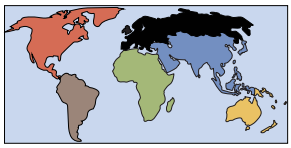
A THE GEOGRAPHY OF HUMAN IMPACTS

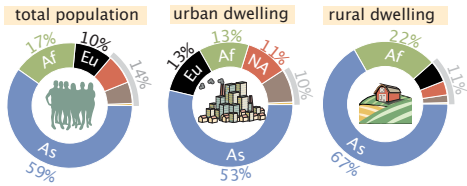
Page 1 represents the impact humans have on the Earth at a global scale. While these numbers are handy, it is important to acknowledge that they vary from country-to-country and continent-to-continent. Furthermore, the consequences of these anthropogenic impacts are also unequally distributed, meaning some regions experience effects disproportionate to their contribution. Here, we give a sense of the geographic distribution of several values presented on page 1, broken down by continental region as shown below.



- Asia — (As)
- North America — (NA)
- South America — (SA)
- Europe — (Eu)
- Oceania — (Oc)
- Africa — (Af)

B THE HUMAN POPULATION

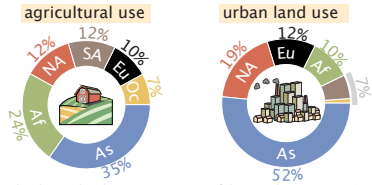
There are ≈ 8 billion humans on the planet, with approximately 50% living in 'urban' environments. The majority of the worlds population (as well as the majority of both urban and rural dwellers) live in Asia.



Sources: Food and Agricultural Organization of the United Nations – World Population **Notes**: Urban/rural designation has no set definition and follows the conventions set by each reporting country.

C LAND USE

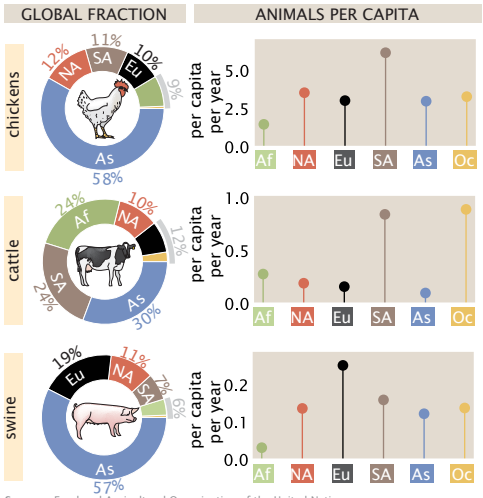
Though humans are nearly evenly split between urban and rural environments, agricultural land is the far more common use of land area. Together, Asia and Africa contain more than half of global agricultural land. Asia alone accomodates more than half of the global urban land area.



Sources: Food and Agricultural Organization (FAO) of the United Nations (2015) — Land Use [agricultural area]. Florczyk et al. 2019 — GHS Urban Centre Database 2015 [urban land area] **Notes**: Urban is defined as any inhabited area with ≥ 2500 residents, as defined by the USDA.

D THE LIVESTOCK POPULATION

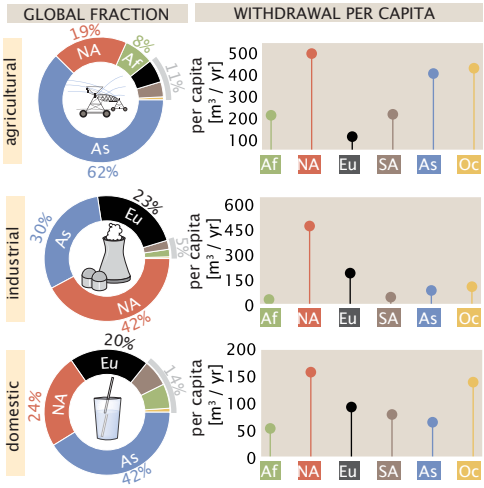
The global population of terrestrial livestock is around 30 billion individuals, most of which are chickens. Asia houses most of the global livestock population, though South America and Europe harbor more animals on a per-capita basis.



