.004	0.000
Shrubs	0.000	0.000	0.001	0.000	0.047	0.001	0.041	0.012	0.001
Short fallow	0.004	0.003	0.006	0.016	0.001	0.055	0.048	0.003	
Other Land Cover	0.001	0.000	0.000	0.003	0.005	0.010	0.014	0.003	0.000
Water	0.037	0.006	0.003	0.009	0.105	0.005	0.115	0.170	
Plantations				0.004	0.003		0.070		0.071

Statistical test - Difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin	Classes of destination: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	n.s.	DECREASE	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Open canopy forest	DECREASE	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Long fallow	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	
Fragmented forest	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Shrubs	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Short fallow	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	DECREASE	
Other Land Cover	n.s.	n.s.	INCREASE	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Water	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	
Plantations				n.s.	n.s.		n.s.		n.s.

Notes: see Table 72.

- **Subregional level**

Table 79. Mean transition probabilities 1980-1990 and 1990-2000 – East Sahelian Africa (subregion code 13)

Probability matrix 1980-1990

Land cover classes in 1980	Land cover classes in 1990								
	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.934	0.003	0.012	0.024	0.001	0.006	0.020		
Open canopy forest	ε	0.963		0.007	0.001		0.029		
Long fallow		0.001	0.424	0.380		0.160	0.036		
Fragmented forest	0.002	0.005		0.887	0.006	0.001	0.100	ε	
Shrubs	ε			0.002	0.953		0.045		
Short fallow						0.326	0.674		
Other Land Cover	ε	0.001		0.001	0.001	ε	0.996	ε	
Water							1.008	-0.008	
Plantations									1.000

Probability matrix 1990-2000

Land cover classes in 1990	Land cover classes in 2000								
	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.940	0.002	0.010	0.026	ε	0.013	0.009		
Open canopy forest	0.001	0.964		0.008	0.001		0.026	ε	
Long fallow			0.352	0.166		0.349	0.133		
Fragmented forest	0.001			0.912	0.003	0.006	0.078	ε	
Shrubs	ε			ε	0.955		0.044		
Short fallow						0.444	0.556		
Other Land Cover	ε	ε		0.001	0.001		0.996	0.001	
Water							0.202	0.798	
Plantations									1.000

Table 80. Difference between mean transition probabilities from the two reference periods- East Sahelian Africa (subregion code 13)

Difference between probability matrices (period 1990-2000 with period 1980-1990)

Classes of origin \ Classes of destination	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.006	-0.002	-0.002	0.001	0.000	0.006	-0.010		
Open canopy forest	0.000	0.001		0.000	0.001		-0.003	0.000	
Long fallow		-0.001	-0.071	-0.214		0.189	0.097		
Fragmented forest	0.000	-0.005		0.025	-0.003	0.005	-0.022	0.000	
Shrubs	0.000			-0.001	0.002		-0.001		
Short fallow						0.118	-0.118		
Other Land Cover	0.000	-0.001		0.000	-0.001	0.000	0.000	0.001	
Water							-0.806	0.806	
Plantations									

Standard error of the difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin \ Classes of destination	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.004	0.001	0.001	0.003	0.000	0.006	0.006		
Open canopy forest	0.001	0.009		0.002	0.001		0.009	0.000	
Long fallow		0.000		0.000		0.000	0.000		
Fragmented forest	0.001	0.003		0.020	0.002	0.006	0.025	0.000	
Shrubs	0.000			0.001	0.003		0.002		
Short fallow						0.000	0.000		
Other Land Cover	0.000	0.000		0.000	0.001	0.000	0.001	0.000	
Water							0.289	0.202	
Plantations									

Statistical test - Difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin \ Classes of destination	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	n.s.	DECREASE	n.s.	n.s.	n.s.	n.s.	n.s.		
Open canopy forest	n.s.	n.s.		n.s.	n.s.		n.s.	n.s.	
Long fallow		DECREASE		DECREASE		INCREASE	INCREASE		
Fragmented forest	n.s.	n.s.		n.s.	n.s.	n.s.	n.s.	n.s.	
Shrubs	n.s.			n.s.	n.s.		n.s.		
Short fallow						INCREASE	DECREASE		
Other Land Cover	n.s.	n.s.		n.s.	n.s.	n.s.	n.s.	n.s.	
Water							DECREASE	INCREASE	
Plantations									

Notes: see Table 72.

Table 81. Mean transition probabilities 1980-1990 and 1990-2000 – West Sahelian and West Africa (subregion code 14)

Probability matrix 1980-1990

Land cover classes in 1980	Land cover classes in 1990: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.827	0.009	0.005	0.090	0.002	0.050	0.016	ε	ε
Open canopy forest		0.894		0.087	0.001	0.001	0.017	ε	ε
Long fallow	0.001		0.923			0.066	0.010		
Fragmented forest	0.001	0.005		0.963	ε	ε	0.032		
Shrubs	0.001	ε		ε	0.994		0.005		
Short fallow	0.001	0.001	0.002	0.005		0.967	0.023	ε	0.002
Other Land Cover	ε	0.001		0.002	ε	0.001	0.995	0.001	ε
Water							0.601	0.399	
Plantations						0.004	0.009		0.987

Probability matrix 1990-2000

Land cover classes in 1990	Land cover classes in 2000: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.855	0.002	0.005	0.106	0.001	0.008	0.023	ε	0.001
Open canopy forest		0.854		0.117	0.003	0.002	0.022	ε	ε
Long fallow			0.981			0.017	0.001		
Fragmented forest	0.002	0.002		0.932	ε	0.001	0.063	ε	
Shrubs	0.001	ε		0.001	0.987		0.010		
Short fallow	ε	0.001	0.002	ε		0.923	0.074	ε	
Other Land Cover	ε	0.001		ε		0.002	0.995	0.001	ε
Water						0.002	0.601	0.396	
Plantations						0.023	0.023		0.954

Table 82. Difference between mean transition probabilities from the two reference periods- West Sahelian and West Africa (subregion code 14)

Difference between probability matrices (period 1990-2000 with period 1980-1990)

Classes of origin \ Classes of destination	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.028	-0.007	0.000	0.015	-0.001	-0.041	0.006	0.000	0.000
Open canopy forest		-0.040		0.030	0.002	0.002	0.006	0.000	0.000
Long fallow	-0.001		0.058			-0.049	-0.009		
Fragmented forest	0.001	-0.002		-0.031	0.000	0.001	0.031	0.000	
Shrubs	0.000	0.000		0.001	-0.007		0.005		
Short fallow	0.000	0.000	0.000	-0.005		-0.044	0.052	0.000	-0.002
Other Land Cover	0.000	0.000		-0.002	0.000	0.002	0.000	0.000	0.000
Water						0.002	0.000	-0.003	
Plantations						0.019	0.014		-0.033

