Development of GTAP version 11
Land Use and Land Cover database
for years 2004, 2007, 2011, 2014 and 2017

by

Uris Lantz C. Baldos and Erwin L. Corong

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I. Background and Motivation

Interdisciplinary assessment of renewable fuels policies, sustainable development targets and environmental issues rely on economic models and databases that incorporate spatially explicit information on land use and land cover (LULC). Over the past two decades, the GTAP LULC database and its variants have been extensively used in a wide variety of applications aimed at examining the land-environment-energy nexus (Golub & Hertel, 2012; Hertel et al., 2010; Johnson et al., 2023; Liu et al., 2014; Stevenson et al., 2013; Taheripour et al., 2019; Taheripour & Tyner, 2013; Tyner & Taheripour, 2007).

The first release of the GTAP LULC database combines geospatial data on land use and land cover into the version 6 GTAP database – benchmarked to year 2001 (GTAP LULCv.6) (Hertel et al., 2009; Lee et al., 2009). Succeeding updates of the GTAP LULC database (namely v.7 and v.8 for 2004 and v.8 for 2004, 2007) relied on readily available GTAP LULCv.6 database to distribute national-level data on land cover, crop production and harvested area across regions and agro-ecological zones (AEZs) using regularly updated country-level data from FAOSTAT (Avetisyan et al., 2010; U. L. C. Baldos & Hertel, 2012). GTAP LULCv.9 (for years 2004, 2007 and 2011) and v.10 (for years 2004, 2007, 2011 and 2014) are created directly from the latest, high-resolution (i.e. 5-minute) spatial land cover and land use maps, updated agro-ecological zone (AEZs) classification using data from FAO/IIASA GAEZ v.3 (IIASA/FAO, 2012) in combination with using national-level statistics from FAOSTAT to update land use and land cover (U. L. C. Baldos, 2017; U. L. Baldos & Corong, 2020).

This memorandum documents the development of the GTAP LULC v.11 database for years 2004, 2007, 2011, 2014 and 2017 (see Appendix I). In addition to using the GTAP v.11 Data Base (Aguiar et al., 2023) as starting point, the main differences between v.10 and v.11 GTAP LULC data consist of (1) updating the AEZ boundaries given length of growing periods and climate zones from FAO/IIASA GAEZ v.4 (Fischer et al., 2021) and (2) using latest data from FAOSTAT (FAO, 2023) on national land use and land cover. This update heavily relies on the methodology for creating GTAP LULC v.9 and v.10 which downscales national-level land cover crop production and harvested area statistics from FAOSTAT (FAO, 2023).

II. Highlights of the GTAP LULC Database v.11

a. Land Cover

Figures 1, 2 and 3 illustrate the global distribution of cropland, pasture and forest land cover area by region and AEZ for the years 2004, 2007, 2011, 2014 and 2017. These figures show that the spatial distribution of these major land cover types generally remained the same over these years. Looking at the cropland maps (Figure 1), sizable cropland areas (i.e. dark colored polygons) are observed in the U.S. (AEZ8, AEZ10 and AEZ11), Russia (AEZ8, AEZ9 and AEZ10), India (AEZ3), Indonesia (AEZ6), China (AEZ9, AEZ10 and AEZ12) and Australia (AEZ8 and AEZ9). The maps also show that cropland cover in Indonesia have increased over this period. The distribution of pastureland cover is illustrated in Figure 2. Land cover areas for pastureland are generally larger than that of cropland. Most pastureland cover are concentrated in Australia (AEZ7), Saudi Arabia (AEZ7), Brazil (AEZ5), Kazakhstan (AEZ7), China (AEZ7, AEZ8 and AEZ9) and the U.S. (AEZ8). The distribution of forest cover shows that most of the world's forests[1] are in boreal and tropical climate zones (Figure 3). Regions with large forest cover include Russia (AEZ14 and AEZ15), Brazil (AEZ6), the U.S. (AEZ10, AEZ11 and AEZ12), Canada (AEZ9), Democratic Republic of the Congo (AEZ6), China (AEZ 12) and Indonesia (AEZ6).

Table 1 summarizes total land cover of cropland, pasture and forest – summed for all countries – for each AEZ given the benchmark years in the GTAP LULC v.11 database. Globally, around 60% of cropland cover are located in AEZ8 to AEZ12. Note that the climate zone in AEZ8 to AEZ12 are classified as "Tropical cool to Temperate cool" with growing days ranging from 60 to 360 days. From 2004 to 2017, cropland area increased by around 57.5 million hectares with most of the increase in cropland located in AEZ1 to AEZ6 which are under "Tropical" climate zone. Table 1 also shows that roughly half of world's pastureland is concentrated in AEZ7 to AEZ9. Pastureland cover has declined over the period 2004 to 2017 by around 106.6 million hectares globally. Around 80% of the reduction in pastureland are located in AEZ1 to AEZ3 ("Tropical" climate zones) and AEZ7 to AEZ8 ("Tropical cool to Temperate cool" climate zones). Most of the world's forests are generally located in AEZ5 and AEZ6 ("Tropical" climate zones), as well as in AEZ9 to AEZ12 ("Tropical cool to Temperate cool" climate zones). From 2004 to

[1] Forestland in the GTAP LULC database refers to accessible forest cover which refers to forests which can supply wood within 10 kilometers of infrastructure (including rivers) with some adjustments in distance for certain countries (Sohngen et al., 2008).

2017, global forestland area remained flat increasing only by around 1.7 million hectares. Over this period, decline in forestland are observed in AEZ4 to AEZ6 ("Tropical" climate zones) while forestland increased in AEZ9 to AEZ11 ("Tropical cool to Temperate cool" climate zones). Table 2 shows cropland, pasture and forest land cover for selected GTAP regions and for years 2004, 2007, 2011, 2014 and 2017. Between 2004 and 2017, cropland cover in the U.S. has declined by around 10.8 million hectares while it increased in Indonesia, Australia and Brazil by roughly 8.9, 5.0, and 4.8 million hectares, respectively. Looking at pastureland, pasture area contracted in Australia by about 28.1 million hectares whereas it expanded in the U.S. and Brazil by approximately 3.6 and 3.3 million hectares, respectively. Over this period, forest cover increased slightly in the U.S. by 4.5 million hectares but declined in China, Brazil and Indonesia (by about 1.1, 1.7, and 2.4 million hectares, respectively)

b. Land Use

Global distribution of coarse grains, paddy rice and wheat production (left, middle and right panels) for years 2004, 2007, 2011, 2014 and 2017 are illustrated in Figure 4. Most of the world's coarse grains (left panel) are produced in the U.S. (AEZ10, AEZ11), China (AEZ9 and AEZ10), Argentina (AEZ12), Brazil (AEZ5, AEZ6, and AEZ12), Russia (AEZ9) and Ukraine (AEZ10). From 2004 to 2017, some of the AEZs in Brazil, Argentina, China and Indonesia become darker indicating growing production of coarse grains in these areas. Hotspots for global paddy rice production (middle panel) are generally concentrated in East, South and Southeast Asia specifically in China (AEZ11 and AEZ12), India (AEZ3, AEZ4, AEZ9), Indonesia (AEZ6), Thailand (AEZ4, AEZ5), Vietnam (AEZ5), and Bangladesh (AEZ4, AEZ5). Global production of wheat are generally located in the "Tropical cool to Temperate cool" climate zones. Regions with high wheat production include China (AEZ9 to AEZ11), Russia (AEZ8 and AEZ9), India (AEZ8 and AEZ9), France (AEZ11), Canada (AEZ8), and the U.S. (AEZ9). Figure 5 shows the global distribution of harvested areas for coarse grains, paddy rice and wheat (left, middle and right panels) for benchmark years 2004, 2007, 2011, 2014 and 2017. The hotspots of harvested area are in the same region-AEZs where production hotspots are observed.

Global production and harvested area for GTAP crop groups and for each benchmark year in the GTAP LULC v.11 database are shown in Table 3. World production for most of these crop groups grew during the period 2004-2017. Global production of Fruits and Vegetables, Sugar Cane

and Beet, Oilseeds and Coarse Grains increased by around 671, 571, 473 and 399 million metric tons, respectively. World output of Paddy Rice and Wheat also grew strongly by around 144 and 137 million metric tons, respectively. For Other Crops and Plant Fibre crop groups, production remained flat (increasing by 50 and 3 million metric tons, respectively). With strong production growth, it is not surprising that global harvested areas particularly for Oilseeds, Fruits and Vegetables, and Coarse Grains also expanded by about 76, 58 36 million hectares. Sugar Cane and Beet and Paddy Rice also showed modest expansion in crop harvested area (by roughly 6 and 13 million hectares). Tables 4 and 5 summarize production and harvested areas of coarse grains, paddy rice, and wheat for selected countries, respectively. China, US and Brazil, which are major producers of coarse grains, increased production over the period 2004 to 2017 by about 127, 65 and 56 million metric tons, respectively. Over this period, Brazil's coarse grain production outpaced other regions increasing by around 82%. Top producers of paddy rice include India and China with production expanding by roughly 44 and 34 million metric tons, respectively. China, Russia and India are top producers of wheat and these countries grew their wheat production by around 42, 40 and 26 million metric tons, respectively. In general, increases in crop production are also accompanied by increases in crop harvested areas especially for Coarse Grains and Paddy Rice in China (15.9 and 2.4 million ha, respectively) and Wheat in Russia and India (4.6 and 4.2 million ha, respectively) (Table 5).

b. Land Rents

Figure 6 shows the after tax value of land endowment supply (EVOS) by region and AEZ. Value of land endowments are highest in China (AEZ9 to AEZ12), Indonesia (AEZ6), India (AEZ3, AEZ4) and the U.S. (AEZ 10 to AEZ 12). Summing EVOS across all regions, Table 6 shows the value of land endowments by AEZ. More than half of the land rents are concentrated in AEZ6, AEZ10 to AEZ12. Globally, the value of land endowment increased by around 18% over the period 2004 to 2017 with most of the increase in value coming from AEZ6, AEZ9 and AEZ10. Table 7 shows the value of land endowment for selected GTAP sectors. Around 48% of the value of land endowments are used in the Fruits and Vegetables and Forestry sectors and most of the global gain in the value of land endowments are due to increases in these sectors.

c. Comparing land cover, land use and land rents in v.11 and v.10

Due to the difference in agroecological zone information (i.e. GAEZ v.4 vs v.3), there are some changes in the distribution of land use and land cover for the same base year in v.11 and v.10. Difference in cropland, forest and pasture cover by AEZ are highlighted in Figure 7 (left, middle and right panels) for years 2004, 2007, 2011 and 2014. The circle markers represent v.10 data while square markers represent v.11 data. Looking at cropland cover, large deviations between v.11 and v.10 are observed in AEZ4, AEZ6, AEZ8, AEZ11 and AEZ12. Cropland cover in AEZ6, AEZ11 and AEZ12 are larger under v.11 relative to v.10 while cropland area is smaller in v.11 for AEZ4 and AEZ8. Forestland cover in AEZ6 is larger in v.11 than in v.10 while it is smaller for AEZ14. For pastureland, the area in AEZ8 in v.11 is smaller compared to v.10.

There are also differences in the patterns of crop production and harvested area. Figures 8 and 9 show the production and harvested area of coarse grains, paddy rice and wheat (left, middle and right panels) by AEZ for years 2004, 2007, 2011 and 2014. Starting with coarse grains, notable differences in production and harvested areas between v.11 and v.10 are observed in AEZ8, AEZ9 and AEZ11. For paddy rice, there are some deviations between v.11 and v.10 in AEZ11 and AEZ12 but these are relatively smaller in magnitude compared to other crop categories. For wheat, large differences in production and harvested area between the two versions are observed in AEZ8 and AEZ11.

Figure 10 shows the differences in the computed land rents for v.11 and v.10 for years 2004, 2007, 2011 and 2014 by AEZ. In Y2004 and Y2007, the computed land rents are generally smaller under v.11 in most AEZs. For years 2011 and 2014, the computed land rents in AEZ6, AEZ7, AEZ11 and AEZ12 are larger in v.11 than in v.10 while land rents are smaller in AEZ4, AEZ8, AEZ9 and AEZ10. Aside from the difference in agroecological zones, the difference in the base data versions likely resulted in different land rents across v.11 and v.10.

III. Summary and conclusion

The GTAP LULCv.11 is created directly from publicly available high-resolution (i.e. 5-minute) spatial land cover and land use maps combined with updated information on length of growing periods and climate zones from FAO/IIASA GAEZ v.4 (Fischer et al., 2021) and using latest data from FAOSTAT (FAO, 2023) and GTAP database version 11 for the base years 2004, 2007, 2011, 2014 and 2017. With better capacity to handle spatial data within the Center, future versions of the

GTAP LULC can immediately incorporate new geospatial information allowing us to have a better understanding of the tensions and trade-offs in the land environment-energy nexus. In the future, new versions of the upcoming land use and land cover database will be immediately incorporated when latest land use and land cover maps become available. We will also mainstream the creation of the GTAP LULC database allowing us to create this database immediately as soon as new GTAP base data versions are available. Finally, work is underway to incorporate volume preserving land use (CET and/or CRETH) functions in the GTAP-AEZ model and to implement the AEZ framework in the recursive dynamic GTAP model.

