1 Class aggregation for each product:

Table S1: Class aggregation of NLCD data.

Original class	Aggregated class
Open Water	Other land
Perennial ice/snow	Other land
Developed open space	Settlement
Developed, low intensity	Settlement
Developed, medium intensity	Settlement
Developed, high intensity	Settlement
Barren	Other land
Deciduous forest	Forest
Evergreen forest	Forest
Deciduous forest II	Forest
Shrub/scrub	Grassland
Grassland/herbaceous	Grassland
Pasture/hay	Grassland
Cultivated crops	Cropland
Woody wetlands	Forest
Emergent herbaceous wetlands	Grassland

Table S2: Class aggregation of CORINE (CLC) data.

Original class	Aggregated class
Continuous urban fabric	Settlement
Discontinuous urban fabric	Settlement
Industrial or commercial units	Settlement
Road and rail networks and associated land	Settlement
Port areas	Settlement
Airports	Settlement
Mineral extraction sites	Settlement
Dump sites	Settlement
Construction sites	Settlement
Green urban areas	Settlement
Sport and leisure facilities	Settlement
Non irrigated arable land	Cropland
Permanently irrigated land	Cropland
Rice fields	Cropland
Vineyards	Cropland
Fruit trees and berry plantations	Cropland
Olive groves	Cropland
Pastures	Grassland
Annual crops associated with permanent crops	Cropland
Complex cultivation patterns	Cropland
Land principally occupied by agriculture	Grassland

Agro-forestry areas	Cropland
Broad-leaved forest	Forest
Coniferous forest	Forest
Mixed forest	Forest
Natural grasslands	Grassland
Moors and heathland	Grassland
Sclerophyllous vegetation	Grassland
Transitional woodland shrub	Forest
Beaches, dunes and sand plains	Other land
Bare rock	Other land
Sparsely vegetated areas	Other land
Burned areas	Other land
Glaciers and perpetual snow	Other land
Inland marshes	Grassland
Peat bogs	Grassland
Salt marshes	Grassland
Salines	Other land
Intertidal flats	Other land
Water courses	Other land
Water bodies	Other land
Coastal lagoons	Other land
Estuaries	Other land
Sea and ocean	Other land

Table S3: Class aggregation of Globeland30 data.

Original class	Aggregated class
Cultivated land	Cropland
Forest	Forest
Grassland	Grassland
Shrubland	Grassland
Wetland	Grassland
Water bodies	Other land
Tundra	Grassland
Artificial surfaces	Settlement
Bareland	Other land
Permanent snow/ice	Other land

Table S4: Class aggregation of RCMRD data. **Note:** We used for all RCMRD data the classification Scheme I for aggregation.

Original class	Aggregated class
Forestland	Forest
Grassland	Grassland
Cropland	Cropland
Wetland	Grassland

Settlement	Settlement
Otherland	Other land

Table S5: Class aggregation of India LC data.

Original class	Aggregated class
Barren land	Other land
Built and Urban	Settlement
Cropland	Cropland
Deciduous forest	Forest
Evergreen forest	Forest
Fallow land	Grassland
Grassland	Grassland
Mangroves	Forest
Mixed forest	Forest
Plantations	Forest
Shrubland	Grassland
Waste land	Other land
Water bodies	Other land
Others	Other land

Table S6: Class aggregation of MoFor data.

Original class	Aggregated class
Primary Upland Forest	Forest
Secondary Upland Forest/Logged Forest	Forest
Primary Swamp Forest	Forest
Secondary Swamp Forest/Logged Area	Forest
Primary Mangrove Forest	Forest
Secondary Mangrove Forest/ Logged	Forest
Crop Forest	Cropland
Plantation/Garden	Forest
Bushes/Shrubland	Grassland
Swampy Bush	Grassland
Savanna	Grassland
Upland Farming	Cropland
Upland Farming Mixed with Bush	Cropland
Rice field	Cropland
Cultured Fisheries/Fishpond	Other land
Settlement/Developed Land	Settlement
Transmigration	Settlement
Open Land	Other land
Mining/mines	Settlement
Water Body	Other land
Swamp	Grassland

