

The New Geography of Human Survival: Climate Change, Resource Insecurity and the Reshaping of Habitable Space

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Abstract:

Human survival has always depended on geography, but the meaning of a “habitable place” is changing. Climate warming, extreme heat, water stress, food insecurity, ecosystem degradation, disasters, rapid urbanization and population mobility increasingly interact with inequality and uneven adaptive capacity. This conceptual review examines these interactions as a new geography of human survival. It draws on authoritative assessments and datasets from the Intergovernmental Panel on Climate Change (IPCC), World Meteorological Organization (WMO), World Health Organization (WHO), UN-Water, Food and Agriculture Organization (FAO), International Labour Organization (ILO), World Bank and United Nations Office for Disaster Risk Reduction (UNDRR). The evidence shows that approximately 3.3–3.6 billion people live in contexts highly vulnerable to climate change; 2.1 billion people still lack safely managed drinking water; about 673 million people experienced hunger in 2024; and heat stress is projected to reduce global working hours by 2.2 per cent in 2030 under the ILO scenario. The article argues that habitability cannot be reduced to temperature or physical occupancy. It is produced through the interaction of environmental tolerance, water and food security, health, livelihoods, infrastructure, governance, technology and social equity. The same climatic hazard can therefore create very different human outcomes in different places. A new geographical distinction is emerging between high-resilience and low-resilience spaces. The paper concludes that the central challenge is not merely to identify where people can physically remain, but to build places where they can live safely, productively and with dignity. Climate-resilient development, anticipatory adaptation, inclusive urban planning, risk-informed infrastructure and justice-centred governance are essential to this transition.

Keywords: human survival; climate change; habitability; water security; food security; climate migration; resilience; environmental justice

1. Introduction

Geography has always shaped the possibilities of human life. Rivers supported agriculture and settlement; coastlines facilitated trade; fertile plains sustained dense populations; and climate influenced crops, disease environments and the availability of water. Yet technological development created an impression that modern societies had progressively escaped geographical limits. Electricity, irrigation, refrigeration, medicine, transportation and engineered infrastructure allowed large populations to occupy environments that earlier societies would have found difficult to sustain. The twenty-first century is revealing the limits of that assumption. Human activity is changing the climate at a time when populations, infrastructure and economic assets are highly concentrated. The World Meteorological Organization reports that 2015–2025 were the eleven warmest years in the observational record and that the global mean near-surface temperature in 2025 was about 1.43°C above the 1850–1900 average (WMO, 2026). The significance of this warming lies not simply in a higher global average, but in altered probabilities of extreme heat, heavy rainfall, drought and compound events.

At the same time, vulnerability is extraordinarily uneven. The IPCC estimates that roughly 3.3–3.6 billion people live in contexts highly vulnerable to climate change (IPCC, 2022, 2023). This does not mean that half the world is becoming physically uninhabitable. It means that environmental hazards increasingly intersect with poverty, weak infrastructure, fragile ecosystems, limited public services and climate-sensitive livelihoods. Consequently, the same physical event can produce radically different human consequences.

This article uses the expression “new geography of human survival” to describe the changing spatial relationship among environmental conditions, essential resources, human vulnerability and adaptive capacity. Its central argument is that habitability is not a fixed property of land. A place may remain physically occupiable while becoming unsafe, economically unsustainable or socially exclusionary. Human survival therefore depends not only on climate, but on whether societies can secure water, food, health, shelter, livelihoods and institutional protection under changing conditions.

2. Method and Conceptual Orientation

The paper follows a conceptual and integrative review design. It does not manufacture primary data or present scenario projections as observed facts. Instead, it synthesizes recent authoritative evidence from major international scientific and development institutions. Preference is given to primary institutional reports and official datasets, including the IPCC Sixth Assessment, WMO State of the Global Climate 2025, WHO climate-health assessments, the 2026 UN World Water Development Report, FAO’s State of Food Security and Nutrition in the World 2025, ILO heat-stress estimates, the World Bank Groundswell analysis and UNDRR’s Global Assessment Report 2025.

