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Global population impacts of land grabbing for large-scale agriculture

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Abstract

The global rise of large-scale land acquisitions (LSLAs) for commodity agriculture has sparked major concerns about their impacts on rural populations. We estimate that 177-250 million people globally, at minimum, have been affected by documented agricultural LSLAs since 2000. These often occur in densely populated areas and in Indigenous Peoples and local communities´ lands, challenging prevailing claims that LSLAs target underutilized lands and raising serious concerns about land rights.

Keywords

Land grabbing; Land deals; Large Agricultural Investments; Customary Lands; Agribusiness.

Main

The rise of large-scale land acquisitions (LSLAs) for commodity agriculture to satisfy global food, fuel, and fiber demand has sparked major concerns about their impacts on local livelihoods and land rights, land use change, and the environment. Also referred to as land grabbing[1], LSLAs involve the transfer, or attempted transfer, of

rights to use, control, or ownership of land through its sale, lease, or concession, often at the expense of local inhabitants, as extensively documented in the literature[2,3]. However, until today we lack information on the scale of human impact in terms of the global population affected by LSLAs. Furthermore, while growing case evidence challenges the common narrative that LSLAs occur on empty, underutilized or barren lands[4–6], no global assessment exists of the land occupancy contexts where LSLAs take place.

To address these gaps, we estimate the number of people living on lands prior to acquisitions for agriculture, as well as the population densities where these LSLAs occur and their overlap with customary lands globally. Data-wise, we combine records of documented agricultural LSLAs from the Land Matrix, the largest global land deals database, with gridded population data from the Global Human Settlement Layer and global maps of lands and territories owned, governed, managed, used, or occupied by Indigenous Peoples and local communities (see Methods).

We find that at least 177 million people globally have been living on 63 million ha of lands subject to concluded agricultural LSLAs documented in the Land Matrix since 2000. This minimum estimate does not account for people inhabiting lands subject to failed or intended land deals, which, despite not having resulted in industrial agriculture, often do involve land reclassification and governance changes leading to the exclusion of local land users from critical livelihood resources[7,8]. Accounting for these failed and intended LSLAs, we estimate that 217 million people, at minimum, have been affected over 89 million ha of documented agricultural LSLAs globally. By further considering people living near land deals as also likely being affected due to loss of access to livelihood resources located within the concession areas[9–11], numbers mount close to 250 million (Figure 1, table in top panel).

Because not all agricultural LSLAs are captured by the Land Matrix (see SI-2 for more detail on limitations), these upper-end values are likely still very conservative estimates of the total number of people that have been affected since 2000. Cernea and Maldonado (2018) estimate that infrastructure-related displacement exceeded 20 million people per year during 2011–2020, amounting to more than 200 million people over one decade[12]. That LSLAs documented since 2000 reach a comparable number suggests that the total population affected is substantially larger than captured here, particularly given the scale of global cropland expansion since 2005[13].

Regarding temporality, our results indicate that the five-year epoch with the maximum number of people affected by recorded agricultural LSLAs was 2005-2009, followed by 2010-2014 (SI Table 1). This is in line with the land grab literature, which recognizes the same period as having been the peak of the global 'land rush' that was triggered by the 2008 financial crisis[14,15]. The peak is also largely reflected in country-level trends (see sparkline plots in Figure 1; SI Table 2), though these also reveal that the land rush for agriculture happened pre and continued post the mid-2000s for a number of countries. For example, in Kenya, India, and South Africa, the number of people affected by LSLAs peaked between 2000 and 2004, while Algeria, Uzbekistan,

and Cuba (among others) saw upticks in the number of people affected well after, between 2015 and 2026 (SI Table 2). These cases highlight the need for attention on both the situated history and the continued evolution of the land rush, with changing global and regional conditions setting the stage for where land becomes worth assembling as a resource for global investment[16–18].

Examining population densities where agricultural LSLAs have taken place, we find that the mainstream narrative of deals occurring in underutilized, empty, or barren lands does not hold (Figure 1, violin plots). Globally, the median population density within LSLA footprints (previous to or at the timepoint that each LSLA was initiated) was of 55 people/km^2 – close to the average global population density today (62 people/km^2)[19,20] and comparable to the densities of cities like Arles (France) and states like Michigan (U.S.A) or Yucatan (Mexico)[21–23]. In effect, a large share of land deals appears to have occurred in contexts of average to high rural population density. This is particularly the case for Africa, where half of all land deals are in areas with population densities greater than 128 people/km^2, compared to the continental average of 53 people/km^2 [24].