References

Aguiar, A., Chepeliev, M., Corong, E., & van der Mensbrugghe, D. (2023). The Global Trade Analysis Project (GTAP) Data Base: Version 11. *Journal of Global Economic Analysis*, *7*(2). https://doi.org/10.21642/JGEA.070201AF (Original work published December 19, 2022)

Avetisyan, M., Baldos, U. L. C., & Hertel, T. W. (2010). *Development of the GTAP Version 7 land Use Data Base* (GTAP Research Memorandum No. 19). Purdue University.

Baldos, U. L. C. (2017). *Development of GTAP version 9 Land Use and Land Cover database for years 2004, 2007 and 2011*. Center for Global Trade Analysis, Department of Agricultural Economics ….

Baldos, U. L. C., & Hertel, T. W. (2012). Development of a GTAP 8 land use and land cover data base for years 2004 and 2007. *GTAP Research Memorandum: West Lafayette, IN, USA.*

Baldos, U. L., & Corong, E. (2020). *Development of GTAP 10 Land Use and Land Cover Data Base for years 2004, 2007, 2011 and 2014* (GTAP Research Memorandum 36). Global Trade Analysis Project (GTAP). https://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=6187

FAO. (2023). *FAOSTAT Database*. http://faostat.fao.org/

Fischer, G., Nachtergaele, F., Velthuizen, H., Chiozza, F., Franceschini, G., Henry, M., Muchoney, D., & Tramberend, S. (2021). *Global Agro-Ecological Zones v4 – Model documentation*. https://doi.org/10.4060/cb4744en

Global ADMinistrative Areas (GADM). (2016). *Global Administrative Areas*. http://gadm.org/country

Golub, A. A., & Hertel, T. W. (2012). Modeling Land Use Change Impacts of Biofuels in the GTAP-BIO Model. *Climate Change Economics, 3*(3).

Hertel, T. W., Golub, A. A., Jones, A., O'Hare, M., Plevin, R. J., & Kammen, D. M. (2010). Effects of US Maize Ethanol on Global Land Use and Greenhouse Gas Emissions: Estimating Market-mediated Responses. *Bioscience*, *60*(3).

Hertel, T. W., Lee, H., Rose, S. K., & Sohngen, B. L. (2009). Modeling Land-use Related Greenhouse Gas Sources and Sinks and their Mitigation Potential. In T. W. Hertel, S. K. Rose, & R. S. J. Tol (Eds.), *Economic Analysis of Land Use in Global Climate Change Policy*. Routledge Press.

International Insititute for Applied Systems Analysis, & Food and Agriculture Organisation of the United Nations. (2012). *Global Agro-ecological Zones (GAEZ v3.0)* (p. 196). IIASA, Laxenburg, Austria; FAO, Rome, Italy. http://www.gaez.iiasa.ac.at/docs/GAEZ_Model_Documentation.pdf

Johnson, J. A., Baldos, U. L., Corong, E., Hertel, T., Polasky, S., Cervigni, R., Roxburgh, T., Ruta, G., Salemi, C., & Thakrar, S. (2023). Investing in nature can improve equity and economic returns. *Proceedings of the National Academy of Sciences*, *120*(27), e2220401120. https://doi.org/10.1073/pnas.2220401120

Lee, H. L., Hertel, T. W., Rose, S. K., & Avetsiyan, M. (2009). An Integrated Land Use Data Base for CGE Analysis of Climate Policy Options. In T. W. Hertel, S. K. Rose, & R. S. J. Tol (Eds.), *Economic Analysis of Land Use in Global Climate Change Policy*. Routledge Press.

Liu, J., Hertel, T. W., Taheripour, F., Zhu, T., & Ringler, C. (2014). International trade buffers the impact of future irrigation shortfalls. *Global Environmental Change*, *29*, 22–31. https://doi.org/10.1016/j.gloenvcha.2014.07.010

Monfreda, C., Ramankutty, N., & Foley, J. A. (2008). Farming the planet: 2. Geographic distribution of crop areas, yields, physiological types, and net primary production in the

year 2000. *Global Biogeochemical Cycles*, *22*, 19 PP. https://doi.org/200810.1029/2007GB002947

Panagos, P., Van Liedekerke, M., Jones, A., & Montanarella, L. (2012). European Soil Data Centre: Response to European policy support and public data requirements. *Land Use Policy*, *29*(2), 329–338. https://doi.org/10.1016/j.landusepol.2011.07.003

Ramankutty, N., Evan, A. T., Monfreda, C., & Foley, J. A. (2008). *Farming the planet: 1. Geographic distribution of global agricultural lands in the year 2000*. http://www.agu.org/pubs/crossref/2008/2007GB002952.shtml

Ramankutty, N., & Foley, J. A. (1999). Estimating historical changes in global land cover: Croplands from 1700 to 1992. *Global Biogeochemical Cycles*, *13*(4), PP. 997-1027. https://doi.org/199910.1029/1999GB900046

Schneider, A., Friedl, M. A., & Potere, D. (2009). A new map of global urban extent from MODIS satellite data. *Environmental Research Letters*, *4*(4), 044003. https://doi.org/10.1088/1748-9326/4/4/044003

Schneider, A., Friedl, M. A., & Potere, D. (2010). Mapping global urban areas using MODIS 500-m data: New methods and datasets based on "urban ecoregions." *Remote Sensing of Environment*, *114*(8), 1733–1746. https://doi.org/10.1016/j.rse.2010.03.003

Sohngen, B. L., Tennity, C., Hnytka, M., & Meeusen, K. (2008). *Global Forestry Data for the Economic Modeling of Land Use*. Center for Global Trade Analysis, Department of Agricultural Economics, Purdue University. http://ideas.repec.org/p/gta/workpp/2602.html

Stevenson, J. R., Villoria, N. B., Byerlee, D., Kelley, T., & Maredia, M. (2013). Green Revolution research saved an estimated 18 to 27 million hectares from being brought into

agricultural production. *Proceedings of the National Academy of Sciences*, *110*(21), 8363–8368. https://doi.org/10.1073/pnas.1208065110

Taheripour, F., Hertel, T. W., & Ramankutty, N. (2019). Market-mediated responses confound policies to limit deforestation from oil palm expansion in Malaysia and Indonesia. *Proceedings of the National Academy of Sciences*, *116*(38), 19193–19199. https://doi.org/10.1073/pnas.1903476116

Taheripour, F., & Tyner, W. E. (2013). Biofuels and Land Use Change: Applying Recent Evidence to Model Estimates. *Applied Sciences*, *3*(1), 14–38. https://doi.org/10.3390/app3010014

Tyner, W. E., & Taheripour, F. (2007). Renewable Energy Policy Alternatives for the Future. *American Journal of Agricultural Economics*, *89*(5), 1303–1310.

Wint, G. R. W., & Robinson, T. P. (2007). *Gridded Livestock of the World* (p. 131). Food and Agriculture Organization of the United Nations.

