![Food and Agriculture Organization of the United Nations]

Land statistics

Global, regional and country trends

1990–2018

>> FAO Statistics Division

Land statistics. Global, regional and country trends 1990–2018

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HIGHLIGHTS

→ **In 2018, world total land area plus inland waters was 13.5 billion hectares, of which more than one-third were agricultural land (4.8 billion hectares), and a bit less than one-third were forest land (4.1 billion hectares).**

→ **Of total agricultural land, one-third was used as cropland (1.6 billion hectares), the remaining two-thirds were permanent meadows and pastures used for livestock (3.2 billion hectares).**

→ **The total agricultural land grew on average by 0.1 percent per year since 1961, with a steady expansion up to the 1990s and a decrease in more recent decades.**

→ **Cropland area increased globally by 5 percent since 1990 whereas the global land used for permanent meadows and pastures decreased by 2 percent.**

→ **During the period 1990–2018, cropland used for permanent crops increased by 25 percent while the area of annual crops remained roughly constant.**

→ **World forest land decreased by almost 4 percent over the period 1990 to 2018, with an average yearly reduction of 0.1 percent.**

→ **Area equipped for irrigation was 340 million hectares in 2018, or nearly 22 percent of world total cropland area. It increased by 30 percent since 1990.**

→ **Inland waters covered some 430 million hectares globally, or about 3 percent of the total.**

→ **Land cover information derived from remote sensing was highly consistent with land use information. It showed in 2018 a range of 13.2–13.5 billion hectares of total land area, of which 1.2–1.9 billion hectares were herbaceous and woody crops; 3.2–3.5 billion hectares were grasslands and shrubland; 4.4–5.0 billion hectares were tree cover; and 382–480 million hectares were inland water bodies.**

→ **Artificial surfaces (including urban areas) covered less than 0.5 percent of the global land, though they had more than doubled since 1990.**

FAOSTAT LAND STATISTICS

INTRODUCTION

The land surface comprises the relevant biophysical features of its living and non-living components, including natural and managed ecosystems such as cropland and forests, urban areas, etc. Land cover statistics codify the visible features of these components into simplified classes, such as grassland, shrubs, tree cover, etc. Land use statistics, in the other hand, seek to describe the use of those same components for human benefits, for instance activities for crop and livestock production, nature conservation, infrastructure development. Both land cover and land use statistics

are central in understanding key local, regional and planetary trends, including agricultural and forest landscapes, to reveal changes such as conversion of land to or from agriculture, deforestation, cropland management, etc. In this perspective, land cover information often serves as a proxy for land use information.

The FAOSTAT Land Use statistics and associated land indicators provide information on the full land use matrix by country, including agricultural land (1961–2018) and forest land (1990–2018). These statistics are based on data collected annually from countries via a standard Land Use, Irrigation and Agricultural Practices questionnaire. Forest land statistics in the dataset are collected separately from countries through the FAO Global Forest Resources Assessment (FRA, 2020). The FAOSTAT Land Cover statistics are conversely produced by FAO, based on its Land Cover Classification System (FAO-LCCS) (De Gregorio, 2015). Information is derived from remote sensing products generated independently by specialized Agencies, currently NASA (MODIS land cover) and the European Copernicus Climate Change service (CCI land cover).

FAO land use and land cover classifications are international statistical standards for environmental statistics and the system of environmental-economic accounting (e.g., FAO and UN 2020). Additionally, the FAO land use classification is consistent with the land use classes of the Intergovernmental Panel on Climate Change (IPCC), used by countries for reporting to the United Nations Framework Convention on Climate Change (UNFCCC).
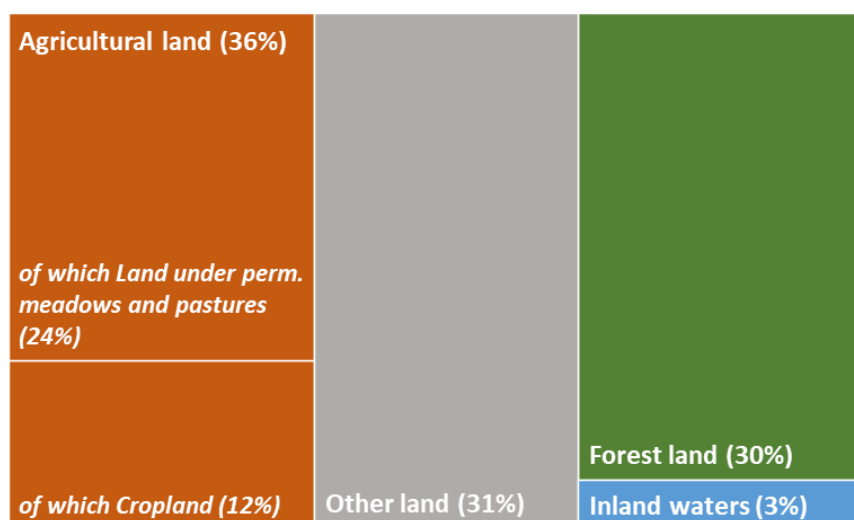
This report is composed of two sections. Firstly, it provides an overview of the main results and changes over time in land use statistics with a focus on agricultural land uses, and with details at global, regional and country level. Additional information is provided in the first section on important irrigation and agricultural practices also collected via the above-mentioned FAO questionnaire. Secondly, it presents some of the results from the land cover dataset also at global, regional and country level and compares them to land use statistics, thus giving for the first time a joint view of land statistics in FAOSTAT.

LAND USE STATISTICS

GLOBAL HIGHLIGHTS

In 2018, the total world land area excluding Antarctica plus the inland waters were about 13.5 billion hectares (ha).Overall, three land uses: Agricultural land, Forest land and Other land occupy about one third each of the total (Figure 1), although the largest share was used for agriculture. In 2018, agricultural land was about 4.8 billion ha; the forest land was 4.1 billion ha; and other land was 4.2 billion ha. In turn, about one-third of the total agricultural land was used for cropland (1.6 billion hectars (ha) and 12 percent of the total) whereas two-thirds were permanent meadows and pastures, covering 3.2 billion ha and nearly one fourth of the global land.

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Figure 1. Global land composition in 2018.

Agricultural land (36%)

of which Land under perm. meadows and pastures (24%)

of which Cropland (12%)

Other land (31%)

Forest land (30%)

Inland waters (3%)

Source: FAOSTAT, 2020

Since the beginning of the historical data, agricultural land increased overall by 7 percent but remained virtually stable since 1990. Over the period 1990–2018, cropland and land used for pastures showed opposite trends. The former increased by 5 percent (about 0.2 percent per year) whereas the latter decreased by 2 percent (on average by 0.1 percent per year) (Figure 2).