The above results offer insight about the population immediately impacted by individual agricultural LSLAs. Yet the implications of LSLAs are not confined to individual deal footprints. The concentration of LSLAs within the same landscape — whether through many deals, very large deals, or both — indicates broader processes of agrarian restructuring, including changes in labour demand, migration, land governance, and environmental conditions[25,26]. To capture where such wider landscape-level transformations are taking place, we developed a LSLA intensity measure which identifies where rural landscapes have been most exposed to concentrated agricultural land acquisition activity between 2000 and 2026 (See Methods).

The resulting exposure surface reveals a geographically uneven pattern of LSLA activity (Figure 2, top panel). The upper exposure classes (Q4/Q5) account for more than three-quarters of all land exposed to LSLAs in South-eastern Asia and Eastern Africa, more than half in Western Africa and Eastern Europe, and more than 40% in Middle Africa and South America (Figure 2, tree plots; SI Table 4). Such regions with high LSLAs exposure have likely experienced deep-set agrarian changes due to a concentration of land deals for large-scale agriculture.

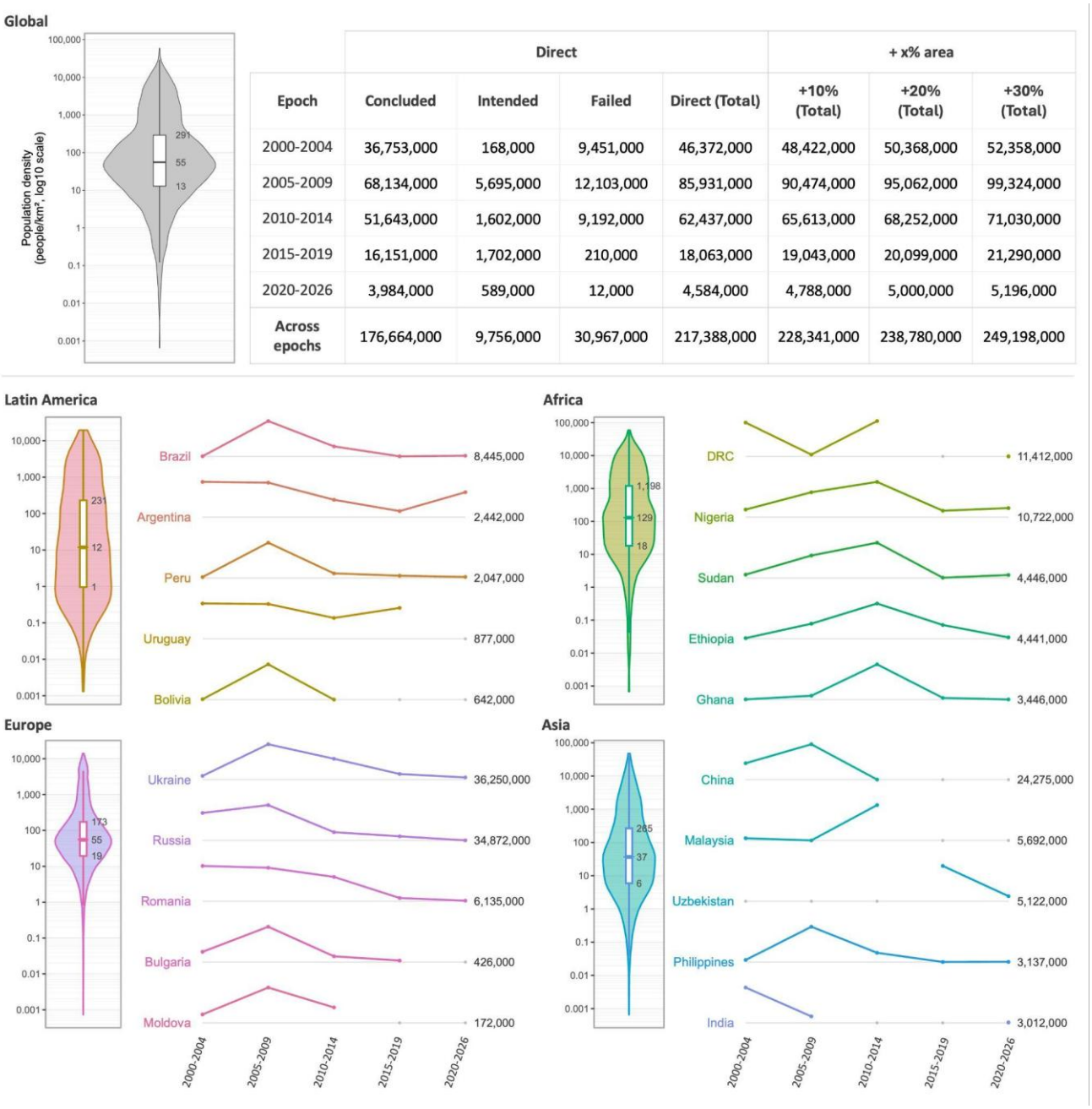
The consequences of concentrated LSLA activity likely brings severe implications for Indigenous Peoples' and local communities' land access in areas where customary governance is at odds with the private property and land lease rules through which large-scale land acquisitions are typically negotiated. This is exacerbated where customary systems of tenure and governance may not be adequately recognized or protected by law, are unevenly formalized, or are politically contested[27–29]. We examined the overlap between the concentration of LSLAs and mapped customary lands and found that more than 80% of Indigenous Peoples' lands in South-eastern Asia, nearly 70% in Eastern Africa, and more than half in Western Africa are located in high LSLA exposure areas (Q4/Q5 classes). For local community lands, the corresponding shares reach nearly all mapped areas in South-eastern Asia, Western Africa, and Middle Africa, and more than 70% in Eastern Africa (SI Table

