Degree Day

Portfolio Hazard Exposure Assessment

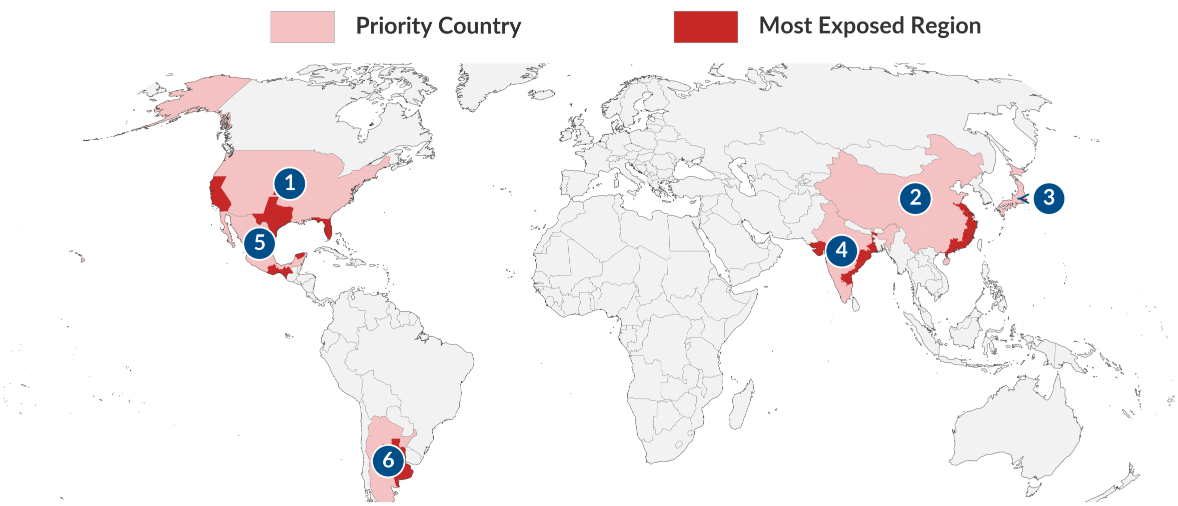
Prepared for ABT Pharmaceuticals Ltd. · March 2026

Contents

Executive Summary

Scope

This report screens **10,000 assets** across **180 countries** for physical hazard exposure to six hazard families: flood, wind, wildfire, tornado, hail, and earthquake. Scores reflect current climatological conditions; forward-looking climate projections are not incorporated but should be considered in resilience planning (see p. 35). Exposure scores identify where hazard is present—they do not account for building quality, existing protections, or operational criticality.



Headline Findings

1. Hail, earthquake, and wind are the most widespread primary hazards in the portfolio. **35.4%** of assets score High or Very High for hail, **34.6%** for earthquake, and **30.3%** for wind, compared with 7.0% for flood. Portfolio-level follow-up should therefore consider all three, not flood alone. → See Priority Hazards, p. 13

2. The US dominates tail risk through multi-hazard co-occurrence. The United States holds 457 of 1,703 Very High assets (27%), driven by tornado, hail, earthquake, and wind overlap in the central and southeastern states. → See Geographic Concentration, p. 10

3. Compound exposure is common across the portfolio. 78 of 158 countries with portfolio assets show significant compound exposure—two or more hazard families each affecting a substantial share of assets. Compound sites require integrated resilience strategies, not single-hazard fixes. → See Portfolio Summary, p. 6

Immediate Actions

1. **Identify critical assets** within the highest-exposure regions using operational dependency, revenue concentration, and replaceability criteria (Section 7.1, p. 30).
2. **Validate hazard scores** at the site level for the top-priority assets before committing capital (Section 7.2, p. 30).
3. **Begin structured resilience planning** for validated high-exposure, high-consequence assets using the hazard-specific starting points in Section 7.5, p. 33.
4. **For long-lived assets, add a future-climate review** after present-day validation. This report reflects current climatological conditions; assets with multi-decade planning horizons should incorporate forward-looking climate projections (Section 7.6, p. 35).

1. How to Read This Report

Before reading the analysis, note four things about how the scores work:

1. Exposure is not risk. A high score means a location sits in a zone of elevated hazard intensity or frequency. It does not predict damage. Actual risk depends on vulnerability, resilience, and consequence—none assessed here. Use scores to identify *where* to look more closely, not to quantify expected loss.

2. Cross-hazard scores are for broad screening, not equivalence. All hazards are scored 0–100 using a normalization designed to span the full range of global hazard data, with fixed tier thresholds. An 85 in flood and an 85 in earthquake both indicate Very High exposure within their respective families, but the physical meaning and consequences differ. Scores support screening-level comparison, not cross-hazard equivalence.

3. Composite burden is a prioritization metric, not a loss metric. Composite burden sums six primary hazard scores (range 0–600) to rank assets by total screening-level exposure. It gives equal weight to each family. A single asset with extreme exposure to one consequential hazard may warrant more attention than an asset with moderate scores across several. Use burden to focus the queue, not to rank business risk.

4. Site validation is required before capital decisions. These are screening-grade scores from global datasets at 30 m to 25 km resolution. They cannot replace site-level assessment. Validate scores using local data, engineering judgment, and professional expertise before committing capital (see Section 7.2).

This report screens your portfolio for physical hazard exposure. It is designed to focus attention, not to replace engineering judgment or site-level assessment.

What This Report Tells You

- Which assets and regions face the highest physical hazard exposure
- Which hazard families drive that exposure and where they are concentrated
- Where multiple hazards overlap at the same location (compound exposure)
- How your portfolio's exposure profile breaks down by country, region, and hazard family

What This Report Does Not Cover

- Asset vulnerability: building quality, age, construction type, or existing protections
- Financial impact: replacement cost, business interruption, or insurance coverage
- Operational criticality: whether an asset is essential or redundant
- Future climate projections: all scores reflect current conditions, not forward-looking scenarios

Hazards Covered

This report assesses the physical hazard exposure of every asset in your portfolio. Each asset is scored from 0 to 100 across six primary hazard families:

Primary Hazards

Flood

Wind

Wildfire

Tornado

Very Large Hail

Earthquake

These are the primary hazard families used to structure the main portfolio narrative because they are most directly associated with physical asset damage and broad portfolio screening value. The following secondary hazards are also scored in the underlying data but are not used to structure the main portfolio prioritization narrative (see Section 6 for detail on each indicator):

Secondary Hazards

Heat Stress

Cold Stress

Drought

Surface Water Flood

Lightning

Landslide

Subsidence

Energy Demand

Note: "Secondary" here means *not used to structure the main portfolio prioritization narrative*—it does not mean unimportant. Some secondary hazards (e.g. surface water flooding, heat stress) are very widespread. They are treated separately because they have greater interpretive ambiguity at global scale or are better assessed through site-specific follow-up. Full screening results for all secondary hazards are included in the hazard detail section and the data workbook.

Exposure Scoring

Scores are based on modeled hazard intensity and frequency at each asset's geographic coordinates under current climatological conditions. Each asset receives a score from 0 to 100 for every hazard family. Scores are grouped into five tiers:

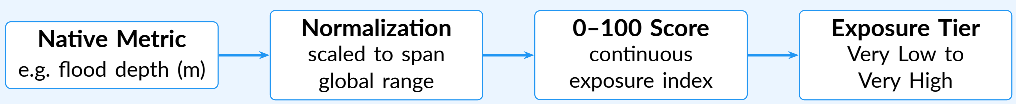
Exposure Score Scale

Very Low (VL): 0–19 **Low (L):** 20–39 **Medium (M):** 40–59
High (H): 60–84 **Very High (VH):** 85–100

Thresholds are fixed and consistent across all hazard families, enabling broad screening-level comparison of relative exposure severity. An asset scoring 85 in Flood and 85 in Tornado faces Very High exposure to both within their respective hazard families, though the physical meaning and consequences of those hazards remain different.

How Scores Are Constructed

Each hazard family starts from a different physical quantity measured in its native units (flood depth in metres, ground acceleration in g, hail frequency in days/year, etc.). To make these comparable for portfolio screening, each raw value is converted through a four-step process:



Normalization converts each raw hazard value to a 0–100 score designed to span the full range of the global distribution for that indicator. Score thresholds are set to separate meaningful differences in hazard intensity, informed by the empirical distribution but not strictly percentile-based. This approach makes scores comparable across hazard families for screening purposes, but it does not imply that an 85 in flood and an 85 in earthquake carry equivalent physical significance or consequence.

Where a hazard family draws on more than one indicator (e.g. flood uses both riverine and coastal layers), the family score reflects the **maximum** of the component scores. Missing data (ocean, ice, non-burnable land) is masked and excluded from scoring.

Report Navigation

The report narrows the aperture in four steps: portfolio-wide context first, then geographic drill-down, then the specific assets that need attention, then hazard-by-hazard detail for supporting context.

Appendix contains methodology notes, hazard family definitions, exposure tier thresholds, data sources and scoring detail, the accompanying data workbook guide, and full references.

2. Portfolio Summary

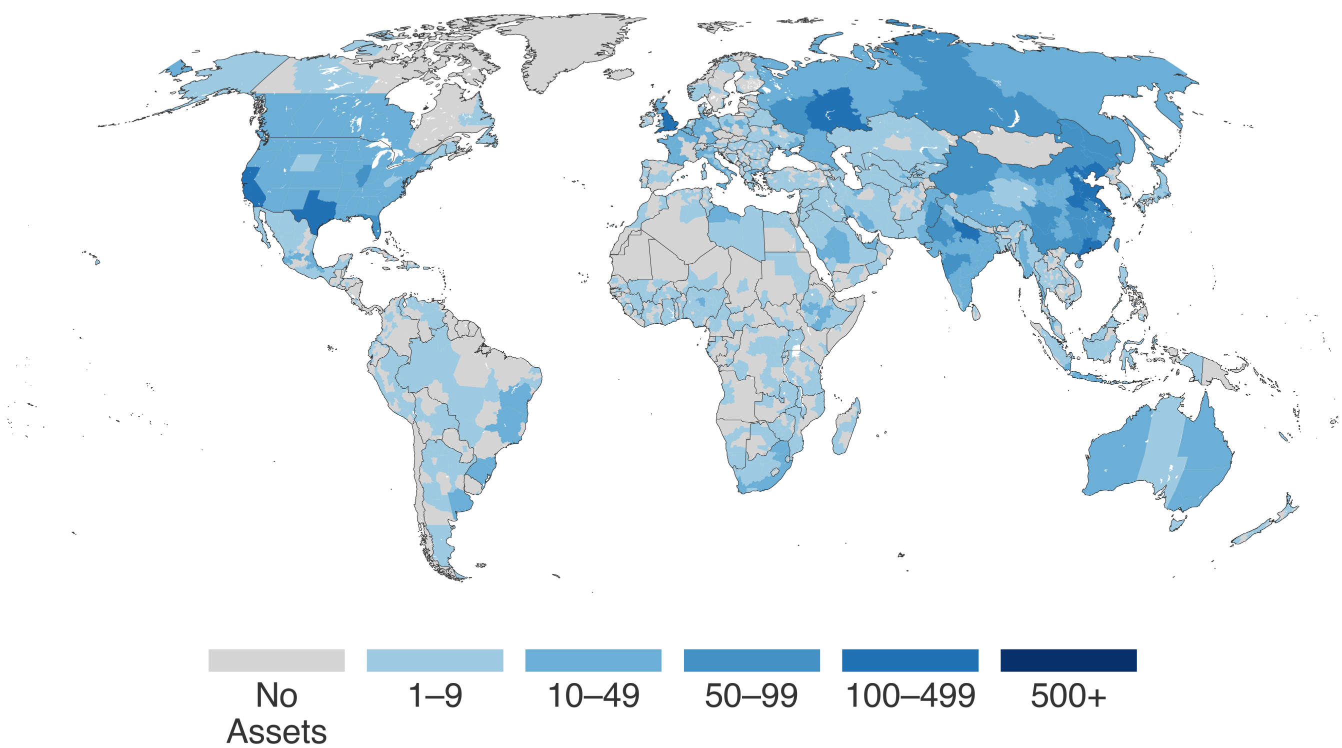
This section provides a high-level view of the portfolio's global asset distribution, hazard exposure breakdown by family, and dominant hazard patterns by country.

> **Hail, earthquake, and wind are the most widespread primary hazards in the portfolio,** each affecting more than 30% of assets at elevated levels. Flood is significant but less pervasive; tornado and wildfire are regionally confined.

Global Asset Distribution

The 10,000 assets span 180 countries, with the heaviest concentrations in China, the United States, and India. The top 20 countries hold over 72% of all assets.

Assets per State / Province



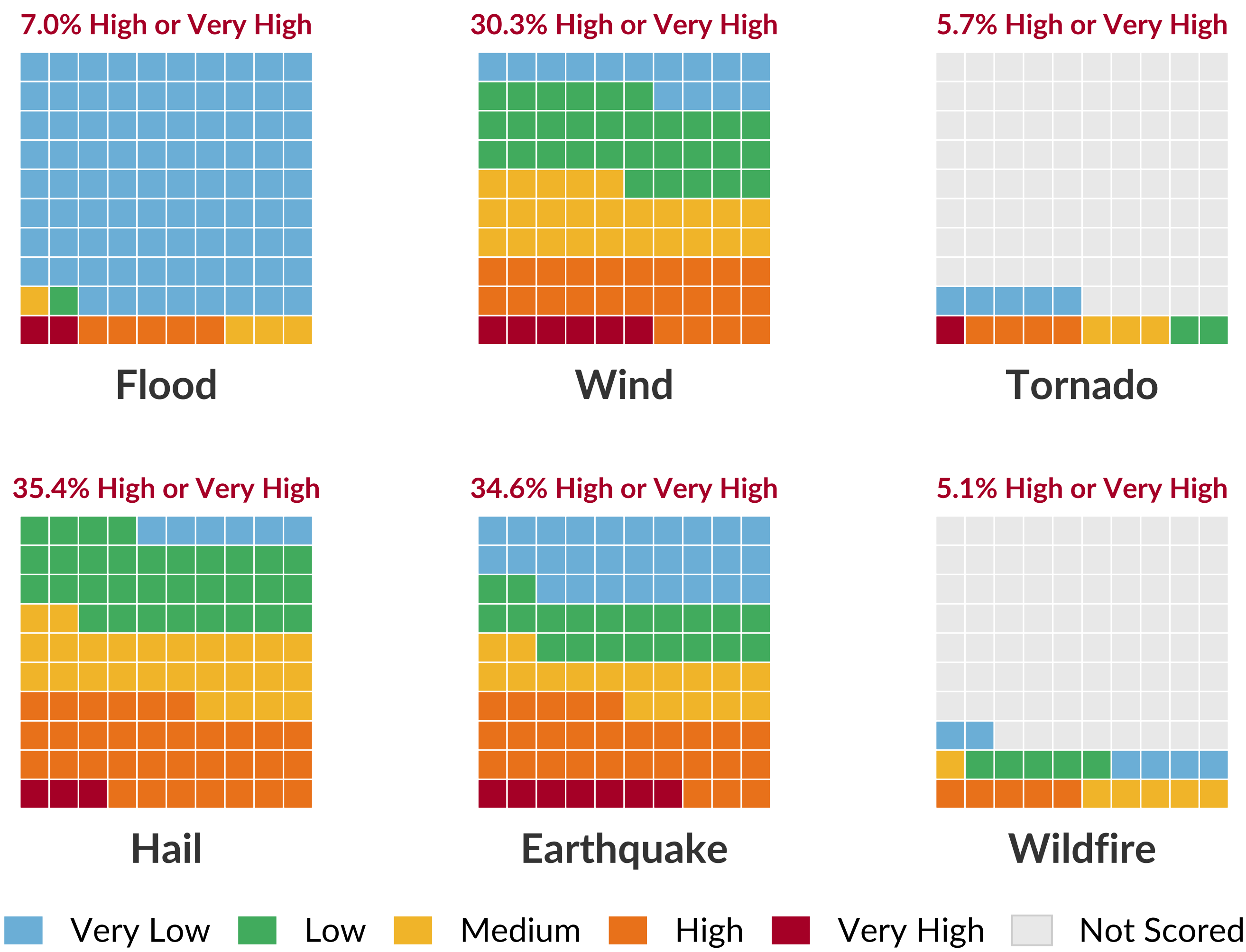
Top 20 Countries by Asset Count

	Country	Assets	Share
1	**China**	**2,074**	20.7%
2	**United States**	**1,255**	12.6%
3	**India**	**632**	6.3%
4	Russia	476	4.8%
5	Brazil	302	3.0%
6	Japan	281	2.8%
7	Germany	232	2.3%
8	France	231	2.3%
9	Mexico	209	2.1%
10	Indonesia	180	1.8%

	Country	Assets	Share
11	Canada	163	1.6%
12	Italy	160	1.6%
13	Nigeria	153	1.5%
14	United Kingdom	138	1.4%
15	Iran	132	1.3%
16	Thailand	130	1.3%
17	Turkey	126	1.3%
18	Poland	118	1.2%
19	Ukraine	115	1.1%
20	South Africa	103	1.0%

Hazard Distribution Summary

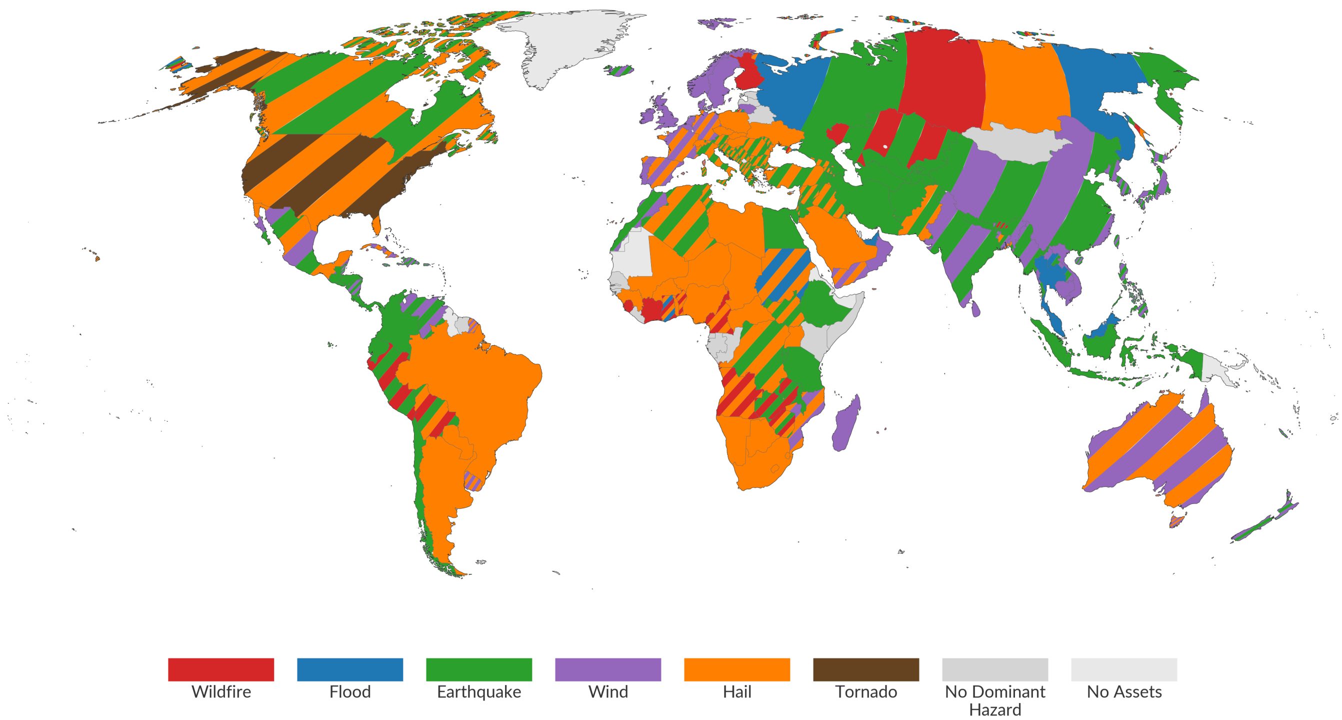
Each waffle grid below represents the full portfolio of assets, with every square equal to 1% of the portfolio. Hail is the most widespread hazard, with **35.4%** of assets scoring High or Very High, followed by Earthquake (34.6%) and Wind (30.3%). Flood (7.0%), Tornado (5.7%), and Wildfire (5.1%) affect smaller but significant subsets.