Cloud	*these areas were masked out*
Airport/Harbor	Other land

2 Pixel shift in Globeland30 and India LC products:

For the Indian LC 1995 to 2005 and for some regions in the Globeland30, we recognized a shift by one pixel between the individual years that were used to calculate the change. This shift caused regular change areas at the borders of class patches (refer to figure S1 (left)). We checked for preprocessing errors from our side, but these shifts also appeared in other applications using a different processing software. Furthermore, the shift was visible in the original data sources. Since both products based on Landsat satellite data, we assume that the original products suffer from errors in the geo-correction procedure. In order to solve this problem, we used a filtering technique to remove change areas caused by this shift, by first applying an expand filter of one pixel for the stable land cover/use classes and second a shrink filter of one pixel for the same classes. The results of the filtering are shown in figure S1 (right).
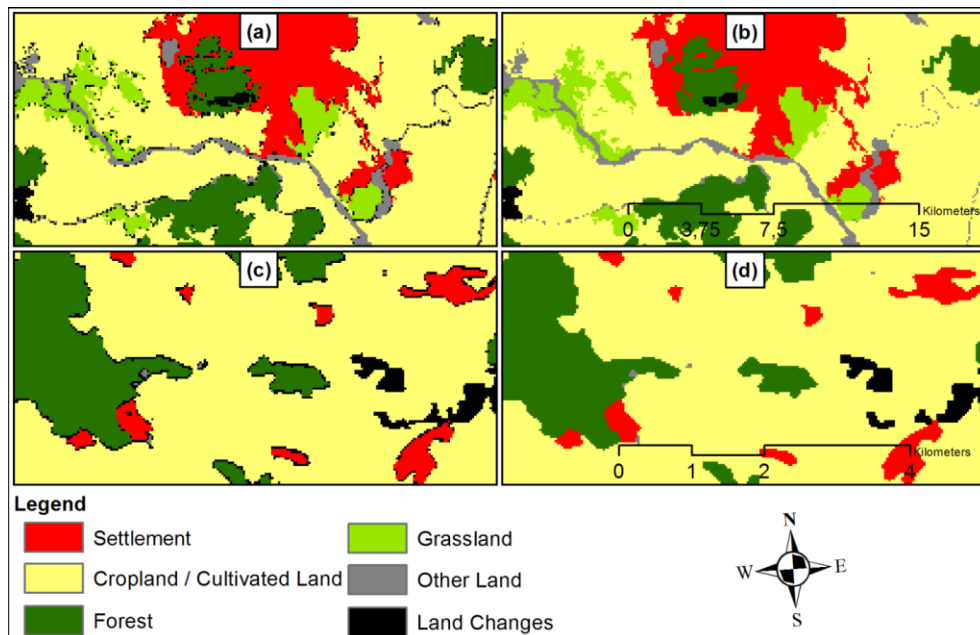

Legend
- Settlement
- Cropland / Cultivated Land
- Forest
- Grassland
- Other Land
- Land Changes

Figure S1: Results of the shift correction. Indian land cover data before the shift correction (a) and after (b). Globeland30 data before the shift correction (c) and after (d).

3 Application of empirically derived land change dynamics parameters on future simulation scenario

We first calculated for each year and land system the net change fraction per land cover fraction. Second, we split the net change fraction, into its land conversion components (e.g. from forest to grasslands) by using the change matrix. From these results, we could retrieve all land conversion types, areas gains and losses for net land changes in our scenario. In a third step, we applied our derived gross/net ratios per land system on all net-change land conversion types. This way we could calculate land conversions, area gains and loss for gross land changes in our chosen scenario (see figure 4 - step 2, right panel).

4 Using regional averages for the semi-natural grassland system

The semi-natural grassland systems occurred in the Tundra and in the Sahel zone. While the Tundra is characterized by almost no human influence (very low change rates), parts of the Sahel zone are subject to shifting cultivation (very high change rates). Averaging our empirical data for this land system globally led to high change rates in the Tundra areas and dampened the change rates for the Sahel zone. Therefore, we separated the two regions from each other. We used only empirical data of Tundra areas to describe the semi-natural grassland system in the Tundra, while we only used empirical data of the Sahel zone to describe the semi-natural grassland system in the Sahel zone.

5 Spatial coverage of data set per land system

Table S7: Spatial coverage of each data set per land system (in 1000km², relative contributions to each land system are indicated in bold)