Figure 2c. Trends in the global Agricultural land and its components (Cropland and Land under permanent meadows and pastures), 1961–2018.
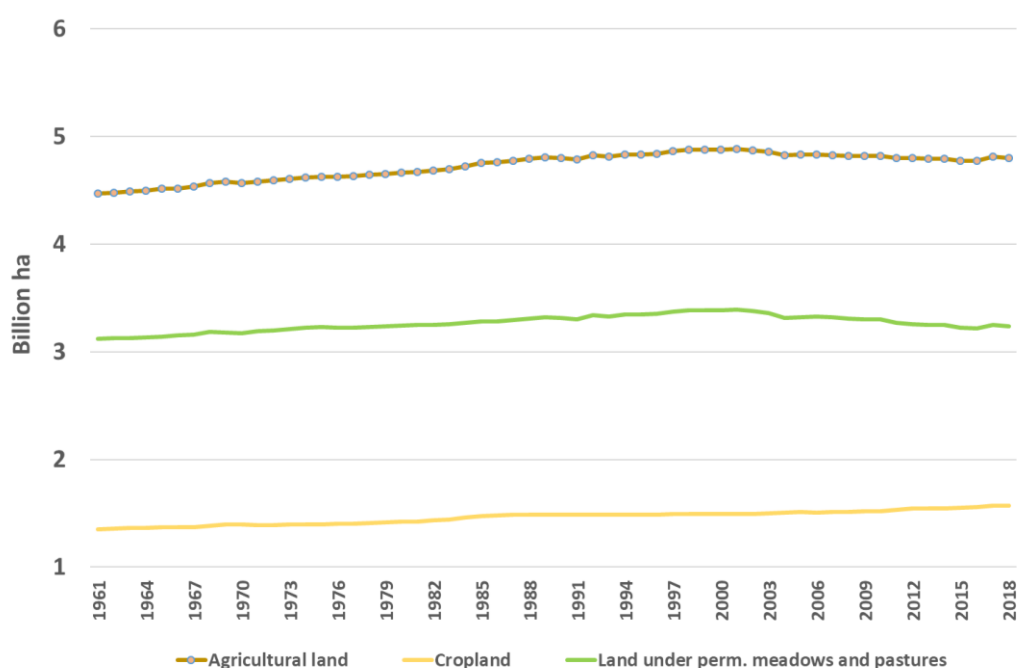
Source: FAOSTAT 2020

In 2018, the area under permanent (tree and shrub) crops—an important subcomponent of cropland—covered about 170 million ha. This land use category showed a significant increase in extent over the period 1990–2018 (+50 percent increase). Conversely, the entire cropland (dominated by much larger areas of annual/temporary crops) did not vary significantly over the period 1990–2018.

Forest land

The global forest land was about 4.1 billion ha in 2018. It declined by almost 4 percent since 1990. While main regional and global features of forest land statistics have been reported elsewhere (e.g., see FRA 2020 and the FAOSTAT forest emissions and removals), the second section of this report will focus on the comparison with relevant land cover information.

Inland Waters and Other Land

Averaged over the period 1900–2018, the global annual extent of inland waters was 430 million hectares, close to 3 percent of the total land area.

Other land was about one third of the global land area and on average 4 billion ha over the period 1990–2018. This category includes the land used for purposes other than agriculture or forestry (e.g. urban zones, barren areas).

Irrigation and Agricultural Practices

In 2018, land area equipped for irrigation covered about 340 million ha, or nearly 22 percent of total cropland area. It increased by 30 percent since 1990.

In 2018, agricultural area under organic agriculture surpassed 71 million ha worldwide, more than tripled its value of 22 million ha recorded in 2004, the first year for which these statistics were available. In 2018, the amount of agricultural area under organic practices was 1.5 percent of the total (4 percent of total cropland area). It is of interest to note that several countries and the European Union report these statistics as a proxy for their national share of sustainable and productive agriculture, including under the Sustainable Development Goal (SDG) 2.4.1.
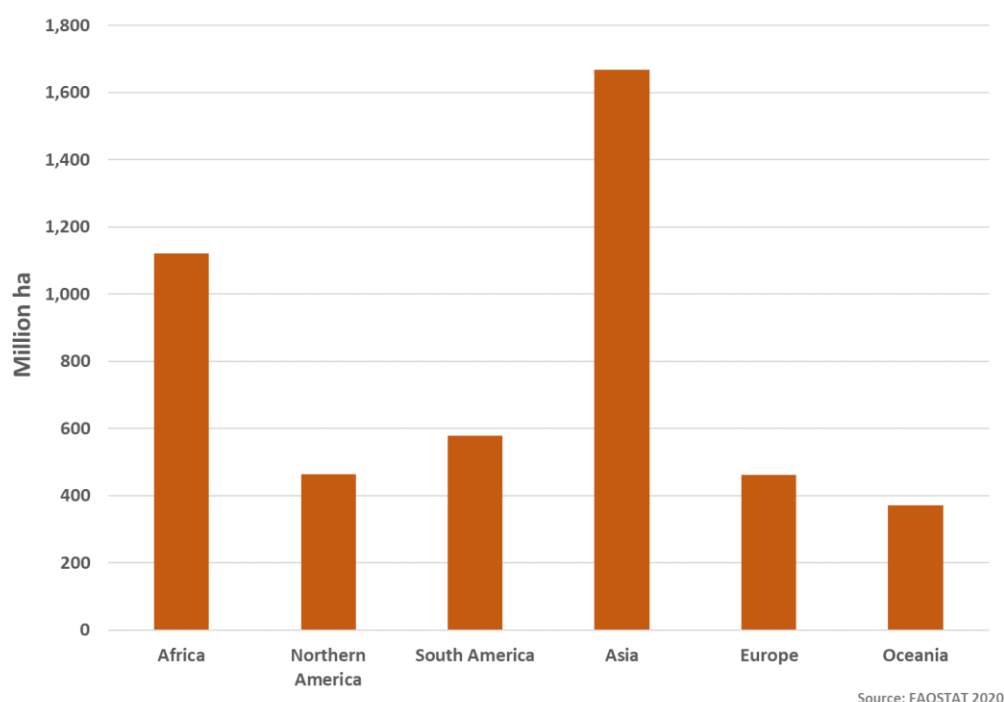
REGIONAL

With nearly 1.7 billion hectares, Asia was the region with the largest area of agricultural land. Africa and South America followed with about 1.1 billion ha and nearly 700 million ha respectively. North America and Europe had similar extent, about 460 million ha each and Oceania had the smallest area (370 million ha) (Figure 3).

The regional distribution of the agricultural land is mostly driven by the distribution of the land used for pastures. In this respect, the regions with the largest area under permanent meadows and pastures were Asia, with 1 080 million ha and Africa, with 840 million ha. These two regions represented together more than 50 percent of the world total pastures. They were followed by South America, with 440 million ha and Oceania, with 340 million ha. North America and Europe were the two regions with the smallest extent of pastures, with 270 and 170 million ha respectively.