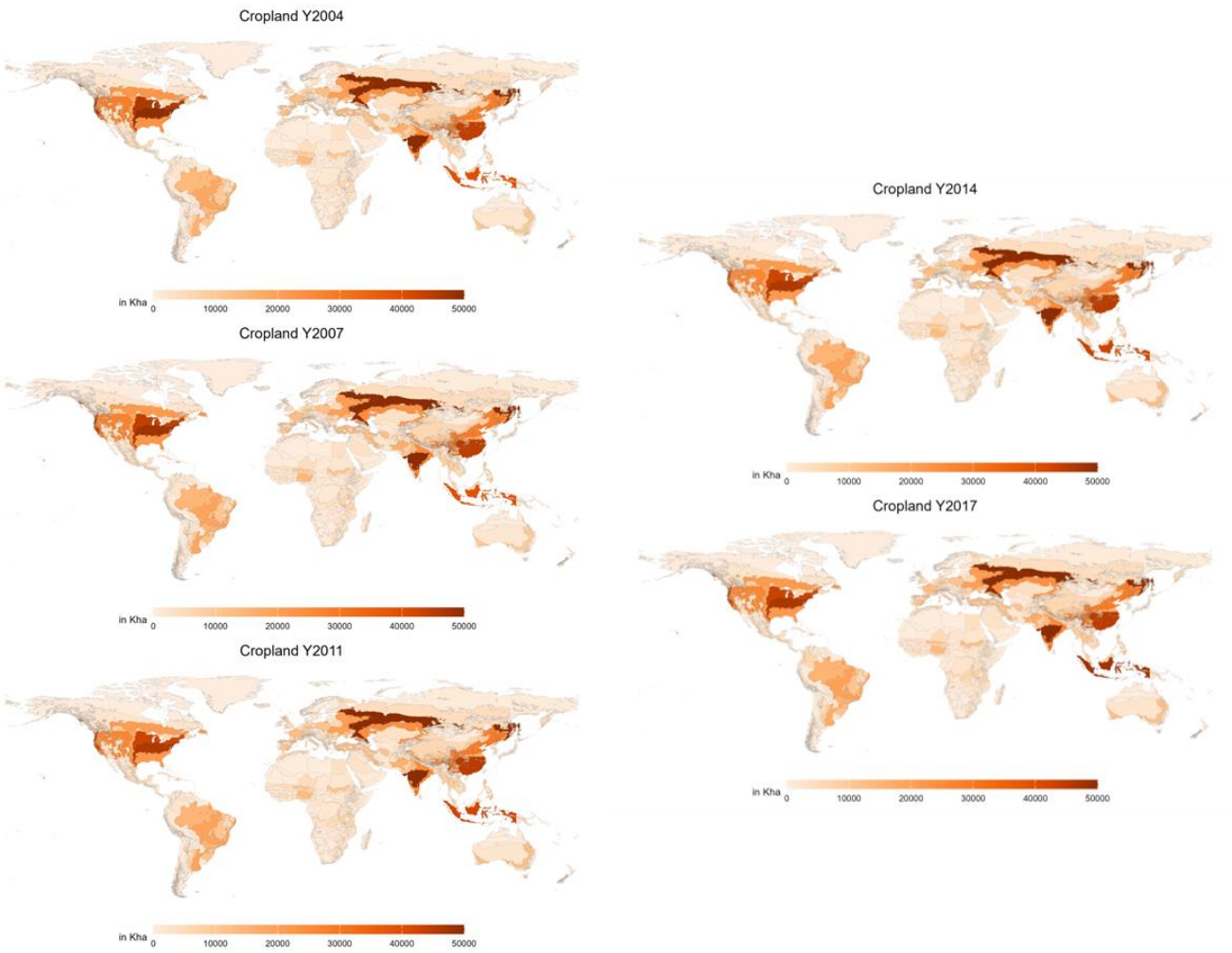


Figure 1. Global distribution of cropland by region and AEZ

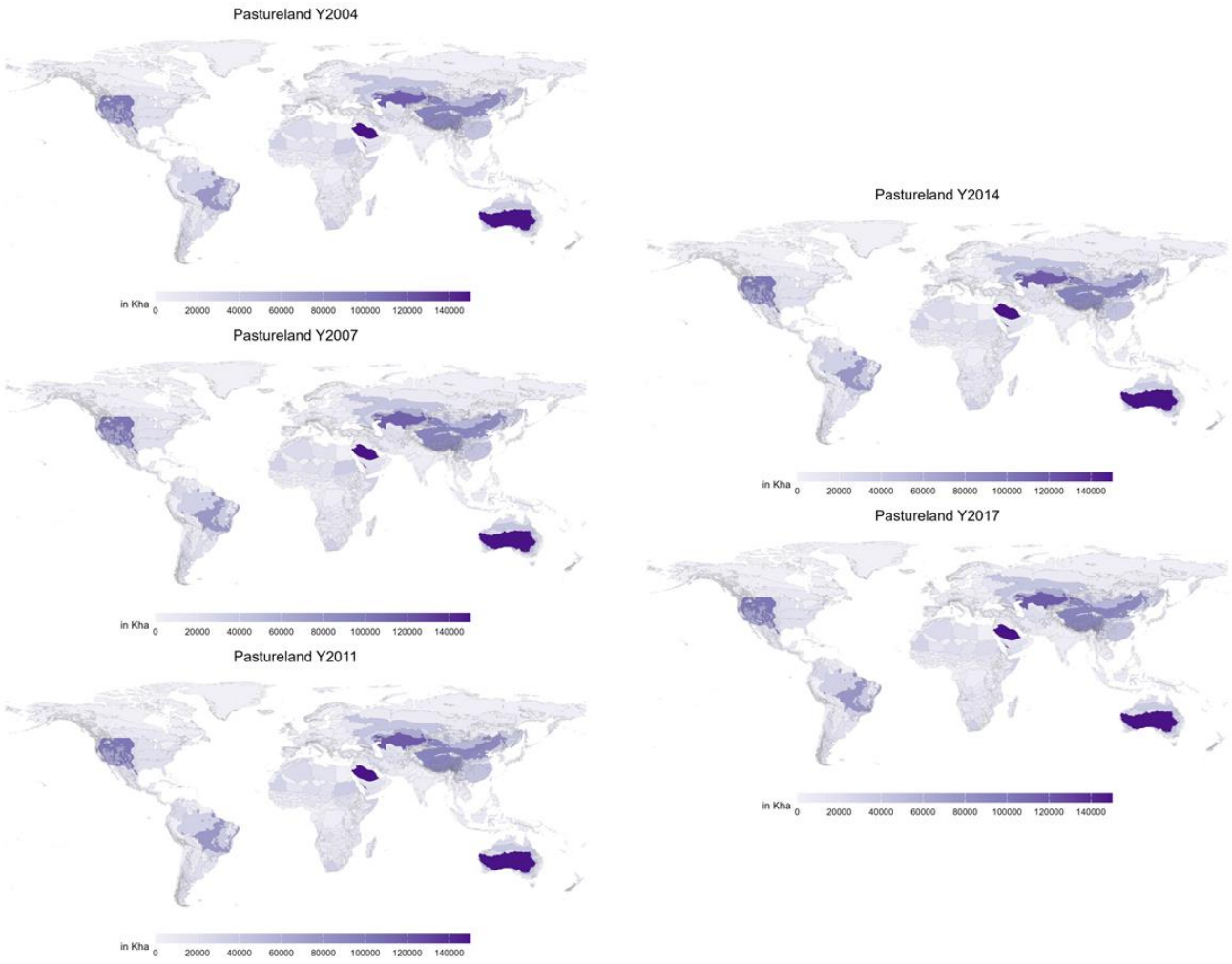


Figure 2. Global distribution of pastureland by region and AEZ

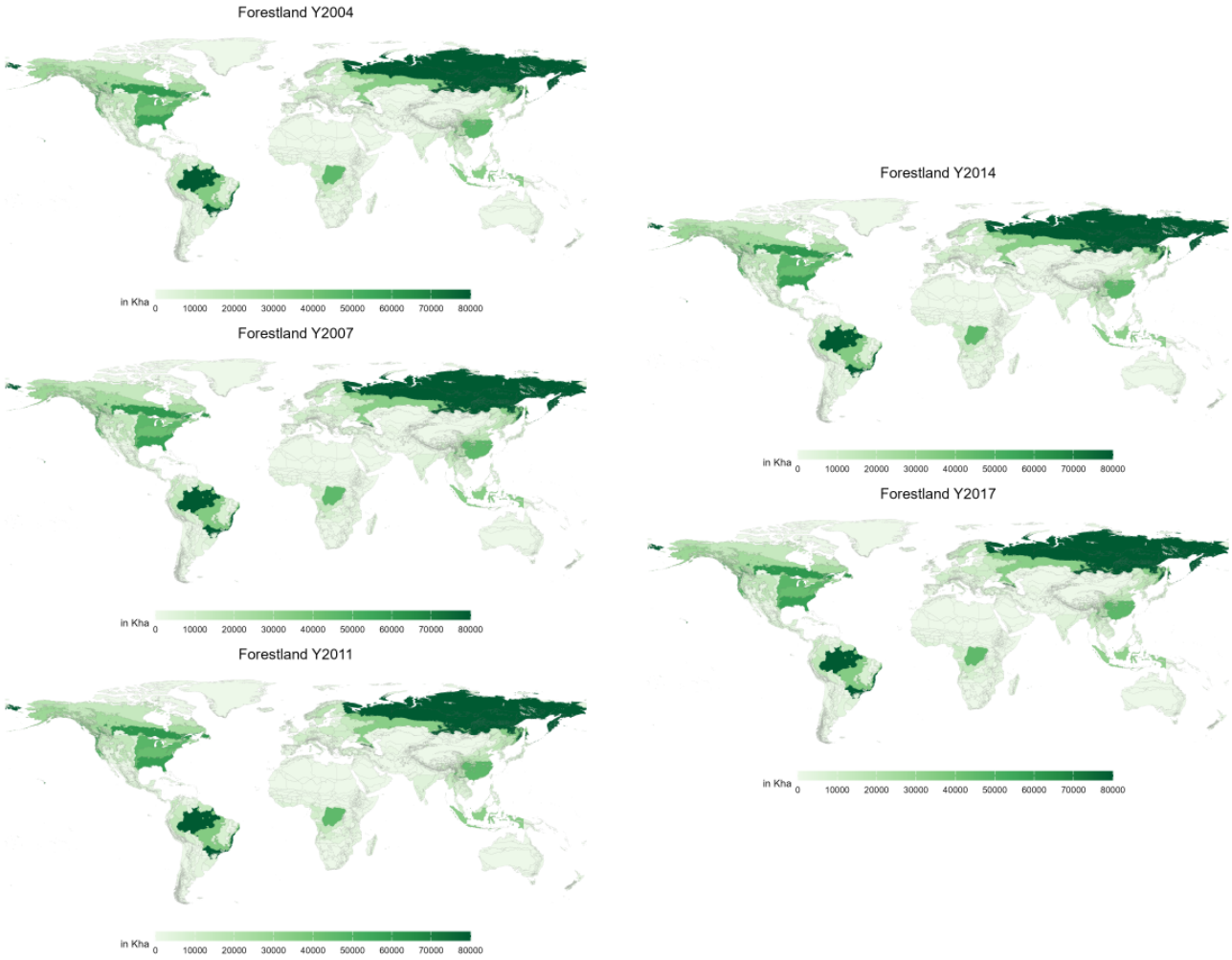


Figure 3. Global distribution of forests by region and AEZ

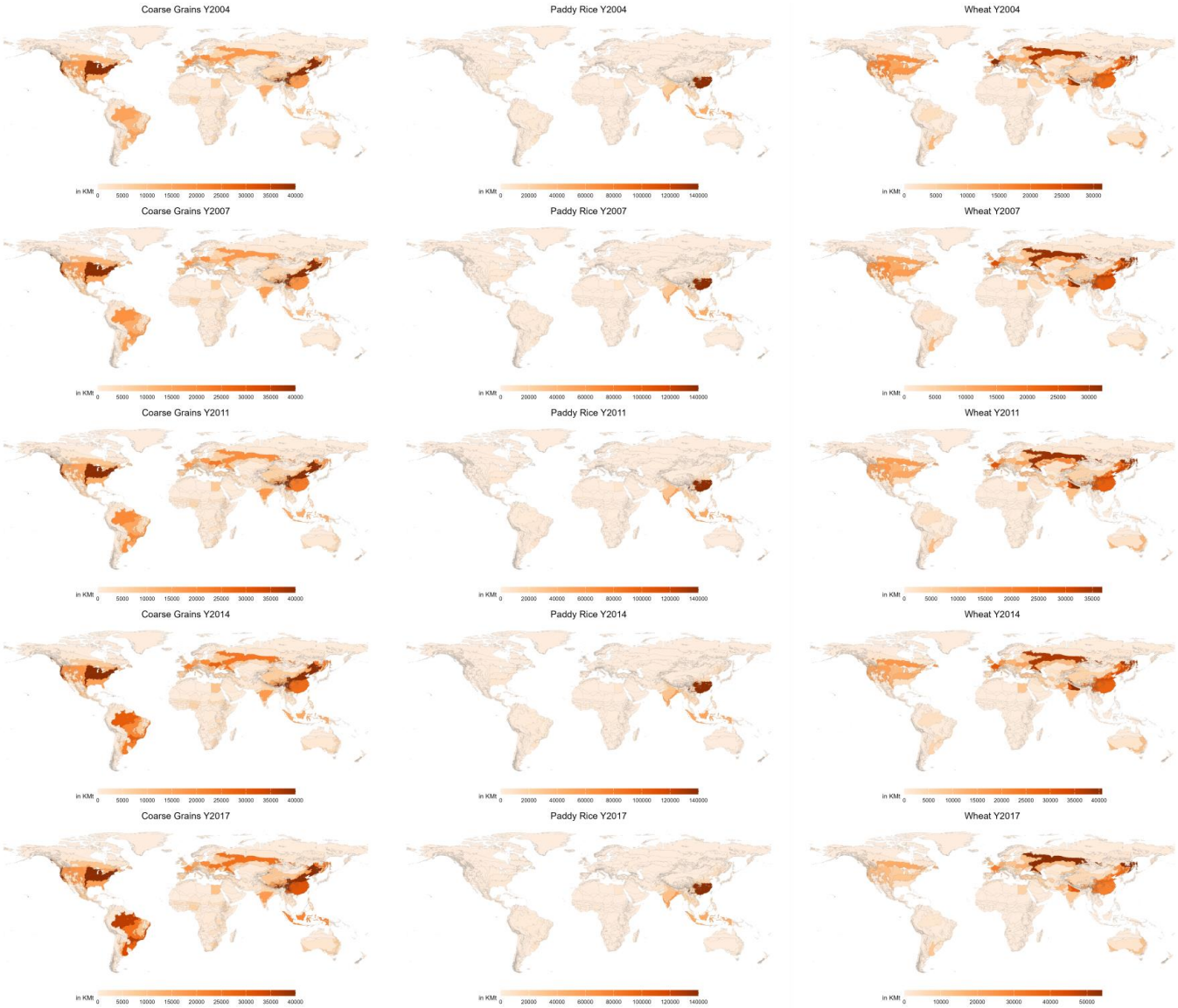


Figure 4. Production of coarse grains, paddy rice and wheat by region and AEZ

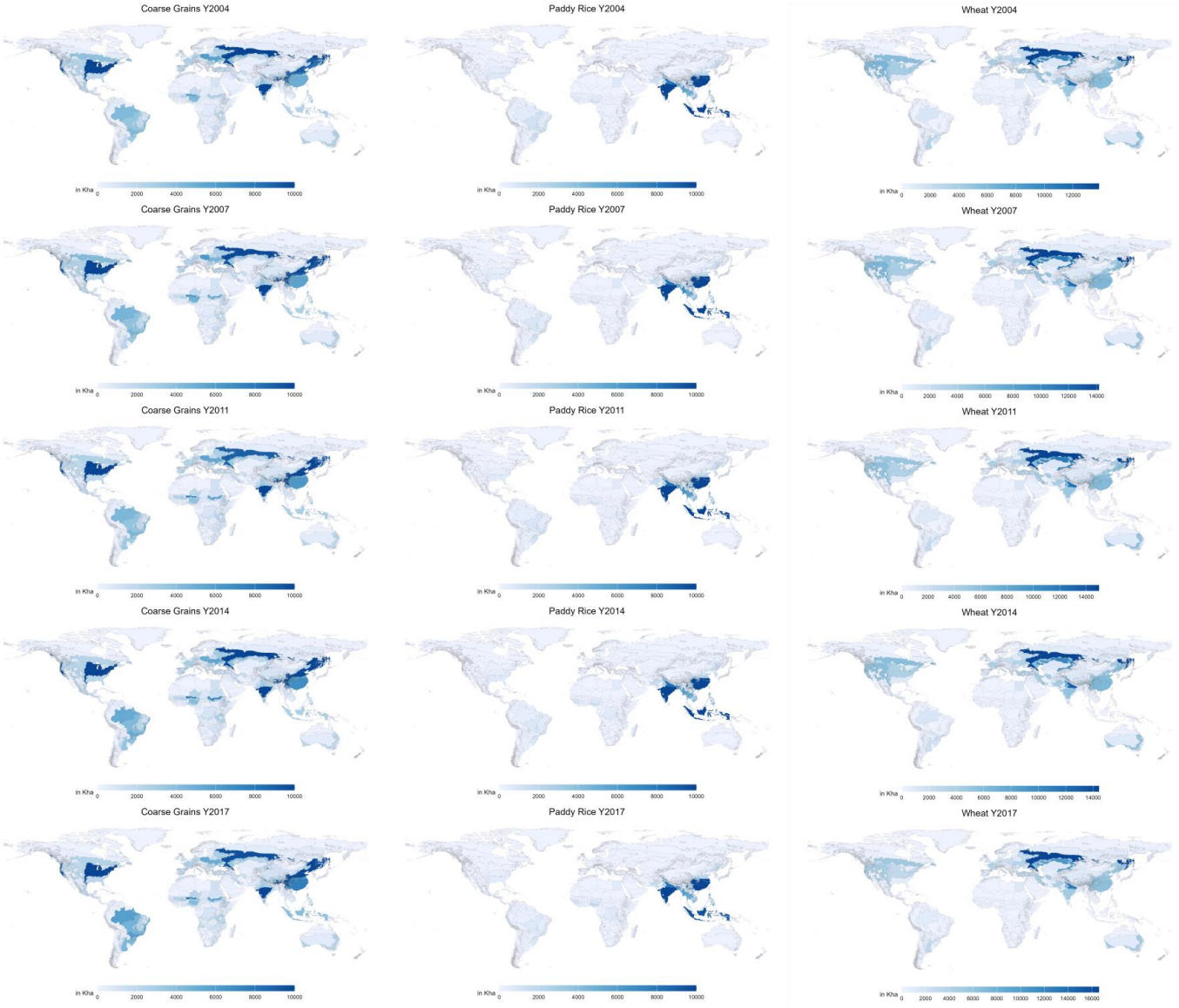


Figure 5. Harvested area of coarse grains, paddy rice and wheat by region and AEZ

