MODULE	**LAND USE AND FORESTRY**
SUBMODULE	**CHANGES IN FOREST AND OTHER WOODY BIOMASS STOCKS**
WORKSHEET	**5-1**
SHEET	**3 OF 3**

STEP 3		STEP 4	
N Carbon Fraction	O Annual Carbon Release (kt C)	P Net Annual Carbon Uptake (+) or Release (-) (kt C)	Q Convert to CO_2 Annual Emission (-) or Removal (+) (Gg CO_2)
	O = (M x N)	P = (E - O)	Q = (P x [44/12])

MODULE	**LAND-USE CHANGE AND FORESTRY**
SUBMODULE	**FOREST AND GRASSLAND CONVERSION - CO_2 FROM BIOMASS**
WORKSHEET	**5-2**
SHEET	**1 OF 5 BIOMASS CLEARED**

		STEP 1				
Vegetation types		A Area Converted Annually (kha)	B Biomass Before Conversion (t dm/ha)	C Biomass After Conversion (t dm/ha)	D Net Change in Biomass Density (t dm/ha)	E Annual Loss of Biomass (kt dm)
					D = (B - C)	E = (A x D)
Tropical	Wet/Very Moist					
	Moist, short dry season					
	Moist, long dry season					
	Dry					
	Montane Moist					
	Montane Dry					
Tropical Savanna/Grasslands						
Temperate	Coniferous					
	Broadleaf					
Grasslands						
Boreal	Mixed Broadleaf/ Coniferous					
	Coniferous					
	Forest-tundra					
Grasslands/Tundra						
Other						
Subtotals						

MODULE	LAND-USE CHANGE AND FORESTRY
SUBMODULE	FOREST AND GRASSLAND CONVERSION - CO_2 FROM BIOMASS
WORKSHEET	5-2
SHEET	2 OF 5 CARBON RELEASED BY ON-SITE BURNING

		STEP 2					
Vegegation types		F Fraction of Biomass Burned on Site	G Quantity of Biomass Burned on Site (kt dm)	H Fraction of Biomass Oxidised on Site	I Quantity of Biomass Oxidised on Site (kt dm)	J Carbon Fraction of Above-ground Biomass (burned on site)	K Quantity of Carbon Released (from biomass burned) (kt C)
			G = (E x F)		I = (G x H)		K = (I x J)
Tropical	Wet/Very Moist						
	Moist, short dry season						
	Moist, long dry season						
	Dry						
	Montane Moist						
	Montane Dry						
Tropical Savanna/Grasslands							
Temperate	Coniferous						
	Broadleaf						
Grasslands							
Boreal	Mixed Broadleaf/Coniferous						
	Coniferous						
	Forest-tundra						
Grasslands/Tundra							
Other							
						Subtotal	

MODULE	**LAND-USE CHANGE AND FORESTRY**
SUBMODULE	**FOREST AND GRASSLAND CONVERSION - CO_2 FROM BIOMASS**
WORKSHEET	**5-2**
SHEET	**3 OF 5 CARBON RELEASED BY OFF-SITE BURNING**

		STEP 3						STEP 4
Vegetation types		L Fraction of Biomass Burned off Site	M Quantity of Biomass Burned off Site (kt dm)	N Fraction of Biomass Oxidised off Site	O Quantity of Biomass Oxidised off Site (kt dm)	P Carbon Fraction of Above-ground Biomass (burned off site)	Q Quantity of Carbon Released (from biomass burned off site (kt C)	R Total Carbon Released (from on and off site burning) (kt C)
			M = (E x L)		O = (M x N)		Q = (O x P)	R = (K + Q)
Tropical	Wet/Very Moist							
	Moist, short dry season							
	Moist, long dry season							
	Dry							
	Montane Moist							
	Montane Dry							
Tropical Savanna/Grasslands								
Temperate	Coniferous							
	Broadleaf							
Grasslands								
Boreal	Mixed Broadleaf/ Coniferous							
	Coniferous							
	Forest-tundra							
Grasslands/Tundra								
Other								
Subtotals								

MODULE	**LAND-USE CHANGE AND FORESTRY**
SUBMODULE	**FOREST AND GRASSLAND CONVERSION - CO_2 FROM BIOMASS**
WORKSHEET	**5-2**
SHEET	**4 OF 5 CARBON RELEASED BY DECAY OF BIOMASS**