The analytical logic is expressed as a chain: environmental change creates or intensifies hazards; hazards matter where people and assets are exposed; exposure becomes harmful according to vulnerability; and the final human outcome is modified by adaptive capacity. Adaptive capacity includes income, infrastructure, governance, technology, health services, education, social

protection and community networks. This framework avoids environmental determinism because it recognizes that hazards do not mechanically determine social outcomes.

The article therefore treats effective habitability as multidimensional. A location can be climatically tolerable yet water insecure; food producing yet economically inaccessible to poor households; physically safe yet lacking healthcare; or environmentally exposed but highly resilient because of strong infrastructure and institutions. The concept of survival geography emerges from the intersection of these conditions rather than from any single environmental threshold.

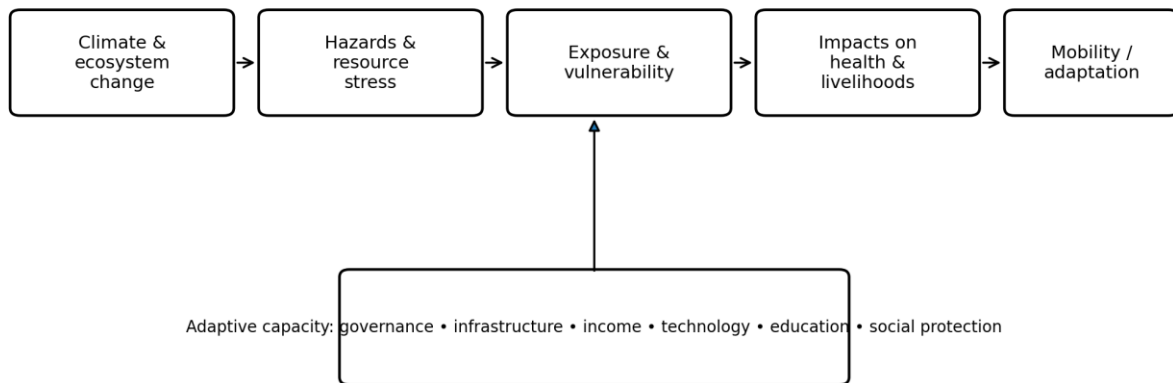


Figure 1. Conceptual pathway of the new geography of human survival

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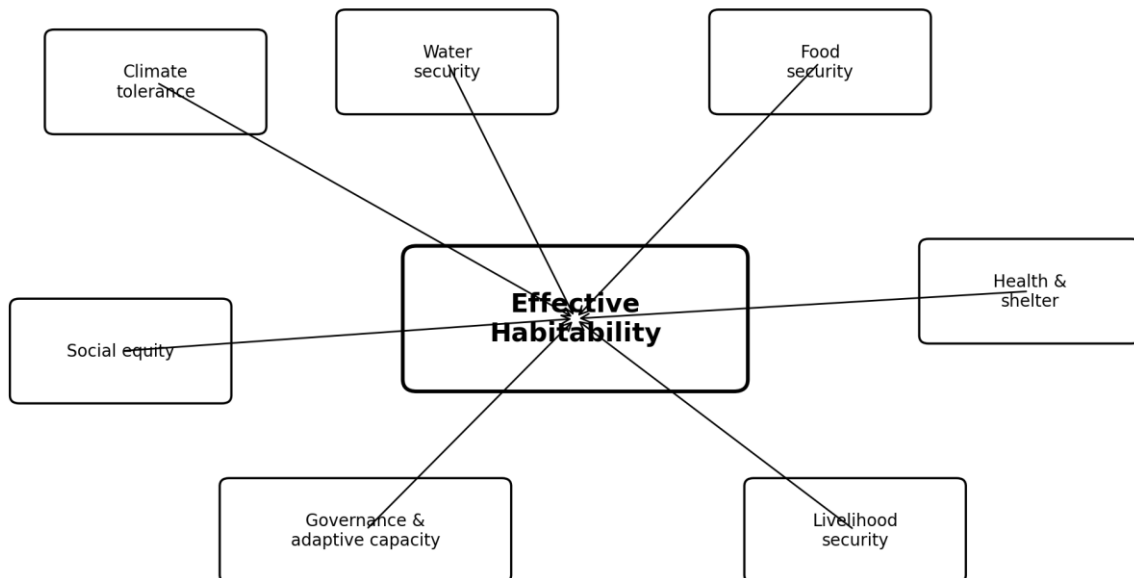