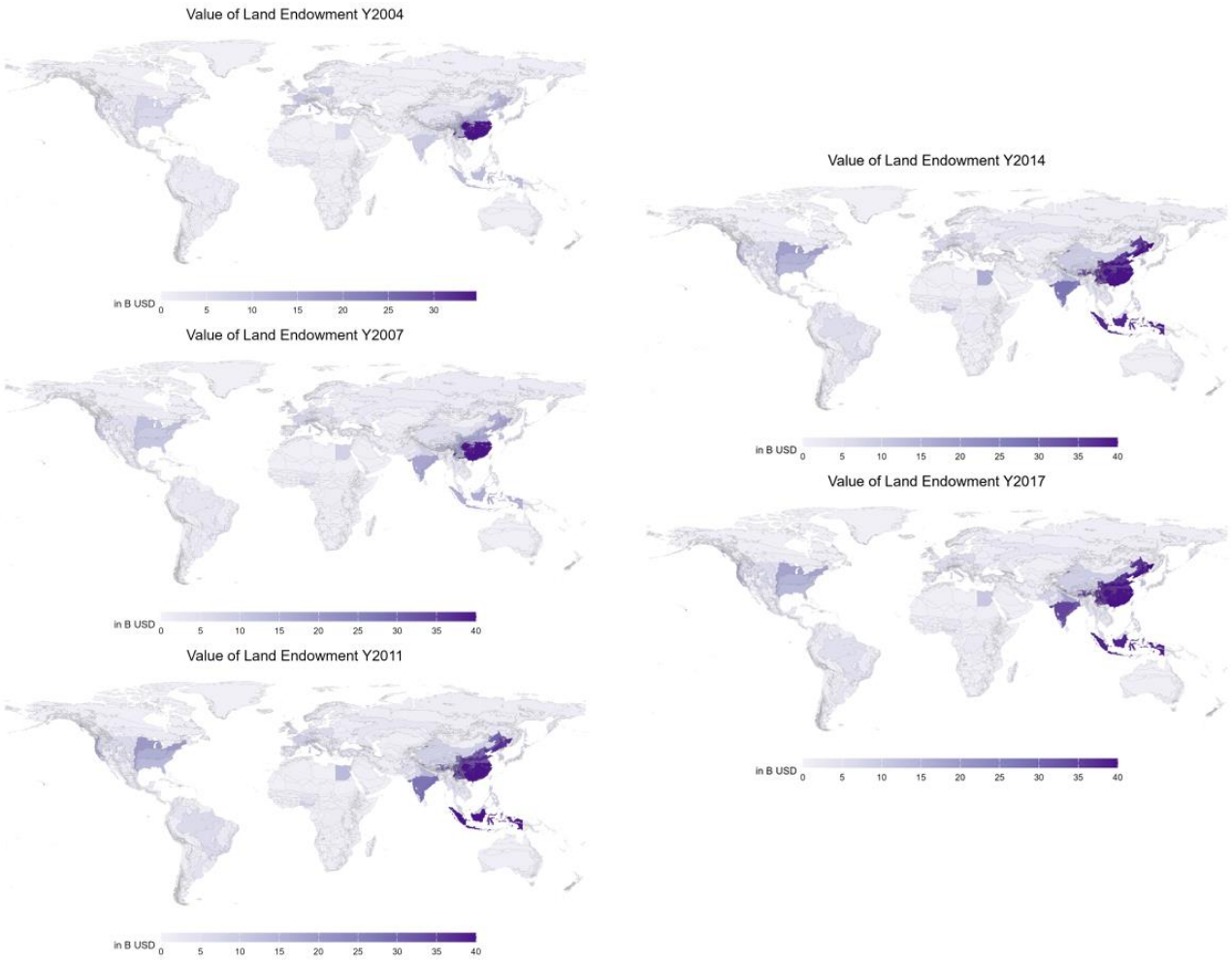


Figure 6. After tax value of land endowment supply (EVOS) by region and AEZ in M USD