STEP 5										
Vegetation types		A Average Area Converted (10 Year Average) (kha)	B Biomass Before Conversion (t dm/ha)	C Biomass After Conversion (t dm/ha)	D Net Change in Biomass Density (t dm/ha)	E Average Annual Loss of Biomass (kt dm)	F Fraction Left to Decay	G Quantity of Biomass Left to Decay (kt dm)	H Carbon Fraction in Above-ground Biomass	I Carbon Released from Decay of Above-ground Biomass (kt C)
					D = (B-C)	E = (A x D)		G = (E x F)		I = (G x H)
Tropical	Wet/Very Moist									
	Moist, short dry season									
	Moist, long dry season									
	Dry									
	Montane Moist									
	Montane Dry									
Tropical Savanna/Grasslands										
Temperate	Coniferous									
	Broadleaf									
Grasslands										
Boreal	Mixed Broadleaf/ Coniferous									
	Coniferous									
	Forest-tundra									
Grasslands/Tundra										
Other										
									Subtotal	

MODULE	**LAND-USE CHANGE AND FORESTRY**
SUBMODULE	**FOREST AND GRASSLAND CONVERSION - CO_2 FROM BIOMASS**
WORKSHEET	**5-2**
SHEET	**5 OF 5 SUMMARY AND CONVERSION TO CO_2**

STEP 6			
A Immediate Release From Burning (kt C)	B Delayed Emissions From Decay (kt C) (10-year average)	C Total Annual Carbon Release (kt C)	D Total Annual CO_2 Release (Gg CO_2)
		C = A + B	D = C x (44/12)

MODULE	**LAND-USE CHANGE AND FORESTRY**
SUBMODULE	**ON-SITE BURNING OF FORESTS - NON-CO_2 TRACE GASES FROM BURNING BIOMASS**
WORKSHEET	**5-3**
SHEET	**1 OF 1 NON-CO_2 GAS EMISSIONS**

STEP 1			**STEP 2**				
A Quantity of Carbon Released (kt C)	B Nitrogen-Carbon Ratio	C Total Nitrogen Released (kt N)		D Trace Gas Emissions Ratios	E Trace Gas Emissions (kt C)	F Conversion Ratio	G Trace Gas Emissions from Burning of Cleared Forests (Gg CH_4, CO)
(From column K, sheet 2 of Worksheet 5-2)		C = (A x B)			E = (A x D)		G = (E x F)
			CH_4			16/12	
			CO			28/12	
					kt N		Gg N_2O, NO_x
					E = (C x D)		G = (E x F)
			N_2O			44/28	
			NO_x			46/14	

MODULE		**LAND-USE CHANGE AND FORESTRY**				
SUBMODULE		**ABANDONMENT OF MANAGED LANDS**				
WORKSHEET		**5-4**				
SHEET		**1 OF 3 CARBON UPTAKE BY ABOVEGROUND REGROWTH - FIRST 20 YEARS**				
		STEP 1				
Vegetation types		A 20-Year Total Area Abandoned and Regrowing (kha)	B Annual Rate of Aboveground Biomass Growth (t dm/ha)	C Annual Aboveground Biomass Growth (kt dm)	D Carbon Fraction of Aboveground Biomass	E Annual Carbon Uptake in Aboveground Biomass (kt C)
				C = (A x B)		E = (C x D)
Tropical	Wet/Very Moist					
	Moist, short dry season					
	Moist, long dry season					
	Dry					
	Montane Moist					
	Montane Dry					
Tropical Savanna/Grasslands						
Temperate	Coniferous					
	Broadleaf					
Grasslands						
Boreal	Mixed Broadleaf/Coniferous					
	Coniferous					
	Forest tundra					
Grasslands/Tundra						
Other						
					Subtotal	

MODULE	LAND-USE CHANGE AND FORESTRY
SUBMODULE	ABANDONMENT OF MANAGED LANDS
WORKSHEET	5-4
SHEET	2 OF 3 CARBON UPTAKE BY ABOVEGROUND REGROWTH - > 20 YEARS

		STEP 2				
Vegetation types		G Total Area Abandoned for more than Twenty Years (kha)	H Annual Rate of Aboveground Biomass Growth (t dm/ha)	I Annual Aboveground Biomass Growth (kt dm)	J Carbon Fraction of Above ground Biomass	K Annual Carbon Uptake in Aboveground Biomass (kt C)
				I = (J x H)		K = (I x J)
Tropical	Wet/Very Moist					
	Moist, short dry season					
	Moist, long dry season					
	Dry					
	Montane Moist					
	Montane Dry					
Tropical Savanna/Grasslands						
Temperate	Coniferous					
	Broadleaf					
Grasslands						
Boreal	Mixed Broadleaf/Coniferous					
	Coniferous					
	Forest tundra					
Grasslands/Tundra						
Other						
					Subtotal	