> **Hail, earthquake, and wind are the most widespread primary hazards in the portfolio.** More than 1 in 3 assets scores High or Very High for each of these three hazards. Earthquake has the highest Very High rate (6.8%), while flood—though less prevalent overall (7.0% High+VH)—remains important in concentrated riverine and coastal zones.

Dominant Hazard by Country

Each country is colored by its dominant hazard family: the group with the highest number of assets scoring ≥ 60. Countries where two or more hazard families each have at least one asset above this threshold are shown with diagonal stripes. Among single-dominant countries, Hail and Earthquake each lead (**26**), followed by Wind (**22**), Flood (**3**), and Wildfire (**3**). An additional 78 countries show significant compound exposure, defined here as cases where at least one additional hazard family affects at least half as many assets at elevated exposure as the dominant hazard.



Countries with Compound Hazard Exposure

Countries where two or more hazard families each have at least one asset scoring ≥ 60. Ordered by total assets at elevated exposure.

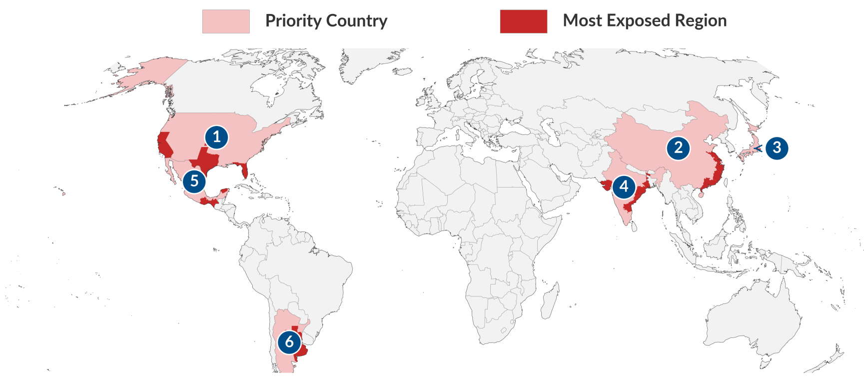
Country	Primary Hazard	Other Elevated Hazards
China	**Wind**	Earthquake Hail Flood Wildfire
United States	**Hail**	Tornado Wind Earthquake Flood Wildfire
India	**Earthquake**	Wind Hail Flood Wildfire
Japan	**Wind**	Earthquake Flood Wildfire
Mexico	**Hail**	Earthquake Wind Wildfire Flood
Italy	**Hail**	Earthquake Wildfire Flood Wind
Turkey	**Earthquake**	Hail Wildfire Wind Flood
Germany	**Wind**	Hail Earthquake Flood
Brazil	**Hail**	Wildfire Flood Earthquake Wind
France	**Wind**	Hail Flood Earthquake Wildfire

Top 10 of 78 compound-exposure countries shown.

3. Geographic Concentration

> **Exposure concentration creates an opportunity for targeted follow-up, not just concentrated risk.** Because 65% of Very High assets sit in just six countries, targeted resilience investments in a small number of regions can address the majority of portfolio exposure.

Hazard exposure in this portfolio is heavily concentrated: six countries hold nearly two-thirds of all Very High exposure assets (score ≥ 85 on a 0–100 scale; see Section 1). **These six countries account for 1,099 of 1,703 Very High assets portfolio-wide (65%).** The United States leads with 457 VH assets driven by diverse hazards (hail, wind, earthquake, tornado), followed by China (222, wind and flood), Japan (194, earthquake), and India (104, wind). Unlike the broader High+Very High distribution, the Very High tail is driven more by earthquake, wind, and hail than by flood.



Countries with the Most Very High Exposure Assets

1. United States — 457 of 1,255 Assets

California	71	Earthquake Wildfire
Florida	65	Wind
Texas	43	Hail Wind
Kansas	33	Hail
Other regions in United States	245	

2. China — 222 of 2,073 Assets

Jiangsu	64	Wind Flood
Zhejiang	34	Wind
Guangdong	23	Flood
Fujian	22	Wind
Other regions in China	79	

3. Japan — 194 of 281 Assets

Tokyo	17	Earthquake
Saitama	15	Earthquake
Ōsaka	14	Earthquake
Chiba	14	Earthquake
Other regions in Japan	134	

4. India — 104 of 632 Assets

Andhra Pradesh	28	Wind
Gujarat	20	Wind Earthquake
West Bengal	17	Wind
Odisha	10	Wind
Other regions in India	29	

5. Mexico — 69 of 209 Assets

Oaxaca	9	Earthquake
Chiapas	7	Earthquake
Tamaulipas	5	Wind
Yucatán	4	Wind
Other regions in Mexico	44	

6. Argentina — 53 of 92 Assets

Santa Fe	8	Hail
Buenos Aires	7	Hail
Córdoba	7	Hail
Entre Ríos	5	Hail
Other regions in Argentina	26	

4. Priority Assets

> **The highest-burden assets are not globally diffuse; they cluster in a few hazard-country combinations.** This concentration means targeted follow-up in a small number of regions is more effective than enterprise-wide action.

This section identifies the individual assets with the greatest overall hazard exposure. Assets are ranked by **composite burden**, a single number that captures how much total hazard each site faces.

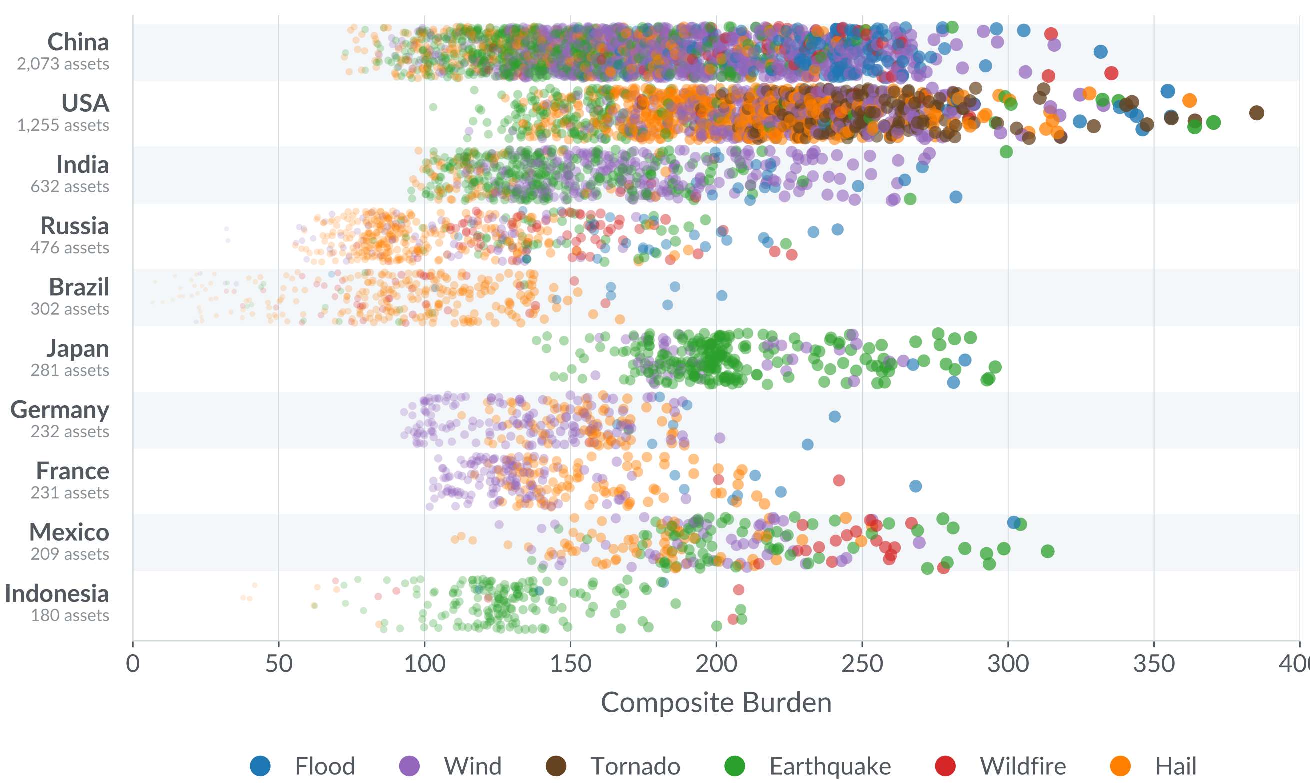
Composite Burden

Composite burden is the sum of the six primary hazard family scores for a given asset. It is a screening metric for relative prioritization only, not a measure of expected damage, loss, or operational impact. Each family score ranges from 0 to 100, so composite burden ranges from 0 (no modeled exposure) to 600 (maximum exposure in every family):

Flood + **Wind** + **Wildfire** + **Tornado** + **Hail** + **Earthquake**

Each score 0 – 100 | Range: 0 (no exposure) to 600 (maximum)

> **The 95th-percentile assets** (505 sites with composite burden ≥ 251) **are led by the United States** (220), with **China** (95), **Japan** (28), and **Mexico** (26) following. Hail, earthquake, wind, and tornado are the most common drivers within this high-burden tier, and multi-hazard co-occurrence across three or more families is common among these sites.



All assets in the ten largest countries by asset count. Each dot is one asset, colored by its dominant hazard family. Larger, more opaque dots indicate higher total exposure.

Top 30 Assets by Composite Burden (Screening Metric)

Using composite burden as a screening metric, 28 of the top 30 assets are in the United States; tornado, hail, earthquake, and flood combinations dominate. China (2) and Mexico (1) also appear. The central US—Oklahoma, Arkansas, Missouri, Louisiana, Kentucky—ranks highest largely because of co-occurring tornado, hail, and earthquake (New Madrid Seismic Zone) exposure.

Cells shaded by severity: Very High | High | Medium | unshaded = below 40.

Rank	Asset ID	Burden	Country	State/Province	Flood	Wind	Wildfire	Tornado	Hail	Quake
1	Asset_08430	381	USA	Oklahoma	80	34	62	87	86	32
2	Asset_03819	369	USA	Missouri	61	40	0	93	75	100
3	Asset_04300	365	USA	Arkansas	58	39	0	94	74	100
4	Asset_07169	363	USA	Louisiana	56	75	60	84	70	18
5	Asset_01091	359	USA	Oklahoma	60	40	41	87	88	43
6	Asset_02576	359	USA	Louisiana	91	89	0	85	76	18
7	Asset_07184	357	USA	Kentucky	78	43	11	95	71	59
8	Asset_03617	352	USA	Tennessee	100	40	0	96	69	47
9	Asset_06768	351	USA	Arkansas	68	35	0	93	75	80
10	Asset_09804	350	USA	Illinois	91	34	0	87	77	61
11	Asset_04027	345	USA	Arkansas	80	37	0	93	75	60
12	Asset_02987	342	USA	Arkansas	61	34	0	93	74	80
13	Asset_00533	341	USA	Alabama	87	83	0	80	70	21
14	Asset_02943	341	USA	Louisiana	91	86	0	75	72	17
15	Asset_03005	337	USA	Arkansas	30	39	0	94	74	100
16	Asset_06415	337	China	Tianjin	58	73	80	0	60	66
17	Asset_08907	337	USA	Louisiana	89	86	0	73	72	17
18	Asset_07826	334	China	Liaoning	85	72	63	0	51	63
19	Asset_08333	332	USA	Missouri	78	31	0	86	79	58
20	Asset_08869	331	USA	Nevada	70	46	57	10	48	100
21	Asset_02191	330	USA	Texas	0	61	80	71	92	26
22	Asset_01010	329	USA	S. Carolina	66	80	25	54	58	46
23	Asset_07049	329	USA	Kentucky	91	41	0	86	70	41
24	Asset_01016	326	USA	Louisiana	79	89	0	69	73	16
25	Asset_01012	318	USA	Texas	0	67	61	76	92	22
26	Asset_00239	317	USA	Iowa	78	47	11	83	85	13
27	Asset_01067	317	USA	Texas	40	87	51	57	71	11
28	Asset_00711	316	USA	Alabama	61	37	13	95	67	43
29	Asset_02663	316	Mexico	Oaxaca	0	79	83	0	54	100
30	Asset_04104	316	USA	Mississippi	64	38	0	94	73	47

What the Table Shows The US tornado–hail–earthquake corridor dominates (28 of 30), driven by co-occurring scores in the central and southeastern states—the New Madrid Seismic Zone pushes Arkansas and Missouri sites to the top. Non-US assets (China, Mexico) are driven by earthquake + wind. Top-30 burdens span 316–381, with most assets at High or Very High in three or more families.

5. Priority Hazards

Detailed exposure analysis for each of the six primary hazard families. Each page shows the portfolio-wide distribution, a geographic map of maximum exposure by region, and the specific assets at High and Very High exposure.

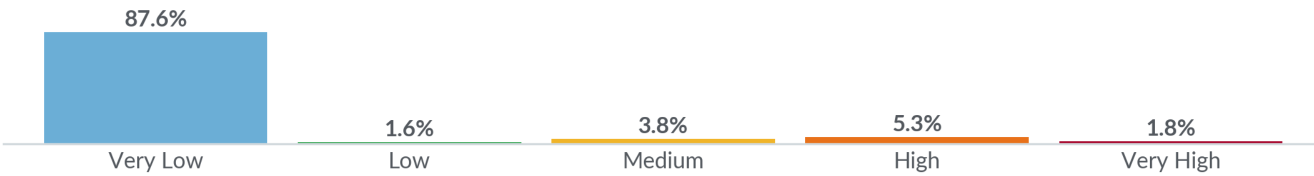
Hazard	Description & Infrastructure Relevance
Flood	River overflow and coastal storm surge that inundate low-lying areas. Flood is the leading cause of infrastructure damage globally, corroding foundations, short-circuiting electrical systems, contaminating water supplies, and rendering buildings structurally unsafe.
Wind	Sustained extreme winds from tropical cyclones and extratropical storms. High winds strip roofing and cladding, shatter glazing, topple equipment and signage, and cause cascading failures in power transmission and communication infrastructure. *Note: this hazard family does not explicitly represent severe convective straight-line wind as a separate hazard layer.*
Wildfire	Uncontrolled fire spreading through vegetation and into the built environment. Wildfire destroys structures through direct flame contact and radiant heat, melts utilities, degrades air quality for occupants, and severs access roads critical for evacuation and emergency response.
Tornado	Violently rotating columns of air (F2+ on the Fujita scale) with extreme wind speeds. Tornadoes cause catastrophic structural collapse, missile-impact damage from airborne debris, and total destruction of lightweight buildings within the damage path.
Hail	Large hailstones ($\geq$50 mm / 2 in diameter) driven by severe thunderstorms. Hail punctures roofing membranes and skylights, dents metal cladding and HVAC equipment, shatters solar panels, and causes costly cosmetic and functional damage to building envelopes.
Earthquake	Ground shaking from seismic activity, measured by peak ground acceleration. Earthquakes crack foundations, shear structural connections, rupture buried utilities, and can trigger secondary hazards such as landslides, liquefaction, and tsunamis that compound damage to infrastructure.

Eight additional secondary screening indicators (heat stress, cold stress, drought, surface water flood, lightning, landslide, subsidence, and energy demand) follow the primary hazard pages below.