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Asia however also had the largest extent of cropland, with nearly 700 million hectares. Africa and Europe followed with 370 and 340 million ha each. The area of cropland was about 230 million ha in South America and nearly 200 million ha in North America. Oceania, at 50 million ha, had the smallest extent.
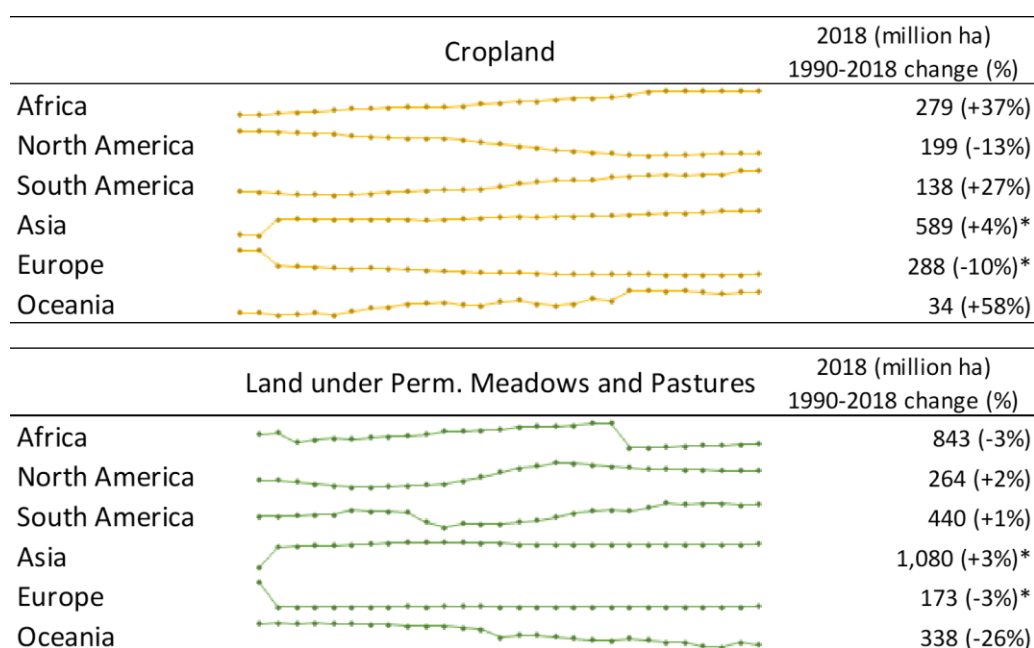
Figure 3. Regional distribution of Agricultural land (composed of Cropland and Land under Permanent Meadows and Pastures), in 2018.

Source: FAOSTAT 2020

Over 1990–2018, regional trends varied in both size and direction for cropland and land under permanent meadows and pastures (Figure 4)[1]. For cropland, Oceania and Africa recorded the largest expansion (+58 and +37 percent respectively), followed by South America (+27 percent) and then Asia (+4 percent). In the same decades, North America and Europe marked instead important reduction in their cropland (-13 and -10 percent respectively). Relative changes were less important for pastures, with the exception of Oceania where there was a reduction of -26 percent since 1990. Asia and the Americas both increased by 3 percent their land under pastures whereas a similar change with opposite direction was observed in Africa and Europe.

[1] FAOSTAT regional aggregate for Europe includes the Russian Federation whereas most of the other countries generated from the split of the former Soviet Union are included in Asia. For this reason, the change for Asia and Europe are calculated since the split, for the period 1992–2018.

Figure 4. Regional trends in the components of Agricultural land, Cropland and Permanent meadows and pastures, 1990–2018.

Cropland		2018 (million ha) 1990-2018 change (%)
Africa		279 (+37%)
North America		199 (-13%)
South America		138 (+27%)
Asia		589 (+4%)*
Europe		288 (-10%)*
Oceania		34 (+58%)

Land under Perm. Meadows and Pastures		2018 (million ha) 1990-2018 change (%)
Africa		843 (-3%)
North America		264 (+2%)
South America		440 (+1%)
Asia		1,080 (+3%)*
Europe		173 (-3%)*
Oceania		338 (-26%)

*Change in Europe and Asia is calculated for the period 1992-2018, to account for the split of the Soviet Union.

Source: FAOSTAT, 2020

Irrigation and Agricultural Practices

In 2018, Asia, with 240 million hectares, had more than two-thirds of all land equipped for irrigation in the world. The Americas were a distant second, with over 50 million ha. Asia was also the region with the highest relative share of land equipped for irrigation to total cropland area (40 percent), followed by the Americas (14 percent), Europe (9 percent), Oceania (8 percent) and Africa (nearly 6 percent).

In 2018, agricultural area under organic agriculture surpassed 71 million ha worldwide, more than tripled its value of 22 million ha recorded in 2004, the first year for which these statistics were available. In 2018, the amount of agricultural area under organic practices was 1.5 percent of the total (and 4 percent of total cropland area).
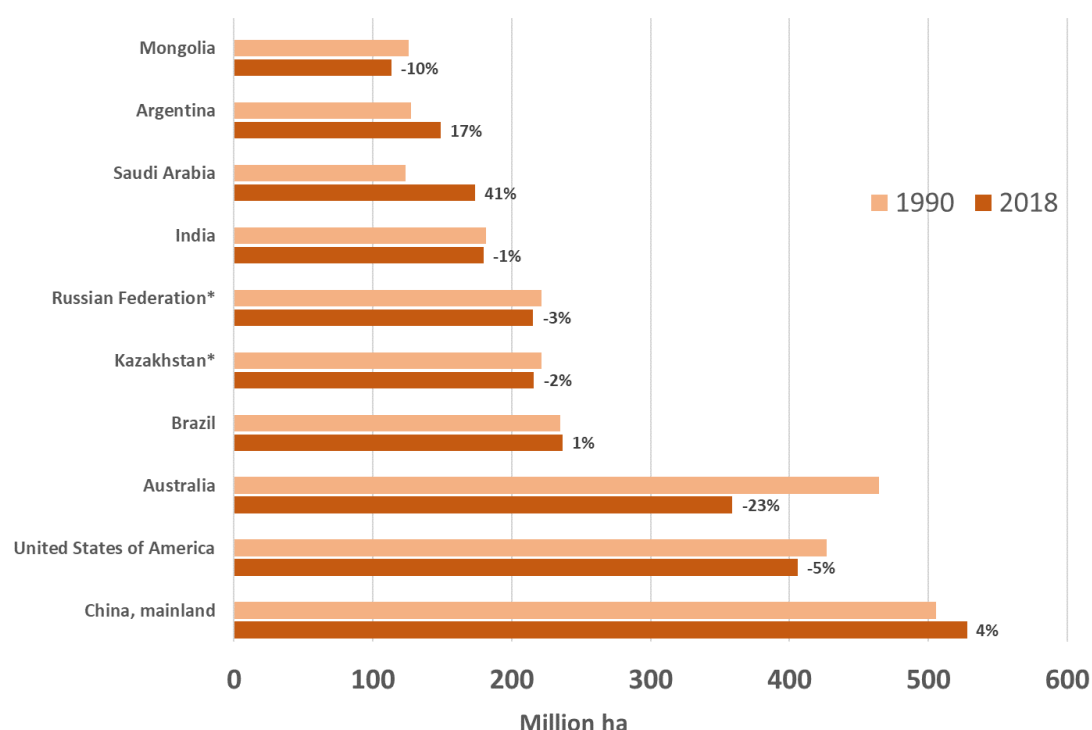
COUNTRY

In 2018, China, mainland had the largest total agricultural land, with nearly 530 million hectares, followed by the United States of America (USA) (405 million ha); Australia (360 million ha) Brazil (240 million ha) and Kazakhstan and Russian Federation (both at about 215 million ha).