MODULE	**LAND-USE CHANGE AND FORESTRY**
SUBMODULE	**ABANDONMENT OF MANAGED LANDS**
WORKSHEET	**5-4**
SHEET	**3 OF 3 TOTAL CO_2 REMOVALS FROM ABANDONED LANDS**

STEP 3	
L Total Carbon Uptake from Abandoned Lands (kt C)	M Total Carbon Dioxide Uptake (Gg CO_2)
L = (E + K)	M = (L x (44/12))

MODULE	**LAND-USE CHANGE AND FORESTRY**						
SUBMODULE	**CHANGE IN SOIL CARBON FOR MINERAL SOILS**						
WORKSHEET	**5-5**						
SHEET	**1 OF 4**						
STEPS 1 AND 2					**STEP 3**		
A Land-use/ Management Systems	B Soil type	C Soil Carbon (t) (Mg C/ha)	D Land Area (t-20) (Mha)	E Land Area (t) (Mha)	F Soil Carbon (t-20) (Tg)	G Soil Carbon (t) (Tg)	H Net change in Soil Carbon in Mineral Soils (Tg per 20 yr)
					F = (C x D)	G = (C x E)	H = (G - F)
	High activity soils						
	Low activity soils						
	Sandy						
	Volcanic						
	Wetland (Aquic)						
Totals							

Note that land areas in columns D and E, summed over all land-use/management systems used in the inventory should be equal. Total land areas within each soil type, across all land-use systems, should also remain constant over the inventory period.

MODULE	**LAND-USE CHANGE AND FORESTRY**
SUBMODULE	**SOIL CARBON FOR AGRICULTURALLY IMPACTED LANDS**
WORKSHEET	**5-5A (SUPPLEMENTAL)**
SHEET	**1 OF 1**

A Land-use/ Management Systems	B Soil type	C Soil Carbon under Native Vegetation (Mg C/ha)	D Base Factor	E Tillage Factor	F Input Factors	G Soil Carbon in Agriculturally Impacted Lands (Mg C/ha)
						E = (C x D x E x F)
	High Activity Soils					
	Low Activity Soils					
	Sandy					
	Volcanic					
	Wetland (Aquic)					

MODULE	LAND-USE CHANGE AND FORESTRY
SUBMODULE	CARBON EMISSIONS FROM INTENSIVELY-MANAGED ORGANIC SOILS
WORKSHEET	5-5
SHEET	2 OF 4

STEP 4			
Agricultural Use of Organic Soils	A Land Area (ha)	B Annual Loss Rate (MgC/ha/yr) (Default)	C Net Carbon Loss from Organic Soils (Mg/yr)
			C = (A x B)
Cool temperate			
Upland crops			
Pasture/Forest			
Warm temperate			
Upland crops			
Pasture/Forest			
Tropical			
Upland crops			
Pasture/Forest			
		Total	

MODULE	LAND-USE CHANGE AND FORESTRY
SUBMODULE	CARBON EMISSIONS FROM LIMING OF AGRICULTURAL SOILS
WORKSHEET	5-5
SHEET	3 OF 4

STEP 5			
Type of lime	A Total Annual Amount of Lime (Mg)	B Carbon Conversion Factor	C Carbon Emissions from Liming (Mg C)
			C = (A x B)
Limestone $Ca(CO_3)$		0.120	
Dolomite $CaMg(CO_3)_2$		0.122	
		Total	

MODULE	LAND-USE CHANGE AND FORESTRY			
SUBMODULE	CALCULATION OF TOTAL CO_2-C EMISSIONS FROM AGRICULTURALLY-IMPACTED SOILS			
WORKSHEET	5-5			
SHEET	4 OF 4			
	STEP 6			
Source	A Worksheet values	B Unit Conversion Factor	C Total Annual Carbon Emissions (Gg)	D Convert to Total Annual CO_2 Emission (Gg/yr)
			C = (A x B)	D= C x (44/12)
Total Net Change in Soil Carbon in Mineral Soils		-50		
Total Net Carbon Loss from Organic Soils		0.001		
Carbon Emissions from Liming		0.001		
			Total	