Standard error of the difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin \ Classes of destination	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.016	0.005	0.004	0.006	0.001	0.018	0.003	0.000	0.001
Open canopy forest		0.019		0.018	0.003	0.002	0.002	0.000	0.000
Long fallow	0.001		0.027			0.029	0.009		
Fragmented forest	0.001	0.002		0.013	0.000	0.001	0.014	0.000	
Shrubs	0.000	0.000		0.000	0.001		0.001		
Short fallow	0.000	0.000	0.001	0.003		0.052	0.052	0.000	0.002
Other Land Cover	0.000	0.000		0.001	0.000	0.001	0.002	0.000	0.000
Water						0.002	0.376	0.379	
Plantations						0.013	0.009		0.006

Statistical test - Difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin \ Classes of destination	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	n.s.	n.s.	n.s.	INCREASE	n.s.	DECREASE	INCREASE	n.s.	n.s.
Open canopy forest		DECREASE		n.s.	n.s.	n.s.	INCREASE	n.s.	n.s.
Long fallow	n.s.		INCREASE			n.s.	n.s.		
Fragmented forest	n.s.	n.s.		DECREASE	n.s.	n.s.	INCREASE	n.s.	
Shrubs	INCREASE	INCREASE		INCREASE	DECREASE		INCREASE		
Short fallow	DECREASE	n.s.	n.s.	n.s.		n.s.	n.s.	n.s.	n.s.
Other Land Cover	n.s.	n.s.		n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Water						n.s.	n.s.	n.s.	
Plantations						n.s.	n.s.		DECREASE

Notes: see Table 72.

Table 83. Mean transition probabilities 1980-1990 and 1990-2000 – Central Africa (subregion code 15)

Probability matrix 1980-1990

Land cover classes in 1980	Land cover classes in 1990								
	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.951	0.011	0.001	0.002		0.031	0.003	ε	ε
Open canopy forest	0.002	0.950	ε	0.007		0.013	0.028		
Long fallow			0.984			0.016			
Fragmented forest	0.002	0.002		0.950		0.001	0.046		
Shrubs									
Short fallow	0.018	0.005		ε		0.960	0.014	0.001	0.001
Other Land Cover	0.001	0.002		0.005		0.002	0.989	ε	ε
Water						0.984	0.066	-0.049	
Plantations							0.036		0.964

Probability matrix 1990-2000

Land cover classes in 1990	Land cover classes in 2000								
	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.966	0.003	0.002	0.002		0.026	0.001	ε	ε
Open canopy forest	ε	0.985	0.001	0.005		0.006	0.004		
Long fallow			0.988	0.009		0.004			
Fragmented forest	0.001	ε		0.965		0.020	0.014		
Shrubs									
Short fallow	0.028	0.002		ε		0.965	0.004	0.002	
Other Land Cover		0.001		0.001		0.001	0.997	ε	0.001
Water								1.000	
Plantations									1.000

Table 84. Difference between mean transition probabilities from the two reference periods- Pan-tropical level Central Africa (subregion code 15)

Difference between probability matrices (period 1990-2000 with period 1980-1990)

Classes of origin \ Classes of destination	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.015	-0.008	0.000	0.000		-0.005	-0.002	0.000	0.000
Open canopy forest	-0.002	0.035	0.001	-0.002		-0.007	-0.024		
Long fallow			0.003	0.009		-0.012			
Fragmented forest	-0.001	-0.002		0.014		0.020	-0.032		
Shrubs									
Short fallow	0.010	-0.004		0.000		0.004	-0.011	0.001	-0.001
Other Land Cover	-0.001	-0.001		-0.004		-0.002	0.008	0.000	0.000
Water						-0.984	-0.066	1.049	
Plantations							-0.036		0.036

Standard error of the difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin \ Classes of destination	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.009	0.003	0.000	0.000		0.009	0.001	0.000	0.000
Open canopy forest	0.001	0.016	0.001	0.003		0.006	0.012		
Long fallow			0.000	0.000		0.000			
Fragmented forest	0.001	0.001		0.016		0.014	0.028		
Shrubs									
Short fallow	0.011	0.002		0.001		0.015	0.006	0.001	0.001
Other Land Cover	0.001	0.001		0.003		0.001	0.003	0.000	0.000
Water						0.083	0.098	0.000	
Plantations							0.011		0.011

Statistical test - Difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin \ Classes of destination	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	n.s.	DECREASE	n.s.	n.s.		n.s.	n.s.	n.s.	n.s.
Open canopy forest	n.s.	INCREASE	n.s.	n.s.		n.s.	DECREASE		
Long fallow			INCREASE	INCREASE		DECREASE			
Fragmented forest	n.s.	n.s.		n.s.		n.s.	n.s.		
Shrubs									
Short fallow	n.s.	DECREASE		n.s.		n.s.	n.s.	n.s.	n.s.
Other Land Cover	n.s.	n.s.		n.s.		n.s.	INCREASE	n.s.	n.s.
Water						DECREASE	n.s.	INCREASE	
Plantations							DECREASE		INCREASE

Notes: see Table 72.

Table 85. Mean transition probabilities 1980-1990 and 1990-2000 – Tropical Southern Africa (subregion code 16)

Probability matrix 1980-1990

Land cover classes in 1980	Land cover classes in 1990: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.951	0.011	0.001	0.002		0.031	0.003	ε	ε
Open canopy forest	0.002	0.950	ε	0.007		0.013	0.028		
Long fallow			0.984			0.016			
Fragmented forest	0.002	0.002		0.950		0.001	0.046		
Shrubs									
Short fallow	0.018	0.005		ε		0.960	0.014	0.001	0.001
Other Land Cover	0.001	0.002		0.005		0.002	0.989	ε	ε
Water						0.984	0.066	-0.049	
Plantations							0.036		0.964

Probability matrix 1990-2000

Land cover classes in 1990	Land cover classes in 2000: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.966	0.003	0.002	0.002		0.026	0.001	ε	ε
Open canopy forest	ε	0.985	0.001	0.005		0.006	0.004		
Long fallow			0.988	0.009		0.004			
Fragmented forest	0.001	ε		0.965		0.020	0.014		
Shrubs									
Short fallow	0.028	0.002		ε		0.965	0.004	0.002	
Other Land Cover		0.001		0.001		0.001	0.997	ε	0.001
Water								1.000	
Plantations									1.000

Table 86. Difference between mean transition probabilities from the two reference periods- Tropical Southern Africa (subregion code 16)

Difference between probability matrices (period 1990-2000 with period 1980-1990)

Classes of origin	Classes of destination: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	-0.006	-0.007	-0.002	0.016	0.000	0.000	-0.001	0.000	-0.001
Open canopy forest	-0.001	-0.004	-0.002	0.002	0.000	0.008	-0.002	0.000	0.000
Long fallow	-0.007	0.005	0.003	0.000	-0.006	0.009	-0.004		
Fragmented forest	-0.006	-0.004	-0.001	0.036	-0.002	-0.027	0.004	0.000	0.000
Shrubs	-0.003		0.001	-0.001	-0.050	0.014	0.038		0.000
Short fallow	-0.007	0.003	0.011	0.037	0.007	-0.029	-0.021		
Other Land Cover	-0.001	-0.002	0.000	-0.002	0.000	0.000	0.008	0.000	-0.002
Water	-0.102	-0.143		-0.061	-0.020		0.540	-0.214	
Plantations	-0.016			0.023		-0.008	0.101		-0.100