Over the period 1990–2018, the top ten countries by the extent of agricultural land showed diverse trends (Figure 5). Argentina and Saudi Arabia were the countries with highest relative growth in

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agricultural land since 1990. In the first country, the increase was mainly driven by the growth in cropland area, whereas in Saudi Arabia, it was the land under permanent meadows and pasture that grew the most. Since the early 1990s, the Russian Federation and the USA recorded similar reductions in their agricultural land, which was due in both cases to decline in cropland extent. Over the past decades, the total agricultural land grew by 4 percent in China, mainland due the combined increase in cropland and land under pastures. Finally in Australia, although the cropland area increased by over 80 percent, the concomitant reduction of 26 percent in the land of permanent meadows and pastures, shaped an overall 23 percent decline in the agricultural land over the period 1990–2018.

Figure 5. Top ten countries by the extent in agricultural land area and change, 1990–2018.

* For the Russian Federation and Kazakhstan, 1992 data

Source: FAOSTAT 2020

Irrigation and Agricultural Practices

In 2018, China and India were the countries with the largest areas equipped for irrigation, above 70 million hectares each, followed by USA (30 million ha); Pakistan (20 million ha); Iran (10 million ha); and Brazil, Mexico, Indonesia, Thailand and Bangladesh with about 5 million ha each (Figure 6). At the same time, in 2018 Egypt was the country with the largest share of area equipped for irrigation over its total agricultural area (nearly 100 percent), followed by Suriname, Bangladesh, Pakistan, People's Republic of Korea (all above 50 percent) (Figure 7).

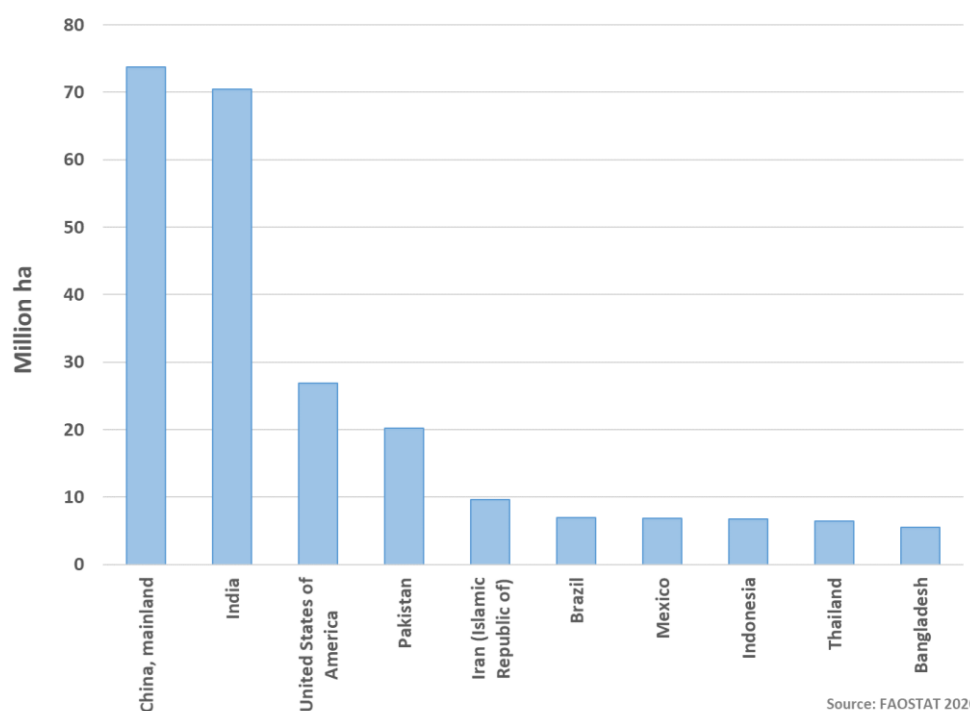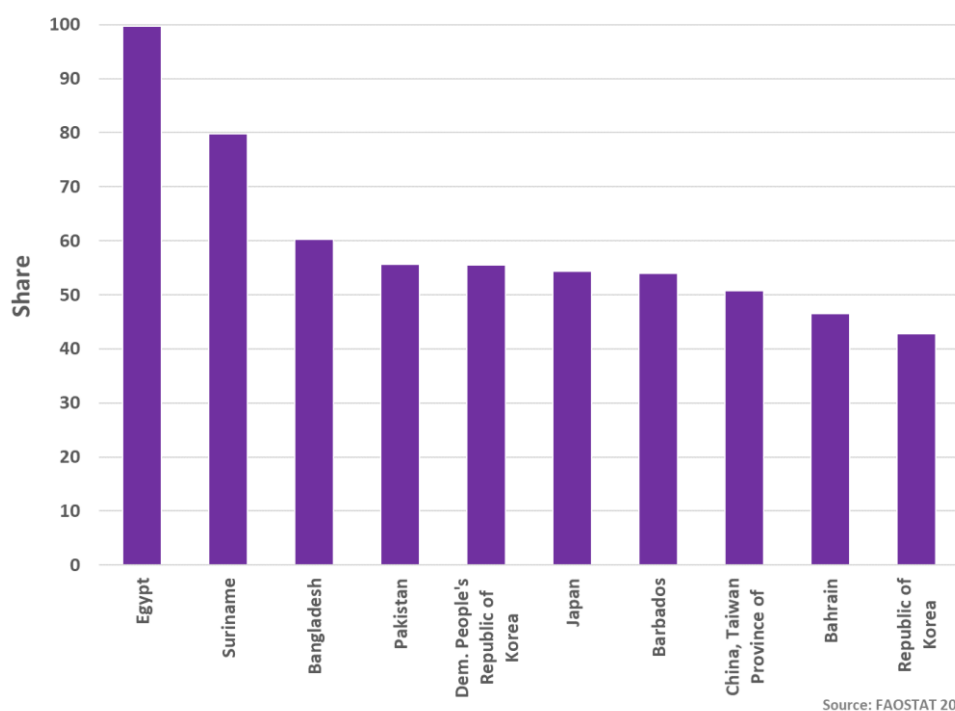**Figure 6. Top ten countries by extent in area equipped for irrigation, 2018.**

Source: FAOSTAT 2020

Figure 7. Top ten countries by share of area equipped for irrigation over total agricultural land area, 2018.

Source: FAOSTAT 2020

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LAND COVER DATA AND COMPARISON TO LAND USE

This second section of the report presents some global, regional and country results from land cover statistics and compares them, where appropriate, to land use. This comparison provides preliminary insights on the use of land cover data as proxy for land use statistics. Future developments will include the analysis of land cover changes and comparison with trends in land use statistics.

