Catastrophe and Climate

Shifting Seasonality in a Changing Climate: Implications for Actuarial Practice

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Shifting Seasonality in a Changing Climate:

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Implications for Actuarial Practice

Executive Summary

Seasonality has long provided a stable and predictable framework for understanding climate behavior, economic activity, and insurance risk. Actuarial models, pricing strategies, and risk management practices have historically relied on the assumption that seasonal patterns—while variable—are broadly stationary over time. However, a growing body of evidence indicates that climate change is not only altering the intensity and frequency of hazards, but also fundamentally reshaping their timing, duration, and geographic occurrence. These shifts in seasonality introduce new complexities that challenge traditional actuarial approaches.

A group of experts was assembled by the SOA on September 8, 2025, to discuss how climate change is influencing insurance affordability, availability, and adequacy in North America. Specific topics that were addressed included:

What seasonality meant to them – not just in terms of temperature and precipitation type, but also about illnesses and vacations, for example, and whether they are seeing evidence of changes in seasonality from climate change. The panelists noted that observed changes include earlier onset of spring, longer warm seasons, shorter and milder winters, and shifting precipitation patterns, and that hazard seasons are expanding and increasingly overlapping. Wildfire seasons are lengthening, severe convective storms are occurring outside their traditional windows, and tropical cyclone activity is extending beyond established calendar boundaries. In addition, phenomena such as "weather weirding" and "weather whiplash" highlight increasing intra-seasonal variability and abrupt transitions between extremes. These dynamics contribute to a rise in compound events, where multiple hazards occur simultaneously or in close succession, amplifying overall risk.

The panelists also addressed the impacts. They noted that the implications extend well beyond physical hazards. Shifting seasonality is affecting infrastructure resilience, public health, economic productivity, and social behavior. Communities are facing increased stress on transportation systems, energy grids, and water infrastructure due to more frequent freeze-thaw cycles, extreme heat, and heavy precipitation events. Health impacts are evolving as well, with longer pollen seasons, expanded vector-borne disease ranges, increased heat-related morbidity, and worsening air quality from wildfire smoke. Economic effects are mixed but significant, influencing agriculture, construction, tourism, supply chains, and labor productivity.

Impacts to the insurance industry, both property and casualty and life and health, were also discussed. For the insurance industry, the changes are particularly consequential. Traditional assumptions about the timing and independence of losses are becoming less reliable, affecting pricing, reserving, capital allocation, and reinsurance structures. Longer and more volatile hazard seasons are contributing to rising premiums, reduced coverage availability, and increased reliance on forward-looking risk assessments. In life and health insurance, shifting seasonal drivers are altering morbidity and mortality patterns, requiring updates to actuarial assumptions and models.

Finally, the panelists discussed the challenges and opportunities for actuaries. Actuaries face a critical need to adapt. Key challenges include updating models to reflect non-stationary climate conditions, incorporating forward-looking climate data, addressing increased uncertainty, and improving the granularity of risk assessments across both time and geography. Scenario analysis, parametric solutions, and enhanced collaboration with climate scientists and other experts will be essential tools. At the same time, these changes present opportunities for innovation in modeling, product design, and risk communication.

In summary, shifting seasonality represents a fundamental transformation in how risk manifests across natural, economic, and human systems. Addressing this transformation will require a move beyond reliance on historical patterns toward more dynamic, interdisciplinary, and forward-looking approaches. By integrating climate science with actuarial practice, the insurance industry can play a vital role in managing emerging risks and supporting resilience in a changing climate.

Section 1 Introduction

Seasonality has historically been a cornerstone of how climate, economic activity, and insurance risk are understood. The annual cycle provides a structure around which expectations are formed, models are calibrated, and resources are allocated. For insurers and actuaries, seasonal signals embedded in historical data have long helped differentiate expected loss patterns from anomalies. This perspective is particularly relevant in the context of evidence of seasonal shifts, where evolving conditions continue to reshape expectations and outcomes.

Climate change is now altering not only the magnitude of hazards but also their timing and where they occur. Warmer conditions, shifting precipitation patterns, and evolving atmospheric dynamics are influencing when hazards occur and how long their seasons last. These changes introduce complexity into risk assessment that extends beyond traditional considerations of severity and frequency. Understanding how the changes are impacting and will impact property and health insurance is particularly important for actuaries.

For actuarial work, the importance of timing cannot be overstated. The annual distribution of losses affects pricing assumptions, reserving development, capital allocation, and reinsurance structures. When seasonal expectations shift, these foundational elements of actuarial analysis may require reassessment.

Another critical issue is the erosion of stationarity. Historical data has traditionally been used with the assumption that underlying processes are stable. As seasonality evolves, this assumption becomes less reliable, requiring greater reliance on forward-looking approaches and interdisciplinary collaboration.

Across regions, the nature of the seasonality change varies. Some areas are experiencing earlier springs, others longer summers, and still others more variability within traditional seasons. This geographic diversity adds another layer of complexity for insurers managing large, diversified portfolios.

An additional consideration is the emergence of compound events. As seasonal boundaries blur, hazards that were once separated in time may overlap. This can amplify losses and challenge assumptions regarding independence among events.

To gain more insight into seasonality: what it is, what it means, how it affects the economy, how it affects people, and how actuaries do their jobs, to name a few, the Society of Actuaries Research Institute Catastrophe & Climate Strategic Research Program hosted a panel of experts in September 2025 to discuss a variety of aspects related to seasonality. The group consisted of actuaries in various specializations, a meteorologist and a planning and infrastructure expert, thus providing a broad cross section of expertise albeit not complete.