Figure 2. Habitability as a multidimensional social-environmental condition

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3. Climate Change and the Redrawing of Habitability

Climate change is the physical background against which the new survival geography is developing. WMO's 2026 assessment confirms a persistent warming trend, with 2025 among the warmest years recorded and the preceding eleven years forming the warmest eleven-year sequence in the

observational record (WMO, 2026). The IPCC further concludes that evidence for human influence on heat extremes, heavy precipitation and several compound events has strengthened (IPCC, 2023). This matters geographically because settlements and infrastructure were largely designed around historical climate conditions. Buildings, drainage systems, reservoirs, transport networks, agricultural calendars and public-health arrangements reflect assumptions about expected temperature and rainfall. As those statistical patterns change, yesterday's "normal" can become an unreliable guide to tomorrow's risk.

Extreme heat illustrates the transition clearly. Heat is not merely an inconvenience; it can limit physiological functioning, raise mortality risk and reduce the ability to perform physical work. Yet heat does not create a uniform boundary between safe and unsafe space. Housing quality, ventilation, urban tree cover, electricity reliability, access to cooling, age, health status and occupation mediate exposure. A wealthy household and an outdoor construction worker may experience the same regional temperature but inhabit very different practical climates.

Thus, the emerging geography is better represented as a mosaic of risk than as a simple map of habitable and uninhabitable zones. Places move along a continuum from relatively secure to increasingly costly, dangerous or difficult to inhabit. The geography of climate change is therefore inseparable from the geography of adaptation.

4. Heat, Health and the Geography of Work

The human body is becoming an important geographical unit. WHO identifies climate change as a threat to basic determinants of health, including clean air, safe drinking water, nutritious food and secure shelter. Its quantitative assessment estimated that, between 2030 and 2050, climate change could cause approximately 250,000 additional deaths per year from heat stress, malaria, diarrhoeal disease and undernutrition alone, under the assumptions of that assessment (WHO, 2014). This figure is deliberately conservative because it covers only selected pathways.

Heat also reshapes the geography of labour. The ILO projects that by 2030 heat stress could reduce total working hours worldwide by 2.2 per cent, equivalent to about 80 million full-time jobs, under its stated warming and labour assumptions (ILO, 2019). Agriculture and construction are especially exposed because work is frequently strenuous and outdoors.

This creates the possibility of "economic uninhabitability." A place need not cross a biological limit before livelihoods become unstable. If workers must reduce activity during the hottest hours, productivity and income can decline. Work may shift to early mornings or nights, while employers and governments face greater obligations for shade, hydration, rest periods and occupational health protection. Where these adaptations are unavailable, climate risk becomes livelihood risk.

The important geographical insight is that health and work are connected. Heat affects the capacity to earn income; income affects access to cooling, housing and healthcare; and those resources in turn affect survival. Climate vulnerability can therefore become self-reinforcing unless public policy interrupts the cycle.

5. Water Security: The Primary Geography of Survival

Water remains the most immediate material foundation of settlement. The United Nations World Water Development Report 2026 states that 2.1 billion people still lack safely managed drinking water (UN-Water, 2026). Water insecurity is not simply a matter of annual rainfall. It is shaped by groundwater recharge, storage, contamination, affordability, infrastructure, competing demand and governance.

Climate change can intensify water insecurity in several directions. Drought can reduce surface supplies and recharge; heavy rainfall can overwhelm drainage and contaminate water sources; coastal processes can contribute to salinization; and changes in snow and ice can alter seasonal water availability. The paradox is that communities can suffer from too little water, too much water or unsafe water.

This makes water security a powerful organizer of future settlement. Cities with diversified supply, wastewater recycling, leakage control, rainwater capture and effective governance can remain viable under considerable climatic pressure. Poor settlements may face severe insecurity even in water-rich regions when infrastructure and public services are inadequate.

Technology can therefore modify physical scarcity, but not without cost. Desalination, long-distance transfers, treatment and pumping require capital and energy. Consequently, future water geography will partly reflect hydrology and partly reflect institutional and technological capacity. The crucial policy objective is not only to increase supply, but to secure reliable, affordable and safe access while maintaining the ecological systems on which long-term water availability depends.