The relevant land use categories are taken as reference in the comparison. To guide it and consolidate information across the two sources of land statistics analyzed herein, a correspondence map between FAO land use categories and land cover classes is provided in Table 1. In addition, land cover data are presented hereinafter as the average of results from the two land cover sources, MODIS and CCI land cover. We also show the spread of individual values across their mean with ± symbol in the text and with line bars in the charts.

Table 1. FAO land use and land cover classes and their correspondence.

Land Use			Land Cover
Agricultural land	**Cropland**	**Arable land**	Herbaceous crops
		Land under permanent crops	Woody crops
			Multiple or layered crops
	Land under permanent meadows and pastures		Grassland
			Shrub-covered areas
Forest land			Tree-covered areas
			Mangroves
Other land			Artificial surfaces (including urban areas)
			Shrubs and/or herbaceous vegetation, aquatic or regularly flooded
			Terrestrial barren land and Sparse vegetation
			Permanent snow and glaciers
Inland waters			Inland water bodies
Coastal waters			Coastal water bodies and intertidal areas

**Source:** FAOSTAT, 2020

GLOBAL LAND COVER

Land cover statistics estimated that the world total land area plus inland waters (excluding Antarctica) was 13.5 billion hectares in 2018 with close agreement between the two land cover sources and in line with global result from the land use data.

The largest share—5.5±0.1 billion ha and about 41 percent of total land—was occupied by land cover classes corresponding to the Agricultural land use and its components (see Table 1 for the correspondences). Land cover classes mapped to Forest land use covered about 4.7±0.3 billion ha

or about 35 percent of total land. The sum of land cover classes mapped to Other land uses was 2.8±0.4 billion ha, corresponding to about 21 percent of the total. Finally, both land cover products mapped the area of water bodies—corresponding to the inland waters of the land use data—at about 400 million ha or 3 percent of the total land.

Land cover results were in good agreement with land use statistics albeit showing larger agricultural and forest extents (Figure 8). For the agricultural land, discrepancies were mostly related to estimates of the land used for pastures. Conversely, land cover and land use statistics closely agreed in quantifying the extent of cropland. The correspondence includes close estimates for the area of woody crops—an important subcomponent of cropland—which was about 200 million ha according to CCI land cover maps[2]—and about 170 million ha in terms of land use data.

Figure 8. Global distribution of main land uses and comparison with corresponding land cover classes, 2018. Detail on the components of agricultural land (cropland and land under permanent meadows and pastures) is also shown.The land cover (dark yellow bars) is the mean of MODIS and CCI land cover data, with line bars showing distance between individual values. Refer to Tab. 1 for actual land cover categories corresponding to land use legend.

Source: FAOSTAT 2020
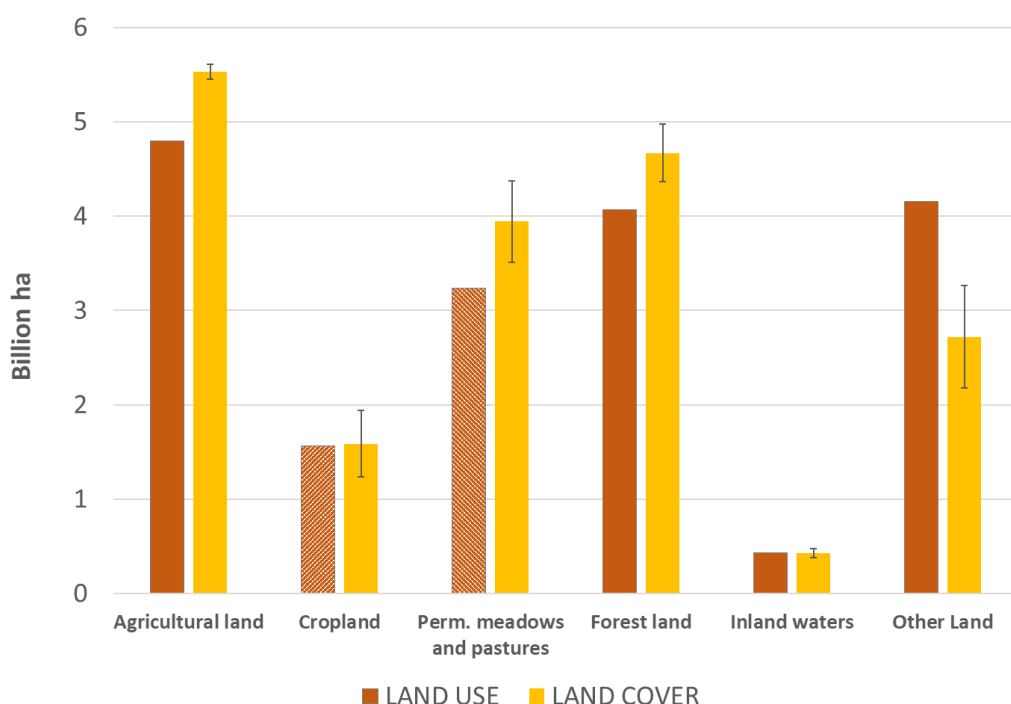
The two land cover products estimated rather consistently that in 2018, the area of artificial surfaces, including urban areas was 60–75 million hectares globally, or about 0.5 percent of total land area. They significantly disagreed on trends however, with CCI land cover estimating growth in area extent

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[2] On this land cover type, MODIS land cover does not provide information and CCI has incomplete global coverage.

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of 70 percent since 2001 (first year for which both data are available), and MODIS less than 10 percent. Land use data are not available for comparison.