Sources: Food and Agricultural Organization of the United Nations

E WATER WITHDRAWAL

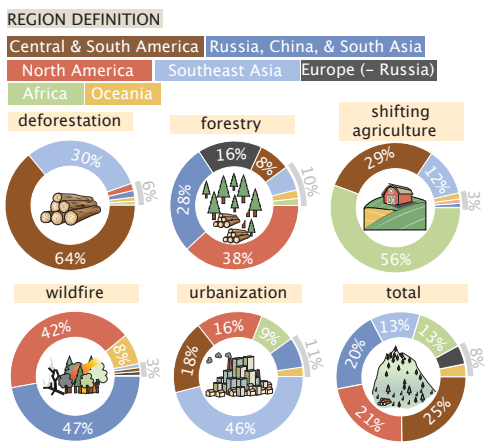
While Asia withdraws the most water for agricultural and municipal needs, North America withdraws the plurality of water for industrial purposes. North America also withdraws more water per capita than any other region.



Source: AQUASTAT Main Database, Food and Agriculture Organization of the United Nations. **Notes:** Values are reported directly from member countries and represent average of 2013–2017 period. Per capita values are computed given population of reporting countries.

F TREE COVERAGE AREA LOSS

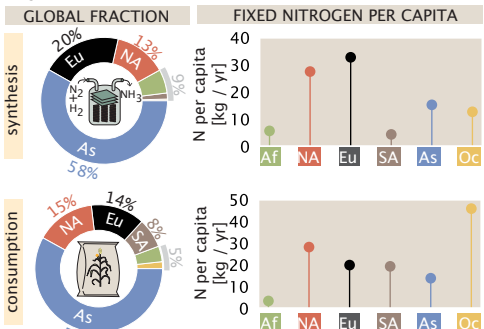
Most drivers of tree coverage area loss are comparable in their effect at a global scale. However, there are drastic regional differences in the relative magnitudes.



Source: Curtis et al. 2018 doi: 10.1126/science.aau3445. **Notes:** Regions are as reported in Curtis et al. 2018. "Deforestation" here denotes permanent removal of tree cover for commodity production. "Shifting agriculture" here denotes forest/shrub land converted to agriculture and later abandoned. All values correspond to breakdown of cumulative tree cover area loss from 2001 – 2015.

G NITROGENOUS FERTILIZER USE & PRODUCTION

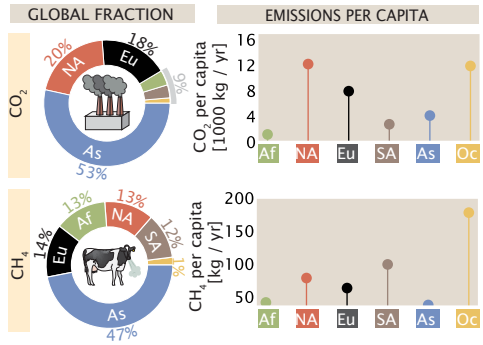
Modern agriculture requires nitrogen in amounts beyond what is produced naturally. Asia synthesizes and consumes a large majority of fixed nitrogen. However, Europe and North America dominate per capita synthesis whereas Oceania consumes more fertilizer per capita than any other region.



Source: Food and Agricultural Organization (FAO) of the United Nations. **Notes:** Values account for reactive nitrogen production/consumption in context of fertilizer only and does not account for plastics, explosives, or other uses.

