# Almost all of the world's mammal biomass is humans and livestock

Humans and livestock make up 95% of the world's mammal biomass; wild mammals are just 5%.

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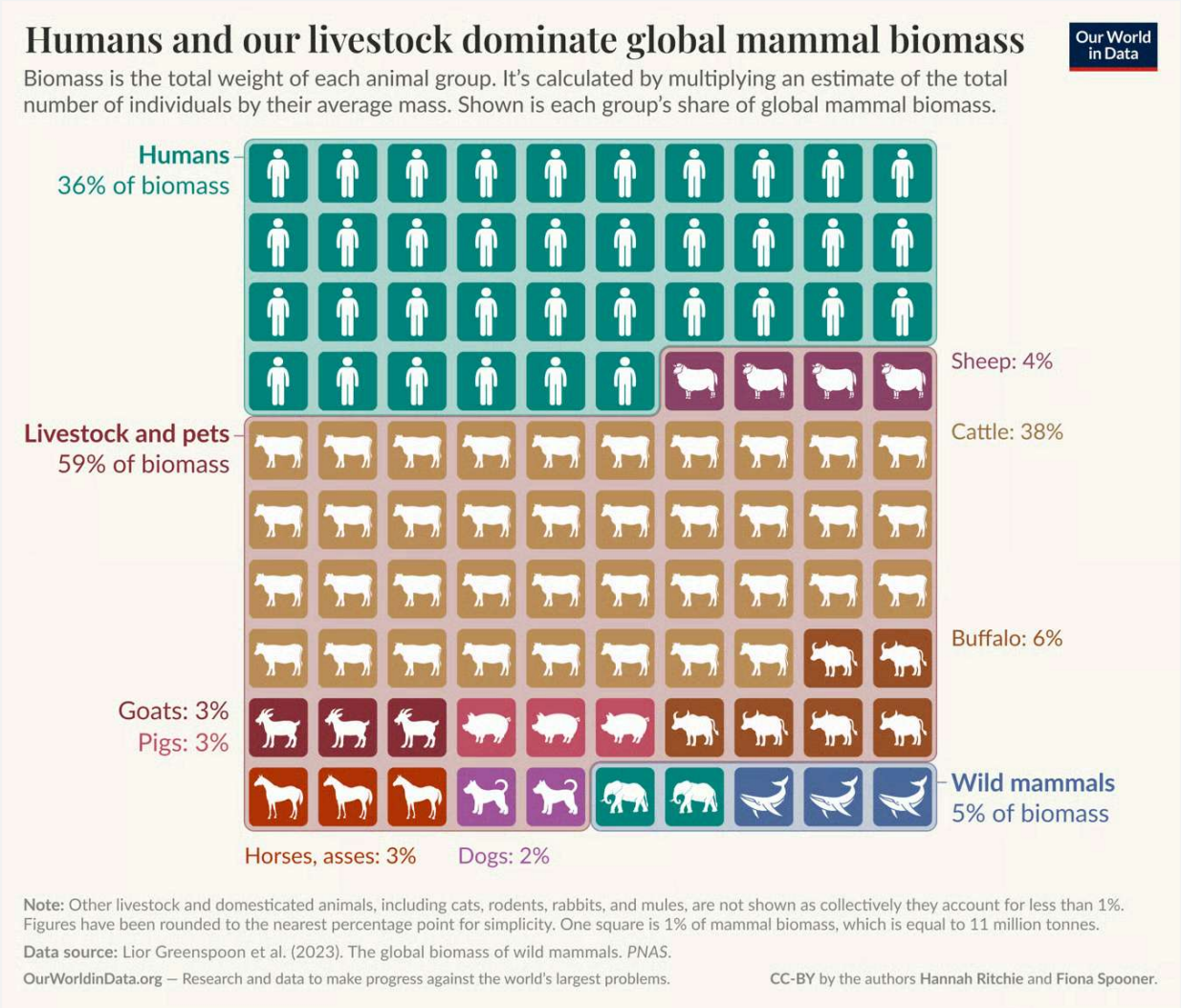
A diverse range of mammals once roamed the planet. This changed dramatically with the arrival of humans, who have become the dominant species through our own populations, as well as the animals we breed and raise for food.

There are various ways to compare the distribution or abundance of different types of mammals. One way is to compare them based on the *number* of individuals. In these terms, very small animals vastly outnumber larger animals, but this doesn't necessarily give us an idea of how much ecological and biological resources different animals use.