REGIONAL LAND COVER AND THEMATIC COMPARISON

Cropland

Land cover data mapped the largest combined extent of herbaceous and woody crops in Asia which, with nearly 600±110 million hectares, accounted alone for one third of the global cropland. Europe and Africa, at 314±29 and 259±110 million ha respectively, were an additional third of the total. More limited cropped areas were recorded in North America (190±.5 million ha); South America (160±80 million ha); and Oceania (39±14 million ha). Averaged figures from MODIS and CCI land cover closely agree with regional land use data for cropland as discussed earlier (Figure 9). Individual land cover data showed however large internal differences and particularly in Africa, Asia and South America. Different results are associated with the difficulties of both land cover products to map extensive and rainfed cropping systems with small fields size that tend to prevail in many countries of these regions.
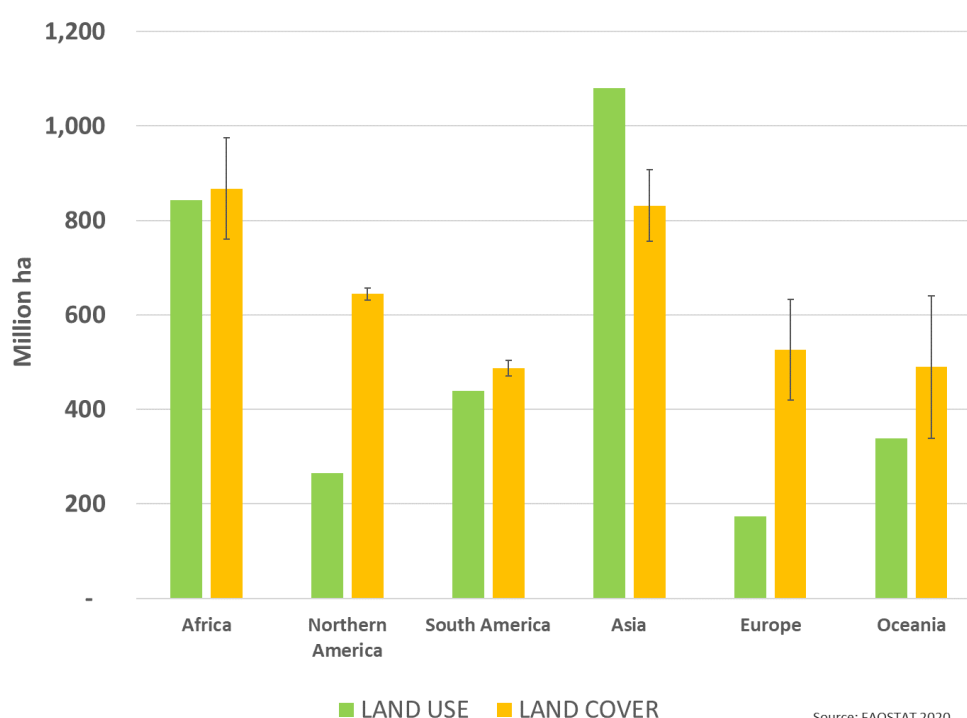
Figure 9. Regional distribution of cropland land use and comparison with corresponding land cover classes (herbaceous plus woody crops), 2018. The land cover (dark yellow bars) is the mean of MODIS and CCI land cover data, with line bars showing distance between individual values.

Source: FAOSTAT 2020
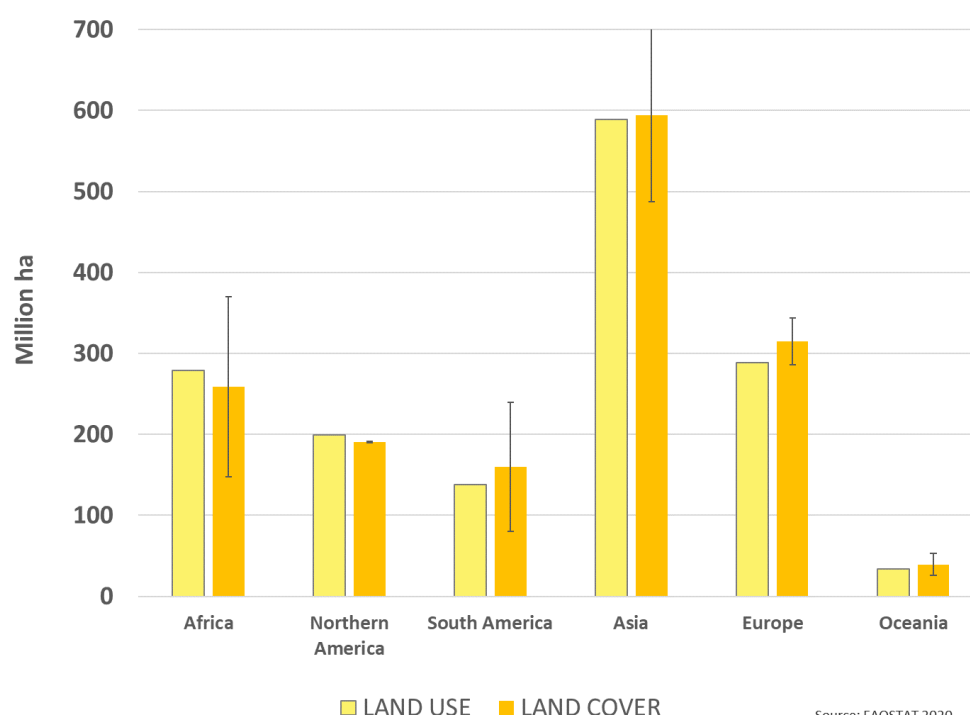
Permanent meadows and pastures

Based on land cover data, Africa and Asia were the regions with largest extent of grassland and shrubland area (870±110 and 830±80 million ha respectively). They were followed by North America, with 650±15 million ha and Europe, with 530±110 million ha. Oceania, with 490±150 million ha and South America, with 480±20 million ha closed the ranking. As observed earlier, land cover data differed significantly from corresponding land use information on the land used for permanent meadows and pastures (Figure 10). Opposite to the results observed for cropland, discrepancy is especially large in Europe and North America. This was likely due by the fact that in countries located in these two regions, livestock is mainly intensively managed, resulting in a mismatch between the bio-physical potential for grazing of natural vegetation and its actual use. Additionally, developed countries in these two regions mostly report the extent of permanent meadows and pastures within their farm areas, while not including common land used for grazing, such as rangelands.

Figure 10. Regional distribution of land under permanent meadows and pastures and comparison with corresponding land cover classes (grassland plus shrub-covered areas), 2018. The land cover (dark yellow bars) is the mean of MODIS and CCI land cover data, with line bars showing distance between individual values.

Source: FAOSTAT 2020

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Forest land

In 2018, tree-covered areas in Europe (including the Russian Federation) occupied about 1 200±14 million hectares, or one fourth of the world total tree covered area. South America followed with nearly 1 000±131 million ha, and then Africa (810±28 million ha) and North America (780±40 million ha). Oceania had the smallest area, about 141±4 million ha of tree-covered areas. Combining data for South America with those for North America, the Americas were the first continent by tree-covered area, with about half of the world total. The overall extent of forest land area, estimated as land use, being smaller (15 percent) than the corresponding land cover category (see also global results), was rather consistent with the fact that not all tree covered areas are classified by countries as forest land (Figure 11). This depends on national circumstances as well as on whether specific FAO definitions for forest are met, including minimum thresholds of area (0.1 ha), tree crown cover (10 percent) and height (5 m). The widest discrepancy between the land cover and land use data was in South America. The latter is also the region where the two land cover products differed the most. This might be partially associated with MODIS land cover mapping tree crops under the areas of natural tree vegetation.

Figure 11. Regional distribution of forest land and comparison with corresponding land cover classes (tree-covered area plus mangroves), 2018. The land cover (dark yellow bars) is the mean of MODIS and CCI land cover data, with line bars showing distance between individual values.