Land system code / Dataset	LS0	LS1	LS2	LS3	LS4	LS5	LS6	LS7	LS8	LS9	LS10	LS11	LS12	LS13	LS14	LS15	LS16	LS17	LS18	LS19	LS20	LS21	LS22	LS23
CLC 00/06	42,47 **2,9%**	3,24 **0,2%**	367,21 **6,9%**	28,32 **2,2%**	677,47 **10,2%**	58,33 **4,0%**	101,55 **6,1%**	59,95 **3,8%**	262,67 **7,7%**	191,57 **7,5%**	18,94 **0,8%**	201,64 **5,1%**	377,24 **9,1%**	175,71 **1,3%**	855,83 **4,5%**	866,63 **4,0%**	217,54 **1,8%**	110,85 **5,1%**	375,60 **3,1%**	88,37 **6,6%**	56,26 **0,4%**	47,53 **0,2%**	422,11 **12,1%**	102,99 **9,8%**
CLC 06/12	42,47 **2,9%**	3,24 **0,3%**	246,54 **4,6%**	28,32 **2,2%**	677,46 **10,2%**	58,33 **4,0%**	101,55 **6,1%**	59,95 **3,8%**	262,67 **7,7%**	191,56 **7,5%**	18,94 **0,8%**	201,63 **5,1%**	377,23 **9,1%**	175,70 **1,3%**	707,11 **3,8%**	738,06 **3,4%**	217,54 **1,8%**	110,85 **5,1%**	375,60 **3,1%**	88,37 **6,6%**	56,26 **0,4%**	47,53 **0,2%**	422,10 **12,1%**	102,99 **9,8%**
NLCD 01/06	0,00 **0,0%**	n/a	345,70 **6,5%**	4,19 **0,3%**	1048,43 **15,8%**	26,05 **1,8%**	10,64 **0,6%**	13,01 **0,8%**	355,54 **10,5%**	406,47 **15,9%**	0,00 **0,0%**	35,42 **0,9%**	596,39 **14,3%**	365,82 **2,8%**	1192,73 **6,3%**	634,24 **3,0%**	1018,20 **8,4%**	9,43 **0,4%**	427,78 **3,5%**	3,34 **0,2%**	294,11 **2,3%**	573,08 **3,0%**	258,88 **7,4%**	136,86 **13,1%**
NLCD 06/11	0,00 **0,0%**	n/a	345,70 **6,5%**	4,19 **0,3%**	1048,43 **15,8%**	26,05 **1,8%**	9,29 **0,6%**	13,01 **0,8%**	355,54 **10,5%**	434,29 **17,0%**	0,00 **0,0%**	35,42 **0,9%**	596,39 **14,3%**	365,82 **2,8%**	1192,32 **6,3%**	634,24 **3,0%**	1018,20 **8,4%**	9,43 **0,4%**	427,78 **3,5%**	3,34 **0,2%**	294,11 **2,3%**	573,08 **3,0%**	258,88 **7,4%**	136,86 **13,1%**
RCMRD Botswana 00/10	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2,89 **0,2%**	n/a	n/a	0,00 **0,0%**	n/a	n/a	n/a	0,00 **0,0%**	40,68 **0,2%**	158,59 **1,3%**	22,08 **1,0%**	309,81 **2,6%**	0,09 **0,0%**	37,69 **0,3%**	7,47 **0,0%**	1,30 **0,0%**	0,17 **0,0%**
RCMRD Ethiopia 03/08	3,43 **0,2%**	4,02 **0,3%**	1,37 **0,0%**	n/a	n/a	n/a	74,76 **4,5%**	62,09 **3,9%**	20,60 **0,6%**	n/a	15,77 **0,7%**	14,37 **0,4%**	n/a	12,75 **0,1%**	64,33 **0,3%**	223,08 **1,0%**	172,62 **1,4%**	22,08 **1,0%**	309,81 **2,6%**	0,09 **0,0%**	37,69 **0,3%**	7,47 **0,0%**	1,30 **0,0%**	0,17 **0,0%**
RCMRD Lesotho 00/14	0,34 **0,0%**	0,14 **0,0%**	n/a	n/a	n/a	n/a	0,26 **0,0%**	2,77 **0,2%**	0,48 **0,0%**	n/a	0,94 **0,0%**	n/a	n/a	n/a	0,00 **0,0%**	6,32 **0,0%**	6,18 **0,1%**	n/a	11,28 **0,1%**	1,53 **0,1%**	n/a	n/a	0,31 **0,0%**	n/a
RCMRD Malawi 00/10	1,83 **0,1%**	n/a	n/a	n/a	n/a	n/a	n/a	7,74 **0,5%**	n/a	n/a	13,50 **0,6%**	n/a	n/a	0,00 **0,0%**	3,20 **0,0%**	39,45 **0,2%**	0,00 **0,0%**	0,43 **0,0%**	26,68 **0,2%**	2,53 **0,2%**	0,00 **0,0%**	n/a	0,17 **0,0%**	0,09 **0,0%**
RCMRD Namibia 00/10	n/a	n/a	n/a	n/a	n/a	n/a	0,00 **0,0%**	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	9,81 **0,0%**	276,11 **2,3%**	0,00 **0,0%**	168,14 **1,4%**	0,00 **0,0%**	124,89 **1,0%**	245,07 **1,3%**	0,74 **0,0%**	n/a
RCMRD Rwanda 00/10	2,70 **0,2%**	2,34 **0,2%**	n/a	n/a	n/a	n/a	0,96 **0,1%**	1,56 **0,1%**	n/a	n/a	8,65 **0,4%**	n/a	n/a	0,00 **0,0%**	1,86 **0,0%**	4,41 **0,0%**	n/a	0,00 **0,0%**	2,06 **0,0%**	0,00 **0,0%**	n/a	n/a	0,20 **0,0%**	0,13 **0,0%**
RCMRD Tanzania 00/10	0,00 **0,0%**	0,11 **0,0%**	n/a	n/a	n/a	n/a	0,00 **0,0%**	5,55 **0,4%**	n/a	n/a	26,82 **1,2%**	0,00 **0,0%**	n/a	n/a	49,79 **0,3%**	490,72 **2,3%**	0,00 **0,0%**	8,09 **0,4%**	212,64 **1,8%**	61,07 **4,6%**	0,00 **0,0%**	0,00 **0,0%**	3,05 **0,1%**	0,25 **0,0%**
RCMRD Uganda 00/14	56,86 **3,9%**	14,91 **1,2%**	n/a	n/a	n/a	n/a	2,19 **0,1%**	13,65 **0,9%**	0,00 **0,0%**	n/a	52,50 **2,3%**	0,00 **0,0%**	n/a	2,94 **0,0%**	17,46 **0,1%**	37,24 **0,2%**	0,51 **0,0%**	1,11 **0,1%**	7,55 **0,1%**	0,90 **0,1%**	0,00 **0,0%**	n/a	1,29 **0,0%**	0,17 **0,0%**
RCMRD	0,00	n/a	n/a	n/a	n/a	n/a	n/a	1,38	n/a	n/a	30,00	n/a	n/a	0,00	108,95	461,81	1,08	1,65	143,72	0,03	0,00	0,09	2,61	0,43