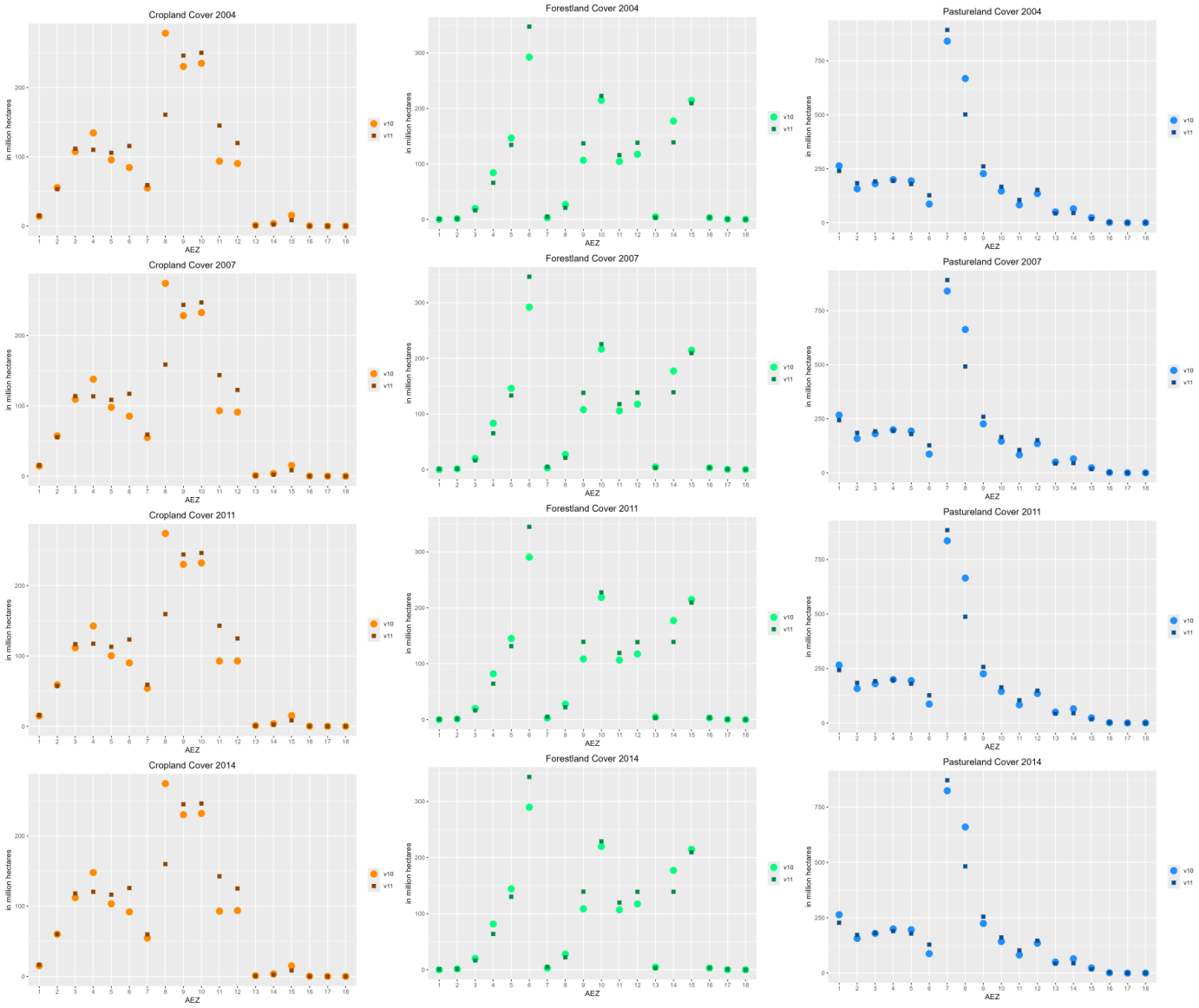


Figure 7. Cropland, forestland and pastureland cover by AEZ

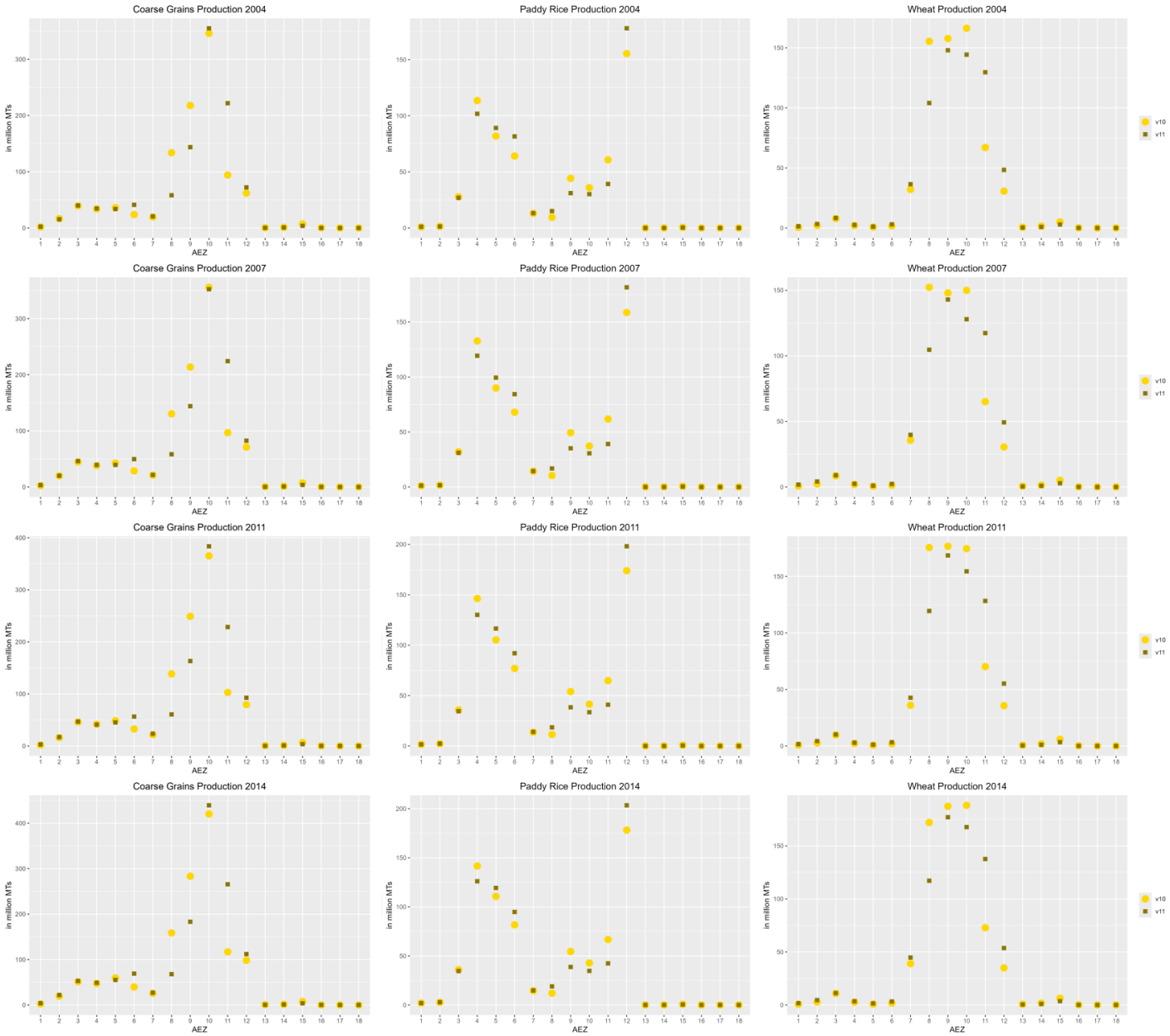


Figure 8. Production of coarse grains, paddy rice and wheat by AEZ

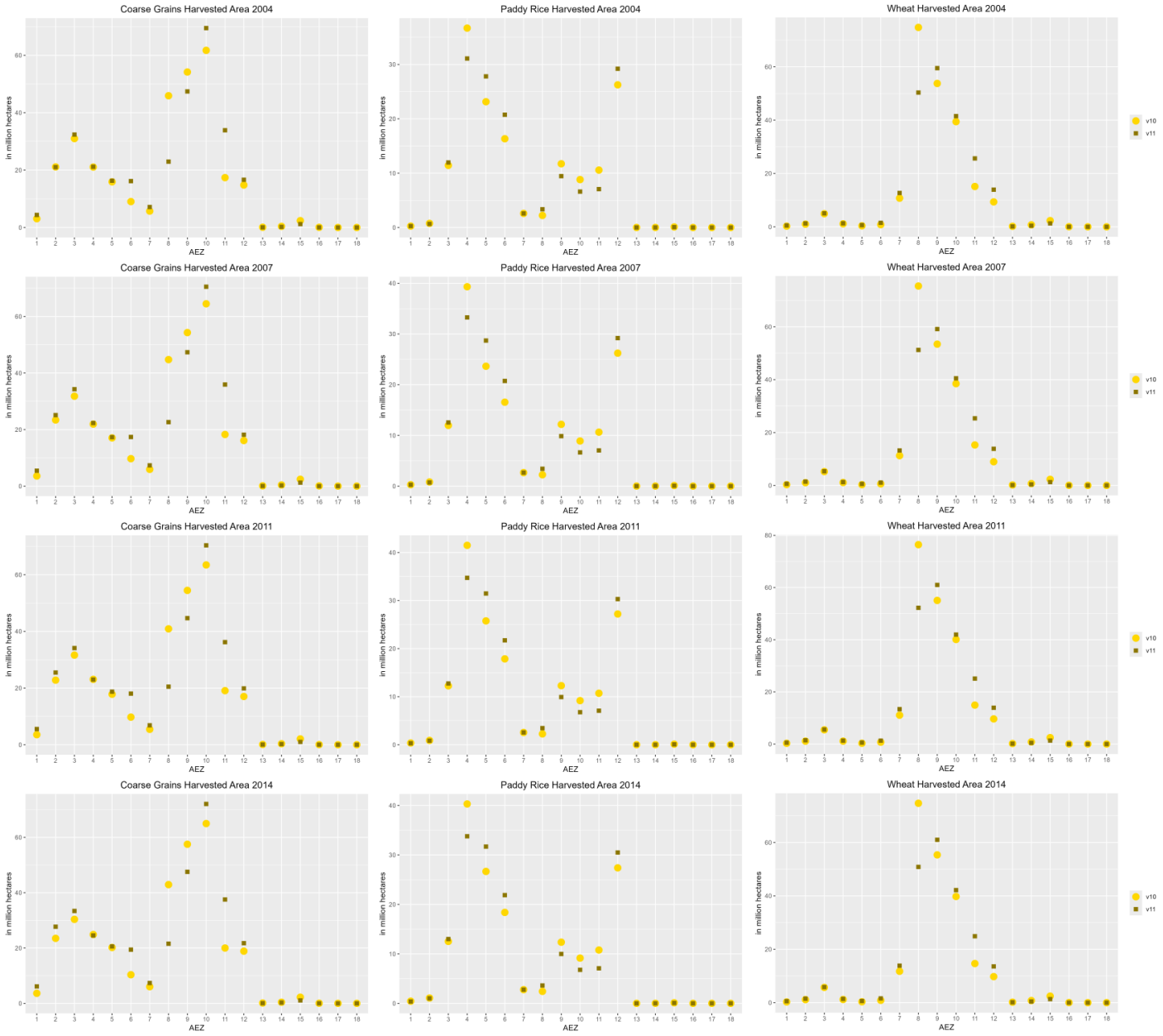


Figure 9. Harvested area of coarse grains, paddy rice and wheat by AEZ

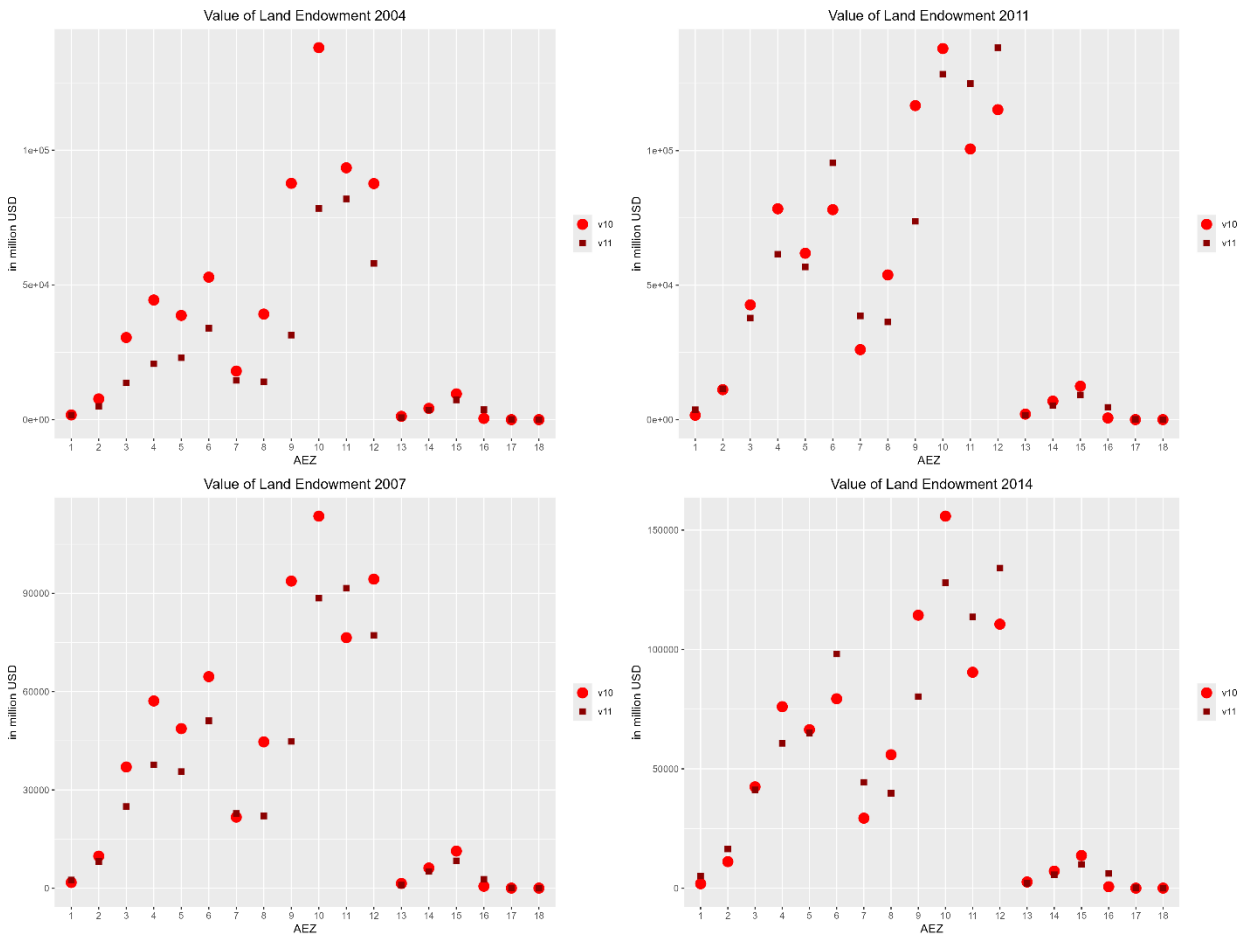


Figure 10. After tax value of land endowment supply (EVOS) in M USD by AEZ

Table 1. Cropland, Pastureland and Forestland Area by AEZ

Area (in M ha)	Cropland					Pastureland					Forestland				
	2004	2007	2011	2014	2017	2004	2007	2011	2014	2017	2004	2007	2011	2014	2017
AEZ1	15.0	15.4	15.7	16.6	16.9	239.6	243.5	242.4	227.5	227.5	0.7	0.7	0.7	0.7	0.7
AEZ2	53.3	55.3	57.4	60.1	61.1	183.4	185.0	184.0	172.4	172.4	1.3	1.3	1.4	1.4	1.4
AEZ3	111.8	113.8	116.8	118.1	118.2	191.7	192.2	192.3	180.7	181.3	16.4	16.4	16.5	16.7	16.8
AEZ4	110.1	113.5	117.4	120.4	121.4	194.5	194.2	196.6	189.7	191.3	66.0	65.2	64.3	63.8	63.3
AEZ5	105.8	108.5	113.0	116.4	118.8	179.0	179.1	180.2	178.5	179.4	134.1	133.1	131.5	130.1	129.0
AEZ6	115.6	117.1	123.4	125.8	135.9	127.2	127.1	127.0	128.7	127.9	347.4	346.7	344.8	343.7	341.1
AEZ7	59.2	59.2	59.2	59.8	60.3	892.9	891.4	884.7	871.0	868.3	4.9	4.9	5.0	5.1	5.1
AEZ8	160.8	158.7	159.5	159.9	160.1	501.3	491.8	487.5	482.4	480.6	21.0	21.1	22.1	22.2	22.3
AEZ9	246.1	243.5	244.2	245.1	244.9	261.1	259.5	257.2	255.0	254.3	137.0	137.9	139.1	139.2	139.3
AEZ10	250.2	246.9	246.4	246.1	245.8	166.7	165.7	163.7	161.2	160.9	222.6	225.6	227.6	228.8	229.3
AEZ11	145.1	143.7	143.0	142.6	141.8	105.7	105.8	104.4	102.7	102.3	115.9	117.6	119.3	119.7	119.8
AEZ12	119.9	122.6	124.9	125.1	125.1	152.5	151.2	148.4	146.6	145.1	138.3	138.3	138.6	139.0	139.1
AEZ13	0.7	0.7	0.7	0.8	0.8	43.1	43.1	42.9	42.7	42.5	3.3	3.3	3.3	3.3	3.3
AEZ14	2.4	2.4	2.4	2.4	2.4	45.0	45.0	44.7	44.4	44.2	138.9	138.9	138.9	138.9	139.0
AEZ15	8.6	8.5	8.5	8.5	8.5	17.4	17.3	17.1	17.0	16.9	209.2	209.3	209.3	209.3	209.3
AEZ16	0.1	0.1	0.1	0.1	0.1	2.5	2.5	2.4	2.4	2.4	3.4	3.5	3.5	3.5	3.5
AEZ17	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.2	0.5	0.5	0.5	0.5	0.5
AEZ18	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
TOTAL	1504.6	1510.0	1532.4	1547.8	1562.1	3303.9	3294.7	3275.7	3202.9	3197.3	1560.9	1564.1	1566.3	1565.9	1562.7

Table 2. Cropland, Pastureland and Forestland Area for Selected Countries

Area (in M ha)	Cropland					Pastureland					Forestland				
	2004	2007	2011	2014	2017	2004	2007	2011	2014	2017	2004	2007	2011	2014	2017
Australia	26.1	23.5	32.1	32.3	31.1	368.8	374.8	364.0	342.1	340.8	1.3	1.3	1.3	1.3	1.3
Brazil	58.7	60.9	61.9	62.7	63.5	170.1	168.8	170.6	172.0	173.4	153.9	153.7	153.1	152.6	152.2
Canada	40.1	39.1	37.5	38.2	38.7	21.7	21.0	20.2	19.7	19.3	129.8	130.6	131.5	131.4	131.3
China	133.3	135.0	136.1	135.9	135.7	392.8	392.8	392.8	392.8	392.8	104.0	103.2	102.8	102.8	102.9
France	19.5	19.4	19.3	19.3	19.5	10.0	9.8	9.6	9.4	9.2	16.0	16.2	16.4	16.5	16.5
Indonesia	42.4	42.0	45.5	46.0	51.3	11.0	11.0	11.0	11.0	11.0	34.6	34.7	33.7	33.6	32.1
India	169.9	169.2	169.4	169.5	168.9	10.5	10.4	10.3	10.3	10.3	16.2	16.3	16.3	16.3	16.3
Russia	124.0	123.4	123.4	123.4	123.4	92.0	92.1	92.1	92.1	92.1	247.0	247.1	247.1	247.1	247.1
USA	171.2	164.5	159.1	158.8	160.4	241.8	248.4	246.0	245.4	245.4	215.3	217.0	220.4	220.7	219.8
South Africa	13.7	13.0	12.4	12.4	12.4	83.9	83.9	83.9	83.9	83.9	1.4	1.4	1.4	1.4	1.4

Table 3. Global production and harvested area for selected crops

GTAP Crop Categories	Production (MMts)				
	2004	2007	2011	2014	2017
Coarse Grains	1043.7	1085.4	1166.4	1351.8	1442.8
Fruits and Veg.	2182.5	2297.1	2585.0	2761.7	2853.5
Oilseeds	562.9	618.5	796.6	888.1	1035.8
Other Crops	62.3	70.3	89.4	101.1	112.5
Paddy Rice	608.7	655.3	721.1	733.1	752.8
Plant Fibres	77.5	80.3	86.6	83.3	81.0
Sugar Cane and Beet	1574.6	1843.5	2063.7	2150.7	2145.3
Wheat	634.7	606.6	696.9	728.8	772.3
GTAP Crop Categories	Harvested Area (Mha.)				
	2004	2007	2011	2014	2017
Coarse Grains	310.4	325.3	324.8	341.0	346.5
Fruits and Veg.	231.7	243.0	260.5	274.9	289.8
Oilseeds	211.6	215.6	249.0	271.4	287.9
Other Crops	33.8	34.0	36.6	37.6	40.1
Paddy Rice	150.9	155.1	162.0	162.5	163.7
Plant Fibres	38.1	36.5	37.6	37.4	37.4
Sugar Cane and Beet	25.5	27.9	30.6	31.6	31.3
Wheat	215.7	215.4	220.3	219.8	218.3