6). In short, mapped Indigenous Peoples' and local communities' lands constitute a substantial part of the high-exposure area worldwide (Figure 2, tree plots). At the country level, Nigeria, Benin, Laos, Malaysia, Gambia, Kenya, Ethiopia, and Myanmar stand out as cases where a substantial share of national land has been highly exposed to documented LSLAs and where, simultaneously, Indigenous Peoples' land coverage within that high-exposure area is also high (Figure 2, scatter plot). Together, these results help identify landscapes where local land access has likely come under heightened pressure due to cumulative land acquisition activity. For Indigenous Peoples and local communities, such pressures may extend beyond reduced access to land and resources, potentially affecting territorial governance, cultural continuity, self-determination, and relationships with ancestral territories.

In summary, this study provides a global estimate of people living on lands subject to reported large-scale land acquisitions for commodity agriculture. By combining global land deal records with population data, we show that at least 177-250 million people have been directly affected by agricultural LSLAs documented since 2000. Our findings challenge persistent narratives that agricultural LSLAs primarily target empty, marginal, or underutilized land. Instead, documented LSLAs frequently occur in populated rural landscapes and substantially overlap with Indigenous Peoples' and local communities' lands and territories, particularly in parts of Africa and South-eastern Asia.

By focusing only on documented LSLAs for agriculture, our results represent conservative lower-end estimates that do not capture people living on lands subject to unreported deals or to acquisitions pursued for other purposes. Existing global land deal datasets remain incomplete and have reporting biases, as they depend on uneven access to local collaborators for data gathering and validation. Furthermore, our analysis does not address how localized impacts of LSLAs are distributed across socially differentiated groups. Reviews have documented major burdens, including livelihood loss, land use change, and environmental degradation[2,3,28,30], while LSLA benefits tend to be unevenly distributed across elites[31]. Looking ahead, there is a need to further document where land acquisitions occur as well as to integrate qualitative analyses of differentiated localized impacts with larger-n assessments such as this one, to trace how the geography, intensity, and governance of the global land rush continue to evolve across diverse contexts[32].