Standard error of the difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin	Classes of destination: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.014	0.003	0.001	0.012	0.000	0.002	0.003	0.000	0.001
Open canopy forest	0.001	0.016	0.002	0.012	0.000	0.004	0.003	0.000	0.000
Long fallow	0.008	0.006	0.021	0.012	0.005	0.009	0.006		
Fragmented forest	0.005	0.002	0.002	0.011	0.001	0.012	0.014	0.000	0.000
Shrubs	0.003		0.000	0.001	0.035	0.011	0.041		0.000
Short fallow	0.007	0.006	0.004	0.020	0.005	0.024	0.023		
Other Land Cover	0.001	0.001	0.000	0.002	0.000	0.000	0.006	0.000	0.002
Water	0.077	0.108		0.034	0.023		0.233	0.360	
Plantations	0.004			0.005		0.011	0.031		0.040

Statistical test - Difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin	Classes of destination: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	n.s.	DECREASE	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Open canopy forest	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Long fallow	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.		
Fragmented forest	n.s.	n.s.	n.s.	INCREASE	DECREASE	DECREASE	n.s.	n.s.	n.s.
Shrubs	n.s.		n.s.	n.s.	n.s.	n.s.	n.s.		n.s.
Short fallow	n.s.	n.s.	INCREASE	n.s.	n.s.	n.s.	n.s.		
Other Land Cover	n.s.	DECREASE	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Water	n.s.	n.s.		n.s.	n.s.		INCREASE	n.s.	
Plantations	DECREASE			INCREASE		n.s.	INCREASE		DECREASE

Notes: see Table 72.

Table 87. Mean transition probabilities 1980-1990 and 1990-2000 – South Asia (subregion code 44)

Probability matrix 1980-1990

Land cover classes in 1980	Land cover classes in 1990								
	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.948	0.019	0.014	0.001	0.001	0.006	0.010	ε	0.001
Open canopy forest	0.016	0.942	ε	0.006	0.007	ε	0.025	0.001	0.003
Long fallow	0.005		0.839	ε	ε	0.129	0.026		ε
Fragmented forest	0.004	0.005	0.002	0.956	0.001	ε	0.029	0.001	0.002
Shrubs		0.009			0.951	0.001	0.030	0.002	0.006
Short fallow	0.011		0.054	0.002	0.001	0.928	0.004		
Other Land Cover	0.001	0.001	ε	0.001	0.001	ε	0.995	0.001	0.001
Water	0.060	0.024					0.347	0.493	0.075
Plantations	0.014	0.007	ε	0.003	0.002	ε	0.018		0.956

Probability matrix 1990-2000

Land cover classes in 1990	Land cover classes in 2000								
	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.980	0.004	0.001	0.003	ε	0.007	0.004	0.001	ε
Open canopy forest	0.005	0.969		0.008	0.002	0.002	0.013	0.001	ε
Long fallow	ε		0.897	0.002	ε	0.090	0.011		
Fragmented forest	0.001	0.002	ε	0.976	ε	0.001	0.015	0.004	0.001
Shrubs		ε		0.002	0.978	0.007	0.011	0.002	
Short fallow	ε		0.071	ε	ε	0.916	0.013		
Other Land Cover	ε	0.001	0.001	0.003	ε	0.001	0.993	0.001	0.001
Water	0.033			0.021			0.170	0.776	
Plantations							0.017		0.983

Table 88. Difference between mean transition probabilities from the two reference periods - South Asia (subregion code 44)

Difference between probability matrices (period 1990-2000 with period 1980-1990)

Classes of origin	Classes of destination: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.032	-0.015	-0.013	0.002	-0.001	0.001	-0.006	0.000	0.000
Open canopy forest	-0.011	0.028	0.000	0.002	-0.005	0.002	-0.012	0.001	-0.003
Long fallow	-0.005		0.057	0.001	0.000	-0.038	-0.015		0.000
Fragmented forest	-0.003	-0.003	-0.001	0.020	-0.001	0.000	-0.014	0.003	-0.001
Shrubs		-0.009		0.002	0.027	0.006	-0.019	-0.001	-0.006
Short fallow	-0.011		0.017	-0.002	-0.001	-0.012	0.009		
Other Land Cover	-0.001	0.000	0.000	0.002	0.000	0.000	-0.002	0.000	0.000
Water	-0.027	-0.024		0.021			-0.178	0.283	-0.075
Plantations	-0.014	-0.007	0.000	-0.003	-0.002	0.000	-0.001		0.027

Standard error of the difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin	Classes of destination: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.018	0.008	0.012	0.001	0.001	0.001	0.004	0.001	0.001
Open canopy forest	0.004	0.014	0.000	0.004	0.004	0.002	0.009	0.001	0.002
Long fallow	0.001		0.082	0.001	0.000	0.073	0.009		0.000
Fragmented forest	0.001	0.002	0.001	0.015	0.001	0.000	0.014	0.006	0.001
Shrubs		0.008		0.002	0.019	0.006	0.008	0.000	0.004
Short fallow	0.006		0.001	0.001	0.000	0.008	0.003		
Other Land Cover	0.000	0.001	0.000	0.002	0.000	0.000	0.003	0.001	0.000
Water	0.043	0.037		0.008			0.146	0.164	0.072
Plantations	0.009	0.005	0.000	0.002	0.002	0.000	0.006		0.015

Statistical test - Difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin	Classes of destination: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Open canopy forest	DECREASE	INCREASE	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Long fallow	DECREASE		n.s.	n.s.	n.s.	n.s.	n.s.		DECREASE
Fragmented forest	DECREASE	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Shrubs		n.s.		n.s.	n.s.	n.s.	DECREASE	n.s.	n.s.
Short fallow	n.s.		INCREASE	DECREASE	DECREASE	n.s.	INCREASE		
Other Land Cover	DECREASE	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Water	n.s.	n.s.		INCREASE			n.s.	n.s.	n.s.
Plantations	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.		n.s.

Notes: see Table 72.