Table 4. Production and relative changes for selected countries and crops

	Production (MMts)				
	2004	2007	2011	2014	2017
Coarse Grains					
Australia	15.7	6.8	11.8	12.3	17.4
Brazil	44.9	54.3	58.4	83.0	101.2
Canada	26.0	27.9	23.0	22.2	26.4
China	140.7	161.1	201.1	224.9	267.3
France	30.8	26.7	27.8	33.8	30.0
India	33.0	40.1	43.1	43.0	43.8
Indonesia	11.2	13.3	17.6	19.0	28.9
Russia	30.1	30.1	34.5	42.4	44.3
South Africa	10.3	7.6	10.9	14.9	18.1
USA	319.8	350.3	322.7	377.6	384.8
Paddy Rice					
Australia	0.6	0.2	0.7	0.8	0.8
Brazil	13.3	11.1	13.5	12.2	12.5
Canada	0.0	0.0	0.0	0.0	0.0
China	180.5	187.4	202.7	208.2	214.4
France	0.1	0.1	0.1	0.1	0.1
India	124.7	144.6	157.9	157.2	169.1
Indonesia	54.1	54.6	58.3	59.1	55.3
Russia	0.5	0.7	1.1	1.0	1.0
South Africa	0.0	0.0	0.0	0.0	0.0
USA	10.5	9.0	8.4	10.1	8.1
Wheat					
Australia	26.1	10.8	27.4	25.3	31.8
Brazil	5.8	4.1	5.7	6.3	4.3
Canada	24.8	20.1	25.3	29.4	30.4
China	92.0	109.3	117.4	126.2	134.2
France	39.7	32.8	36.0	39.0	38.7
India	72.2	75.8	86.9	95.8	98.5
Indonesia	0.0	0.0	0.0	0.0	0.0
Russia	45.4	49.4	56.2	59.7	86.0
South Africa	1.7	1.9	2.0	1.8	1.5
USA	58.7	55.8	54.4	55.1	47.4

Table 5. Harvested area and relative changes for selected countries and crops

	Harvested Area (Mha.)				
	2004	2007	2011	2014	2017
Coarse Grains					
Australia	6.9	6.3	5.5	5.3	6.4
Brazil	13.9	14.8	14.3	16.7	18.7
Canada	6.8	7.5	5.1	4.6	4.8
China	29.4	33.2	36.7	40.3	45.3
France	4.1	3.9	3.8	4.3	4.1
India	29.3	28.9	27.5	25.6	25.0
Indonesia	3.4	3.6	3.9	3.8	5.5
Russia	17.4	16.7	15.6	18.1	16.5
South Africa	3.5	2.8	2.6	2.9	3.2
USA	35.2	40.2	37.1	38.0	37.0
Paddy Rice					
Australia	0.1	0.0	0.1	0.1	0.1
Brazil	3.7	2.9	2.8	2.3	2.0
Canada	0.0	0.0	0.0	0.0	0.0
China	28.6	29.2	30.3	30.6	31.0
France	0.0	0.0	0.0	0.0	0.0
India	41.9	43.9	44.0	44.1	43.8
Indonesia	11.9	11.7	11.7	11.5	10.9
Russia	0.1	0.2	0.2	0.2	0.2
South Africa	0.0	0.0	0.0	0.0	0.0
USA	1.3	1.1	1.1	1.2	1.0
Wheat					
Australia	26.1	10.8	27.4	25.3	31.8
Brazil	5.8	4.1	5.7	6.3	4.3
Canada	24.8	20.1	25.3	29.4	30.4
China	92.0	109.3	117.4	126.2	134.2
France	39.7	32.8	36.0	39.0	38.7
India	72.2	75.8	86.9	95.8	98.5
Indonesia	0.0	0.0	0.0	0.0	0.0
Russia	45.4	49.4	56.2	59.7	86.0
South Africa	1.7	1.9	2.0	1.8	1.5
USA	58.7	55.8	54.4	55.1	47.4

Table 6. After tax value of land endowment supply by AEZ in M USD

EVOS (in M USD)	2004	2007	2011	2014	2017
AEZ1	1699.3	2497.2	3693.8	5091.3	4670.5
AEZ2	4939.9	8156.6	11440.3	16428.4	14373.1
AEZ3	13680.6	24937.5	37785.7	41162.2	46134.8
AEZ4	20746.4	37654.7	61505.3	60695.2	66328.1
AEZ5	23002.3	35597.1	56794.6	65058.4	62473.8
AEZ6	33955.4	51128.8	95495.2	98152.3	96098.8
AEZ7	14590.3	22821.2	38596.7	44340.5	38756.4
AEZ8	14056.4	22070.9	36339.9	39775.7	38982.1
AEZ9	31388.4	44813.1	73750.1	80236.9	81612.3
AEZ10	78401.3	88545.4	128421.2	127946.3	125662.0
AEZ11	81921.8	91593.5	124932.0	113646.2	111507.6
AEZ12	57992.2	77190.5	138272.0	134096.9	145364.4
AEZ13	770.5	947.5	1654.3	2044.3	1934.2
AEZ14	3594.4	5112.2	5257.3	5646.2	5029.5
AEZ15	7336.5	8339.7	9178.5	9947.2	9501.9
AEZ16	3709.6	2731.2	4611.5	6175.7	6037.5
AEZ17	96.7	75.3	118.0	158.2	156.5
AEZ18	0.0	0.0	0.0	0.1	0.1

Table 7. After tax value of land endowment supply by sector in M USD

EVOS (in M USD)	2004	2007	2011	2014	2017
Paddy Rice	36231.0	43478.0	81280.7	72716.3	87539.7
Wheat	25129.7	19612.9	31816.4	36646.6	38026.4
Coarse Grains	31330.0	30404.4	52074.4	61491.9	58565.7
Fruits and Veg.	118202.7	182810.9	282078.5	269821.9	272100.8
Oilseeds	30489.8	31598.4	59233.0	65133.1	57641.2
Sugar Cane and Beet	7290.8	11260.9	17633.9	22027.8	23064.9
Plant Fibres	10635.6	13392.7	33438.8	29840.7	25297.5
Other Crops	21109.3	25243.7	39357.1	35919.0	38313.8
Cattle, sheep, goats, horses	22383.7	34776.4	53779.9	59604.1	56603.5
Raw milk	26916.5	44378.4	57835.5	61024.7	60623.8
Wool, silk-worm cocoons	760.5	1530.6	2328.5	5091.8	2854.9
Forestry	61402.5	85725.3	116989.7	131283.9	133991.3

Appendicies

Appendix I. Data and Methods for GTAP LULC v.11

Figure A.1 and A.2 summarize the data and methods used in creating and updating the land cover and land use information in the GTAP LULCv.11 database, respectively. The main differences between versions v.11 and v.10 are the use of FAO/IIASA GAEZ v.4 (Fischer et al., 2021) for constructing the AEZ maps and latest data from FAOSTAT (FAO, 2023) on national land use and land cover. The methods used to create v.11 are the same as v.9 and v.10. It starts with the fine-resolution (5-minute) geospatial maps on administrative areas, growing conditions, land cover and land use. Each workflow starts with the creation of Global Agro-Ecological Zone (GAEZ) map which contains both administrative and agro-ecological zone information. Administrative boundaries are taken from the Global Administrative Areas map v2.8 (2016) which contains information on the boundaries of 256 countries. These are mapped to the 251 GTAP countries and GTAP regions for v.11 (see Appendix II). Each 5-minute grid-cell of the Earth's land area is classified according to agro-ecological zones (AEZs) (see Appendix IV and Appendix V). The AEZ categories are created using information on length of growing period (LGP) and thermal climate from the latest information from FAO/IIASA GAEZ v.4 (Fischer et al., 2021). The LPG shows the number of days in a year when the prevailing temperature and available moisture permit crop growth (i.e. days wherein average daily temperature is above 5^{o}C and actual evapotranspiration is above the threshold level of 0.5). On the other hand, the thermal climates broadly classify each grid-cell according to tropics, subtropics, temperate, boreal and arctic climates. The original thermal climates (8 types) are reclassified to 3 zones (Tropical, Temperate and Boreal).

With the GAEZ map on hand, Figure A.1 further shows how information from different land cover maps are combined into the GTAP LULC database. Fractional cropland and pasture cover maps for year 2000/01 developed by Ramankutty et al (2008) (downloadable from http://www.earthstat.org/) is combined with the fractional urban cover information created from urban cover maps by Schneider et al (2009, 2010). Fractional cropland, pasture and urban land information are then added together in each grid cells. To ensure that total fractional land cover do not exceed 100%, fractional land cover data are normalized for grid cells which exceed the said threshold. For each grid cell, the residual fractional land cover (taken from the difference between 100% and the combined fractional cropland, pasture and urban cover) are reassigned to

vegetation classes using the potential vegetation map developed by Ramankutty and Foley (1999). The authors assigned each grid cell of the world to one of 13 potential vegetation classes. These classes are further reclassified into 4 land types (namely Forests, Shrubland, Savanna + Grasslands and Other Lands). The complete fractional land cover maps are converted to hectares using 5-minute surface area map from the European Soil Data Center (2012). To separate managed and unmanaged forest cover, the region-18AEZ shares computed by Sohngen et al (2008) for GTAP LULC v.6 are used. The resulting land cover database from the data and methods mentioned above is for base year 2001, 160 regions, 7 land cover types and for 18 and 108 AEZs.

To the best of our knowledge, there are no available maps which have more recent land cover (as well as land use) information. So in order to update the new 2001 base year land cover database for each benchmark years (i.e. 2004, 2007, 2011, 2014, 2017) national level data from FAOSTAT (FAO, 2023) is used. Cropland and pasturelands are first updated using national-level land cover for these land types for each benchmark year. Thus, cropland and pastureland area between FAO and GTAP LULC at the national-level are the same. Note that land cover is updated only in region-AEZ wherein both cropland, pasture and other land types are present (if this condition is not met, land cover in a region-AEZ is fixed to the 2001 base year values). For each region-AEZ that is updated, the net change in cropland and pasture are allocated to other land types using their original shares in the base year 2001.

Figure A.2 shows the workflow of the land use data for GTAP LULC v.11. Starting with the GAEZ map, the gridded production and harvested area for 172[2] crops from Monfreda et al. (2008) are used. To share-out livestock land rents, v.11 gridded livestock (6 types) output from FAO (2007) is used. National level prices from FAOSTAT are used to calculate the value of crop and livestock production. Once output, harvest area and value of output data are constructed for base year 2001, region-AEZ shares for these variables are created. These shares are then used to share-out national level output, harvest area and value of output data information from FAOSTAT for the benchmark years (Appendix IV).

[2] The original Monfreda et al database is for 175 crops but at the time of creating the database production and harvested area for minor commodities (popcorn, coir, gums) were not available.

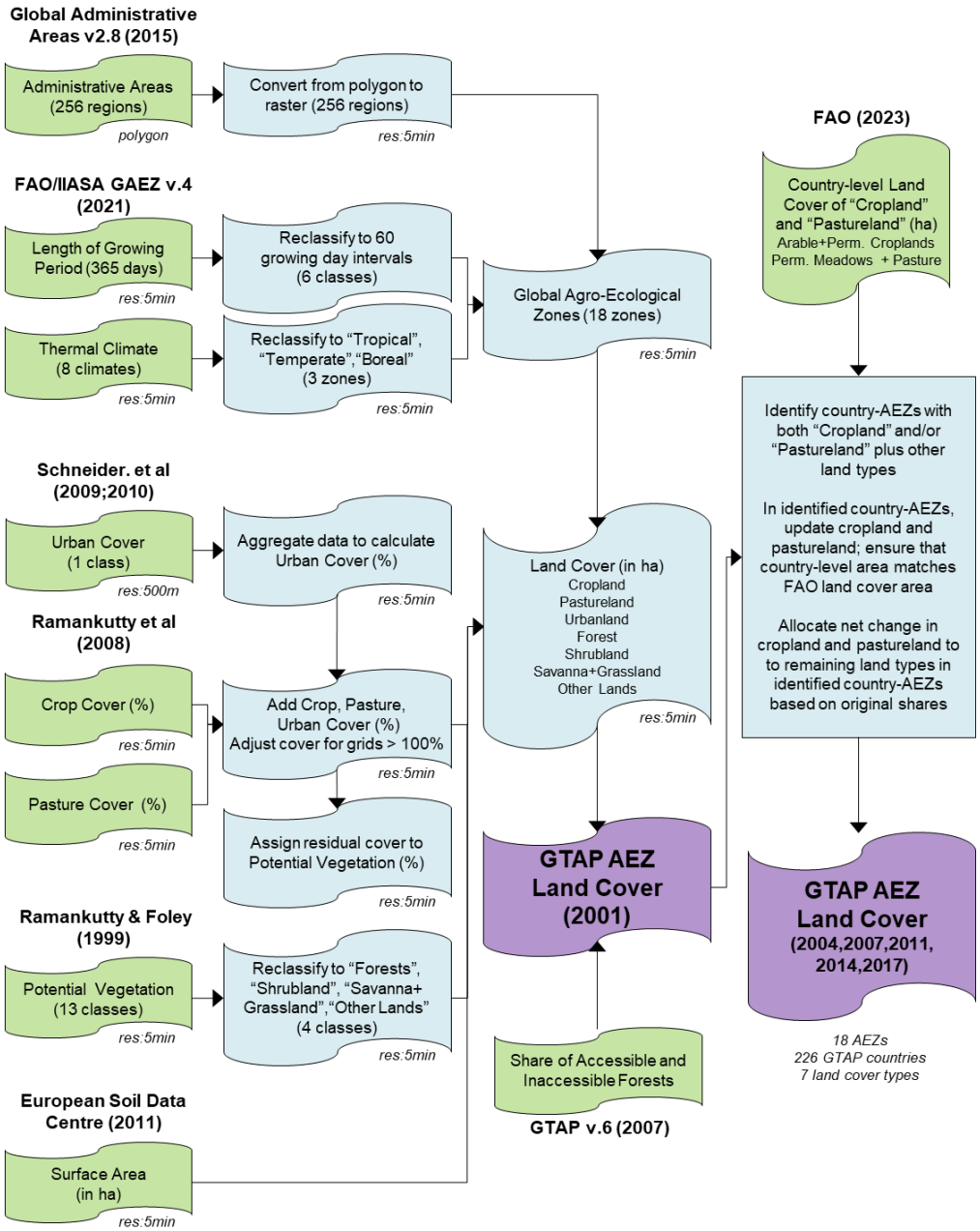


Figure A.1. Workflow for creating GTAP LULCv11 land cover data for years 2004, 2007, 2011, 2014 and 2017