Another metric that ecologists often use is biomass — the total weight of all animals of a given species. This not only takes into account the number of animals but also factors in their size.[1] It gives more weight to larger animals at higher levels of the ecological "pyramid": these rely on well-functioning bases below them.

Let's then look at the breakdown of the global mammal kingdom in these terms.[2] It's shown in the chart below. This data is sourced from the study by Lior Greenspoon and colleagues.[3]

Each square represents one percent of the world's mammal biomass, including both land and marine animals. For context, that 1% is equal to around 11 million tonnes.




The dominance of humans is clear. We account for more than one-third of mammal biomass. Our biomass is more than seven times greater than all wild mammals combined.

Our livestock and pets, which are primarily cattle, account for 59%.

That leaves just 5% as wild mammals, which includes thousands of different species, from elephants and deer to lions and whales.

Beyond the totals for humans, livestock, and wild animals, there are a few striking comparisons that we found surprising. Farmed pigs weigh as much as all of the world's whales, orcas, sea otters, seals, and dolphins combined. All the dogs in the world, including pets and feral dogs, weigh as much as all wild mammals on land.

*At the end of this article, we provide more details on the assumptions made in the underlying study, and give some cross-checks on the credibility of these numbers.*

# Chickens and other poultry outweigh wild birds

When we show people the chart above, one question often comes up: what about chickens? Of course, chickens are not mammals. But we can make a similar comparison between poultry and wild birds.

Like mammals, poultry livestock collectively weigh much more than all the world's wild birds. You can see this in the next chart.[4]


The *size* of the difference between poultry and wild birds, though, is much less certain than it is for humans and livestock versus wild mammals. That's because estimates for the number of wild birds vary a lot.

## Our biomass is more than seven times greater than all wild mammals combined.

The underlying study that this data comes from uses several methods to estimate the weight of wild birds globally. The different techniques yield quite different estimates: 5 million tonnes in one, and 24 million tonnes in the other. They take the geometric mean of the two, which is their final estimate shown below. It suggests that poultry weigh more than twice as much as wild birds.

But this result is clearly very sensitive to the choice of methodology. If we used the "5 million tonnes" figure, then wild birds would account for just 14%. If we assumed 24 million tonnes, they'd be 44%. We explain this uncertainty in more detail in our appendix at the end of this article.

Using any method, the overall direction of the result is the same: chickens and other livestock birds weigh more than their wild cousins.



# Wild mammals have declined, but the total amount of mammal biomass has increased a lot

How did humans come to dominate the mammal kingdom?

A huge decline in the number and size of wild mammals has played a major role. Estimates suggest that the biomass of wild mammals has declined by roughly 85% over the last 100,000 years, and particularly since the migration of human populations across the planet.[5]

But that's not the only reason. It's not that the abundance of wild mammals was replaced one by one by humans and livestock. In fact, human activity has dramatically

increased the total amount of mammal biomass on the planet.

Around 100,000 years ago, the total biomass of land mammals summed up to approximately 120 million tonnes, essentially all of it in the form of *wild* animals.[6] By 10,000 years ago, this had fallen to 90 million tonnes. But the most dramatic changes followed the advent of agriculture. Wild mammal populations and biomass continued to decline, while human and livestock populations gradually increased.

> *In this section, we're focusing on terrestrial mammals, so marine mammal figures have not been included.*

By 1850, the total mammal biomass on land — including wild animals, humans, and livestock — had increased to an estimated 250 million tonnes.[7] Since then, this has continued to increase rapidly. Today, mammals weigh roughly 1100 million tonnes, which represents a quadrupling since 1850. Wild mammals declined, but this was more than offset by the huge rise in biomass of humans and farmed mammals.

## Farmed pigs weigh as much as all of the world's whales, orcas, sea otters, seals, and dolphins combined.

Humans achieved this by harnessing external resources and energy inputs that weren't available to wild animal populations before. We've used fossil fuels and agricultural innovations to harness synthetic fertilizers. We've engineered extremely productive crop varieties that grow much faster — and supply more energy — than conventional plants. We've cleared land to make space for raising livestock at higher densities than you'd find them in the wild. Essentially, we've added huge amounts of energy to the system that was there in the absence of human populations.

But while the mammal kingdom is more "vast" than ever before, this has, at least so far, come at the cost of diversity. Wild mammals have shrunk not just in relative terms, but also in absolute terms.


### Acknowledgments

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Humans hunted many of the world's large mammals to extinction. This threat still exists today, but it doesn't have to be that way.