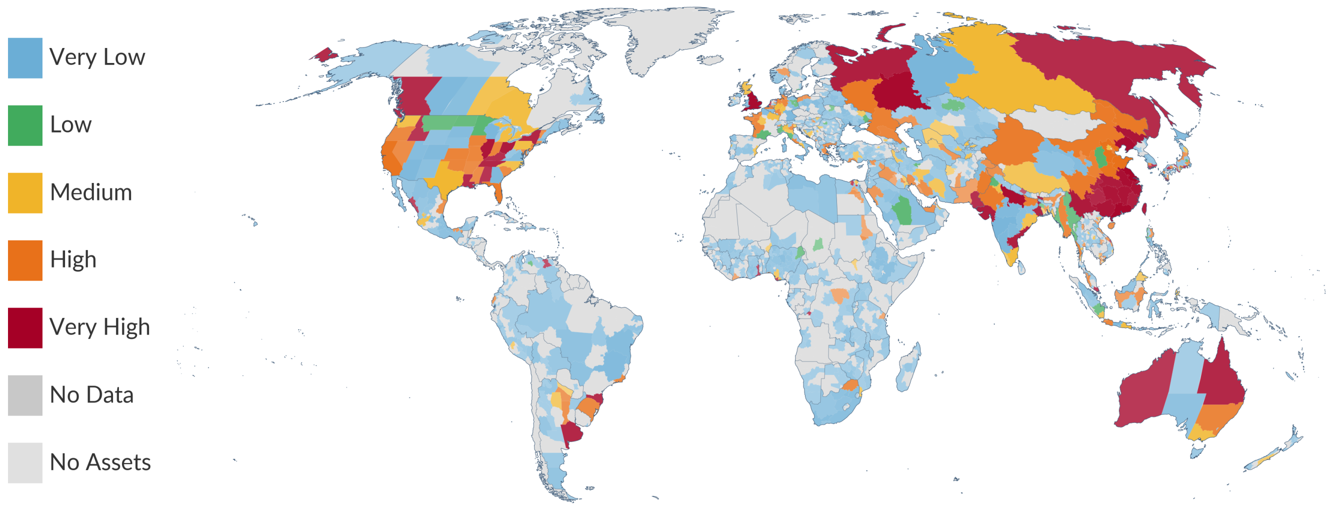
River and Coastal Flood

> **River and coastal flood affects 7.0% of assets at high or very high exposure. While less prevalent than hail, earthquake, or wind at portfolio scale, flood remains highly decision-relevant because severe exposure is concentrated in specific riverine and coastal corridors across China, India, and the Gulf Coast of the United States.**

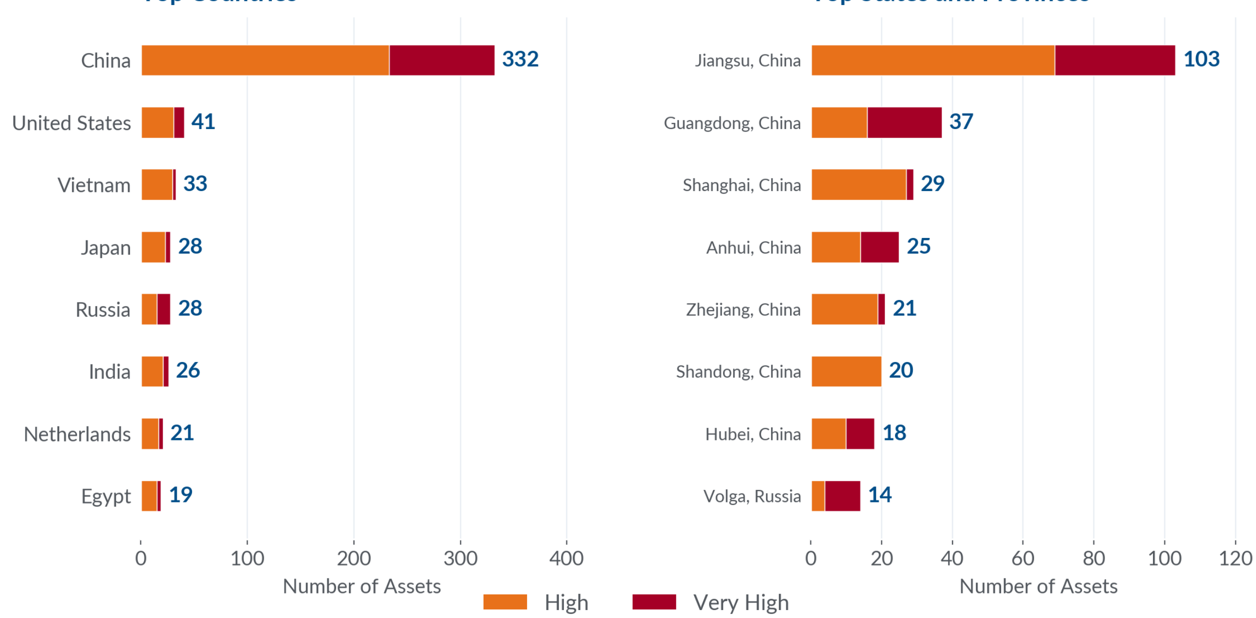
Percent of Assets in Each River and Coastal Flood Exposure Category



Maximum River and Coastal Flood Exposure Score by Region



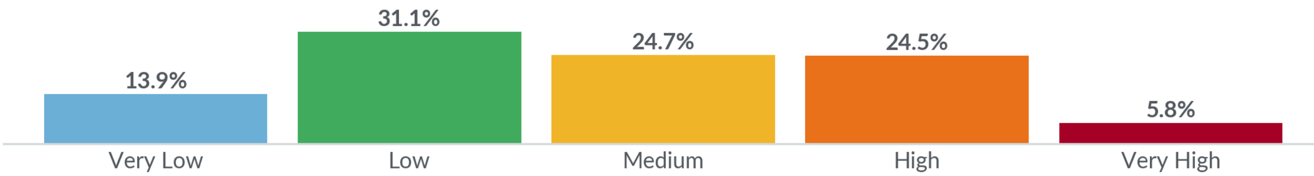
Assets at High and Very High River and Coastal Flood Exposure



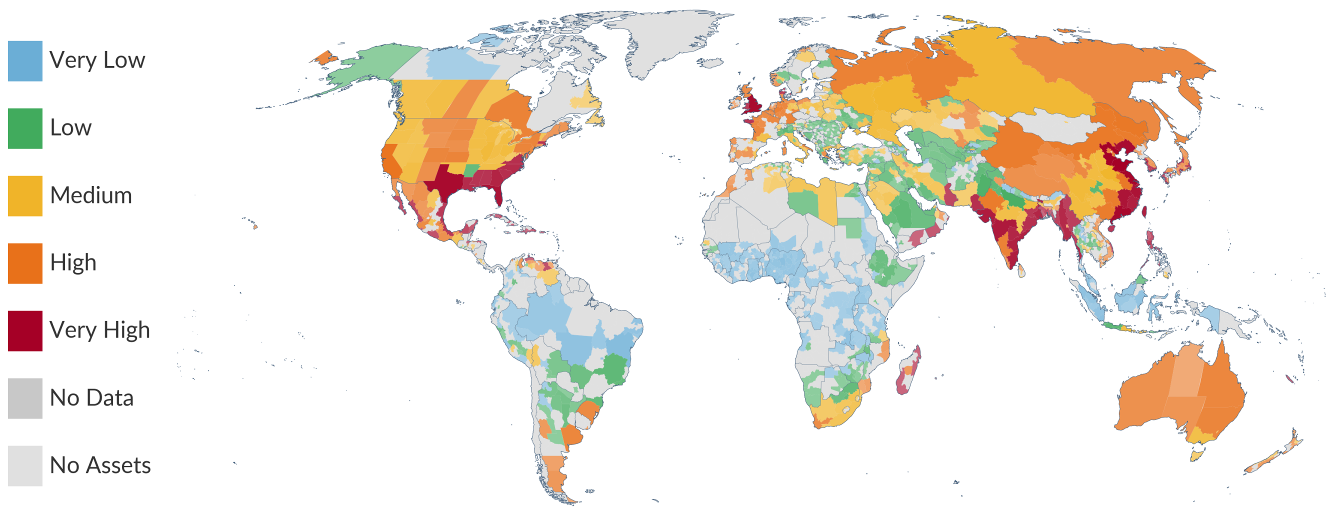
Wind

Extreme wind affects 30.3% of assets at high or very high exposure—one of the three most widespread primary hazards. Exposure is widespread across tropical cyclone corridors and other wind-prone regions, making wind one of the most geographically pervasive primary hazards in the portfolio. China, India, Japan, and the southeastern United States account for the largest share of high-exposure assets.

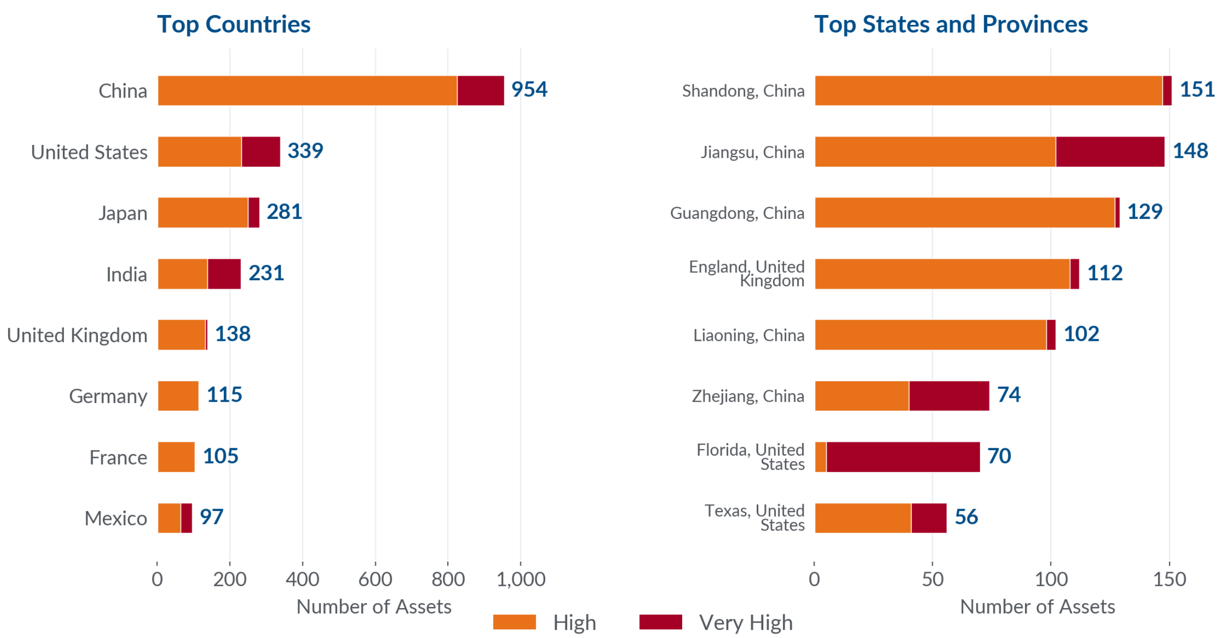
Percent of Assets in Each Wind Exposure Category



Maximum Wind Exposure Score by Region



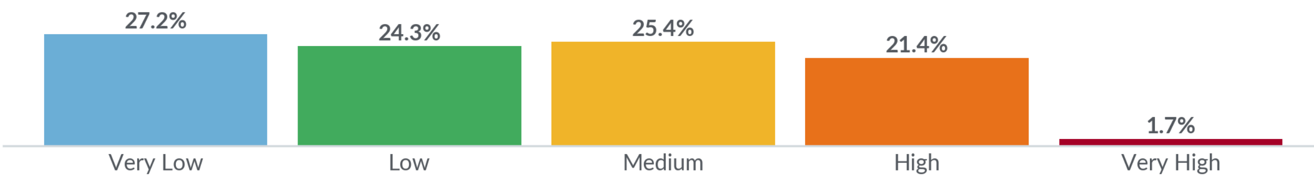
Assets at High and Very High Wind Exposure



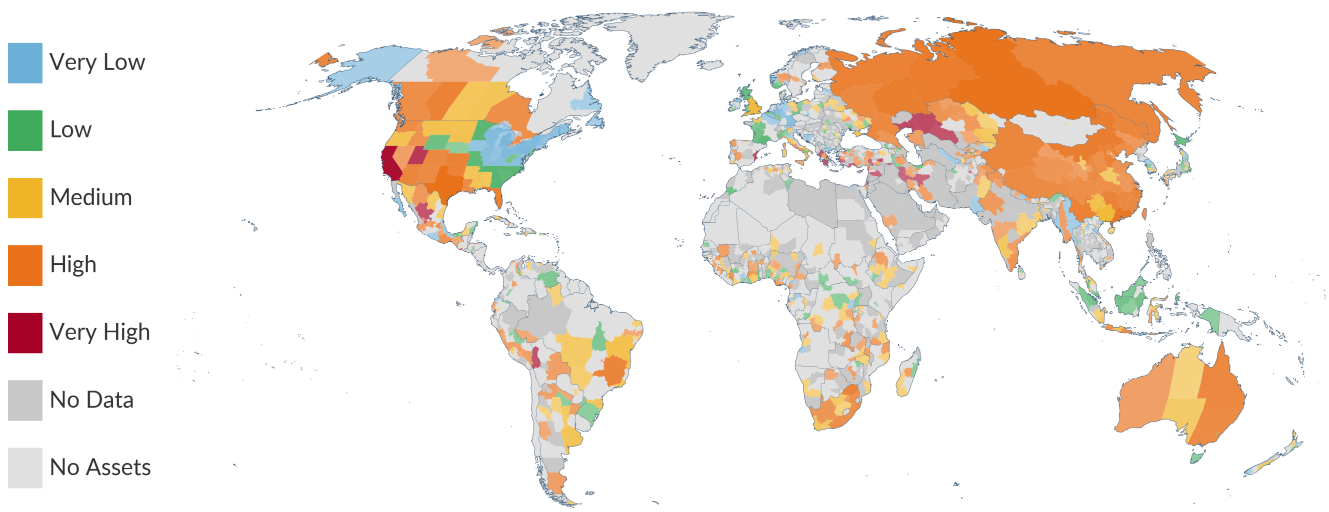
Wildfire

Wildfire affects 5.1% of assets at high or very high exposure—a less prevalent primary hazard, but one that is regionally important where exposure clusters near fire-prone landscapes. Geographic exposure spans the western United States, Turkey, southern Europe, and parts of South America and Australia.

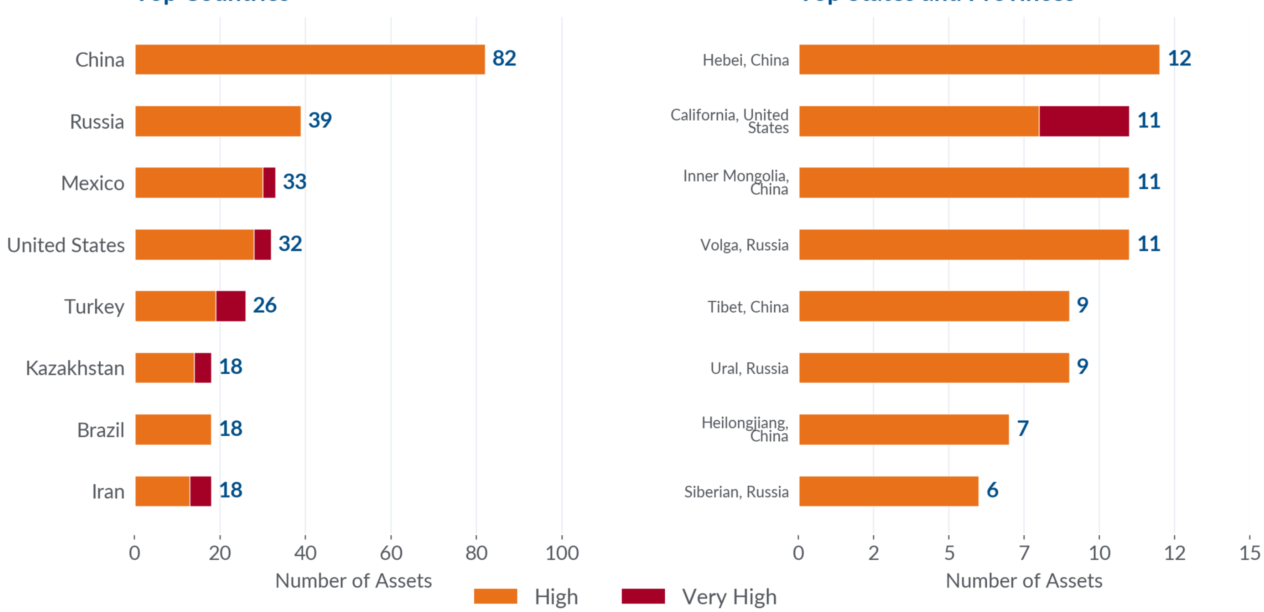
Percent of Assets in Each Wildfire Exposure Category



Maximum Wildfire Exposure Score by Region



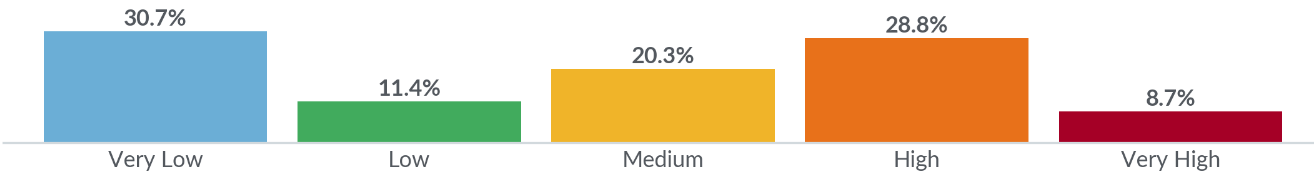
Assets at High and Very High Wildfire Exposure



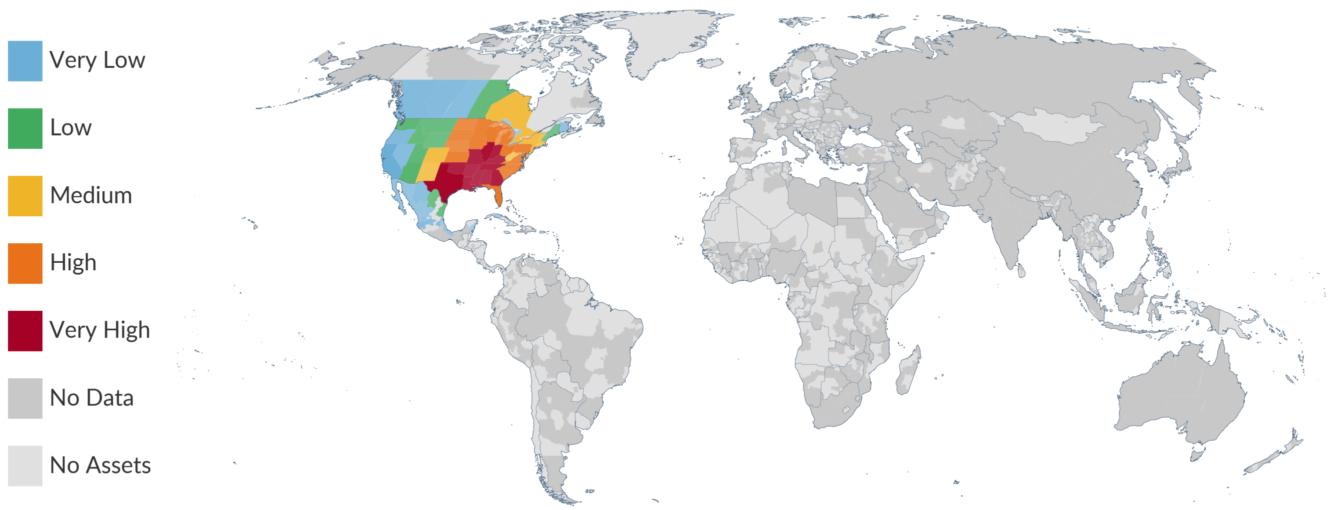
Tornado

Significant tornado risk (F2+) affects 5.7% of assets at high or very high exposure—a geographically narrow but intense US-concentrated hazard. Exposure is almost entirely in the Great Plains and Gulf Coast tornado corridors of the United States.