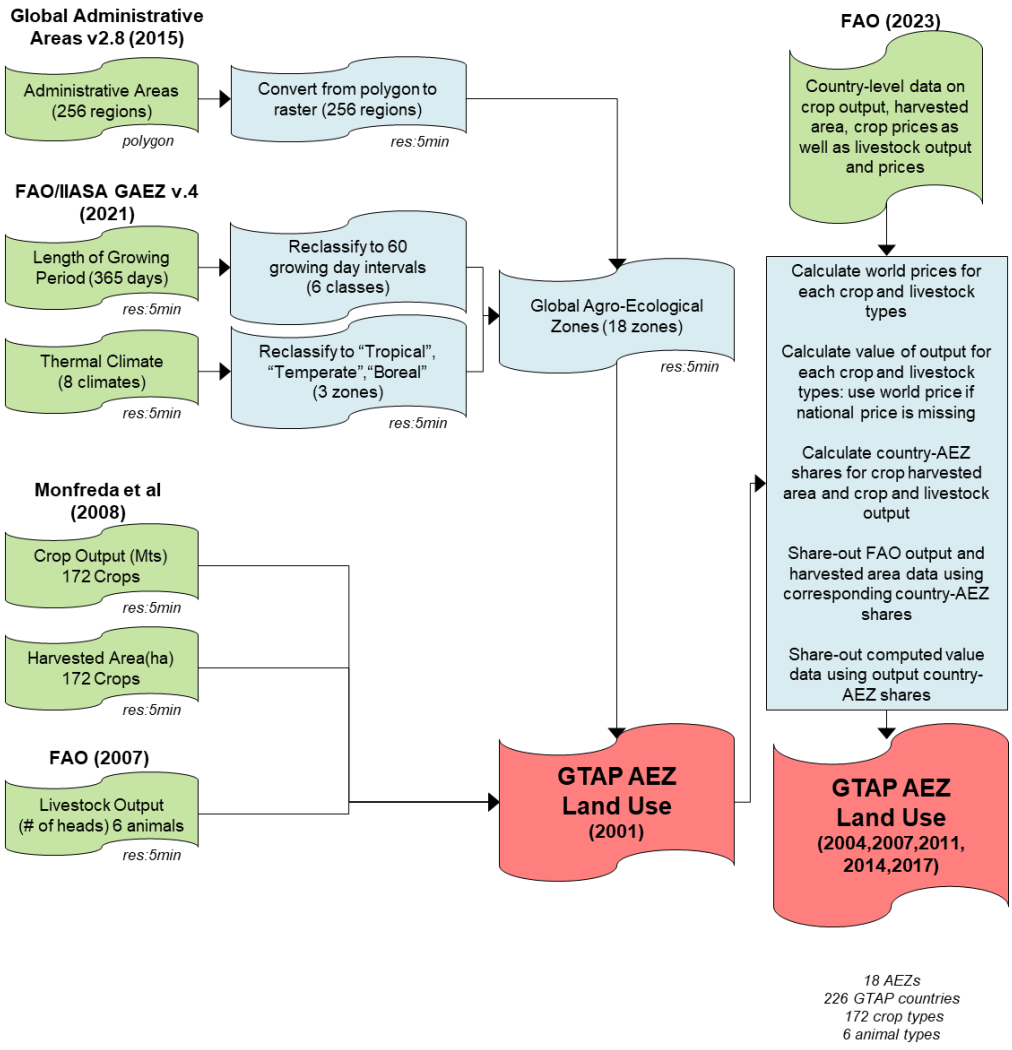


Figure A.2. Workflow for creating GTAP LULCv11 land use data for years 2004, 2007, 2011, 2014 and 2017

Appendix II. Country mapping

Code	Area	GTAPv11 (160)
abw	Aruba	xcb
afg	Afghanistan	afg
ago	Angola	xac
aia	Bahamas	xcb
ala	Ãland Islands	fin
alb	Albania	alb
and	Andorra	xer
are	United Arab Emirates	are
arg	Argentina	arg
arm	Armenia	arm
asm	American Samoa	xoc
ata	Antarctica	xtw
atf	French Southern Territories	xtw
atg	Barbados	xcb
aus	Australia	aus
aut	Austria	aut
aze	Azerbaijan	aze
bdi	Burundi	xec
bel	Belgium	bel
ben	Benin	ben
bes	Bonaire, Sint Eustatius and Saba	xcb
bfa	Burkina Faso	bfa
bgd	Bangladesh	bgd
bgr	Bulgaria	bgr
bhr	Bahrain	bhr
bhs	British Virgin Islands	xcb
bih	Bosnia and Herzegovina	xer
blm	Cayman Islands	xcb
blr	Belarus	blr
blz	Belize	xca
bmu	Bermuda	xna
bol	Bolivia (Plurinational State of)	bol
bra	Brazil	bra
brb	Cuba	xcb
brn	Brunei Darussalam	brn
btn	Bhutan	xsa
bvt	Bouvet Island	xtw
bwa	Botswana	bwa
caf	Central African Republic	caf
can	Canada	can
cck	Cocos (Keeling) Islands	aus
che	Switzerland	che
chl	Chile	chl
chn	China	chn
civ	Côte d?Ivoire	civ
cmr	Cameroon	cmr
cod	Democratic Republic of the Congo	cod
cog	Congo	cog
cok	Cook Islands	xoc
col	Colombia	col
com	Comoros	com
cpv	Cabo Verde	xwf
cri	Costa Rica	cri
cub	Curaçao	xcb
cuw	Dominica	xcb
cxr	Christmas Island	aus
cym	Grenada	xcb
cyp	Cyprus	cyp
cze	Czechia	cze
deu	Germany	deu
dji	Djibouti	xec
dma	Haiti	hti

dnk	Denmark	dnk
dom	Dominican Republic	dom
dza	Algeria	dza
ecu	Ecuador	ecu
egy	Egypt	egy
eri	Eritrea	xec
esh	Western Sahara	xnf
esp	Spain	esp
est	Estonia	est
eth	Ethiopia	eth
fin	Finland	fin
fji	Fiji	xoc
flk	Falkland Islands (Malvinas)	xsm
fra	France	fra
fro	Faroe Islands	xer
fsm	Micronesia (Federated States of)	xoc
gab	Gabon	gab
gbr	United Kingdom of Great Britain and Northern Ire	gbr
geo	Georgia	geo
ggy	Guernsey	xer
gha	Ghana	gha
gib	Gibraltar	xer
gin	Guinea	gin
glp	Guadeloupe	fra
gmb	Gambia	xwf
gnb	Guinea-Bissau	xwf
gnq	Equatorial Guinea	gnq
grc	Greece	grc
grd	Montserrat	xcb
grl	Greenland	xna
gtm	Guatemala	gtm
guf	French Guiana	xsm
gum	Guam	xoc
guy	Guyana	xsm
hkg	China, Hong Kong Special Administrative Region	hkg
hmd	Heard Island and McDonald Islands	aus
hnd	Honduras	hnd
hrv	Croatia	hrv
hti	Saint Barthélemy	xcb
hun	Hungary	hun
idn	Indonesia	idn
imn	Isle of Man	xer
ind	India	ind
iot	British Indian Ocean Territory	xtw
irl	Ireland	irl
irn	Iran (Islamic Republic of)	irn
irq	Iraq	irq
isl	Iceland	xef
isr	Israel	isr
ita	Italy	ita
jam	Jamaica	jam
jey	Jersey	xer
jor	Jordan	jor
jpn	Japan	jpn
kaz	Kazakhstan	kaz
ken	Kenya	ken
kgz	Kyrgyzstan	kgz
khm	Cambodia	khm
kir	Kiribati	xoc
kna	Saint Kitts and Nevis	xcb
kor	Republic of Korea	kor
kwt	Kuwait	kwt
lao	Lao People's Democratic Republic	lao
lbn	Lebanon	lbn
lbr	Liberia	xwf
lby	Libya	xnf
lca	Saint Lucia	xcb
lie	Liechtenstein	xef
lka	Sri Lanka	lka
lso	Lesotho	xsc
ltu	Lithuania	ltu

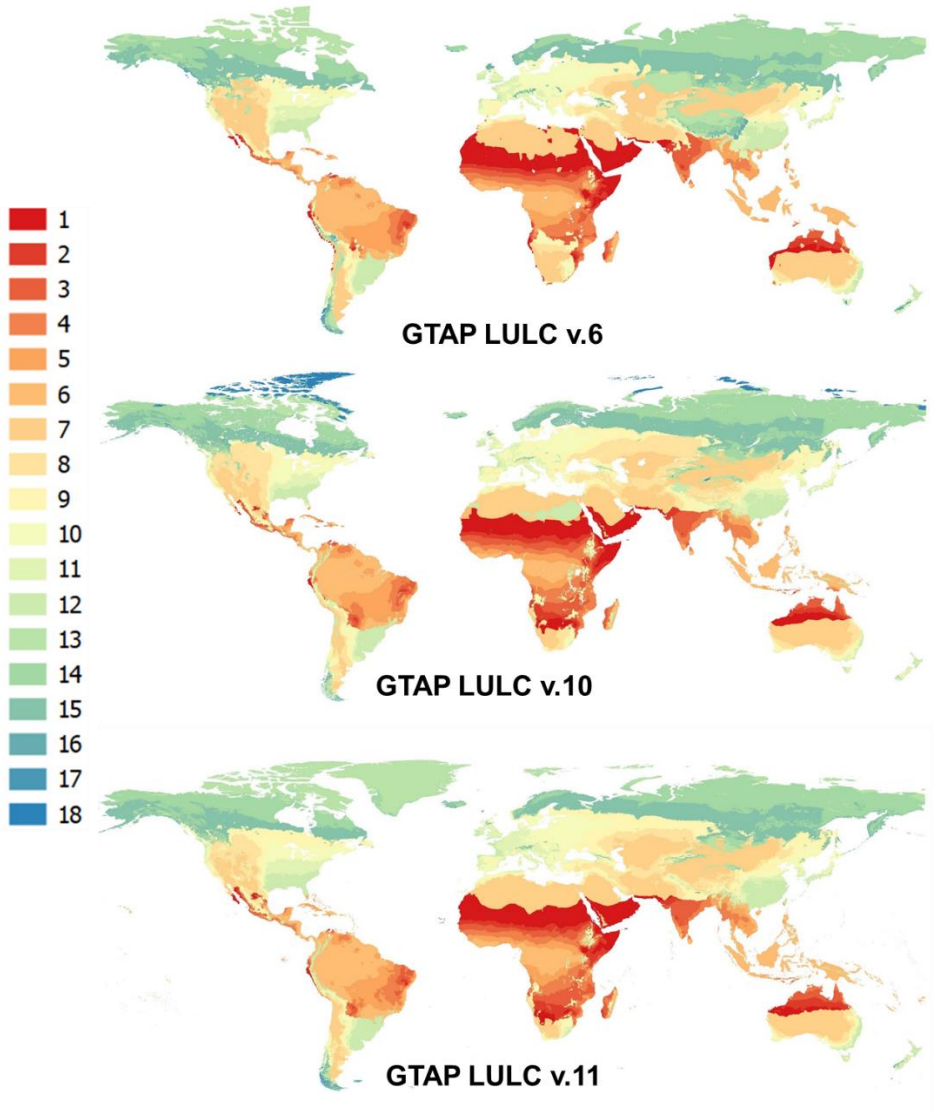
lux	Luxembourg	lux
lva	Latvia	lva
mac	China, Macao Special Administrative Region	xea
maf	Saint Martin (French Part)	xcb
mar	Morocco	mar
mco	Monaco	xer
mda	Republic of Moldova	xee
mdg	Madagascar	mdg
mdv	Maldives	xsa
mex	Mexico	mex
mhl	Marshall Islands	xoc
mkd	North Macedonia	xer
mli	Mali	mli
mlt	Malta	mlt
mmr	Myanmar	xse
mne	Montenegro	xer
mng	Mongolia	mng
mnp	Northern Mariana Islands	xoc
moz	Mozambique	moz
mrt	Mauritania	xwf
msr	Saint Vincent and the Grenadines	xcb
mtq	Martinique	fra
mus	Mauritius	mus
mwi	Malawi	mwi
mys	Malaysia	mys
myt	Mayotte	xec
nam	Namibia	nam
ncl	New Caledonia	xoc
ner	Niger	ner
nfk	Norfolk Island	aus
nga	Nigeria	nga
nic	Nicaragua	nic
niu	Niue	xoc
nld	Netherlands	nld
nor	Norway	nor
npl	Nepal	npl
nru	Nauru	xoc
nzl	New Zealand	nzl
omn	Oman	omn
pak	Pakistan	pak
pan	Panama	pan
pcn	Pitcairn	xoc
per	Peru	per
phl	Philippines	phl
plw	Palau	xoc
png	Papua New Guinea	xoc
pol	Poland	pol
pri	Puerto Rico	pri
prk	Democratic People's Republic of Korea	xea
prt	Portugal	prt
pry	Paraguay	pry
pse	State of Palestine	pse
pyf	French Polynesia	xoc
qat	Qatar	qat
reu	Réunion	fra
rou	Romania	rou
rus	Russian Federation	rus
rwa	Rwanda	rwa
sar	Sark	xer
sau	Saudi Arabia	sau
sdn	Sudan	sdn
sen	Senegal	sen
sgp	Singapore	sgp
sgs	South Georgia and the South Sandwich Islands	xsm
shn	Saint Helena	xwf
sjm	Svalbard and Jan Mayen Islands	nor
slb	Solomon Islands	xoc
sle	Sierra Leone	xwf
slv	El Salvador	slv
smr	San Marino	xer
som	Somalia	xec