Table 89. Mean transition probabilities 1980-1990 and 1990-2000 – Continental South-East Asia (subregion code 45)

Probability matrix 1980-1990

Land cover classes in 1980	Land cover classes in 1990								
	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.890	0.010	0.029	0.006	0.002	0.011	0.035	0.003	0.014
Open canopy forest	0.007	0.906	0.008	0.005	0.016	0.004	0.050	0.004	ε
Long fallow	0.020	0.001	0.884	0.002	0.003	0.032	0.055	0.003	ε
Fragmented forest	0.009	0.004	0.008	0.815	0.021	0.012	0.121	0.004	0.005
Shrubs	0.004	0.007	0.004	0.008	0.836	0.003	0.131	0.005	0.003
Short fallow	0.023	0.006	0.020	0.002	0.008	0.781	0.156	0.004	ε
Other Land Cover	0.002	0.002	0.001	0.001	0.003	ε	0.988	0.002	0.001
Water	0.035			0.005	0.003		0.114	0.829	0.014
Plantations	ε	ε					0.002		0.997

Probability matrix 1990-2000

Land cover classes in 1990	Land cover classes in 2000								
	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.938	0.002	0.017	0.008	0.001	0.017	0.016	0.002	ε
Open canopy forest	0.006	0.882	0.012	0.003	0.009	0.017	0.069	0.001	
Long fallow	0.015		0.927	0.001	0.001	0.036	0.019	0.002	
Fragmented forest	0.007	0.004	0.013	0.878	ε	0.026	0.068	ε	0.003
Shrubs	0.007	0.003	0.003	0.002	0.865	0.017	0.097	0.005	0.002
Short fallow	0.006	ε	0.016	0.004	0.002	0.886	0.083	0.002	
Other Land Cover	0.002	0.001	0.001	0.001	0.002	0.001	0.989	0.001	0.002
Water	0.015			0.005	0.013		0.055	0.911	
Plantations	0.001						0.005		0.995

Table 90. Difference between mean transition probabilities from the two reference periods - Continental South-East Asia (subregion code 45)

Difference between probability matrices (period 1990-2000 with period 1980-1990)

Classes of origin	Classes of destination: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.047	-0.007	-0.012	0.001	-0.001	0.006	-0.019	-0.002	-0.013
Open canopy forest	-0.001	-0.024	0.004	-0.002	-0.007	0.013	0.020	-0.004	0.000
Long fallow	-0.006	-0.001	0.042	-0.001	-0.003	0.005	-0.036	-0.001	0.000
Fragmented forest	-0.002	0.000	0.005	0.062	-0.021	0.014	-0.053	-0.004	-0.003
Shrubs	0.003	-0.004	-0.001	-0.006	0.029	0.014	-0.033	-0.001	0.000
Short fallow	-0.016	-0.006	-0.003	0.002	-0.006	0.105	-0.073	-0.002	0.000
Other Land Cover	0.000	-0.001	0.000	0.000	-0.001	0.001	0.001	-0.001	0.001
Water	-0.020			0.001	0.010		-0.059	0.082	-0.014
Plantations	0.000	0.000					0.003		-0.002

Standard error of the difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin	Classes of destination: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.020	0.005	0.006	0.005	0.001	0.004	0.009	0.001	0.014
Open canopy forest	0.005	0.066	0.004	0.003	0.007	0.011	0.049	0.004	0.000
Long fallow	0.008	0.001	0.019	0.001	0.001	0.013	0.024	0.002	0.000
Fragmented forest	0.004	0.002	0.006	0.046	0.009	0.011	0.035	0.002	0.006
Shrubs	0.004	0.003	0.002	0.004	0.064	0.015	0.066	0.003	0.002
Short fallow	0.010	0.006	0.006	0.003	0.005	0.076	0.059	0.002	0.000
Other Land Cover	0.001	0.002	0.001	0.001	0.002	0.001	0.004	0.001	0.002
Water	0.025			0.001	0.012		0.065	0.081	0.018
Plantations	0.000	0.000					0.001		0.001

Statistical test - Difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin	Classes of destination: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	INCREASE	n.s.	DECREASE	n.s.	n.s.	n.s.	DECREASE	n.s.	n.s.
Open canopy forest	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Long fallow	n.s.	n.s.	INCREASE	n.s.	DECREASE	n.s.	n.s.	n.s.	n.s.
Fragmented forest	n.s.	n.s.	n.s.	n.s.	DECREASE	n.s.	n.s.	DECREASE	n.s.
Shrubs	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Short fallow	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Other Land Cover	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Water	n.s.			n.s.	n.s.		n.s.	n.s.	n.s.
Plantations	INCREASE	DECREASE					n.s.		n.s.

Notes: see Table 72.

Table 91. Mean transition probabilities 1980-1990 and 1990-2000 – Insular South-East Asia (subregion code 46)

Probability matrix 1980-1990

Land cover classes in 1980	Land cover classes in 1990								
	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.889	0.003	0.023	0.006	0.001	0.027	0.037	0.001	0.013
Open canopy forest	0.012	0.727	0.043	0.070	0.002	0.047	0.076		0.024
Long fallow	0.019		0.784	0.001	0.007	0.162	0.026		ε
Fragmented forest	0.001	0.006	0.013	0.748	0.035	0.016	0.177		0.004
Shrubs	0.025		0.025	0.009	0.720	0.003	0.195		0.023
Short fallow	0.009	0.001	0.021	0.003	0.005	0.880	0.078	0.001	0.003
Other Land Cover	0.001		0.004	ε	0.003	0.002	0.977	0.003	0.009
Water							0.224	0.776	
Plantations	0.011		0.001	0.001		0.025	0.127	0.001	0.833

Probability matrix 1990-2000

Land cover classes in 1990	Land cover classes in 2000								
	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.862	0.001	0.023	0.001	0.001	0.016	0.074	0.005	0.016
Open canopy forest	0.015	0.790	0.028	0.069	0.043	0.008	0.045		0.001
Long fallow	0.012	ε	0.750			0.113	0.113		0.011
Fragmented forest	0.006	ε	0.017	0.779	0.044	0.012	0.136	ε	0.005
Shrubs				ε	0.833	0.058	0.107	ε	0.001
Short fallow	0.002		0.009	ε		0.829	0.147	0.002	0.011
Other Land Cover	0.001		0.001	ε	ε	0.004	0.943	0.004	0.047
Water							0.140	0.860	
Plantations	ε			ε		0.004	0.088		0.908

Table 92. Difference between mean transition probabilities from the two reference periods - Insular South-East Asia (subregion code 46)

Difference between probability matrices (period 1990-2000 with period 1980-1990)

Classes of origin	Classes of destination: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	-0.027	-0.002	0.000	-0.005	0.000	-0.011	0.037	0.004	0.003
Open canopy forest	0.003	0.063	-0.015	-0.001	0.041	-0.038	-0.030		-0.023
Long fallow	-0.007	0.000	-0.033	-0.001	-0.007	-0.049	0.087		0.011
Fragmented forest	0.005	-0.006	0.004	0.031	0.009	-0.004	-0.040	0.000	0.002
Shrubs	-0.025		-0.025	-0.009	0.113	0.056	-0.087	0.000	-0.022
Short fallow	-0.007	-0.001	-0.012	-0.002	-0.005	-0.051	0.069	0.001	0.007
Other Land Cover	0.000		-0.003	0.000	-0.003	0.002	-0.034	0.002	0.038
Water							-0.084	0.084	
Plantations	-0.011		-0.001	-0.001		-0.021	-0.038	-0.001	0.074