Percent of Assets in Each Tornado Exposure Category

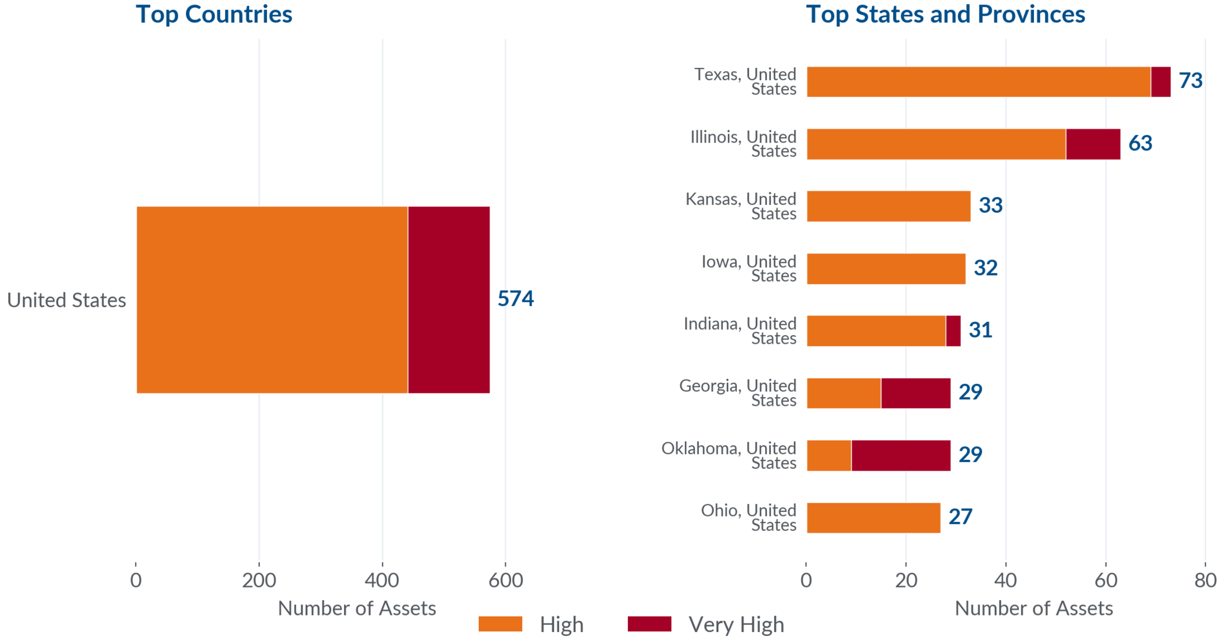


Maximum Tornado Exposure Score by Region



Assets at High and Very High Tornado Exposure

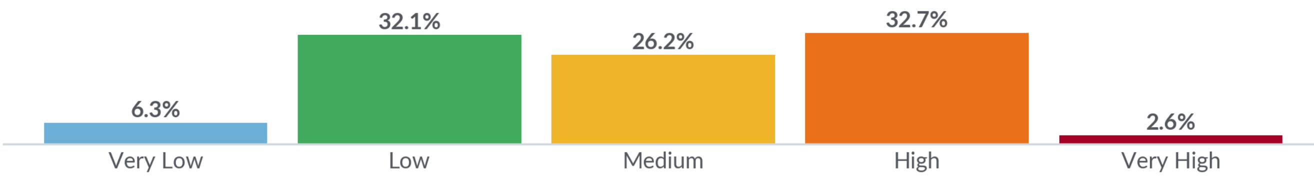
Top Countries / Top States and Provinces



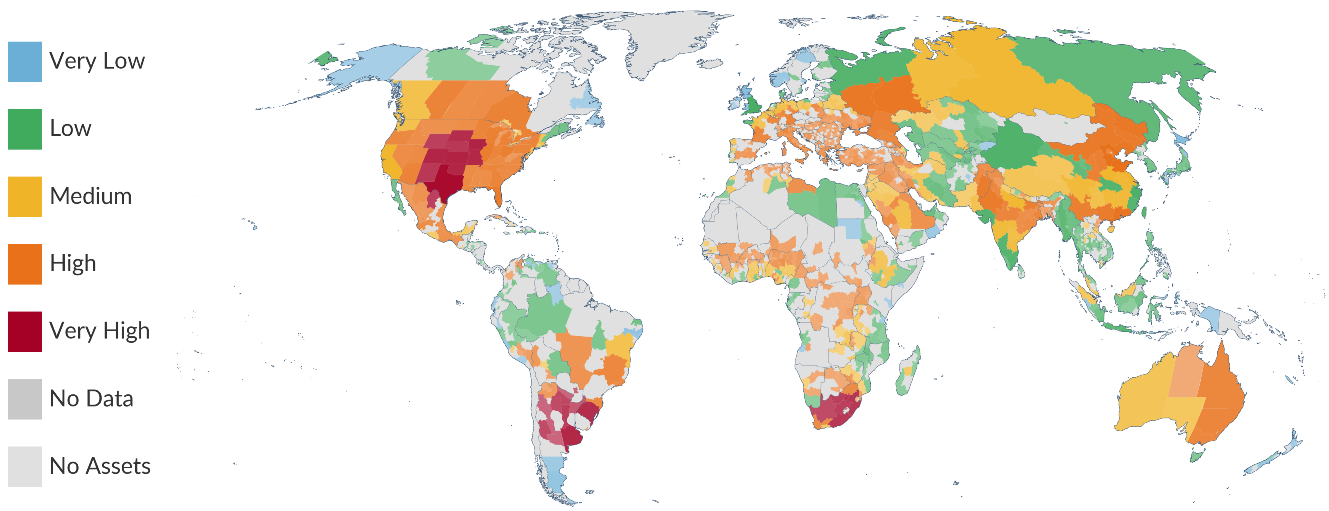
Very Large Hail

Very large hail (≥50 mm) affects 35.4% of assets at high or very high exposure—the most widespread primary hazard in the portfolio. The United States (Great Plains and Midwest), Argentina, Brazil, and South Africa carry the greatest asset counts at elevated exposure, and while the highest concentrations occur in the United States and parts of the Southern Hemisphere, hail exposure is geographically widespread enough to matter at portfolio scale.

Percent of Assets in Each Very Large Hail Exposure Category



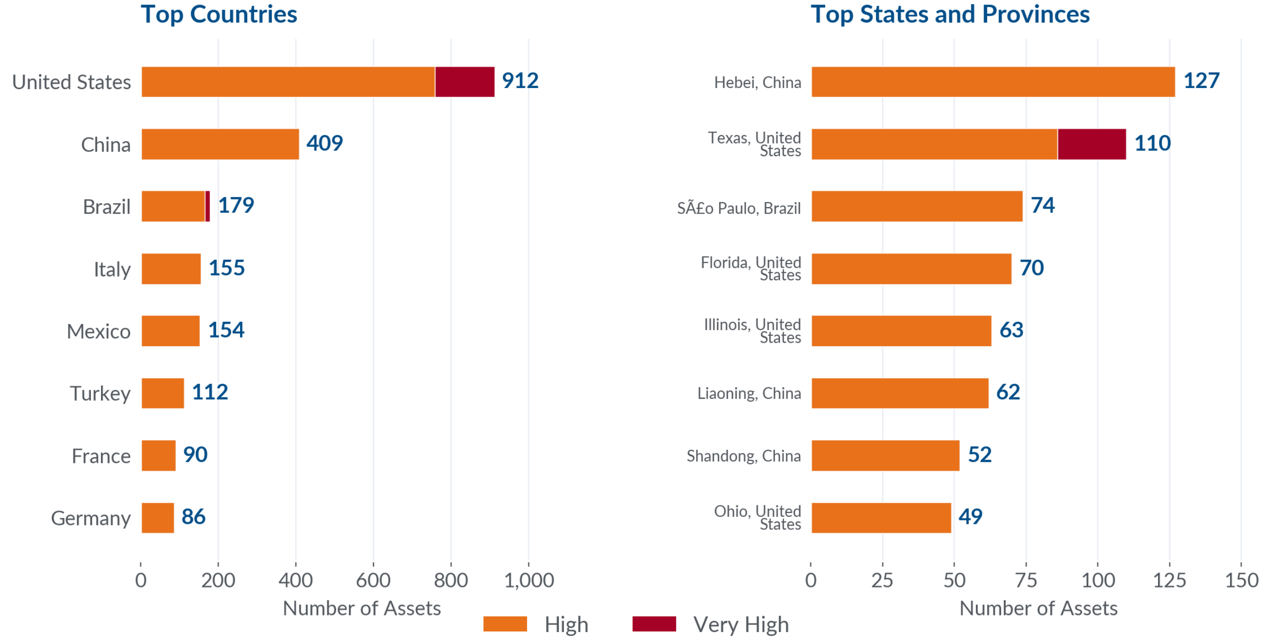
Maximum Very Large Hail Exposure Score by Region



Assets at High and Very High Very Large Hail Exposure

Top Countries

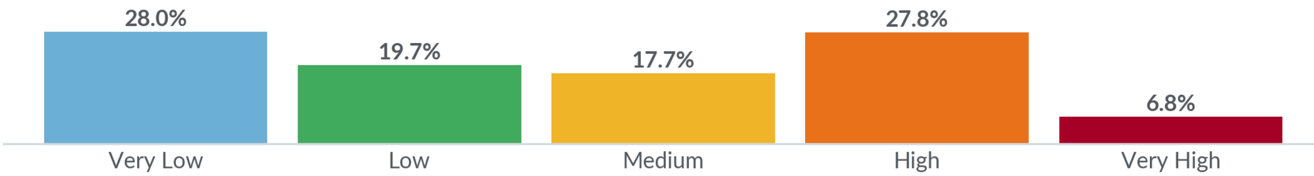
Top States and Provinces



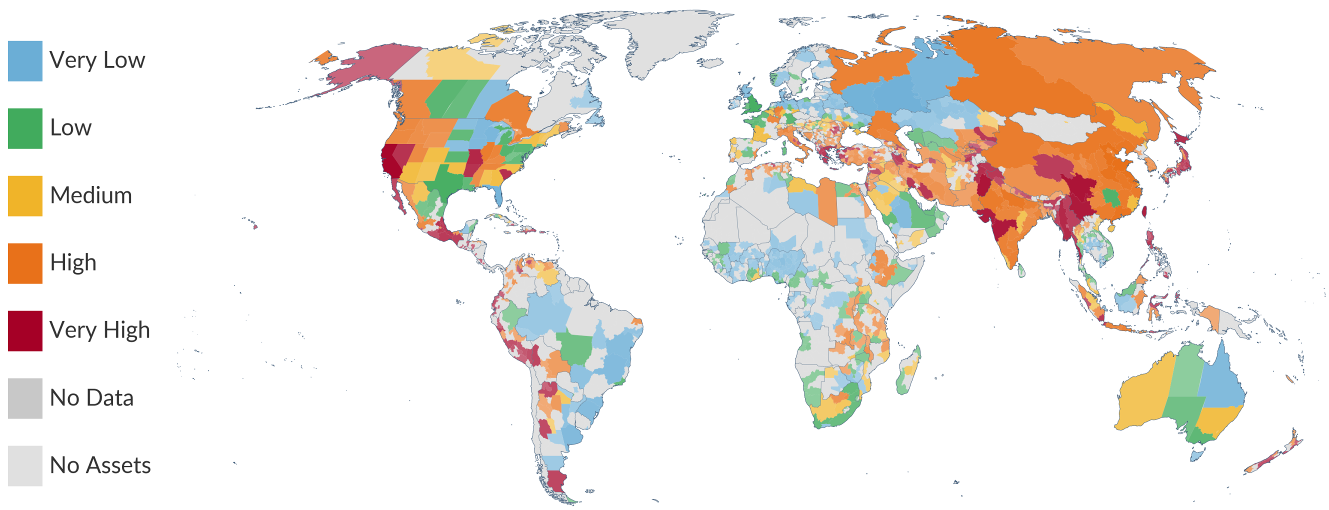
Earthquake

Earthquake affects 34.6% of assets at high or very high exposure—one of the three most widespread primary hazards and the leader in Very High scores (6.8%). Exposure is concentrated along active tectonic margins and major seismic belts, making earthquake one of the most consequential globally distributed hazards in the portfolio screening results. Japan, Turkey, Iran, Mexico, the western United States, and the New Madrid Seismic Zone carry the highest concentrations.

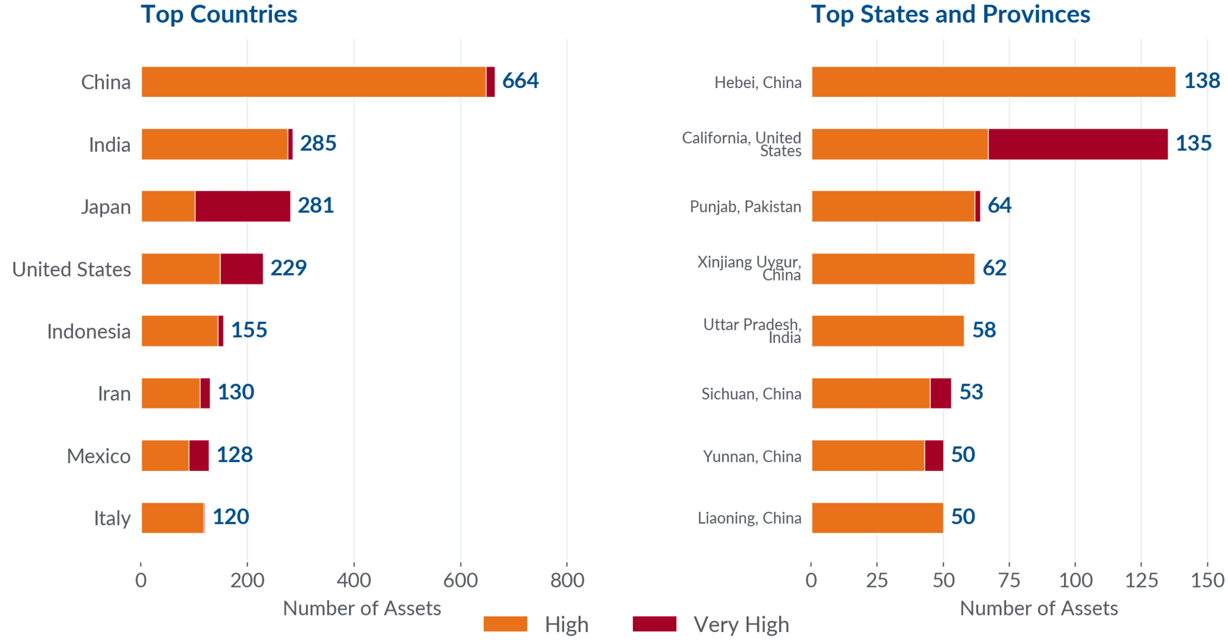
Percent of Assets in Each Earthquake Exposure Category



Maximum Earthquake Exposure Score by Region



Assets at High and Very High Earthquake Exposure



6. Secondary Screening Indicators

The following eight indicators are scored using the same 0–100 framework as the primary hazard families but are not used to structure the main portfolio prioritization narrative. They provide additional screening context for asset-level triage and regional follow-up.

Why these are secondary: These hazards are treated as secondary in this report because they either (a) are not used to structure the main portfolio prioritization narrative, (b) have lower confidence or greater interpretive ambiguity at global scale, or (c) are better assessed through site-specific follow-up rather than portfolio-level screening. Scores for all secondary indicators are included in the accompanying data workbook (see the *Asset Scores* and *Raw Hazard Values* sheets). Use them for asset-level triage, not portfolio-wide prioritization.

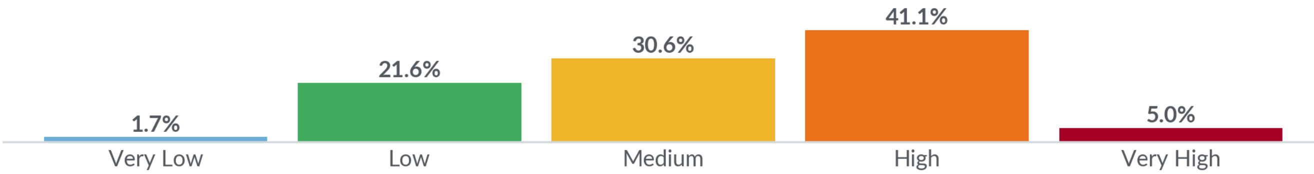
Important limitations: Secondary hazard models generally have coarser resolution, shorter calibration records, or less mature global coverage than the primary families. Treat these scores as directional indicators, not precise exposure estimates.