H GREENHOUSE GAS EMISSIONS

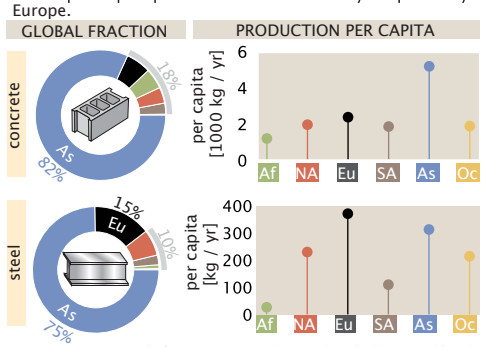
CO_2 and CH_4 are two potent greenhouse gases which are routinely emitted by anthropogenic processes such as burning fuel and rearing livestock. While Asia emits roughly half of all CO_2 and CH_4, North America and Oceania produce the most on a per capita basis, respectively.



Sources: CO_2 data collated by: Friedlingstein, P. et al. (2019). doi: 10.5194/essd-11-1783-2019. See Panel K on Pg. 4 for complete list of sources. CH_4 data from Saunois et al, 2020 doi: 10.5194/essd-12-1561-2020 **Notes:** Values report decadal averages in kg CO_2 or CH_4 per year over time period 2008–2017.

I MATERIAL PRODUCTION

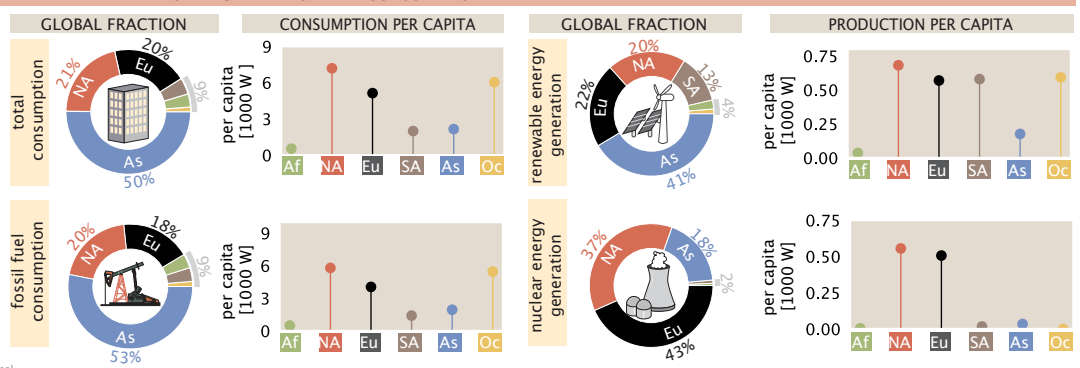
Humans excavate an enormous amount of material from the Earth's crust and transform it to build our structures. Two of these materials, concrete and steel, are produced primarily in Asia on both a global and per capita basis. Asia's per capita production of steel is only outpaced by Europe.



Sources: USGS Statistics and Information 2020, Steel Statistical Yearbook 2019 World Steel Association. Food and Agricultural Organization (FAO) of the United Nations — Annual Population. **Notes:** Reported values for cement and steel production corresponds to 2017 and 2018 values, respectively. Mass of concrete was calculated using a rule-of-thumb that 1 kg of cement yields 7 kg of concrete (Monteiro et al. 2017. doi: 0.138/nmat4930).

J POWER GENERATION AND CONSUMPTION

From heating water, to powering lights, to moving our vehicles, nearly every facet of modern human life requires the consumption of power, culminating in nearly 20 TW of power use in recent years. Asia consumes over half of the power derived from combustion of fossil fuels, with Europe and North America each consuming around 20% of the global total. Asia also produces the plurality of power from renewable technologies, such as hydroelectric, wind, and solar, however, North America, South America, and Europe each produce more on a per capita basis. Nuclear energy, however, is primarily produced in Europe, with North America and Asia coming in second and third place, respectively. On a per-capita basis, North America consumes or produces more energy than all other regions considered here, yielding a total power consumption of nearly 10,000 W per person.



Source: Energy Information Administration of the United States (2017) **Notes:** "Renewables" includes hydroelectric, biofuels, biomass (wood), geothermal, wind, and solar. "Fossil fuels" includes coal, oil, and natural gas.