Standard error of the difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin	Classes of destination: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.022	0.002	0.005	0.003	0.000	0.007	0.017	0.005	0.002
Open canopy forest	0.006	0.048	0.011	0.005	0.017	0.025	0.020		0.011
Long fallow	0.003	0.000	0.048	0.001	0.007	0.032	0.032		0.005
Fragmented forest	0.006	0.005	0.005	0.078	0.014	0.008	0.080	0.000	0.001
Shrubs	0.035		0.035	0.005	0.086	0.045	0.065	0.000	0.012
Short fallow	0.007	0.001	0.008	0.002	0.004	0.044	0.053	0.001	0.006
Other Land Cover	0.001		0.002	0.000	0.002	0.002	0.017	0.004	0.017
Water							0.391	0.391	
Plantations	0.007		0.001	0.000		0.016	0.057	0.002	0.068

Statistical test - Difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin	Classes of destination: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	INCREASE	n.s.	n.s.
Open canopy forest	n.s.	n.s.	n.s.	n.s.	INCREASE	n.s.	n.s.		DECREASE
Long fallow	DECREASE	n.s.	n.s.	n.s.	n.s.	n.s.	INCREASE		INCREASE
Fragmented forest	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Shrubs	n.s.		n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Short fallow	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Other Land Cover	n.s.		DECREASE	DECREASE	n.s.	n.s.	DECREASE	n.s.	INCREASE
Water							n.s.	n.s.	
Plantations	n.s.		n.s.	n.s.		n.s.	n.s.	n.s.	n.s.

Notes: see Table 72.

Table 93. Mean transition probabilities 1980-1990 and 1990-2000 – Mexico and Central America (subregion code 31)

Probability matrix 1980-1990

Land cover classes in 1980	Land cover classes in 1990								
	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.907	0.019	0.025	0.018	0.002	0.015	0.012	ε	
Open canopy forest	0.002	0.945	0.002	0.007	0.004	0.013	0.025	0.001	ε
Long fallow	0.038	0.017	0.757	0.008		0.147	0.033		
Fragmented forest	0.005	ε	0.003	0.939	ε	ε	0.049	0.002	0.001
Shrubs		ε			0.989		0.010	0.001	ε
Short fallow	0.009	0.014	0.008	ε	0.002	0.919	0.041	0.007	
Other Land Cover	0.001	ε	ε	ε	0.001	ε	0.993	0.001	0.004
Water	0.056					0.037	0.224	0.683	
Plantations							0.169		0.831

Probability matrix 1990-2000

Land cover classes in 1990	Land cover classes in 2000								
	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.934	0.001	0.015	0.032	ε	0.006	0.011	ε	
Open canopy forest	ε	0.971	0.004	0.008	ε	0.003	0.013	ε	ε
Long fallow	0.021	0.006	0.876			0.089	0.009		
Fragmented forest	0.001	0.002	0.004	0.962		0.001	0.027		0.003
Shrubs					0.996		0.004		
Short fallow	0.002	0.008	0.011	0.003		0.962	0.013	ε	
Other Land Cover	ε	ε	ε	ε	ε	ε	0.996	ε	0.002
Water					0.059	0.081		0.860	
Plantations							0.163		0.837

Table 94. Difference between mean transition probabilities from the two reference periods - Mexico and Central America (subregion code 31)

Difference between probability matrices (period 1990-2000 with period 1980-1990)

Classes of origin \ Classes of destination	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.027	-0.018	-0.011	0.014	-0.002	-0.009	-0.002	0.000	
Open canopy forest	-0.002	0.026	0.001	0.000	-0.003	-0.010	-0.012	-0.001	0.000
Long fallow	-0.017	-0.011	0.119	-0.008		-0.059	-0.024		
Fragmented forest	-0.004	0.001	0.001	0.023	0.000	0.000	-0.022	-0.002	0.002
Shrubs		0.000			0.008		-0.006	-0.001	0.000
Short fallow	-0.007	-0.006	0.003	0.003	-0.002	0.043	-0.027	-0.007	
Other Land Cover	-0.001	0.000	0.000	0.000	-0.001	0.000	0.004	-0.001	-0.002
Water	-0.056				0.059	0.044	-0.224	0.177	
Plantations							-0.006		0.006

Standard error of the difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin \ Classes of destination	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.033	0.011	0.007	0.021	0.001	0.005	0.003	0.000	
Open canopy forest	0.001	0.019	0.003	0.004	0.002	0.009	0.008	0.001	0.000
Long fallow	0.019	0.007	0.078	0.006		0.091	0.026		
Fragmented forest	0.002	0.001	0.001	0.012	0.000	0.000	0.014	0.002	0.001
Shrubs		0.000			0.005		0.005	0.001	0.000
Short fallow	0.004	0.010	0.003	0.002	0.002	0.047	0.033	0.007	
Other Land Cover	0.001	0.000	0.000	0.000	0.001	0.000	0.003	0.001	0.002
Water	0.061				0.060	0.070	0.146	0.124	
Plantations							0.150		0.150

Statistical test - Difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin \ Classes of destination	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	
Open canopy forest	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Long fallow	n.s.	n.s.	n.s.	n.s.		n.s.	n.s.		
Fragmented forest	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Shrubs		n.s.			n.s.		n.s.	n.s.	n.s.
Short fallow	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	
Other Land Cover	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Water	n.s.				n.s.	n.s.	n.s.	n.s.	
Plantations							n.s.		n.s.

Notes: see Table 72.

Table 95. Mean transition probabilities 1980-1990 and 1990-2000 – Tropical South America, excluded Brazil (subregion code 34)

Probability matrix 1980-1990

Land cover classes in 1980 \ Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.979	ε	0.002	0.002	0.001	0.003	0.010	0.004	ε
Open canopy forest	0.001	0.994					0.005		
Long fallow	0.053		0.795			0.142	0.004	0.006	
Fragmented forest	0.001			0.893	0.001	0.006	0.089	0.010	
Shrubs	0.001				0.993		0.006		
Short fallow	0.004		0.021			0.956	0.014	0.005	
Other Land Cover	0.001	ε	ε	ε	0.005	ε	0.987	0.007	ε
Water	0.003		0.011	0.051			0.136	0.799	
Plantations									

Probability matrix 1990-2000

Land cover classes in 1990 \ Land cover classes in 2000	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.986		0.001	0.001	ε	0.002	0.009	0.001	
Open canopy forest		0.999					0.001		
Long fallow	0.006		0.919			0.045	0.030		
Fragmented forest	0.001		ε	0.884	0.002		0.105	0.007	
Shrubs					0.975		0.025		
Short fallow	0.007		0.003			0.919	0.071	0.001	
Other Land Cover	0.002		ε	ε	ε	ε	0.994	0.003	ε
Water	0.052		0.004	0.012			0.186	0.746	
Plantations									1.000

Table 96. Difference between mean transition probabilities from the two reference periods - Tropical South America, excluded Brazil (subregion code 34)

Difference between probability matrices (period 1990-2000 with period 1980-1990)