spm	Saint Pierre and Miquelon	xna
srb	Serbia	srb
ssd	South Sudan	xec
stp	Sao Tome and Principe	xac
sur	Suriname	xsm
svk	Slovakia	svk
svn	Slovenia	svn
swe	Sweden	swe
swz	Eswatini	swz
sxm	Sint Maarten (Dutch part)	xcb
syc	Seychelles	xec
syr	Syrian Arab Republic	syr
tca	Turks and Caicos Islands	xcb
tcd	Chad	tcd
tgo	Togo	tgo
tha	Thailand	tha
tjk	Tajikistan	tjk
tkl	Tokelau	xoc
tkm	Turkmenistan	xsu
tls	Timor-Leste	xse
ton	Tonga	xoc
tto	Trinidad and Tobago	tto
tun	Tunisia	tun
tur	Turkey	tur
tuv	Tuvalu	xoc
twn	Taiwan, China	twn
tza	United Republic of Tanzania	tza
uga	Uganda	uga
ukr	Ukraine	ukr
umi	United States Minor Outlying Islands	xoc
ury	Uruguay	ury
usa	United States of America	usa
uzb	Uzbekistan	uzb
vat	Holy See	xer
vct	United States Virgin Islands	xcb
ven	Venezuela (Bolivarian Republic of)	ven
vgb	Anguilla	xcb
vir	Antigua and Barbuda	xcb
vnm	Viet Nam	vnm
vut	Vanuatu	xoc
wlf	Wallis and Futuna Islands	xoc
wsm	Samoa	xoc
xkx	Kosovo	xer
yem	Yemen	xws
zaf	South Africa	zaf
zmb	Zambia	zmb
zwe	Zimbabwe	zwe

Appendix IV. AEZ mapping

AEZ	Length of Growing Days		Thermal Climate
AEZ1	0	59	Tropics
AEZ2	60	119	
AEZ3	120	179	
AEZ4	180	239	
AEZ5	240	299	
AEZ6	300	360	
AEZ7	0	59	Tropics cool + subtropics + temperate cool
AEZ8	60	119	
AEZ9	120	179	
AEZ10	180	239	
AEZ11	240	299	
AEZ12	300	360	
AEZ13	0	59	Temperate cold to boreal
AEZ14	60	119	
AEZ15	120	179	
AEZ16	180	239	
AEZ17	240	299	
AEZ18	300	360	

Appendix V. Comparison of GTAP LULC v.6, v.10 and v.11 AEZs



Appendix VI. Crop commodity mapping

GTAP	GTAPNAMES	FAOCODE	FAONAME
1	Barley	44	Barley
2	Buckwheat	89	Buckwheat
3	CanarySeed	101	Canary seed
4	Cerealsnes	108	Cereals, nes
5	Fonio	94	Fonio
6	Maize	56	Maize
7	Millet	79	Millet
8	MixedGrain	103	Mixed grain
9	Oats	75	Oats
10	PopCorn	68	Popcorn
11	Quinoa	92	Quinoa
12	PaddyRice	27	Rice, paddy
13	Rye	71	Rye
14	Sorghum	83	Sorghum
15	Triticale	97	Triticale
16	Wheat	15	Wheat
17	Abaca_M_H	809	Manila Fibre (Abaca)
18	AgaveFibrNES	800	Agave Fibres Nes
19	Coir	813	Coir
20	FibreCropNES	821	Fibre Crops Nes
21	FlaxFibr_Tow	773	Flax fibre and tow
22	HempFibr_Tow	777	Hemp Tow Waste
23	Jute	780	Jute
24	JuteLikeFibr	782	Other Bastfibres
25	KapokFibre	778	Kapok Fibre
26	KapksdShell	311	Kapokseed in Shell
27	Ramie	788	Ramie
28	SeedCotton	328	Seed cotton
29	Sisal	789	Sisal
30	Alff4FrgSlg	641	Alff4FrgSlg
31	Beets4Fodder	647	Beets4Fodder
32	Cabbage4Fddr	644	Cabbage4Fddr
33	Carrots4Fddr	648	Carrots4Fddr
34	Clovr4FrgSlg	640	Clovr4FrgSlg
35	FrgProdNES	651	FrgProdNES
36	GrsNESFrgSlg	639	GrsNESFrgSlg
37	GrnOlsd4Fddr	642	GrnOlsd4Fddr
38	LgmNESFrgSlg	420	Leguminous vegetables, nes
39	Maize4FrgSlg	636	Maize4FrgSlg
40	MxGrss_Lgm	645	MxGrss_Lgm
41	RyeGrsFrgSlg	638	RyeGrsFrgSlg
42	Srgm4FrgSlg	637	Srgm4FrgSlg
43	Swedes4Fddr	649	Swedes4Fddr
44	Turnips4Fddr	646	Turnips4Fddr
45	Vgt_RootFddr	655	Vgt_RootFddr
46	Apples	515	Apples
47	Apricots	526	Apricots
48	Avocados	572	Avocados
49	Bananas	486	Bananas
50	Berriesnes	558	Berries Nes
51	Blueberries	552	Blueberries
52	Carobs	461	Carobs
53	Cashewapple	591	Cashewapple
54	Cherries	531	Cherries
55	CitrusFrtNES	512	Citrus fruit, nes
56	Cranberries	554	Cranberries
57	Currants	550	Currants
58	Dates	577	Dates
59	Figs	569	Figs
60	FrtFrshNES	619	Fruit Fresh Nes
61	FrtTrpFrNES	603	Fruit, tropical fresh nes
62	Gooseberries	549	Gooseberries
63	Grpfrt_Pmlos	507	Grapefruit (inc. pomelos)
64	Grapes	560	Grapes
65	KiwiFruit	592	Kiwi fruit
66	Lmn_Lme	497	Lemons and limes
67	Mangoes	571	Mangoes, mangosteens, guavas

68	Oranges	490	Oranges
69	Papayas	600	Papayas
70	Peach_Nctrn	534	Peaches and nectarines
71	Pears	521	Pears
72	Persimmons	587	Persimmons
73	Pineapples	574	Pineapples
74	Plantains	489	Plantains
75	Plums	536	Plums and sloes
76	Quinces	523	Quinces
77	Raspberries	547	Raspberries
78	SourCherries	530	Sour cherries
79	StnFrtNESFrh	541	Stone fruit, nes
80	Strawberries	544	Strawberries
81	TngMndClmnt	495	Tangerines, mandarins, clem.
82	CastorBeans	265	Castor oil seed
83	Coconuts	249	Coconuts
84	GrndntWShll	242	Groundnuts, with shell
85	Hempseed	336	Hempseed
86	KrtNtSheant	263	Karite Nuts (Sheanuts)
87	Linseed	333	Linseed
88	Melonseed	299	Melonseed
89	MustardSeed	292	Mustard seed
90	OilPalmFruit	254	Oil palm fruit
91	Oilseedsnes	339	Oilseeds, Nes
92	Olives	260	Olives
93	PoppySeed	296	Poppy seed
94	Rapeseed	270	Rapeseed
95	SfflwrSeed	280	Safflower seed
96	SesameSeed	289	Sesame seed
97	Soybeans	236	Soybeans
98	SnflwrSeed	267	Sunflower seed
99	TungNuts	275	Tung Nuts
100	Ans_bdn_fnnl	711	Anise, badian, fennel, corian.
101	ArcNtBtl	226	Arecanuts
102	ChicoryRoots	459	Chicory roots
103	CnnmnCnlla	693	Cinnamon (canella)
104	cloves	698	Cloves
105	CocoaBeans	661	Cocoa beans
106	CoffeeGreen	656	Coffee, green
107	ginger	720	Ginger
108	Hops	677	Hops
109	Kolanuts	224	Kolanuts
110	Mate	671	Maté
111	NaturalGums	839	Gums Natural
112	NatRubber	836	Natural rubber
113	Ntmg_Mc_Crdm	702	Nutmeg, mace and cardamoms
114	Pepper	687	Pepper (Piper spp.)
115	Peppermint	748	Peppermint
116	Pimento	689	Chillies and peppers, dry
117	PrthrmDrdFlw	754	Pyrethrum,Dried
118	spicesnes	723	Spices, nes
119	Tea	667	Tea
120	TbccLeaves	826	Tobacco, unmanufactured
121	Vanilla	692	Vanilla
122	BambaraBeans	203	Bambara beans
123	BeansDry	176	Beans, dry
124	BrdBeansDry	181	Broad beans, horse beans, dry
125	ChickPeas	191	Chick peas
126	CowPeasDry	195	Cow peas, dry
127	Lentils	201	Lentils
128	Lupins	210	Lupins
129	PeasDry	187	Peas, dry
130	PigeonPeas	197	Pigeon peas
131	Pulsesnes	211	Pulses, nes
132	Vetches	205	Vetches
133	Cassava	125	Cassava
134	Potatoes	116	Potatoes
135	Root_TbrNES	149	Roots and Tubers, nes
136	SweetPotato	122	Sweet potatoes
137	TaroCocoYam	136	Taro (cocoyam)
138	Yams	137	Yams

139	YautiaCcYam	135	Yautia (cocoyam)
140	SugarBeets	157	Sugar beet
141	SugarCane	156	Sugar cane
142	SugarCrpNES	161	Sugar crops, nes
143	Almonds	221	Almonds, with shell
144	BrazilNuts	216	Brazil nuts, with shell
145	CashewNuts	217	Cashew nuts, with shell
146	Chestnuts	220	Chestnuts
147	HzlntFlbrt	225	Hazelnuts, with shell
148	Nutsnes	234	Nuts, nes
149	Pistachios	223	Pistachios
150	Walnuts	222	Walnuts, with shell
151	Artichokes	366	Artichokes
152	Asparagus	367	Asparagus
153	BeanGreen	414	Beans, green
154	BrdBeanGreen	9003	BrdBeanGreen
155	Cabbages	358	Cabbages and other brassicas
156	Cntlp_othMln	568	Other melons (inc.cantaloupes)
157	Carrots	426	Carrots and turnips
158	Cauliflower	393	Cauliflowers and broccoli
159	Chll_PpprGrn	401	Chillies and peppers, green
160	Ccmbr_Ghrkn	397	Cucumbers and gherkins
161	Eggplants	399	Eggplants (aubergines)
162	Garlic	406	Garlic
163	GrnCornMaize	446	Maize, green
164	Lettuce	372	Lettuce and chicory
165	Mushrooms	449	Mushrooms and truffles
166	Okra	430	Okra
167	OnionDry	403	Onions, dry
168	OnionShlltGn	402	Onions (inc. shallots), green
169	PeasGreen	417	Peas, green
170	PmpknSqshGrd	394	Pumpkins, squash and gourds
171	Spinach	373	Spinach
172	StringBeans	423	String beans
173	Tomatoes	388	Tomatoes
174	VgtbFrshNES	463	Vegetables fresh nes
175	Watermelons	567	Watermelons