Indicator	Description
Heat Stress	Extreme wet-bulb temperature combining heat and humidity, reflecting physiological heat-stress limits for outdoor workers and occupants.
Cold Stress	Extreme cold temperature exceedance, driving pipe-burst risk, heating-demand spikes, and outdoor worker safety concerns.
Drought	Composite meteorological drought severity based on long-term precipitation deficits, relevant to water supply and agricultural operations.
Surface Water Flood	Extreme short-duration rainfall intensity as a proxy for pluvial (stormwater) flooding risk. Does not model drainage or flood depth.
Lightning	Thunderstorm frequency indicating exposure to lightning strikes, relevant for electrical systems, wildfire ignition, and outdoor safety.
Landslide	Terrain susceptibility to landslides based on slope, geology, soil properties, and land cover.
Subsidence	Gradual ground subsidence rate from groundwater extraction, sediment compaction, or tectonic processes, damaging foundations and buried infrastructure over time.
Energy Demand	Heating and cooling degree days quantifying climate-driven energy consumption for space conditioning.

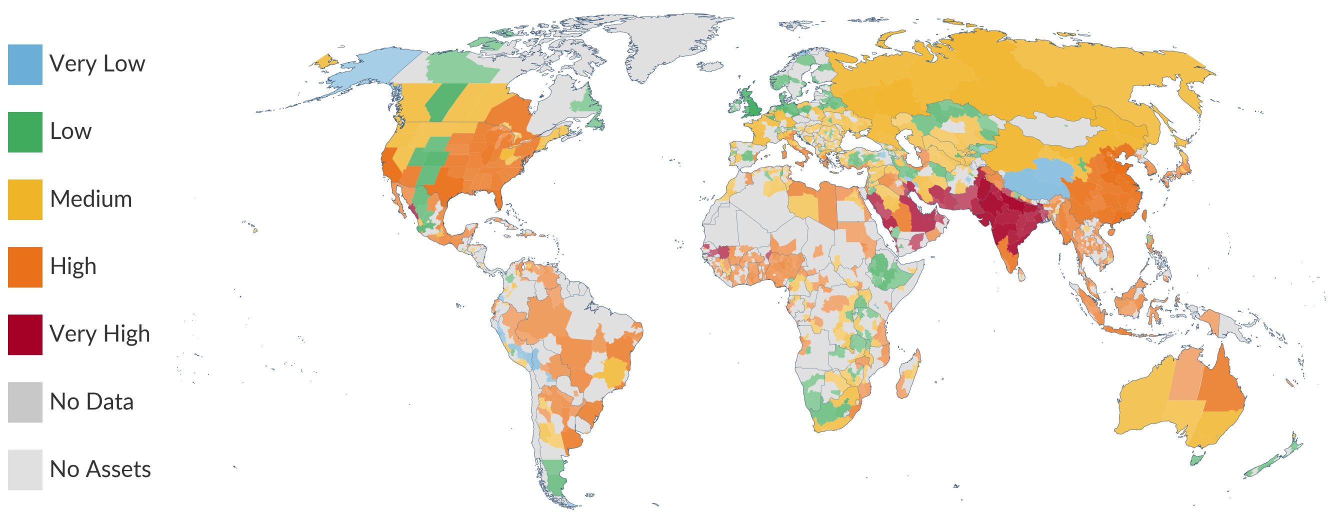
Heat Stress

Heat stress is a widespread secondary screening hazard, with 41.1% of assets at High and 5.0% at Very High exposure. Exposure is concentrated in China, the United States, and India. Scored by wet-bulb globe temperature (WBGT) exceedance days per year.

Percent of Assets in Each Heat Stress Exposure Category

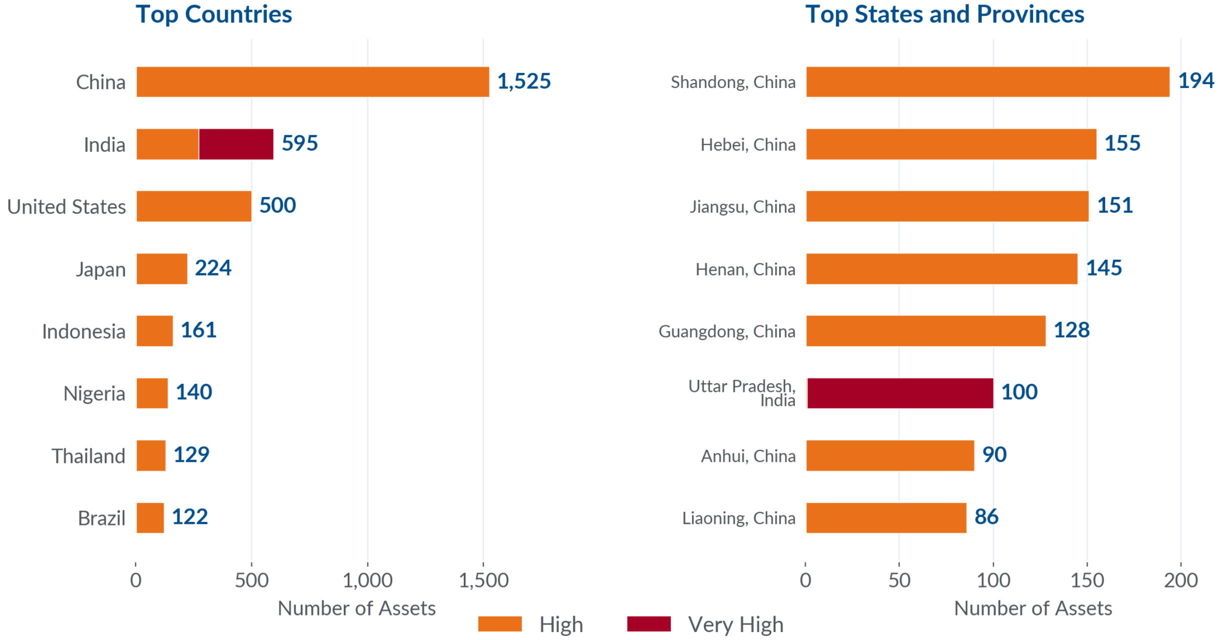


Maximum Heat Stress Exposure Score by Region



Assets at High and Very High Heat Stress Exposure

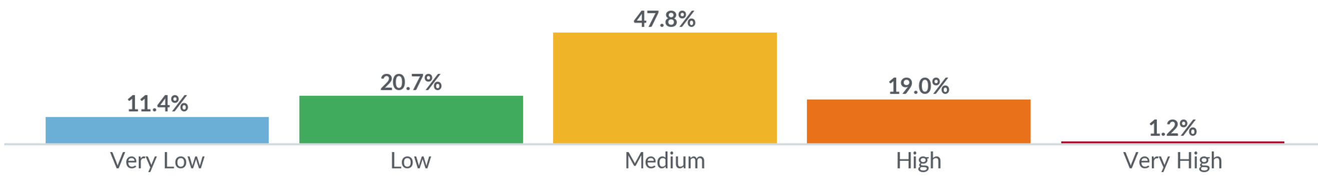
Top Countries | **Top States and Provinces**



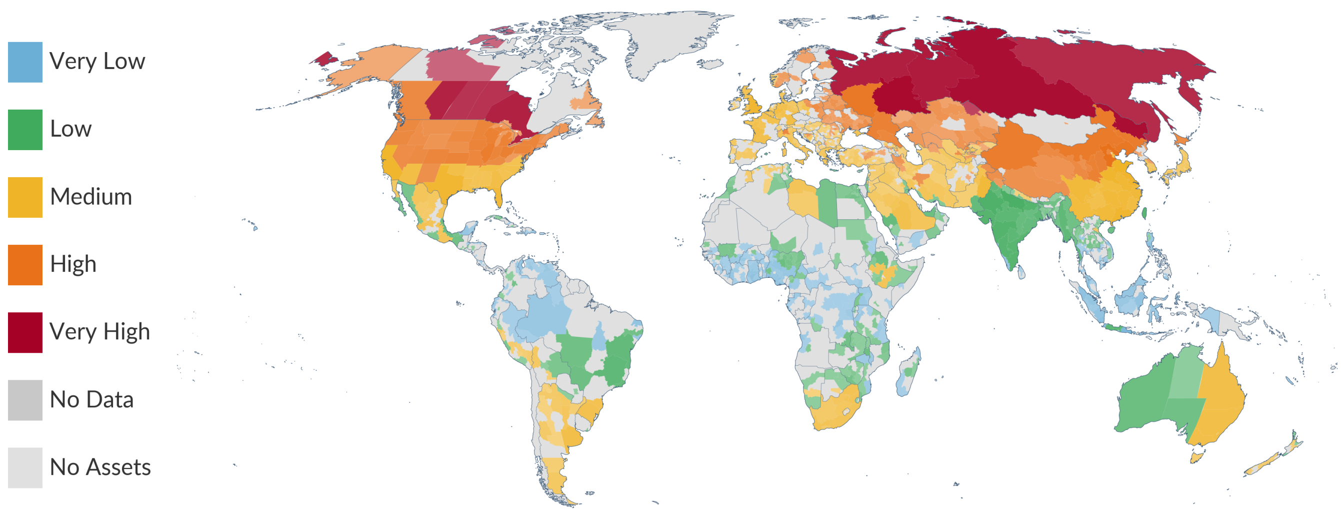
Cold Stress

Cold stress affects 19.0% of assets at High and 1.2% at Very High exposure—a significant secondary hazard concentrated in northern latitudes. The United States, Russia, and China carry the most exposed assets. Scored by extreme cold exceedance days per year.

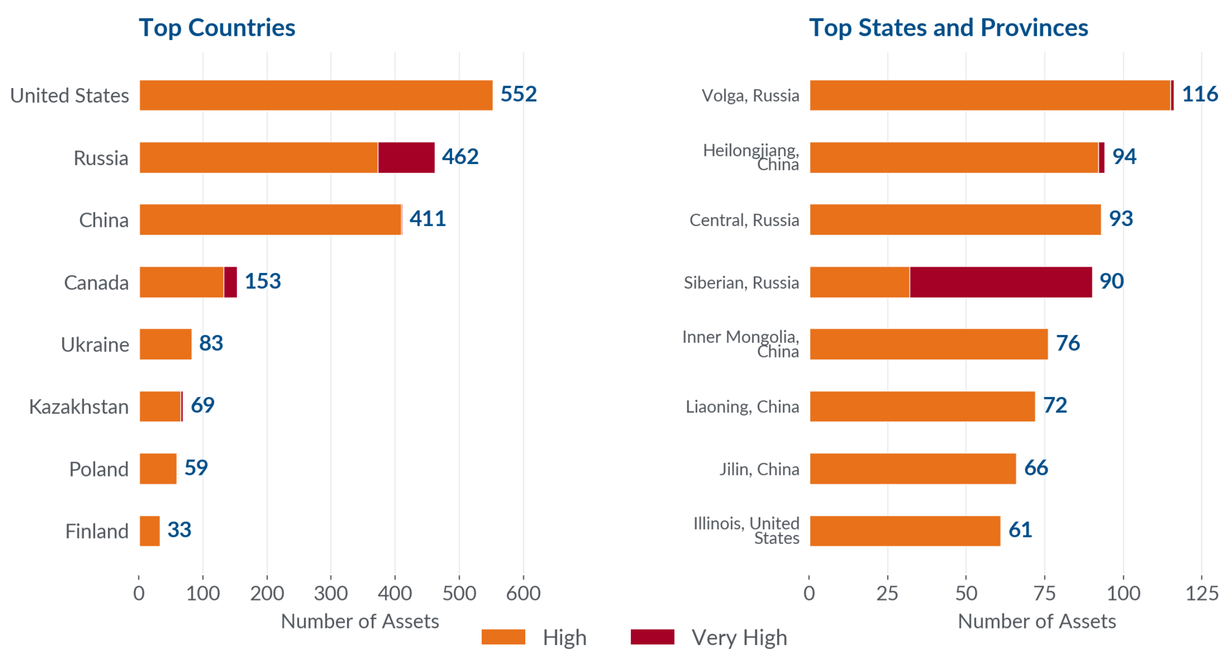
Percent of Assets in Each Cold Stress Exposure Category



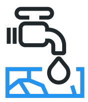
Maximum Cold Stress Exposure Score by Region



Assets at High and Very High Cold Stress Exposure

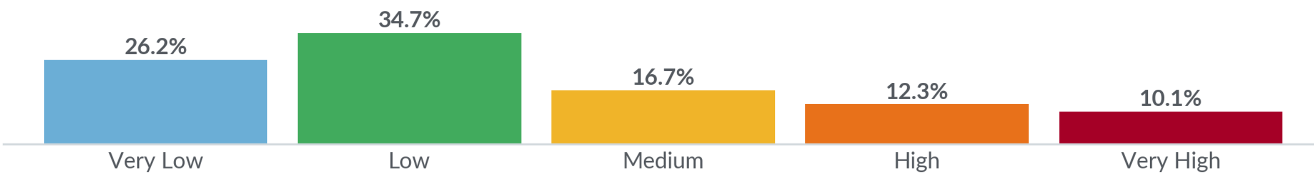


Drought

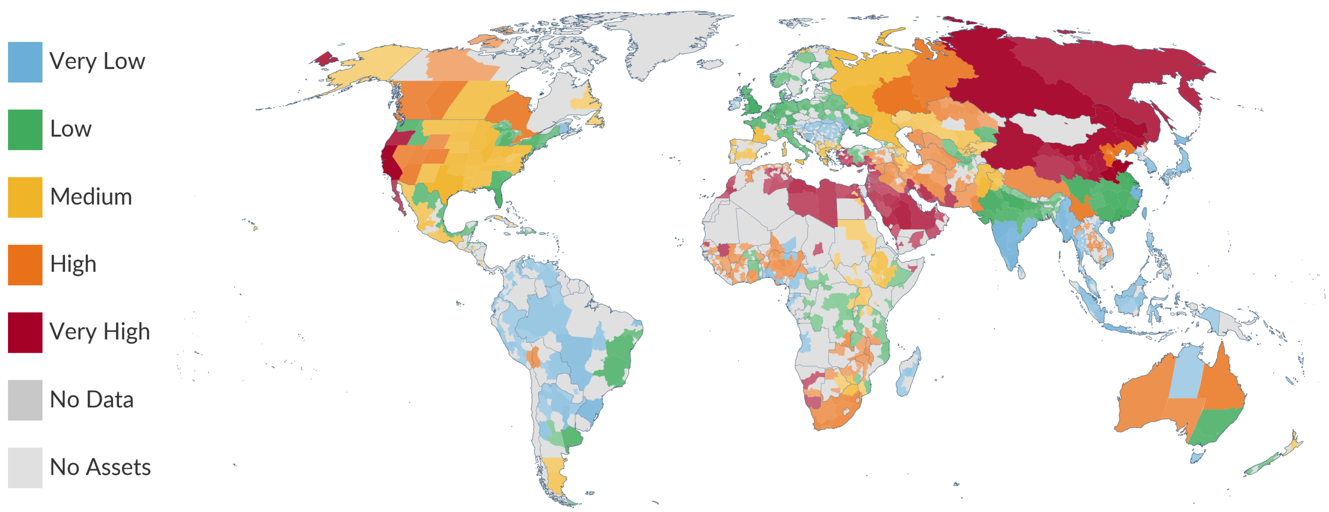


Drought affects 10.1% of assets at Very High and 12.3% at High exposure, indicating meaningful operational screening relevance in some regions even though drought is not used as a primary portfolio-structuring hazard in this report. China, the United States, and Russia are the most affected countries. Scored by Standardized Precipitation Index (SPI) severity.