Classes of origin \ Classes of destination	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.007	0.000	0.000	-0.002	-0.001	-0.001	-0.001	-0.003	0.000
Open canopy forest	-0.001	0.005					-0.004		
Long fallow	-0.047		0.124			-0.098	0.026	-0.006	
Fragmented forest	0.000		0.000	-0.010	0.002	-0.006	0.016	-0.002	
Shrubs	-0.001				-0.018		0.019		
Short fallow	0.003		-0.018			-0.037	0.057	-0.004	
Other Land Cover	0.001	0.000	0.000	0.000	-0.004	0.000	0.007	-0.004	0.000
Water	0.049		-0.007	-0.039			0.050	-0.052	
Plantations									1.000

Standard error of the difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin \ Classes of destination	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.008	0.000	0.001	0.001	0.000	0.001	0.005	0.004	0.000
Open canopy forest	0.001	0.004					0.003		
Long fallow	0.005		0.059			0.064	0.013	0.001	
Fragmented forest	0.002		0.000	0.087	0.002	0.006	0.083	0.002	
Shrubs	0.001				0.014		0.014		
Short fallow	0.009		0.016			0.057	0.045	0.005	
Other Land Cover	0.001	0.000	0.000	0.000	0.004	0.000	0.007	0.005	0.000
Water	0.061		0.010	0.036			0.254	0.339	
Plantations									

Statistical test - Difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin \ Classes of destination	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Open canopy forest	n.s.	n.s.					n.s.		
Long fallow	DECREASE		INCREASE			n.s.	n.s.	DECREASE	
Fragmented forest	n.s.		n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	
Shrubs	n.s.				n.s.		n.s.		
Short fallow	n.s.		n.s.			n.s.	n.s.	n.s.	
Other Land Cover	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Water	n.s.		n.s.	n.s.			n.s.	n.s.	
Plantations									

Notes: see Table 72.

Table 97. Mean transition probabilities 1980-1990 and 1990-2000 – Brazil (subregion code 35)

Probability matrix 1980-1990

Land cover classes in 1980	Land cover classes in 1990								
	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.922	0.002	0.004	0.010	0.003	0.005	0.053	0.001	ε
Open canopy forest	0.001	0.838	0.001	0.007	0.027	0.004	0.103	0.015	0.002
Long fallow	0.008		0.939	0.006	0.002	0.026	0.018	ε	
Fragmented forest	0.002	0.001	ε	0.797	0.006	0.037	0.147	0.006	0.003
Shrubs	ε	ε	0.002	ε	0.787	0.001	0.202	0.006	0.002
Short fallow	0.006	0.003	0.008	0.010	ε	0.766	0.200	0.007	
Other Land Cover	0.002	ε	ε	0.004	0.009	0.014	0.965	0.003	0.002
Water	0.049	0.010	0.003	0.015	0.002	0.013	0.237	0.673	
Plantations				0.001			0.041		0.958

Probability matrix 1990-2000

Land cover classes in 1990	Land cover classes in 2000								
	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.914	ε	0.001	0.004	0.003	0.002	0.075	ε	ε
Open canopy forest	ε	0.886	ε	0.019	0.012	0.001	0.081	0.001	0.001
Long fallow	0.110	0.013	0.449	0.014	0.005	0.011	0.397	ε	
Fragmented forest	0.005	0.004	ε	0.897	0.004	0.003	0.082	0.001	0.003
Shrubs	ε	0.001	ε	ε	0.867	0.001	0.104	0.026	ε
Short fallow	0.007	0.003	0.016	0.043	0.001	0.734	0.195	ε	
Other Land Cover	0.002	ε	0.003	0.015	0.034	0.043	0.899	0.003	0.001
Water	0.003	0.005		0.002	0.237	0.007	0.116	0.629	
Plantations				0.009	0.006		0.158		0.827

Table 98. Difference between mean transition probabilities from the two reference periods - Brazil (subregion code 35)

Difference between probability matrices (period 1990-2000 with period 1980-1990)

Classes of origin	Classes of destination: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	-0.008	-0.002	-0.003	-0.005	0.000	-0.003	0.022	-0.001	0.000
Open canopy forest	-0.001	0.048	-0.001	0.012	-0.015	-0.003	-0.023	-0.014	-0.001
Long fallow	0.102	0.013	-0.490	0.008	0.002	-0.015	0.379	0.000	
Fragmented forest	0.003	0.003	0.000	0.100	-0.002	-0.033	-0.065	-0.005	0.000
Shrubs	0.000	0.001	-0.002	0.000	0.081	0.000	-0.097	0.020	-0.002
Short fallow	0.001	0.000	0.008	0.033	0.001	-0.032	-0.005	-0.007	
Other Land Cover	0.000	0.000	0.002	0.011	0.025	0.029	-0.066	0.000	-0.002
Water	-0.046	-0.005	-0.003	-0.012	0.235	-0.005	-0.121	-0.044	
Plantations				0.008	0.006		0.118		-0.131

Standard error of the difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin	Classes of destination: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	0.013	0.001	0.002	0.004	0.002	0.002	0.016	0.001	0.000
Open canopy forest	0.001	0.049	0.001	0.011	0.021	0.003	0.026	0.013	0.001
Long fallow	0.082	0.009	0.235	0.009	0.002	0.013	0.148	0.000	
Fragmented forest	0.003	0.002	0.000	0.084	0.003	0.019	0.070	0.005	0.000
Shrubs	0.000	0.001	0.001	0.000	0.063	0.001	0.053	0.017	0.001
Short fallow	0.008	0.001	0.010	0.030	0.001	0.093	0.078	0.002	
Other Land Cover	0.003	0.000	0.001	0.007	0.011	0.019	0.029	0.002	0.001
Water	0.042	0.008	0.003	0.007	0.183	0.005	0.055	0.150	
Plantations				0.004	0.005		0.079		0.079

Statistical test - Difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin	Classes of destination: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other Land Cover	Water	Plantations
Closed canopy forest	n.s.	DECREASE	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Open canopy forest	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Long fallow	n.s.	n.s.	DECREASE	n.s.	n.s.	n.s.	INCREASE	n.s.	
Fragmented forest	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Shrubs	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Short fallow	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	DECREASE	
Other Land Cover	n.s.	n.s.	INCREASE	n.s.	INCREASE	n.s.	DECREASE	n.s.	n.s.
Water	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	DECREASE	n.s.	
Plantations				n.s.	n.s.		n.s.		n.s.

Notes: see Table 72.