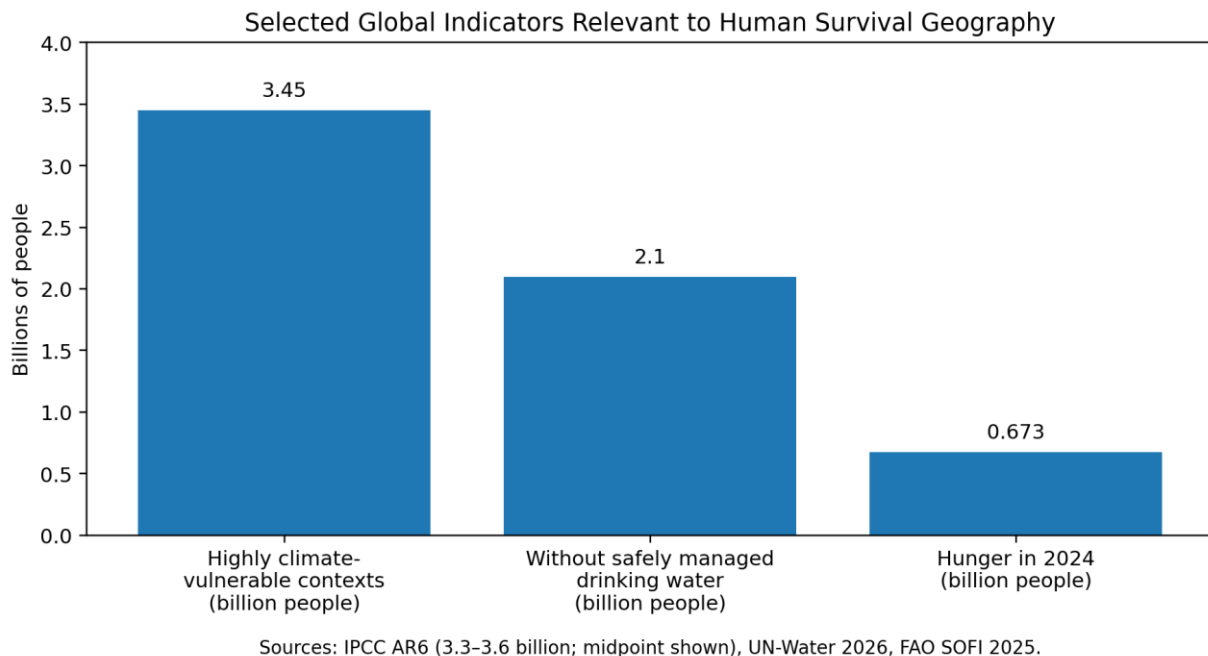


Figure 3. Selected global indicators relevant to human survival geography.

6. Food Security and Changing Productive Landscapes

Food systems connect climate, water, land, markets and household income. FAO and partner agencies estimated that about 673 million people, or 8.2 per cent of the global population, experienced hunger in 2024. The global figure improved modestly from the preceding years, but

regional progress was uneven and hunger continued to worsen in several parts of Africa and western Asia (FAO et al., 2025).

Climate-related food insecurity operates through more than crop yields. Heat, drought, floods, pests and water stress can disrupt production, but transport interruptions, market volatility and price inflation can also reduce access. A household can therefore become food insecure without experiencing a local crop failure. This is particularly important for low-income families that devote a high share of income to food.

The new geography of food survival consists of at least three overlapping spaces: production zones, distribution networks and household purchasing power. Resilience must address all three. Drought-tolerant crops, efficient irrigation, soil conservation, crop diversification, storage, early-warning information and reduced post-harvest loss can strengthen production. Social protection and stable market access are necessary to protect consumption.

Local and Indigenous knowledge can contribute to this transition when it is critically evaluated alongside contemporary science. Long-established practices concerning mixed cropping, water harvesting, seed selection and seasonal observation may contain valuable place-specific knowledge. The objective should not be to romanticize tradition, but to combine tested local experience with climate science and modern agronomy.