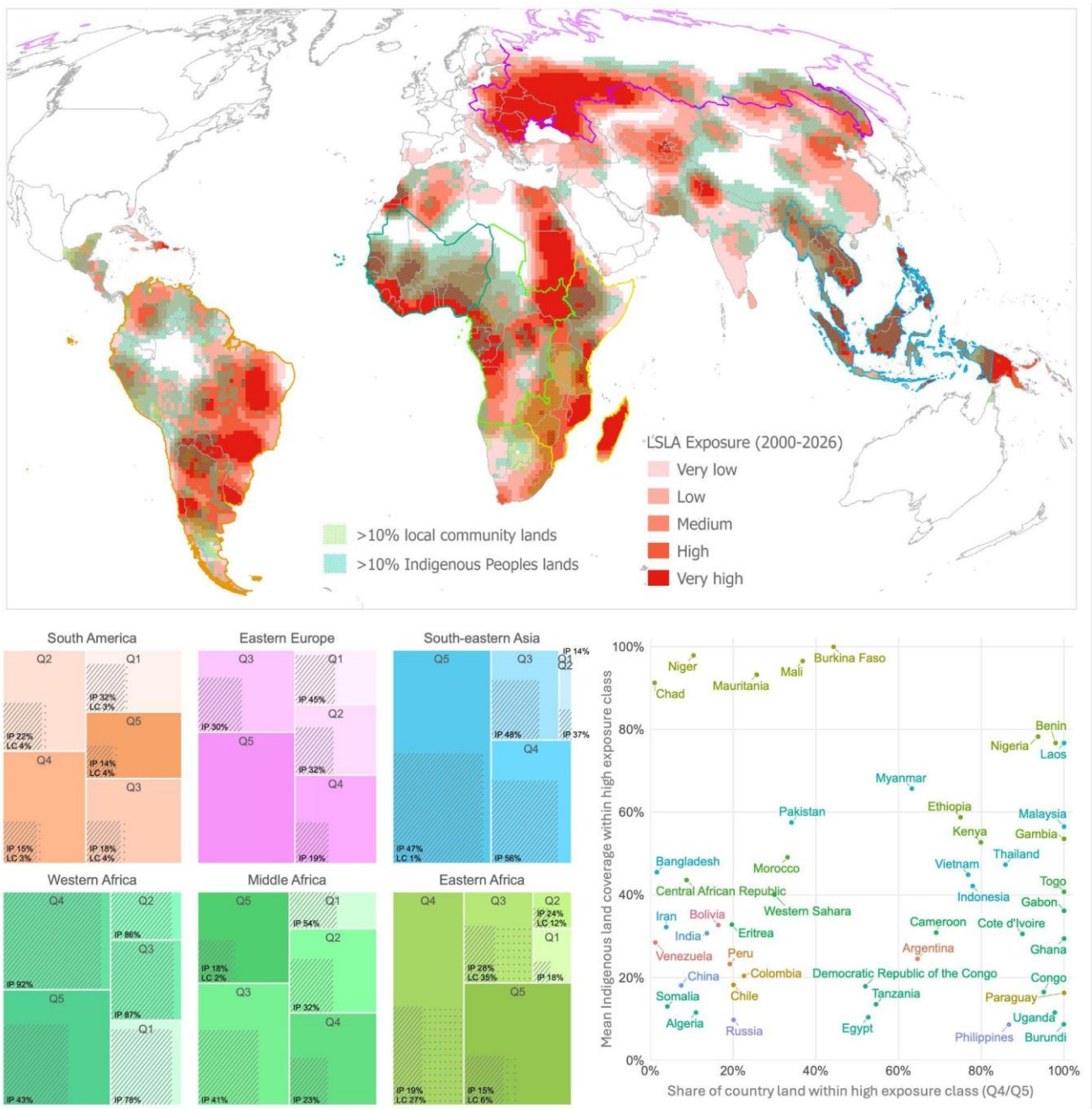
As global resource extraction grows and sustainability agendas add substantial land demands for energy provision, biodiversity conservation, and carbon offsetting[30,33], research and monitoring of land grabbing and its impacts remains urgent. Upholding rights and enabling local groups to continue living on their lands if they wish to do so calls for a broad range of measures, such as meaningful participation in land-use decisions[34], securing customary tenure[35], building accountability chains[36], and pursuing land restitution and redistribution to redress past damages and vulnerabilities[37]. A basic premise for any of these measures is recognizing that the vast majority of acquired lands are not empty or underutilized but inhabited by millions of people who depend on them.



	Direct				+ x% area		
Epoch	Concluded	Intended	Failed	Direct (Total)	+10% (Total)	+20% (Total)	+30% (Total)
2000-2004	36,753,000	168,000	9,451,000	46,372,000	48,422,000	50,368,000	52,358,000
2005-2009	68,134,000	5,695,000	12,103,000	85,931,000	90,474,000	95,062,000	99,324,000
2010-2014	51,643,000	1,602,000	9,192,000	62,437,000	65,613,000	68,252,000	71,030,000
2015-2019	16,151,000	1,702,000	210,000	18,063,000	19,043,000	20,099,000	21,290,000
2020-2026	3,984,000	589,000	12,000	4,584,000	4,788,000	5,000,000	5,196,000
Across epochs	176,664,000	9,756,000	30,967,000	217,388,000	228,341,000	238,780,000	249,198,000

Main manuscript - Figure 1

Estimated number of people living within documented large-scale land acquisitions for agriculture (2000-2026). *Table*: Global estimates (rounded to the thousands) by negotiation status and by epoch. *Upper-left violin plot (grey)*: Log-scaled distribution of population density within LSLA deal-sized footprints globally (all periods). Boxplot within the violin plot shows the median (central line), interquartile range (25th to 75th percentile), and whiskers (variability of data outside the middle 50%). *Four-part grid (per continent of interest)*: Violin plot showing the log-scaled distribution of population density (across epochs) within LSLA footprints. Sparkline plots show the relative number of people living within LSLA footprints by epoch for the five countries with the largest total population affected within each continent. Total population directly affected within each top-5 country is displayed to the right of its sparkline (sum across epochs).