- **Ecological zone level**

Table 99. Mean transition probabilities 1980-1990 and 1990-2000 – Tropical rain forest

Probability matrix 1980-1990

Land cover classes in 1980 \ Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	0.943	0.002	0.008	0.005	0.001	0.010	0.027	0.001	0.003
Open canopy forest	0.003	0.902	0.004	0.016	0.001	0.005	0.052	0.017	0.002
Long fallow	0.017	ε	0.827	0.004	0.004	0.126	0.022	ε	ε
Fragmented forest	0.002	0.002	0.002	0.894	0.005	0.016	0.073	0.001	0.004
Shrubs	0.001		0.003	ε	0.760	ε	0.225	0.009	0.001
Short fallow	0.009	0.001	0.014	0.002	0.002	0.905	0.063	0.001	0.002
Other land cover	0.001	0.001	0.001	0.001	0.003	0.001	0.989	0.001	0.002
Water	0.067		0.010	0.040	0.001	0.014	0.148	0.714	0.006
Plantations	0.006	ε	ε	ε		0.012	0.063	0.001	0.918

Probability matrix 1990-2000

Land cover classes in 1990 \ Land cover classes in 2000	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	0.937	ε	0.006	0.004	0.001	0.006	0.042	0.001	0.002
Open canopy forest	0.002	0.921	0.004	0.019	0.002	0.005	0.045	0.001	0.001
Long fallow	0.017	0.001	0.804	0.003	ε	0.081	0.087	ε	0.005
Fragmented forest	0.005	0.001	0.003	0.883	0.006	0.007	0.091	0.001	0.003
Shrubs	0.001	0.001	ε	ε	0.866	0.004	0.087	0.041	ε
Short fallow	0.008	0.001	0.011	0.001	ε	0.854	0.119	0.001	0.005
Other land cover	0.001	ε	0.002	0.003	0.001	0.004	0.979	0.001	0.008
Water	0.006	0.005	0.004	0.011	0.027	0.011	0.101	0.835	
Plantations	ε			0.001		0.002	0.044		0.953

Table 100. Difference between mean transition probabilities from the two reference periods - *Tropical rain forest*

Difference between probability matrices (period 1990-2000 with period 1980-1990)

Classes of origin	Classes of destination: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	-0.006	-0.001	-0.003	-0.001	0.000	-0.004	0.015	0.000	-0.001
Open canopy forest	-0.002	0.019	0.000	0.003	0.002	0.000	-0.007	-0.016	-0.001
Long fallow	0.000	0.001	-0.023	0.000	-0.003	-0.045	0.066	0.000	0.005
Fragmented forest	0.004	-0.002	0.000	-0.011	0.001	-0.009	0.018	0.000	-0.001
Shrubs	-0.001	0.001	-0.003	0.000	0.105	0.004	-0.139	0.033	-0.001
Short fallow	0.000	-0.001	-0.003	-0.001	-0.002	-0.051	0.056	0.000	0.002
Other land cover	0.000	0.000	0.001	0.002	-0.002	0.003	-0.010	0.000	0.006
Water	-0.061	0.005	-0.007	-0.029	0.026	-0.003	-0.047	0.121	-0.006
Plantations	-0.005	0.000	0.000	0.000		-0.009	-0.020	-0.001	0.035

Standard error of the difference between mean transition probabilities (1990-2000 with 1980-1990)

Classes of origin	Classes of destination: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	0.006	0.000	0.001	0.002	0.001	0.002	0.007	0.001	0.001
Open canopy forest	0.001	0.015	0.003	0.004	0.002	0.003	0.014	0.014	0.001
Long fallow	0.009	0.001	0.043	0.001	0.004	0.023	0.027	0.000	0.002
Fragmented forest	0.003	0.001	0.000	0.036	0.002	0.015	0.030	0.000	0.001
Shrubs	0.001	0.001	0.002	0.000	0.092	0.003	0.075	0.024	0.001
Short fallow	0.005	0.001	0.004	0.001	0.002	0.030	0.032	0.001	0.003
Other land cover	0.001	0.000	0.000	0.002	0.002	0.002	0.005	0.001	0.003
Water	0.058	0.002	0.005	0.018	0.010	0.008	0.048	0.078	0.007
Plantations	0.004	0.000	0.000	0.001		0.007	0.028	0.001	0.035

Statistical test - Difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin	Classes of destination: Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	n.s.	DECREASE	n.s.	n.s.	n.s.	DECREASE	INCREASE	n.s.	n.s.
Open canopy forest	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Long fallow	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	INCREASE	n.s.	INCREASE
Fragmented forest	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Shrubs	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Short fallow	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Other land cover	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	INCREASE
Water	n.s.	INCREASE	n.s.	n.s.	INCREASE	n.s.	n.s.	n.s.	n.s.
Plantations	n.s.	n.s.	n.s.	n.s.		n.s.	n.s.	n.s.	n.s.

Notes: see Table 72.

Table 101. Mean transition probabilities 1980-1990 and 1990-2000 – *Tropical moist deciduous forest*

Probability matrix 1980-1990

Land cover classes in 1980	Land cover classes in 1990								
	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	0.900	0.014	0.006	0.020	0.003	0.019	0.033	0.005	ε
Open canopy forest	0.002	0.930	0.002	0.009	0.006	0.011	0.039	ε	0.001
Long fallow	0.011	0.002	0.896	0.004	0.002	0.033	0.051	0.001	ε
Fragmented forest	0.004	0.003	0.001	0.886	0.004	0.025	0.074	0.002	ε
Shrubs	0.001	0.001	0.001	0.001	0.915	0.003	0.076	0.001	0.002
Short fallow	0.009	0.006	0.004	0.013	0.003	0.910	0.054	0.002	ε
Other land cover	0.001	0.002	ε	0.004	0.002	0.004	0.983	0.003	0.001
Water	0.012	0.011		0.010	0.004	0.035	0.311	0.617	
Plantations	0.023	0.009		0.003		0.002	0.062		0.900

Probability matrix 1990-2000

Land cover classes in 1990	Land cover classes in 2000								
	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	0.934	0.002	0.003	0.020	0.001	0.015	0.023	0.001	ε
Open canopy forest	0.001	0.955	0.002	0.011	0.003	0.007	0.021	ε	ε
Long fallow	0.010	0.004	0.935	0.001	0.001	0.030	0.018	0.002	
Fragmented forest	0.002	0.002	0.001	0.940	0.001	0.015	0.039	0.001	ε
Shrubs	0.001	ε	ε	0.001	0.931	0.003	0.063	ε	ε
Short fallow	0.005	0.003	0.005	0.027	0.002	0.933	0.022	0.001	
Other land cover	0.001	0.001	ε	0.003	0.010	0.011	0.971	0.002	0.001
Water	0.033	ε		0.002	0.164	0.001	0.203	0.596	
Plantations	0.004			0.008	0.003		0.183		0.802

Table 102. Difference between mean transition probabilities from the two reference periods - *Tropical moist deciduous forest*

Difference between probability matrices (period 1990-2000 with period 1980-1990)

Classes of origin \ Classes of destination	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	0.035	-0.012	-0.003	0.000	-0.002	-0.004	-0.010	-0.003	0.000
Open canopy forest	-0.002	0.025	0.000	0.003	-0.004	-0.004	-0.018	0.000	0.000
Long fallow	-0.002	0.002	0.039	-0.002	-0.001	-0.004	-0.032	0.001	0.000
Fragmented forest	-0.003	-0.001	0.000	0.053	-0.003	-0.010	-0.036	-0.002	0.000
Shrubs	0.000	0.000	0.000	0.000	0.016	0.000	-0.013	-0.001	-0.002
Short fallow	-0.003	-0.002	0.001	0.014	0.000	0.023	-0.032	0.000	0.000
Other land cover	-0.001	-0.001	0.000	0.000	0.008	0.008	-0.012	-0.001	-0.001
Water	0.021	-0.010		-0.008	0.161	-0.034	-0.109	-0.021	
Plantations	-0.019	-0.009		0.005	0.003	-0.002	0.121		-0.098