7. Disasters and the Economics of Staying in Place

Disaster risk is increasingly a question of whether places remain financially sustainable. UNDRR's Global Assessment Report 2025 estimates direct disaster losses at roughly US\$202 billion annually, while the broader economic burden exceeds US\$2.3 trillion per year when cascading and ecosystem effects are included (UNDRR, 2025). These broader effects include interrupted livelihoods, damaged health and education systems, supply-chain disruption and ecosystem losses.

Repeated disasters can erode the economic foundations of settlement before physical abandonment becomes unavoidable. Households lose savings; governments borrow for recovery; insurance premiums rise; lenders reassess risk; and public budgets are diverted from development to reconstruction. A property may remain standing yet become difficult to insure. A farm may remain productive in normal years yet become financially unviable after repeated droughts.

This suggests the concept of "financial habitability." The ability to remain in a place depends partly on whether households, businesses and governments can afford the cost of recurring risk. It also explains why disaster-risk reduction should be treated as investment rather than emergency expenditure. Safer buildings, drainage, early-warning systems, resilient infrastructure and ecosystem protection can prevent losses before they occur.

The geography of disasters is consequently not simply a map of hazards. It is a map of exposure, accumulated assets, debt, insurance, public investment and the capacity to recover.

8. Migration and the Geography of Mobility

Human mobility has always been an adaptation to environmental and economic change. Contemporary climate pressures may alter the scale and direction of that mobility, but climate migration should not be described as a simple one-cause process. People move because

environmental stress interacts with employment, food prices, water availability, conflict, family networks and public policy.

The World Bank's Groundswell analysis projected that climate-related pressures could contribute to as many as 216 million internal climate migrants across six world regions by 2050 under a high-impact scenario. The same analysis found that strong climate and development action could reduce the projected scale substantially, potentially by as much as 80 per cent (World Bank, 2021). These are scenario-based projections, not a prediction that a fixed number of people will inevitably migrate. Mobility can be adaptive when people have information, resources, legal protection and opportunities at destination. It becomes damaging when displacement is sudden, unsafe or involuntary. Equally important is the problem of immobility. Some highly vulnerable households may be unable to move because migration itself requires money, networks and knowledge.

The future geography of survival is therefore a geography of both movement and staying. Policy must protect the right to remain where adaptation is feasible while making planned mobility safer where environmental and economic conditions are deteriorating. Receiving cities also need housing, employment, schools, healthcare and infrastructure capable of accommodating population change.

9. Urbanization: Cities as Risk Concentrators and Resilience Hubs

Cities occupy a contradictory position in the survival geography. They concentrate people, assets and infrastructure, which can magnify losses from heat, floods and service failure. Impermeable surfaces can increase runoff, dense built environments can intensify urban heat, and informal settlements are often located on floodplains, unstable slopes or poorly serviced peripheral land.

At the same time, cities concentrate the very capacities needed for adaptation: hospitals, universities, technical expertise, emergency services, public transport, communication networks and investment. Well-governed cities can therefore become resilience hubs rather than merely risk hotspots.

The decisive issue is the quality of urbanization. Heat-sensitive building standards, shaded public space, urban forests, reliable water and electricity, drainage, affordable housing, accessible healthcare and public transport can reduce vulnerability. Distributed energy and backup systems can prevent one infrastructure failure from cascading into others.

Urban planning should therefore be understood as survival planning. Land-use decisions made today can lock populations into risk for decades. Conversely, risk-informed planning can reduce future exposure before expensive protective measures become necessary.

10. Inequality and Adaptive Capacity

Perhaps the most important finding of contemporary climate research is that environmental risk is socially differentiated. The IPCC emphasizes that vulnerability varies greatly within and among regions and is shaped by inequity, marginalization, development constraints, unsustainable resource use and governance (IPCC, 2022).

This means that two people living in the same city can occupy different survival geographies. One may have insulated housing, reliable electricity, private transport, savings and health insurance. Another may work outdoors, live in poorly ventilated housing, depend on intermittent water supply and possess no financial buffer. The weather is shared; the risk is not.

Adaptive capacity is therefore becoming a geographical resource. Technology such as air-conditioning, desalination or insurance can reduce risk, but access is unequal. If adaptation depends mainly on private purchasing power, climate change may deepen existing inequality and create protected enclaves alongside highly exposed populations.