147

148 **Main manuscript - Figure 2**

149 Global exposure to LSLAs. *Top panel:* LSLA exposure intensity (2000-2026), calculated as the mean kernel
150 density value per 100x100km grid cell; positive exposure values classified by quintiles. Hashed and dotted
151 overlays show grid cells where Indigenous Peoples' (IP) and/or local communities' (LC) lands occupy greater
152 than 10% of a given grid cell. *Bottom left*: Tree plots show the share of each region's land area split by LSLA
153 exposure class (Q1-Q5), within which hashed and dotted overlays show the share of each exposure class that
154 is Indigenous Peoples and/or local communities' lands, respectively. Regions outlines (coloured accordingly)
155 are provided in the map in the top panel. *Bottom right*: Scatter plot showing the intersection between the
156 share of each country's land that is highly exposed to documented LSLAs (pooled Q4/Q5 class) against the
157 average coverage (%) of Indigenous Peoples' lands within that highly exposed area.

Methods

We retrieved reported agricultural LSLA locations from the Land Matrix[38], retaining records with administrative or finer spatial accuracy and grouping them by negotiation status: concluded, intended, or failed. Deal area was taken from the area currently under contract or operation for concluded or failed deals, and from the intended deal size field for intended deals. For acquisitions associated with multiple locations (i.e., 'subsumed' deals), this area was evenly allocated across those locations before constructing area footprints. Each location was then represented by a circular buffer centred on the reported location and equal in area to its allocated deal size. These circular deal-size footprints were used as spatial proxies for concession areas. Full filtering, deal-size, date-assignment, and location-allocation rules are reported in the Supplementary Information (SI 1.1).

Population living on lands prior to acquisition was estimated by summing the Global Human Settlement Layer population grid (GHS-POP) counts within these deal-size-derived footprints. GHS-POP provides gridded estimates (1x1-km) of residential population at five-year intervals (2000, 2005, 2010, 2015, 2020, 2025)[39]. Each LSLA was assigned to the most recent population epoch at or before its earliest recorded start year, which was derived from dated Land Matrix status, implementation, and size-history fields. This assignment produced an estimation of the population present before the acquisition was first recorded. Records without a valid start year but marked as updated since 2000 were assigned to the earliest population epoch (i.e., 2000). To provide upper-bound estimates for populations living beyond the reported deal area but that were plausibly affected by nearby LSLA activity, we repeated the population calculation after expanding each footprint area by 10%, 20%, and 30%. Population density was calculated from the same raster extraction by dividing the population counted within each footprint by the combined area of the GHS-POP raster cells included in that count.

To identify where reported agricultural LSLAs are spatially concentrated, we constructed a deal-size-weighted kernel density surface from the retained LSLA locations. Each location contributed to the surface in proportion to its allocated deal size, so that larger reported acquisitions contributed more strongly to the exposure-intensity measure. Kernel density was calculated using a 500-km search radius and restricted to land areas. This radius was selected from an optimized hotspot analysis that identified the spatial scale at which the retained LSLA locations clustered most strongly. The resulting surface represents smoothed LSLA exposure intensity: values are highest near large or clustered acquisitions and decline with distance until the search-radius limit. Mean kernel density was then summarized to a global 100-km land grid. Grid cells with no kernel density value were retained as a separate zero-exposure class. Positive kernel-density values were divided into ordered exposure classes. *High LSLA exposure* refers throughout to the pooled upper two positive quintiles (Q4/Q5).

We assessed spatial convergence between LSLA exposure intensity and customary lands using the Indigenous Peoples' lands dataset produced by Garnett et al. (2018) and the local communities' lands dataset compiled for the 2021 global assessment of Indigenous Peoples' and local communities' lands and territories[40,41]. The Indigenous Peoples' lands dataset identifies areas where Indigenous tenure is officially recognized or where Indigenous Peoples retain substantial de facto influence over land management. The local communities' lands dataset maps community-managed or community-held lands compiled separately from the Indigenous Peoples' lands layer. We overlaid both mapped extents with the 100x100-km exposure grid to calculate the area of Indigenous Peoples' lands and local communities' lands within each LSLA exposure class. For country-level comparisons, we calculated the share of national land in the pooled high-exposure class (Q4/Q5) and the area-weighted mean Indigenous Peoples' or local communities' land coverage within that same high-exposure area.

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