Percent of Assets in Each Drought Exposure Category

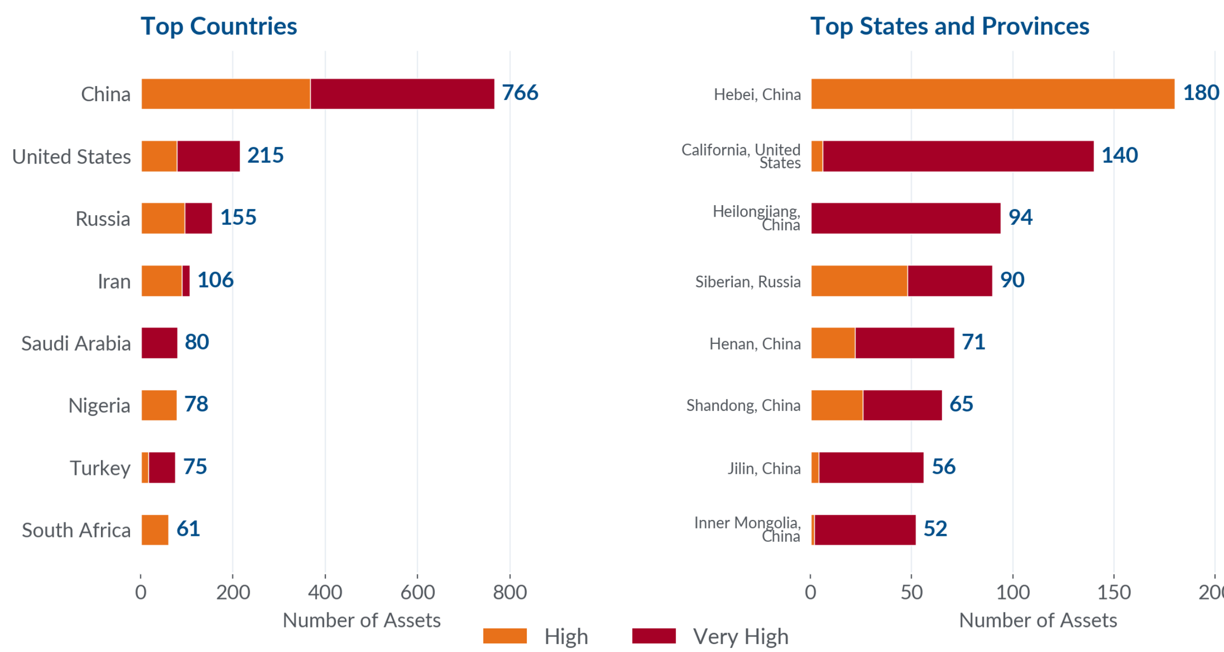


Maximum Drought Exposure Score by Region



Assets at High and Very High Drought Exposure

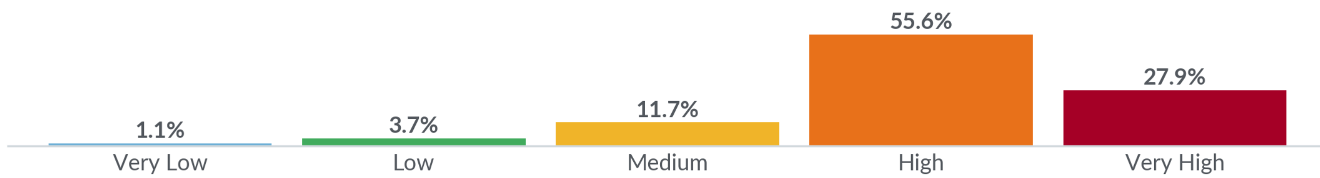
Top Countries / Top States and Provinces



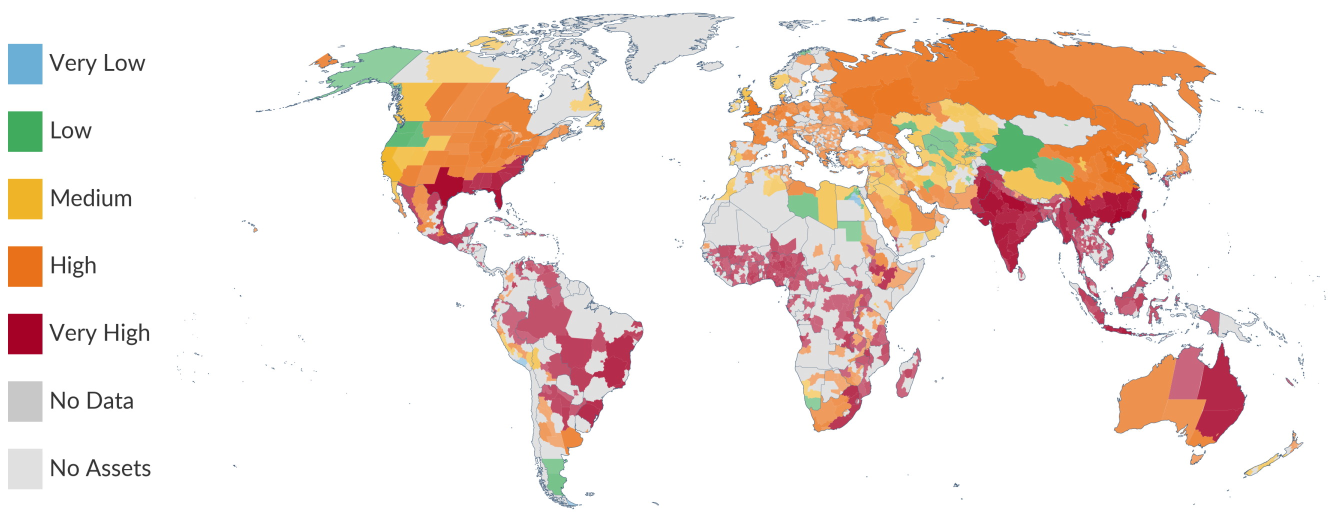
Surface Water Flood

Surface water flooding is the most widespread secondary screening hazard in the portfolio, with 27.9% of assets at Very High and 55.6% at High exposure. Because this layer is based on rainfall intensity rather than site-specific drainage performance or flood depth, it is best interpreted as a triage indicator of potential pluvial flooding concern rather than a portfolio-wide prioritization metric. China, the United States, and India carry the most exposed assets. Scored by 50-year return-level 1-hour rainfall intensity (IDF).

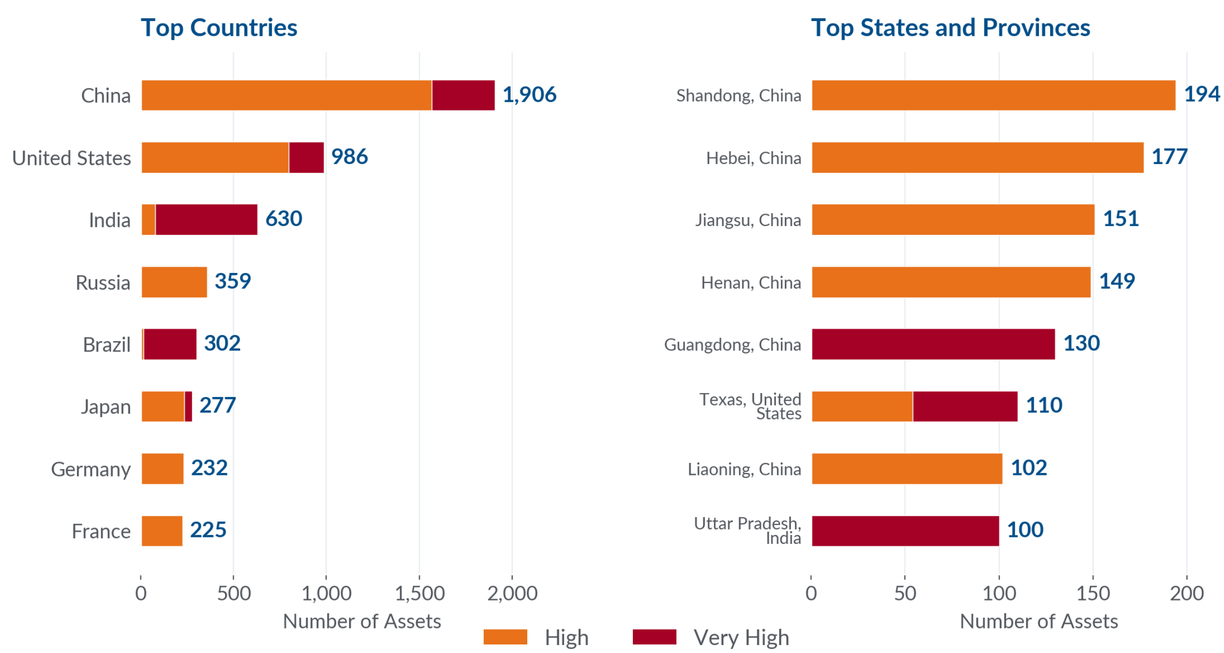
Percent of Assets in Each Surface Water Flood Exposure Category



Maximum Surface Water Flood Exposure Score by Region



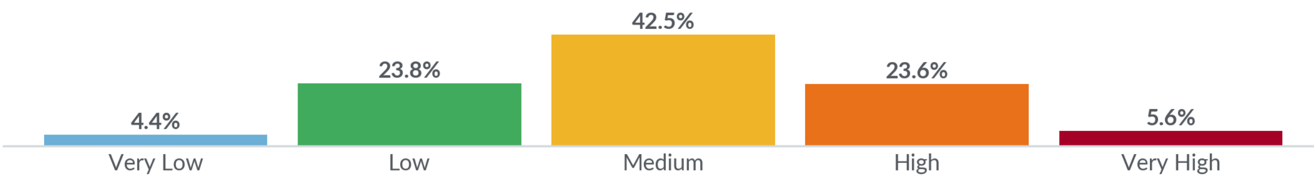
Assets at High and Very High Surface Water Flood Exposure



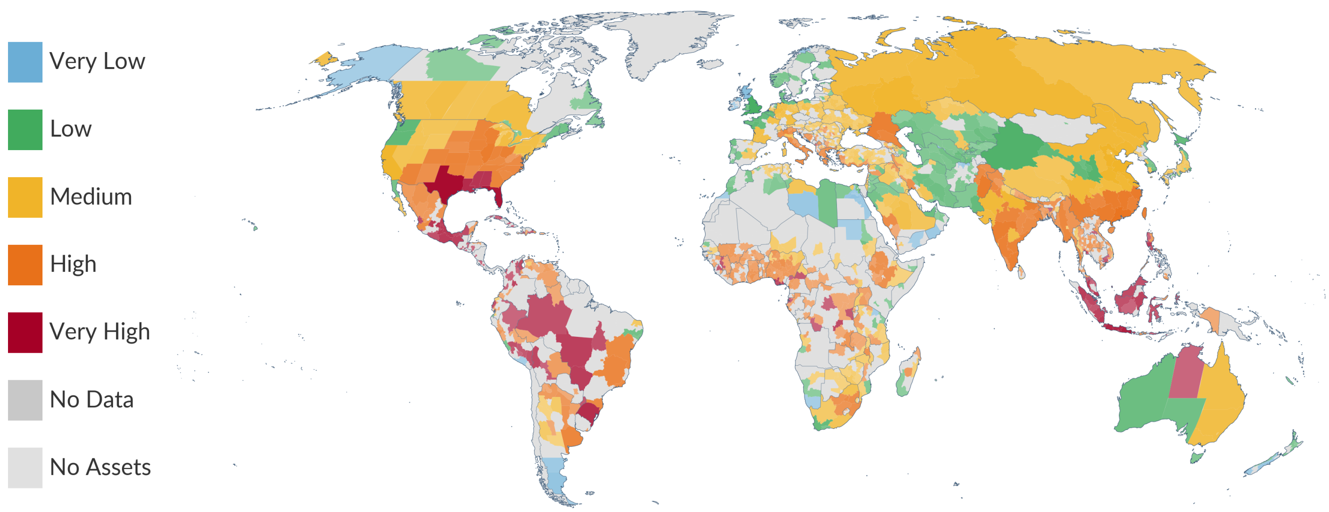
Lightning

Lightning affects 23.6% of assets at High and 5.6% at Very High exposure—a widespread hazard concentrated in tropical regions with high convective activity. Indonesia, Nigeria, and Brazil carry the most exposed assets. Scored by flash density (flashes/km^2/year).

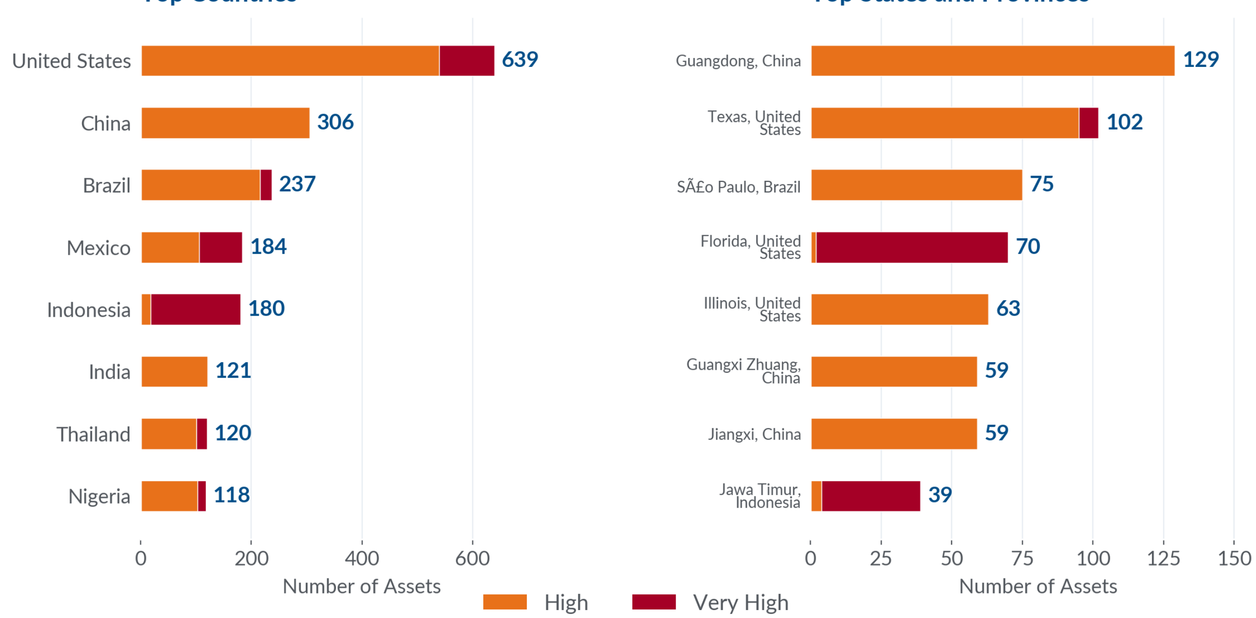
Percent of Assets in Each Lightning Exposure Category



Maximum Lightning Exposure Score by Region



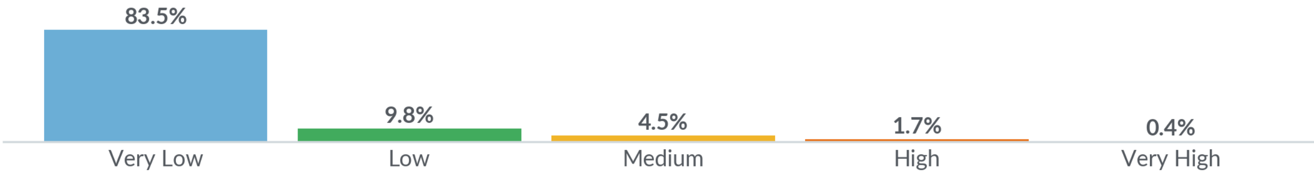
Assets at High and Very High Lightning Exposure



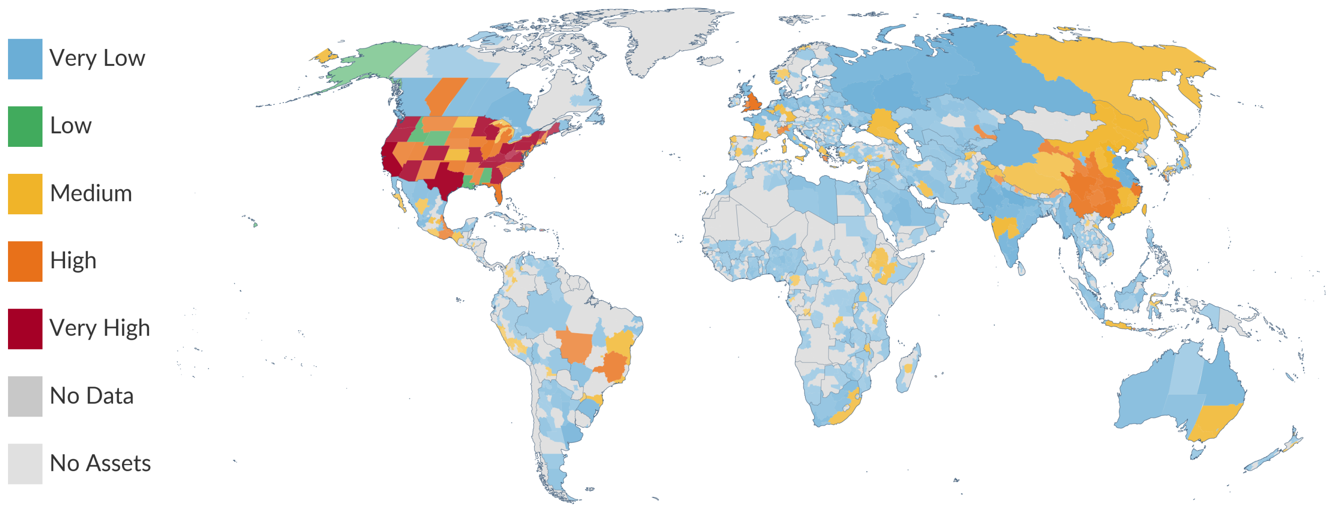
Landslide

Landslide susceptibility affects 1.7% of assets at High and 0.4% at Very High exposure—a niche hazard, but potentially catastrophic at individual sites on steep or unstable terrain. Japan, Turkey, and the western United States carry the most exposed assets. Scored by landslide susceptibility index.