A justice-centred approach requires public adaptation: heat action plans, universal water and sanitation, resilient schools and hospitals, social protection, safe housing, early warnings and accessible cooling. The aim is to prevent adaptation from becoming a privilege available only to those who can buy protection.

11. A New Geography of Resilience

The evidence reviewed here suggests that the central geographical distinction of the future may increasingly be between high-resilience and low-resilience spaces. High-resilience places are not necessarily free from hazards. They are places able to anticipate, absorb, adapt to and recover from shocks without sacrificing basic human capabilities.

This reframes the question of habitability. Instead of asking only “Where can humans live?”, policy must ask “Under what environmental, economic and institutional conditions can people live safely and with dignity?” The answer requires mitigation and adaptation together. Mitigation limits the magnitude of future climate change; adaptation reduces harm from changes already occurring or no longer fully avoidable.

Five priorities follow. First, infrastructure must be designed for future rather than historical climate conditions. Second, adaptation should be anticipatory, because waiting for repeated loss is economically and socially expensive. Third, planning must consider compound risks: heat, flood, drought, disease and power failure can interact. Fourth, mobility should be governed with dignity, including livelihood and social support for relocated populations. Fifth, adaptation must prioritize groups with high exposure and low capacity to protect themselves.

Education is also part of resilience infrastructure. Climate-literate citizens are better able to interpret warnings, conserve resources, recognize misinformation and participate in local planning. Universities can contribute through interdisciplinary research, teacher education, risk communication and training for resilient development.

12. Discussion

The concept of a new geography of human survival brings together processes often studied separately. Climate change, water scarcity, food insecurity, health, disasters, migration and urbanization are not independent sectors. They interact through households, labour markets, infrastructure and institutions.

Three forces appear especially important: environmental change, population concentration and unequal adaptive capacity. Their interaction explains why hazard maps alone cannot predict human outcomes. A severe hazard in a well-prepared community may cause limited long-term disruption, while a moderate hazard in a marginalized community can trigger lasting poverty and displacement. The concept also cautions against deterministic narratives. Climate change does not create a single inevitable migration route or a fixed future map of uninhabitable regions. Human decisions matter.

Investments in water systems, public health, resilient agriculture, housing and social protection can change outcomes. Conversely, poorly planned development can increase exposure even where climatic change is moderate.

The geography of survival also crosses national boundaries. Food markets, river basins, supply chains, disease risks and migration networks connect distant places. A drought in one production region can influence prices elsewhere; a disaster in an industrial hub can interrupt international supply; and large-scale displacement can affect multiple jurisdictions. Resilience is therefore both local and cooperative.

The most useful implication is that survival should be measured not by physical presence alone but by sustained human capability. A population that remains in place while losing health, livelihood, education and security cannot be described as successfully adapted. Effective adaptation must protect dignity as well as occupancy.

13. Conclusion

The new geography of human survival is already visible in intensifying heat exposure, water insecurity, changing food systems, rising disaster costs, climate-sensitive mobility and the vulnerability of rapidly expanding cities. Yet it cannot be represented by a simple boundary separating habitable from uninhabitable land.

Habitability is increasingly conditional. People require more than tolerable temperature: they require safe water, adequate food, health protection, shelter, livelihoods, infrastructure, functioning institutions and social stability. When these systems weaken together, effective habitability can decline even while physical occupation remains possible.

Geography, however, is not destiny. Human societies can modify risk through science, education, technology, governance, infrastructure and collective action. This is why adaptive capacity is emerging as one of the defining resources of the twenty-first century.

The central challenge is therefore to transform a geography of exposure into a geography of resilience. Development must become climate-informed, adaptation anticipatory, infrastructure risk-sensitive and governance justice-centred. The goal should not merely be to keep people in places at any cost, but to sustain the conditions in which people can live safely, productively and with dignity.

The fundamental question for the coming decades is no longer only, “Where will humans be able to live?” A more meaningful question is, “How can societies create and protect places in which human life remains secure, equitable and sustainable under rapidly changing environmental conditions?” The answer will shape the human map of this century.

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