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Zambia 00/10	0,0%					0,1%			1,3%			0,0%	0,6%	2,1%	0,0%	0,1%	1,2%	0,0%	0,0%	0,0%			0,1%	0,0%
MoFor Indonesia 00/03	26,14	0,28	136,43	3,76	106,22	8,91	1,20	2,72	12,65	5,99	113,75	359,84	139,35	551,05	229,20	49,54	0,00	4,03	8,33				37,37	9,97
	1,8%	0,0%	2,6%	0,3%	1,6%	0,6%	0,1%	0,2%	0,4%	0,2%	5,1%	9,1%	3,3%	4,2%	1,2%	0,2%	0,0%	0,2%	0,1%	n/a	n/a	n/a	1,1%	1,0%
MoFor Indonesia 03/06	26,14		136,52	3,76	106,22	8,91	1,20	2,72	12,65	5,99	113,75	359,88	139,35	551,06	229,20	49,54		4,03	8,33	0,54		0,65	37,37	9,97
	1,7%	n/a	2,6%	0,3%	1,6%	0,6%	0,1%	0,2%	0,4%	0,2%	5,2%	9,1%	3,3%	4,2%	1,2%	0,2%	n/a	0,2%	0,1%	0,0%	n/a	0,0%	1,1%	1,0%
MoFor Indonesia 06/09	26,14	0,28	136,56	3,76	106,21	8,91	1,20	2,72	12,65	5,99	113,75	359,89	139,35	551,02	229,24	49,55	0,19	4,03	8,33	0,54	0,00	0,65	37,37	9,97
	1,8%	0,0%	2,6%	0,0%	1,6%	0,6%	0,1%	0,2%	0,4%	0,2%	5,1%	9,1%	3,3%	4,2%	1,2%	0,2%	0,0%	0,2%	0,1%	0,0%	0,0%	0,0%	1,1%	1,0%
India LC 95/05	125,63	526,10	83,69	463,04	94,42	444,33	298,60	34,59	21,90	14,20	85,86	118,74	58,16	49,09	153,02	150,16	29,58	2,61	24,45	28,28	173,51	161,48	108,01	20,12
	8,6%	40,9%	1,6%	35,7%	1,4%	30,2%	18,1%	2,2%	0,6%	0,6%	3,8%	3,0%	1,4%	0,4%	0,8%	0,7%	0,2%	0,1%	0,2%	2,1%	1,4%	0,8%	3,1%	1,9%
Globeland30 00/10	1151,38	728,04	3505,98	763,83	2781,82	829,27	1049,63	1301,34	2073,02	1302,31	1623,86	2264,99	1741,12	10342,33	13810,34	16995,64	8985,99	1877,55	9288,05	1056,72	11595,31	17634,36	1897,89	517,46
	76,2%	56,7%	66,1%	58,6%	41,9%	56,4%	63,3%	81,9%	61,1%	50,9%	72,3%	57,3%	41,8%	78,7%	73,3%	79,1%	74,2%	85,8%	76,5%	79,1%	91,5%	91,4%	54,4%	49,3%