Standard error of the difference between mean transition probabilities (1990-2000 with 1980-1990)

Classes of origin \ Classes of destination	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	0.012	0.003	0.001	0.005	0.001	0.005	0.006	0.004	0.000
Open canopy forest	0.001	0.011	0.001	0.003	0.003	0.003	0.006	0.000	0.000
Long fallow	0.008	0.002	0.016	0.003	0.001	0.014	0.020	0.001	0.000
Fragmented forest	0.002	0.001	0.001	0.029	0.001	0.011	0.026	0.002	0.000
Shrubs	0.000	0.000	0.001	0.000	0.016	0.001	0.016	0.001	0.001
Short fallow	0.002	0.002	0.002	0.011	0.001	0.017	0.014	0.001	0.000
Other land cover	0.001	0.001	0.000	0.002	0.003	0.008	0.011	0.002	0.001
Water	0.037	0.005		0.004	0.156	0.035	0.181	0.294	
Plantations	0.009	0.006		0.006	0.002	0.003	0.025		0.034

Statistical test - Difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin \ Classes of destination	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	INCREASE	DECREASE	DECREASE	n.s.	DECREASE	n.s.	n.s.	n.s.	n.s.
Open canopy forest	DECREASE	INCREASE	n.s.	n.s.	n.s.	n.s.	DECREASE	n.s.	n.s.
Long fallow	n.s.	n.s.	INCREASE	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Fragmented forest	n.s.	n.s.	n.s.	n.s.	DECREASE	n.s.	n.s.	n.s.	n.s.
Shrubs	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Short fallow	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	DECREASE	n.s.	n.s.
Other land cover	n.s.	n.s.	n.s.	n.s.	INCREASE	n.s.	n.s.	n.s.	n.s.
Water	n.s.	DECREASE		DECREASE	n.s.	n.s.	n.s.	n.s.	
Plantations	DECREASE	n.s.		n.s.	n.s.	n.s.	INCREASE		DECREASE

Notes: see Table 72.

Table 103. Mean transition probabilities 1980-1990 and 1990-2000 – *Tropical dry forest and shrubland*

Probability matrix 1980-1990

Land cover classes in 1980 \ Land cover classes in 1990	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	0.958	0.011	0.004	0.009	0.001	0.002	0.013	0.001	0.001
Open canopy forest	0.001	0.941	0.001	0.039	0.001	0.002	0.014	0.001	ε
Long fallow	0.006	0.004	0.916	0.003	0.010	0.023	0.031	0.008	
Fragmented forest	0.002	0.007		0.947	0.002	ε	0.042	ε	ε
Shrubs	ε	0.001	ε	0.002	0.944	0.001	0.048	0.001	0.002
Short fallow	0.034	0.010	0.001	0.003	0.005	0.889	0.051	0.006	
Other land cover	ε	0.001	ε	0.001	0.001	ε	0.996	0.001	ε
Water	0.052	0.056		0.020	0.003		0.288	0.568	0.013
Plantations					0.003		0.013		0.984

Probability matrix 1990-2000

Land cover classes in 1990 \ Land cover classes in 2000	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	0.974	0.003	0.001	0.009	ε	0.006	0.007	0.001	ε
Open canopy forest	0.001	0.926	0.001	0.045	0.001	0.009	0.018	ε	ε
Long fallow			0.920	0.013		0.050	0.017		
Fragmented forest	ε	0.005		0.954		ε	0.040	ε	
Shrubs	ε	ε	ε	ε	0.943	0.005	0.049	ε	0.001
Short fallow	0.013	0.032	0.009		0.031	0.824	0.091		
Other land cover	ε	ε	ε	0.001	ε	ε	0.997	0.001	ε
Water	0.018			0.011	0.016		0.088	0.867	
Plantations							0.016		0.984

Table 104. Difference between mean transition probabilities from the two reference periods- Tropical dry forest and shrubland

Difference between probability matrices (period 1990-2000 with period 1980-1990)

Classes of origin \ Classes of destination	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	0.015	-0.008	-0.002	0.000	-0.001	0.004	-0.006	-0.001	-0.001
Open canopy forest	-0.001	-0.015	0.000	0.007	0.000	0.007	0.004	-0.001	0.000
Long fallow	-0.006	-0.004	0.005	0.009	-0.010	0.027	-0.014	-0.008	
Fragmented forest	-0.001	-0.003		0.007	-0.002	0.000	-0.002	0.000	0.000
Shrubs	0.000	-0.001	0.000	-0.002	-0.001	0.004	0.000	-0.001	0.000
Short fallow	-0.021	0.022	0.008	-0.003	0.025	-0.064	0.040	-0.006	
Other land cover	0.000	-0.001	0.000	0.000	-0.001	0.000	0.001	0.000	0.000
Water	-0.034	-0.056		-0.009	0.013		-0.200	0.299	-0.013
Plantations					-0.003		0.003		0.000

Standard error of the difference between mean transition probabilities (1990-2000 with 1980-1990)

Classes of origin \ Classes of destination	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	0.012	0.004	0.002	0.003	0.001	0.002	0.004	0.001	0.000
Open canopy forest	0.001	0.015	0.000	0.011	0.001	0.004	0.006	0.001	0.000
Long fallow	0.005	0.003	0.038	0.006	0.004	0.010	0.015	0.008	
Fragmented forest	0.001	0.001		0.015	0.001	0.000	0.014	0.000	0.000
Shrubs	0.000	0.001	0.000	0.001	0.013	0.004	0.013	0.000	0.000
Short fallow	0.019	0.018	0.006	0.003	0.019	0.039	0.039	0.007	
Other land cover	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000
Water	0.036	0.054		0.015	0.015		0.116	0.173	0.015
Plantations					0.004		0.008		0.006

Statistical test - Difference between probability matrices (1990-2000 with 1980-1990)

Classes of origin \ Classes of destination	Closed canopy forest	Open canopy forest	Long fallow	Fragmented forest	Shrubs	Short fallow	Other land cover	Water	Plantations
Closed canopy forest	n.s.	DECREASE	n.s.	n.s.	DECREASE	n.s.	n.s.	n.s.	n.s.
Open canopy forest	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Long fallow	n.s.	n.s.	n.s.	n.s.	DECREASE	INCREASE	n.s.	n.s.	
Fragmented forest	n.s.	DECREASE		n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Shrubs	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Short fallow	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	
Other land cover	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Water	n.s.	n.s.		n.s.	n.s.		n.s.	n.s.	n.s.
Plantations					n.s.		n.s.		n.s.

Notes: see Table 72.