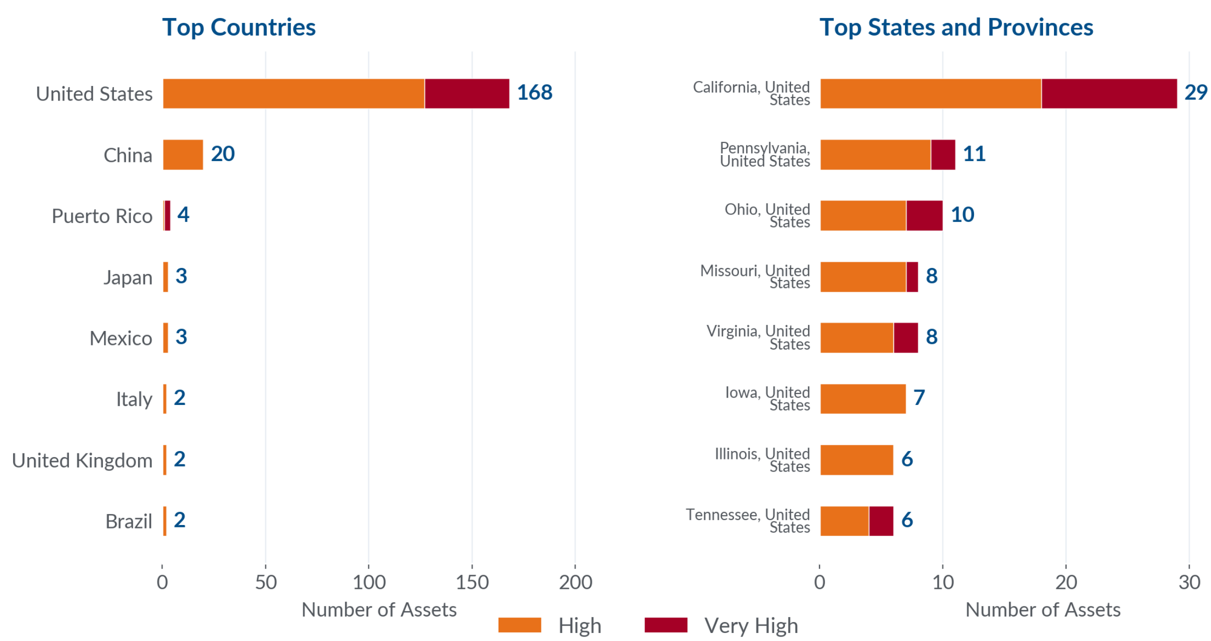
Percent of Assets in Each Landslide Exposure Category



Maximum Landslide Exposure Score by Region



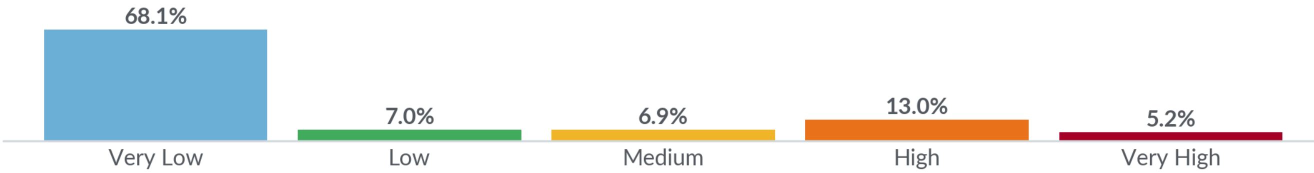
Assets at High and Very High Landslide Exposure



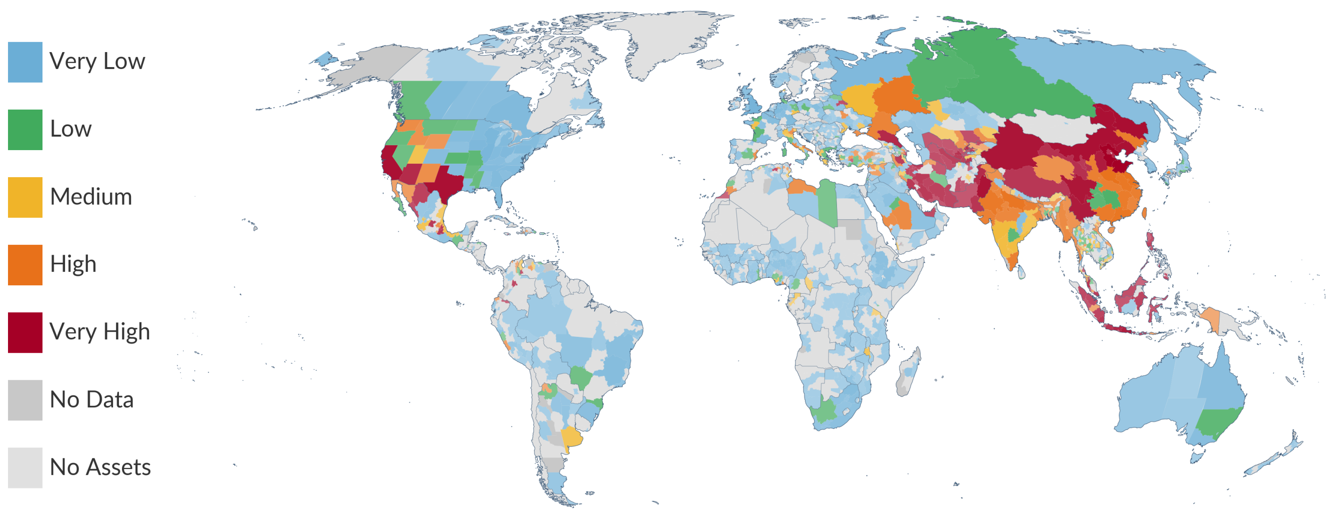
Subsidence

Subsidence affects 9.0% of assets at High and 3.6% at Very High exposure—a slow-onset hazard that compounds flood risk in sinking deltas and over-extracted basins. China, the United States, and Iran carry the most exposed assets. Scored by vertical displacement rate (mm/year).

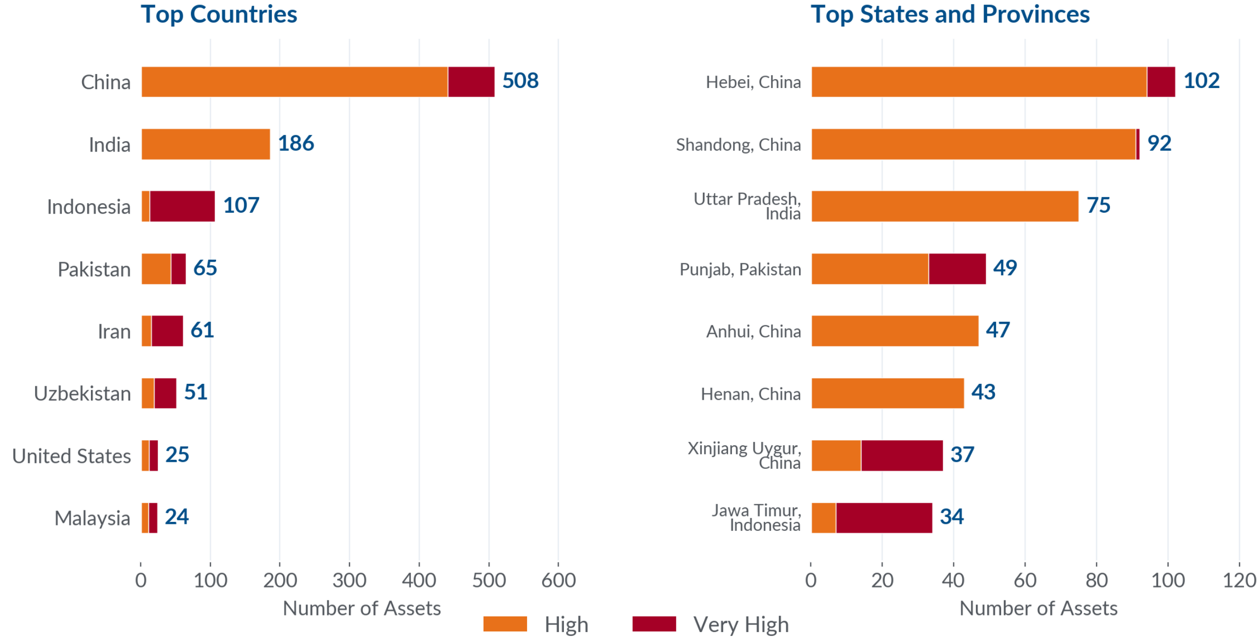
Percent of Assets in Each Subsidence Exposure Category



Maximum Subsidence Exposure Score by Region



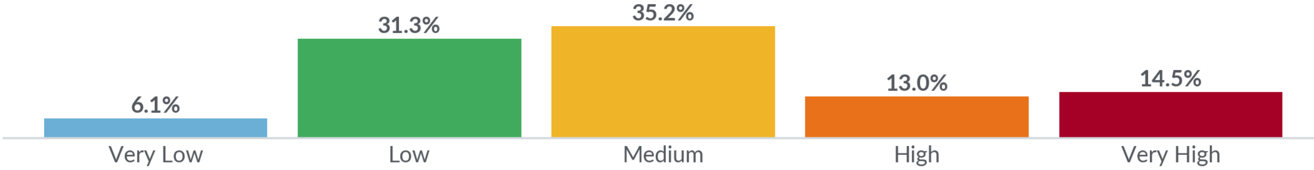
Assets at High and Very High Subsidence Exposure



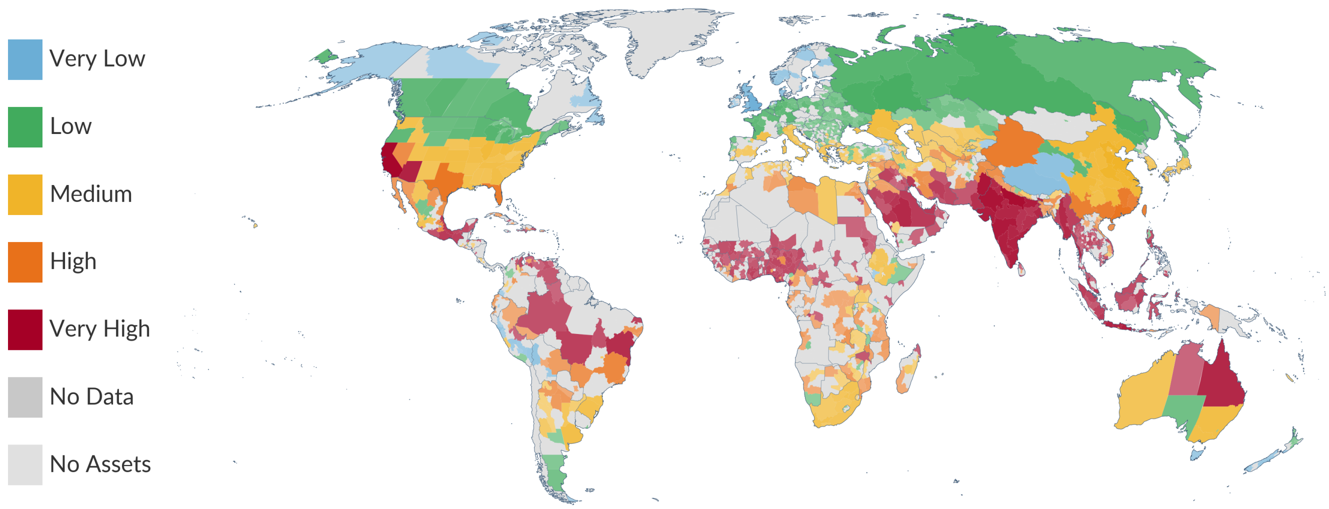
Cooling Demand

Cooling demand affects 13.0% of assets at High and 14.5% at Very High exposure—a significant operational cost driver in tropical and subtropical regions. India, Indonesia, and Nigeria carry the most exposed assets. Scored by cooling degree days.

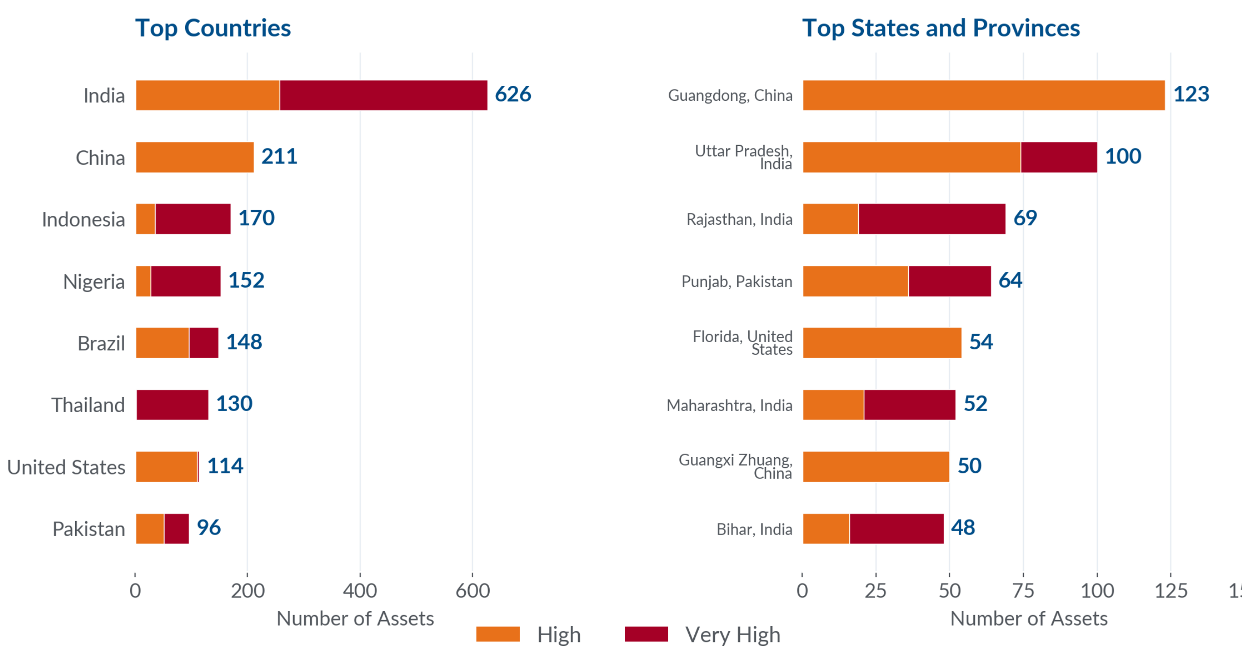
Percent of Assets in Each Cooling Demand Exposure Category



Maximum Cooling Demand Exposure Score by Region



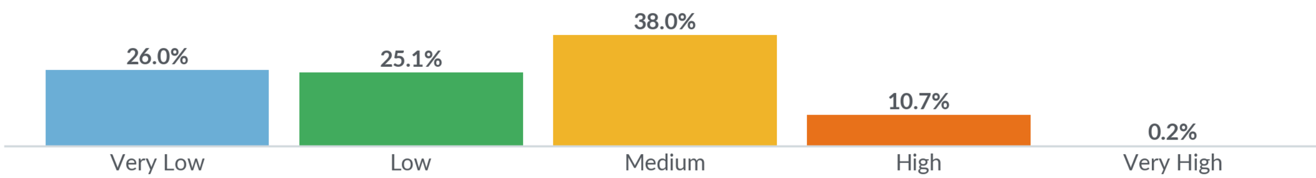
Assets at High and Very High Cooling Demand Exposure



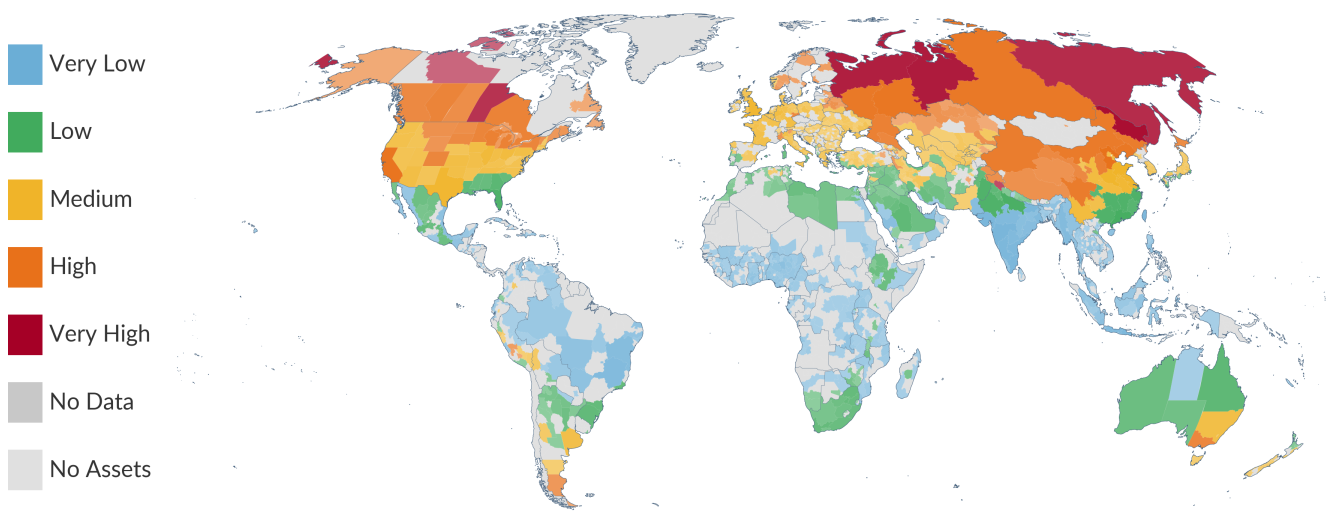
Heating Demand

Heating demand affects 10.7% of assets at High and 0.2% at Very High exposure—concentrated in high-latitude continental climates where prolonged cold drives significant energy costs. Russia, China, and Canada carry the most exposed assets. Scored by heating degree days.

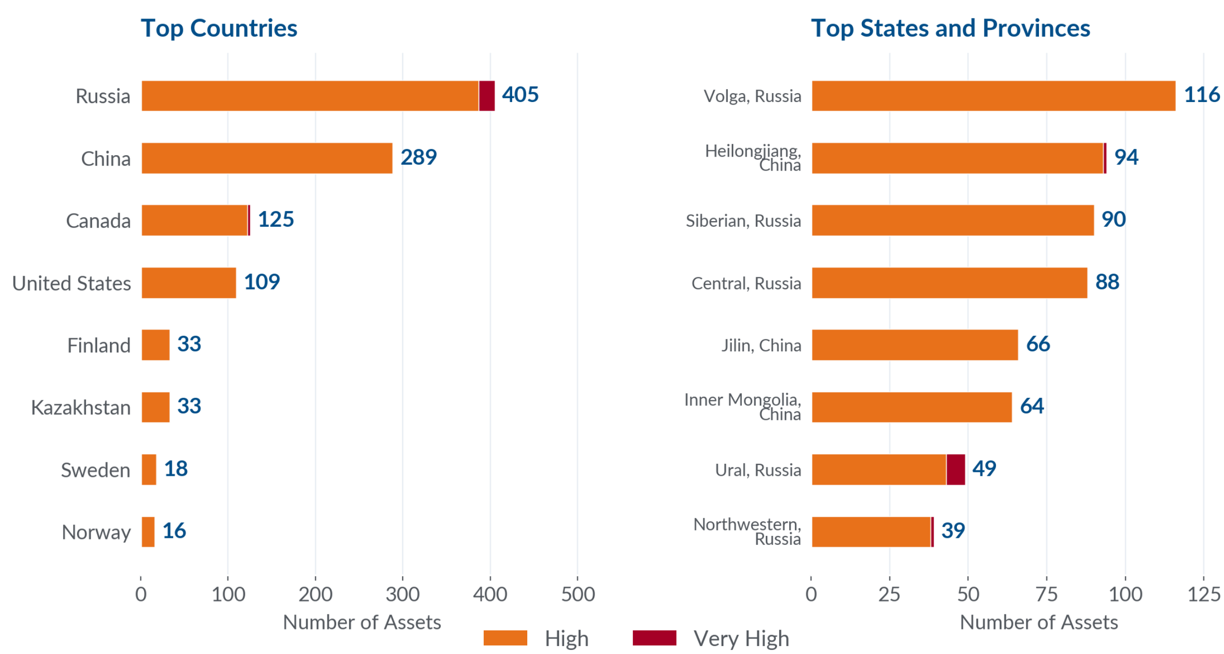
Percent of Assets in Each Heating Demand Exposure Category



Maximum Heating Demand Exposure Score by Region



Assets at High and Very High Heating Demand Exposure



7. Next Steps

The preceding sections identify *where* hazard exposure is highest. The next question is not "Which asset is worst?" but "Which assets matter operationally, and are worth validating first?" This section provides a structured process for answering that question. Exposure scores are a screening tool—they identify which assets deserve closer attention, not which assets are definitively at risk. Translating scores into decisions requires two additional inputs: an understanding of which assets are *critical* to your organization, and *validation* of the underlying hazard data at the site level.