Source: FAOSTAT 2020
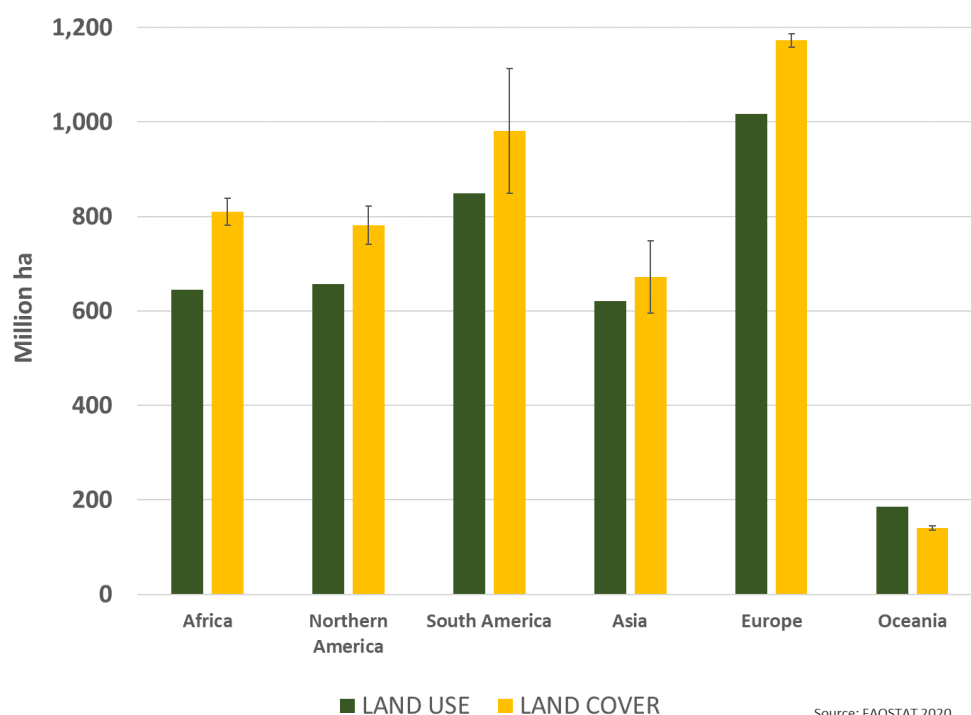
Inland waters

In 2018, one third of the global water bodies (corresponding to inland waters under the land use dataset), was located in North America (123±6 million hectares). Asia and Europe followed with 97±20 and 85±8 million hectares respectively. Africa and South America had comparable extent, at 31±1 and 28±1 million ha each. The water bodies in Oceania covered about 15±11. Overall, the regional distribution of water bodies showed a good agreement with the inland waters of land use statistics. Both MODIS and CCI land cover poorly capturing narrow rivers and temporary water surfaces might partially explaining some of the discrepancy observed between the two sources of land statistics. Due to different processes and data inputs, MODIS and CCI land cover showed very different estimate of the extent of water bodies in Oceania (Figure 12).

Figure 12. Regional distribution of inland waters and comparison with corresponding land cover class (water bodies), 2018. The land cover (dark yellow bars) is the mean of MODIS and CCI land cover data, with line bars showing distance between individual values.


Source: FAOSTAT 2020
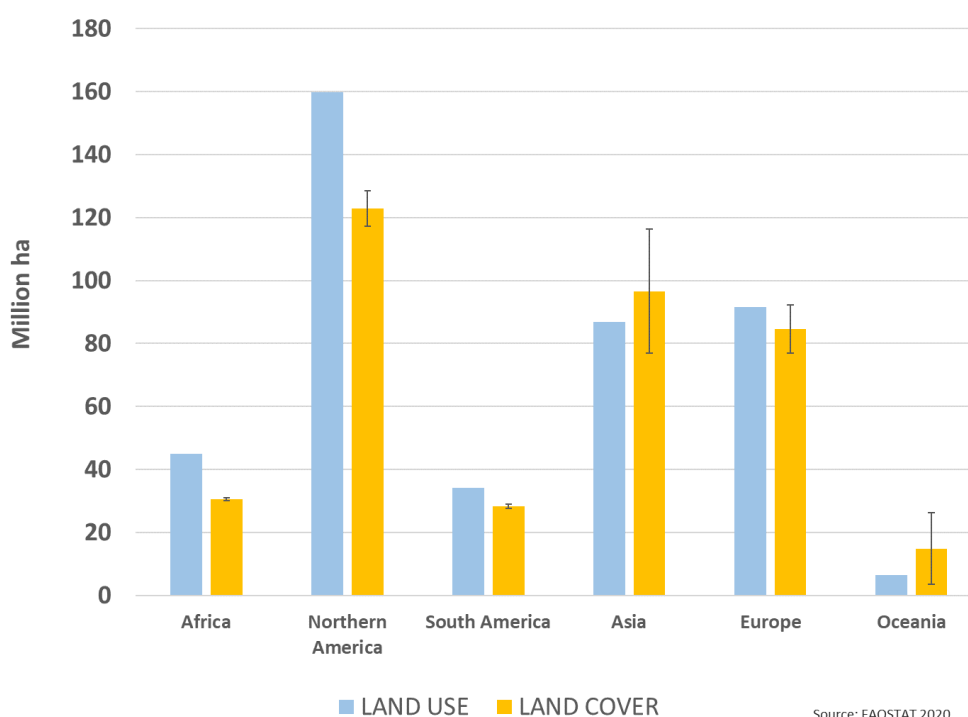
COUNTRY LAND COVER STATISTICS FOR AGRICULTURE

We observed earlier in the report that land cover data agreed quite consistently with land use statistics in 2018 on area estimates for the land cover categories of herbaceous and woody crops. These are mapped to the components of cropland land use, arable land and permanent crops respectively (see Table 1). A good correspondence was found at both global and regional levels. Below, we explore further land cover statistics from a national perspective.

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Arable land

In 2018, land cover data recorded the top five areas of herbaceous crops in India (178±16 million hectares); China, mainland (158±23 million ha); USA (141±0.2 million ha); Russian Federation (128±12 million ha); and Brazil (79±37 million ha). Ranking was similar in land use statistics of arable land that however indicated the largest extent of arable land being in order in USA, India, Russian Federation, China and Brazil (Figure 13). Overall, the two sources of land statistics agree well for the top ten countries. Discrepancies include both smaller and larger values of herbaceous crops than corresponding values of arable land. On the one hand, this might be due to land cover data mapping incompletely the fallow land and all the land that is temporarily cultivated. On the other hand, the land cover products underlying the statistics of herbaceous crops might also record natural herbaceous vegetation as part of the cultivated land. It is interesting to note that land use and land cover estimates were in significant disagreement only for Brazil among largest countries, with CCI land cover estimating more than twice the land use estimated amount, while MODIS underestimated it.