**Wild mammals have declined by 85% since the rise of humans, but there is a possible future where they flourish**

Wild mammal biomass has declined by 85% since the rise of humans. But we can turn things around by reducing the amount of land we use for agriculture.

## Appendix: Estimation methods and uncertainties

In the sections below, we detail the methods and figures that the authors of the scientific papers used in producing the statistics shown in this article. We do this to help make the work and methodology more transparent and understandable.

Unless otherwise stated, the methods we're describing are those of the paper by Lior Greenspoon et al. (2023).[8]

### Humans +

How do researchers estimate the total biomass of humans?

### Livestock +

How do researchers estimate the total biomass of cattle, pigs, and sheep?

### Pets +

How do researchers estimate the total biomass of cats, dogs, and other pets?

## Wild mammals

Uncertainties in the biomass of wild mammals

## Poultry and wild birds

The uncertainty in estimates of wild birds is particularly high

### ENDNOTES

1. To calculate the biomass of a taxonomic group, the researchers multiplied the average weight of a given animal by the number of individuals in that group. In humans, for example, they take the average weight of a person and multiply it by the human population. Sometimes this is given in tonnes of *carbon*. To estimate that, you can take the "wet biomass" — the total of an animal when it's alive — and divide by six.

2. Unfortunately, due to data availability, not all of these estimates are for the same year. 2018 is the year used to calculate the weight of livestock. For humans, the year was 2021. For wild mammals, there is even greater variability. These differences are worth noting, but are likely to have only marginal impacts on the final figures.

3. Greenspoon, L., Krieger, E., Sender, R., Rosenberg, Y., Bar-On, Y. M., Moran, U., ... & Milo, R. (2023). The global biomass of wild mammals. Proceedings of the National Academy of Sciences.

   In an earlier version of this article, we presented data from an earlier paper from Bar-On et al. (2018). The results are similar, but the Greenspoon et al. (2023) paper gives updated estimates.

   Bar-On, Y. M., Phillips, R., & Milo, R. (2018). The biomass distribution on Earth. Proceedings of the National Academy of Sciences.

4. For the bird comparison, we've used data from the study by Bar-On et al. (2018).

   Bar-On, Y. M., Phillips, R., & Milo, R. (2018). The biomass distribution on Earth. Proceedings of the National Academy of Sciences.

5. Bar-On, Y. M., Phillips, R., & Milo, R. (2018). The biomass distribution on Earth. Proceedings of the National Academy of Sciences.

6. Barnosky, A. D. (2008). Megafauna biomass tradeoff as a driver of Quaternary and future extinctions. Proceedings of the National Academy of Sciences.

7. This figure comes from Greenspoon et al. (2025). The global biomass of mammals since 1850. Nature Communications.

   The authors attempt to quantify the change in global mammal biomass since 1850. These figures, especially for wild mammals, are highly uncertain, especially further back in time. They estimate that humans and livestock weighed 200 million tonnes, and wild land mammals, 50 million tonnes. The 200 million figure is likely to be much more certain than the latter.

8. Greenspoon, L., Krieger, E., Sender, R., Rosenberg, Y., Bar-On, Y. M., Moran, U., ... & Milo, R. (2023). The global biomass of wild mammals. Proceedings of the National Academy of Sciences.

9. This comes from an older paper from Woodall et al. (1988).

   P. F. Woodall, I. P. Johnstone, Dimensions and allometry of testes, epididymides and spermatozoa in the domestic dog (Canis familiaris). Journal of Reproduction and Fertility.

10. Population estimates come from the following source.

    Young et al. (2011), Urban carnivores: Ecology, conflict, conservation. The Journal of Wildlife Management.

11. Gaston KJ, Blackburn TM (1997). How many birds are there? Biodiversity Conservation.

12. Nee, S., Read, A. F., Greenwood, J. J., & Harvey, P. H. (1991). The relationship between abundance and body size in British birds. Nature.

13. In the original paper, the authors calculate this weight in tonnes of carbon. To convert our wet weight to tonnes of carbon, you'd divide by 6. That would give 4 million tonnes of carbon.

14. Callaghan, C. T., Nakagawa, S., & Cornwell, W. K. (2021). Global abundance estimates for 9,700 bird species. Proceedings of the National Academy of Sciences.

15. Robinson, O. J., Socolar, J. B., Stuber, E. F., Auer, T., Berryman, A. J., Boersch-Supan, P. H., ... & Johnston, A. (2022). Extreme uncertainty and unquantifiable bias do not inform population sizes. Proceedings of the National Academy of Sciences.

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