Identifying Critical Assets

Not all assets with elevated exposure scores require the same response. The first step is determining which assets are critical to your organization, because criticality determines the consequence of a disruption event and, in turn, the urgency of any response.

Consider the following when assessing asset criticality:

- **Operational dependency.** Is the asset a sole-source facility, a regional distribution hub, or a key node in the supply chain? Disruption at these sites cascades beyond the asset itself.
- **Revenue concentration.** Does the asset generate a disproportionate share of revenue or serve a disproportionate share of customers?
- **Replaceability.** Could operations be rerouted to another facility within an acceptable timeframe, or would a loss result in prolonged downtime?
- **Regulatory or contractual exposure.** Does the asset carry regulatory obligations, service-level agreements, or contractual commitments that would trigger penalties or liability in the event of disruption?
- **Occupancy and life safety.** Does the asset house a large workforce or serve a public-facing function where disruption poses safety risks?

Example: A regional fulfillment center serving 40% of East Coast customers is operationally critical even if its replacement value is modest. Conversely, a high-value warehouse with full redundancy at a nearby facility may be lower priority despite its book value.

Validating Hazard Exposure

A high hazard score identifies *exposure*, not *impact*. The same flood score at two different sites can represent very different levels of actual risk depending on building construction, elevation relative to flood sources, existing protective infrastructure, and operational dependencies.

Before making decisions based on elevated scores, the underlying data should be validated. The screening model used in this report is designed to identify potential exposure efficiently across large portfolios, but it is not a site-specific engineering assessment. Validation helps determine whether the modelled exposure reasonably reflects actual conditions on the ground.

Approaches to data validation:

- **Cross-reference with historical loss data.** Has the asset experienced past losses from the flagged hazard? Insurance claims, incident reports, and maintenance records can confirm or challenge the modelled score.
- **Review local protective infrastructure.** Flood levees, seawalls, stormwater systems, firebreaks, and seismic retrofits may substantially reduce actual exposure below what a regional-scale model predicts.
- **Check site-specific characteristics.** Elevation relative to flood sources, building construction type, roof age and condition, and proximity to wildland-urban interfaces are site details that screening models may not fully capture.

- **Consult existing assessments.** Phase I/II environmental reports, structural engineering reviews, municipal hazard maps, or prior risk assessments may provide ground-truth data for comparison.
- **Conduct targeted site inspections.** For the highest-priority assets, a physical site visit by a qualified professional remains the most reliable form of validation.

> **Degree Day can assist with hazard data validation and consequence assessment.** Our advisory team provides site-level hazard verification, consequence assessment, and independent review of screening results for priority assets. For more information, visit degreeday.org/services/advisory-research.

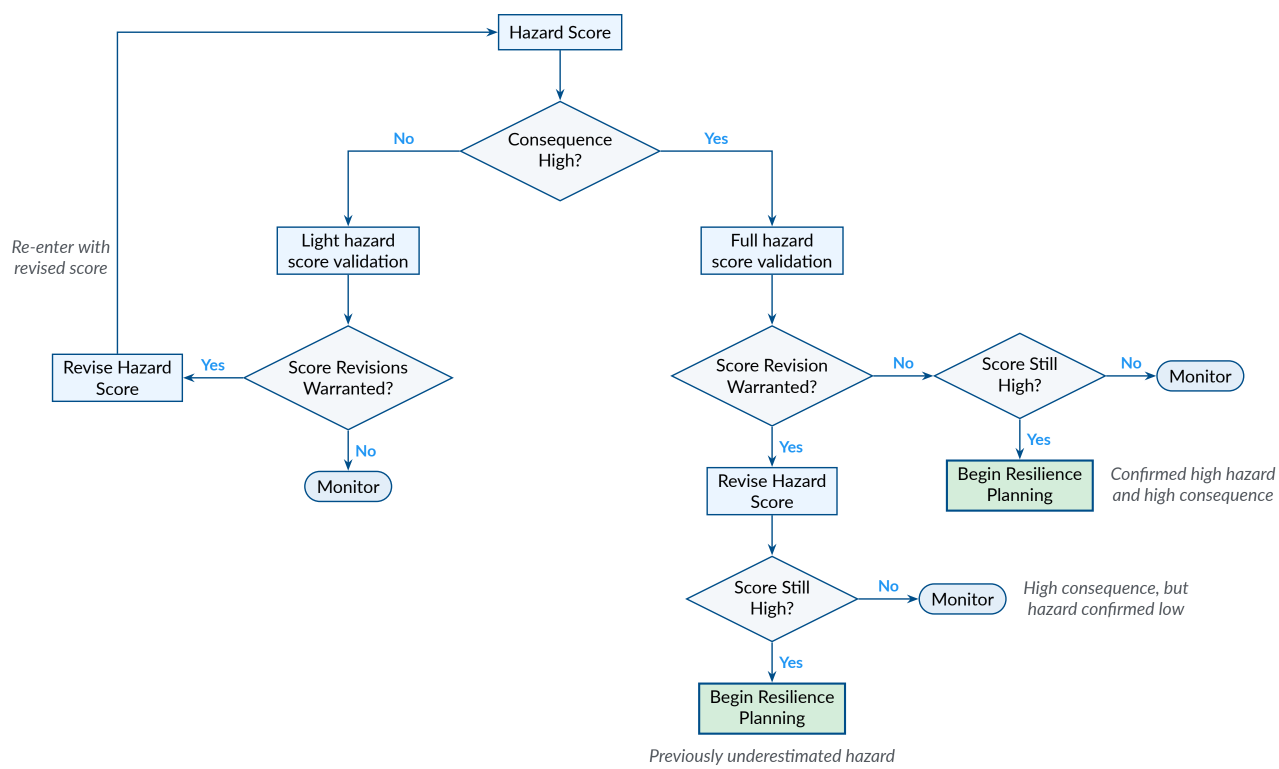
Validation Workflow

The PortfolioHazards™ screening score is the starting point for risk prioritization, not the final determination. All assets can be placed within a validation pathway, though the depth of validation should be risk-based and proportionate to consequence. This reflects the reality that screening models can both overestimate and underestimate site-level hazard exposure.

The first decision gate is consequence severity. Assets where a disruption event would not produce material impact are routed to a light validation check, a focused review of data quality and site conditions sufficient to confirm whether the score is credible. If no revision is warranted, the asset is monitored on a normal review cycle. If the score requires revision, it re-enters the framework with an updated value.

Assets where consequences would be material receive a full validation review covering both data quality and site-specific conditions. Where no score revision is warranted, the original score is taken as confirmed: assets with a high confirmed score proceed to resilience planning; those with a low confirmed score are monitored, with a note that hazard exposure has been independently verified as low despite the high-consequence designation. Where revision is warranted, the updated score determines the response. A score that remains high after revision reflects a previously underestimated hazard and triggers resilience planning accordingly. A score that revises downward returns the asset to monitoring.

This structure ensures that capital allocation and resilience planning decisions are always grounded in validated, site-specific evidence rather than raw screening output.



Outcomes

The validation workflow terminates in one of two dispositions. Every asset in the portfolio will ultimately be classified into one of these categories based on the combination of its hazard exposure, asset criticality, and validation results.

Monitor

The hazard score has been validated or revised downward and does not warrant further action at this time. The asset remains in the normal monitoring cycle and will be reassessed in the next portfolio review.

Examples:

- A warehouse flagged for high flood exposure is confirmed to sit behind a recently upgraded levee system—actual residual risk is low.
- A facility with an elevated wind score is located in a region where building codes already require hurricane-rated construction; existing controls are adequate.
- An asset's earthquake score is revised downward after site inspection reveals it sits on bedrock rather than the soft soil assumed by the regional model.

Begin Resilience Planning

The hazard score has been confirmed as high after validation and the asset is critical to operations. A structured resilience plan is needed addressing the dominant hazard drivers, existing controls, and cost-effective mitigation options.

Examples:

- A sole-source manufacturing facility with confirmed high flood exposure and no flood barriers in place—requires evaluation of flood mitigation options and business continuity planning.
- A data center with validated high earthquake scores in a region with no seismic retrofit history—requires structural assessment and redundancy planning.
- A regional hub with confirmed high wind and tornado exposure serving irreplaceable logistics functions—requires hardening assessment and operational contingency plans.

Degree Day provides resilience planning support. For assets that enter resilience planning, our advisory team can assist with hazard-specific mitigation strategies, cost-benefit analysis of protective measures, and development of site-level resilience plans. For more information, visit degreeday.org/services/advisory-research.

Resilience Strategies by Priority Hazard

For assets that enter resilience planning, the following provides immediate actions and authoritative guidance for each of the six priority hazards assessed in this report. These are starting points for structured resilience work, not exhaustive programs.

Flood

Flood resilience strategies fall into two categories: dry-proofing, which keeps water out entirely through elevation, relocation, or retirement of exposed assets, and wet-proofing, which accepts water entry but limits damage. At the asset level, prioritize critical systems and components most vulnerable to water: electrical switchgear, controls, telecom, mechanical equipment, and fuel systems. Consider whether access routes to the facility remain passable during flood events. Flood resilience measures can and do fail, so designs should incorporate freeboard above the modeled flood level to account for uncertainty. Before investing in resilience measures, consider commissioning a detailed, site-specific flood study. The exposure data in this report are derived from global flood models, which lack the resolution needed for reliable site-level predictions. False positives and missed exposures are both likely without higher-resolution analysis.

References: ASCE 24 | FEMA P-348 | FEMA NFIP Technical Bulletins | REDi for Floods

Wind

Wind affects both the structural system and the building envelope. Building codes address life safety but do not target property protection or operational continuity, so code-compliant buildings still suffer significant wind losses. Envelope failures drive the majority of damage: breached roofing, façade, or glazing allows rainwater intrusion, and broken cladding becomes wind-borne debris that damages adjacent structures. Verify that the design basis for each asset reflects current wind-speed criteria, not the code edition in effect when it was constructed. Focus hardening on roof-to-wall connections, opening protection, rooftop equipment anchorage, and exterior mechanical equipment that can detach under load. Account for damage outside the building as well: downed trees, powerlines, and fencing can block site access and delay re-occupancy even when the structure itself is intact.

References: ASCE 7-22 | FEMA P-804 | REDi for Wind

Wildfire

Wildfire resilience focuses on keeping embers and radiant heat out of the building. Most structure losses begin not from direct flame contact but from windborne embers entering through vents, soffits, eaves, and gaps in the building envelope. Harden the building skin accordingly: rated roofing, screened vents, enclosed eaves, and tempered or multi-pane glazing. Establish and maintain defensible space as a recurring program, not a one-time cleanup. Plan for the compound event of smoke infiltration and utility outage occurring simultaneously by ensuring air filtration capability and backup power.

References: FEMA P-737 | ICC Wildland-Urban Interface Code | IBHS Wildfire Home Retrofit Guide

Tornado

While most tornadoes are weak, managing damage from violent tornadoes is exceptionally challenging and costly—hardening an entire building against EF3+ winds is rarely practical. Tornado resilience therefore centers on protecting human life through storm shelters. Determine which facilities require dedicated shelter capability based on occupancy, warning time, and the availability of off-site refuge. Verify that occupants can actually reach designated shelter areas within the expected warning window—typically under 15 minutes. Design and operate shelters to ICC 500 and FEMA safe-room standards, ensuring each has independent power, ventilation, communications, and clearly posted procedures. Run drills at least annually and after any personnel turnover in safety-critical roles. For assets in the highest-risk corridors, consider whether relocating operations to a lower-hazard tornado region is a viable long-term strategy—particularly for facilities that cannot be cost-effectively sheltered or that house irreplaceable processes.

References: FEMA P-361 | FEMA P-320 | ICC 500 | FEMA ICC 500-2023 highlights

Earthquake

Earthquake resilience addresses both the structure and its nonstructural components. Building codes target life safety, not operational continuity, so even code-compliant buildings can suffer major financial losses and extended downtime after a design-level event. For older buildings, verify that the structural system meets current seismic code requirements, as design standards have changed substantially over the past several decades. Nonstructural damage is typically the primary driver of post-earthquake downtime: unanchored equipment, piping, control systems, and suspended ceilings fail at shaking intensities well below those that threaten the structural system. Begin with a rapid screening of both structural and nonstructural vulnerabilities, and prioritize nonstructural bracing and anchorage first. For critical facilities, evaluate whether advanced systems such as base isolation or supplemental damping are justified. Account for ambient risks as well: surrounding structures can collapse or shed debris, and liquefaction or slope failure can block site access even when the building itself is undamaged.

References: ASCE 41-23 | ASCE 7-22 | FEMA E-74 | FEMA P-58-1 | FEMA P-154 | REDi for Seismic

Large Hail

Large hail damages the building envelope first. Roofing membranes, skylights, gutters, HVAC condensers, and solar panels are the most vulnerable. Vehicles and vegetation, including crops, are also at risk. Unlike other hazards, hail rarely threatens life safety, but repair costs accumulate quickly and secondary water intrusion from a breached roof can far exceed the initial impact damage. Specify impact-rated roofing, glazing, and equipment screens during any envelope replacement or new construction. Retrofitting solely for hail is hard to justify, but bundling hail resistance into scheduled wind-hardening or re-roofing work adds marginal cost.

References: ASCE 7-22 | FM Global DS 1-34

A Note on Future Climate

The exposure scores in this report reflect current climate conditions, not future projections. For long-lived assets, organizations should also consider how hazard exposure may change over time.

Climate models are useful tools for long-term planning, but they are not precise site-level forecasts. Confidence varies by hazard: temperature projections are generally more reliable than projections for tornadoes or hurricanes. Any projections used in planning should align with observed local trends, not rely on isolated model outputs.

Interpreting climate projections responsibly requires expertise. Degree Day provides advisory services to help organizations interpret climate projections and responsibly incorporate credible projections into resilience planning.

Appendix

Methodology, scoring, and data notes

A. Appendix: Methodology and Data Notes

Hazard Families

Each asset is scored across six hazard families. Where a family draws on more than one underlying indicator, the family score reflects the maximum of the underlying component scores.

Hazard Family	Description
Flood	Riverine overflow and coastal storm-surge inundation
Wind	Extreme sustained or gust wind speeds
Wildfire	Wildfire susceptibility based on fuel, climate, and terrain
Tornado	Significant tornado occurrence frequency
Hail	Large hail event frequency and intensity
Earthquake	Peak ground acceleration from seismic activity

Exposure Tier Definitions

All scores are expressed on a 0–100 scale. Tier thresholds are fixed across all hazard families to support broad screening-level comparison across hazards.

Tier	Score Range
Very Low	0–19
Low	20–39
Medium	40–59
High	60–84
Very High	85–100

Composite Burden

The composite burden for an individual asset is the sum of its six hazard family scores (theoretical range 0–600). This metric is used for relative ranking only. It is not a risk score and should not be interpreted as one.

Data Sources and Scoring

Scores are derived from global climate and hazard datasets. Each hazard family draws on one or more source datasets; raw indicator values are normalized to a 0–100 exposure score using a normalization designed to span the full range of global hazard distributions. These normalized scores support portfolio screening and relative prioritization, but they do not imply equivalent physical magnitude or consequence across different hazard families. The table below summarizes the primary source, native metric, approximate spatial resolution, and key limitation for each hazard family.

Hazard	Primary Source	Native Metric	Resolution	Key Limitation
Flood	Global flood models (riverine + coastal)	Inundation depth (m)	∼30 m	Lacks local drainage, levees, and recent infrastructure
Wind	Tropical cyclone track models + reanalysis	Peak gust speed (m/s)	∼1 km	Underestimates terrain and urban roughness effects
Wildfire	Fire weather & vegetation susceptibility	Composite susceptibility index	∼1 km	Does not capture active fire management or recent burns
Tornado	Historical tornado density (SPC/ERA5)	Annual frequency (events/yr)	∼25 km	Sparse observational records outside the US
Hail	Severe convective environment proxies	Max hailstone diameter (mm)	∼25 km	Indirect proxy; limited surface hail observations globally
Earthquake	Probabilistic seismic hazard (USGS/GEM)	PGA at 475-yr return (g)	∼10 km	Does not reflect local soil amplification without site data

Coverage quality varies by region; areas with sparse observational networks may have higher model uncertainty. All scores reflect current climatological conditions and do not incorporate forward-looking climate projections.

Full details on data sources, model selection, and scoring methodology are available in the accompanying Methodology Document.

Accompanying Data File

An Excel workbook is delivered alongside this report containing the full asset-level dataset. Each row represents one portfolio asset. The columns are organized into three groups:

Column Group	Description
Location	Asset identifier, coordinates (latitude / longitude), country, state / province, elevation, and climate zone.
Raw Indicators	Untransformed hazard indicator values for each peril in native units (e.g. flood depth, ground acceleration, wind speed).
Scored Indicators	Normalized 0–100 exposure scores used in this report for tier classification, composite burden, and all figures.

The workbook includes scored columns for all assessed perils. This report focuses on the six hazard families listed above; additional scored indicators are included in the workbook for completeness.

References

The following references are cited in the resilience strategy tables in Section 6. They are listed alphabetically by issuing organization.

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