Figure 13. Top ten countries by extent in land use of arable land and comparison with corresponding land cover class (herbaceous crops), 2018. The land cover (dark yellow bars) is the mean of MODIS and CCI land cover data, with line bars showing distance between individual values.
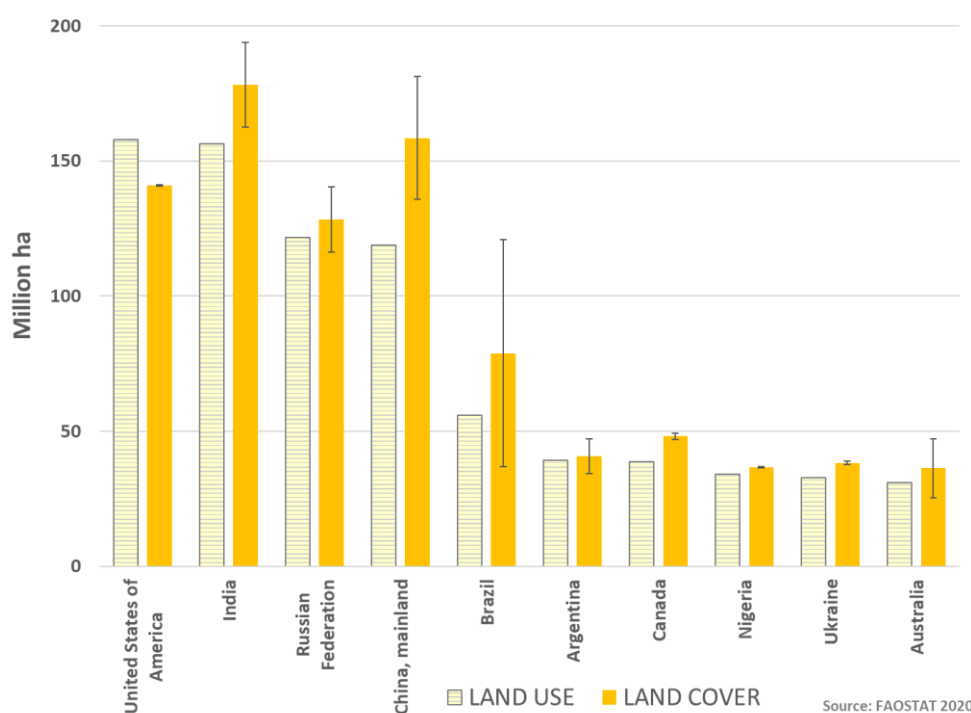
Permanent crops

In 2018, land cover data recorded the top five areas of permanent crops in Indonesia and China, mainland (about 20 million ha each); in Brazil (19 million ha); India (13 million ha); and in Nigeria and the Ivory Coast (both with 7 million ha). Land use and land cover statistics (limited to CCI land cover) agreed to Indonesia, China and India as the three top countries by area, above 10 million hectares each (and above 20 for Indonesia), followed by Brazil with almost 8 million ha, then Malaysia, Philippines, Nigeria, Spain with areas around 5 million hectares (Figure 14). This list of diverse countries reflects the variety of permanent crops cultivated around the world, from oil pam in Indonesia and Malaysia and cocoa in Nigeria to olives and grapes in Spain.

Figure 14. Top ten countries by extent in land use of permanent crops and comparison with corresponding land cover class (woody crops) from CCI land cover data, 2018.
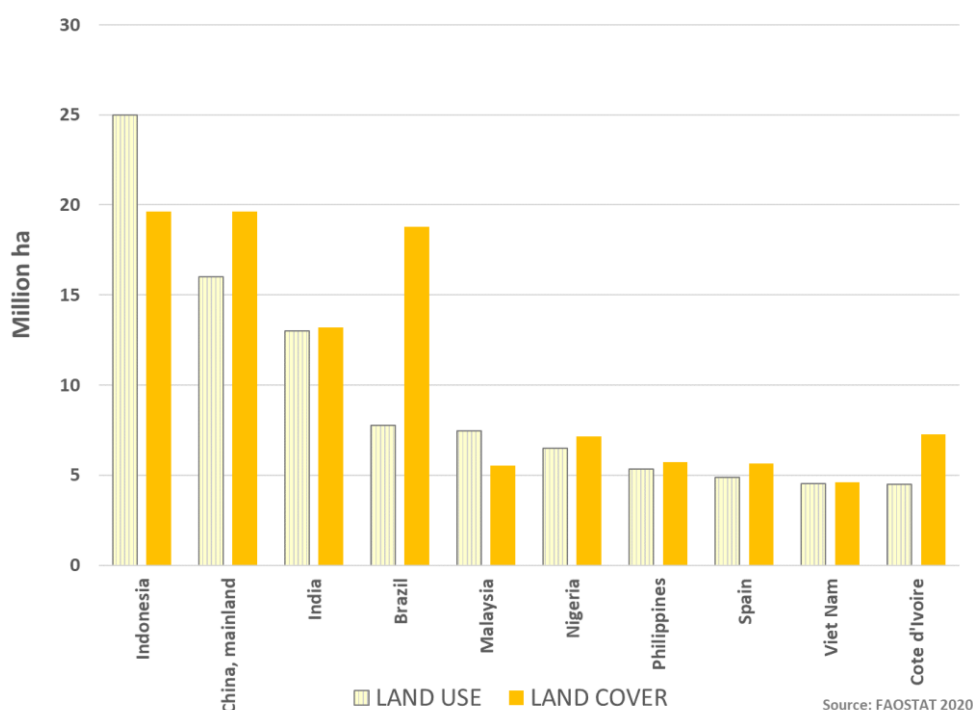
Results for the large countries above, belonging to diverse geographic and economic contexts, the analysis of the correspondence between land cover and land use statistics builds confidence in the use of land cover information as a proxy for land use trends also in smaller countries of the same regions, particularly where land use data are limited.

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EXPLANATORY NOTES

> The FAOSTAT Land Use and Land Cover statistics, together with Land Indicators, are available for 198 countries and 43 territories over 1961–2018 for land use and 1992–2018 for land cover. The domains provide statistics of land use and cover area, aggregated at national level by country, for all FAO land use classes and the fourteen land cover classes adopted by the UN System for Environmental-Economic Accounting (FAO and UN, 2020), based on FAO Land Cover Classification System (LCCS) classifiers. The land use dataset is compiled from data reported by countries annually, while the land cover dataset is computed by FAO from annual maps of two global land cover products, as follows:

> 1) MODIS-LCCS. NASA MODIS Land Cover Collection 6 (MCD12Q1), available for the years 2001–2018 (Sulla-Menashe and Friedl 2018; Sulla-Menashe *et al.,* 2019) and in particular from the Land Cover Classification System (LCCS) land cover types at 500m resolution.

> 2) CCI Land Cover. Catholic University of Louvain (UCLouvain) Geomatics land cover, produced as part of the Climate Change Initiative of the European Spatial Agency and currently under the framework of the European Copernicus Climate Change Service (C3S) (Defourny *et al.*, 2017) available for the years 1992–2018. These maps have a spatial resolution of 300m.

> MODIS LCCS and CCI-LC are both medium-resolution products with comparable overall mapping accuracy (i.e., between 75 and 80 percent for the MODIS LCCS land cover and 72.3 percent for the CCI land cover) and high multi-year stability—i.e., the detection of spurious land cover change is minimized in the processing chains.

> Based on corresponding LCCS classifiers and following a mutually-exclusive approach, the land cover classes of the MODIS-LCCS and CCI-LC land cover maps images were mapped to SEEA FAO land cover classes. The mapping between land use and land cover classifications allowed for the comparisons presented in this work. A complete description of the methodology is available under "Related documents" section of each domain.

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