The discussion was to address an illustrative set of discussion points, with the goal of describing the current status or future possibilities of this topic and with the understanding that this may not be verbatim what evolves during the discussion and that the discussion would thrive from group interaction and a broad set of views and approaches.

The complete set of questions is listed below…

I. Geo-hazard Aspects

How do you define “seasonality? (What does seasonality mean to you?)

Are we seeing evidence of seasonal shifts in weather patterns and, if so, are they climate change related?

As the climate continues to warm, what can we expect in terms of when specific types of extreme weather might occur, by region in the U.S. and Canada, and how might seasonal shifts make compound weather events more frequent and intense?

II. Bio-Socio-Economic Aspects

What are the challenges of regional seasonal changes for retirees?

How have seasonal shifts impacted retirees, such as extreme temperatures in regions or months not normally expected?

What are the agriculture / crop insurance impacts of shifts in seasonality, including both cold weather as well as hot weather?

What sort of impacts will seasonally shifting weather patterns have on local, regional, and national economies?

What are the impacts to city climate-related resilience planning, when extreme weather perils shift to new expected times of the year?

How might seasonal responses and readiness planning by first responders be impacted by seasonal and regional shifts in weather extremes?

III. Impacts to the Insurance Industry

What are the property and casualty insurance implications of shifts in seasonality, including pricing and reserving?

What should the insurance industry be thinking about regarding shifts in seasonality that we have not covered today?

IV. Challenges and Opportunities for Actuaries

How will seasonal shifts affect how probabilities and uncertainty of extreme events are calculated?

How can this be incorporated into actuaries' day-to-day work?

What are the life and health insurance implications of shifting seasonal weather patterns, including pricing and reserving?

Responses to the general areas discussed include the anonymized comments and explanations provided by the panelists at the time of the discussion (September 8, 2025) – as well as complementary ones made during a review of the report – as well as information included by the author thought to be important, but which may have been otherwise missed. The purpose of writing this report is to provide a document with information that is useful for actuaries who need to consider how changing seasonality will influence their decision-making.

Section 2 Geo-Hazard Aspects

The canonical interpretation of seasonality is etched in how the different quartiles or periods of weather that characterize a region throughout the year are defined and how they occur. The primary astro-geophysical influences are the tilt of the earth's rotational axis with respect to the orbital plane, the time of year, latitude, and longitude (which includes distance from large water bodies, elevation, and surrounding land type). While these parameters are, for the most part, time invariant, they all influence the intra- and inter-seasonal weather that occurs. And those weather ranges influence how humans live, their daily behavior plans, and the disasters from which they must recover. Some parts of the world only experience two seasons, like wet and dry or warm and cool. For many locations and the mid-latitudes, there are four. North America as a whole experiences four seasons, although the difference from one to the next certainly varies according to location and elevation.

2.1 UNDERSTANDING SEASONALITY

In the broad context, seasonality can be understood from multiple perspectives. In meteorology, it refers to the expected timing of weather phenomena during the year. In actuarial science, it often refers to recurring patterns in claims experience or financial outcomes. Social and behavioral factors also contribute to seasonality, influencing tourism patterns, energy demand, agriculture, and healthcare utilization. In short, there are many ways to define seasonality and that was echoed by the panelists.

2.1.1 MULTIPLE DEFINITIONS OF SEASONALITY

The panelists noted that seasonality can be defined in different ways depending on disciplinary context. From a scientific perspective, they noted that seasonality refers to recurring patterns within the annual cycle driven by variations in solar radiation, atmospheric circulation, and ecological processes. In meteorology, seasonal patterns determine when particular weather phenomena—such as snowstorms, hurricanes, or heat waves—are most likely to occur.

One panelist more formally defined seasonality as being fundamentally about the types of weather phenomena expected during particular times of the year, including temperature patterns, precipitation regimes, and storm behavior. Some specific weather types and their seasons are shown in Table 1.

But other panelists noted that seasonality often refers to systematic variations in financial outcomes or claims costs that repeat each year. For example, health insurers frequently observe higher claims costs during winter months due to influenza and respiratory illnesses. Conversely, healthcare utilization may decline during summer months when individuals travel or engage in outdoor activities.

One participant noted… there is a flu season, a fire season and a heat season … (Table 2) and explained that seasonal patterns have traditionally been incorporated into actuarial models through seasonality factors, which adjust expected claims costs by month based on historical experience.

And yet other panelists noted that seasonality may also be understood in broader economic and societal contexts. Retail activity, tourism demand, agricultural production, and energy consumption all exhibit strong seasonal patterns influenced by weather conditions and cultural traditions.

Table 1

SEASONALITY DEFINED IN TERMS OF TYPICAL WEATHER PHENOMENA (REGION-DEPENDENT)

Hazard Type	Typical Seasonality Pattern
Hurricanes	Jun–Nov (peak Aug–Oct)
Wildfires	Late summer–fall (West)
Severe convective storms	Spring–early summer
Winter storms	Dec–Feb
Heatwaves	Jun–Aug

Table 2

SEASONALITY DEFINED IN TERMS OF HEALTH CONCERN (REGION-DEPENDENT)

Health Concern	Typical Seasonality Pattern
Pollen	Spring
Heat	Summer
Fire (smoke)	Fall
Flu/Respiratory Illnesses	Winter

2.1.1.1 SEASONALITY AS A LIFE-CYCLE CONCEPT

One panelist noted that seasonality does not always correspond to the calendar year, noting instead that it may reflect the life cycle of a process, which can extend far beyond a single year. For example:

- Some insurance products involve claims that develop over several decades.
- Ecological cycles may operate over multi-year time scales.
- Climate processes such as drought cycles may extend beyond annual patterns.

From this perspective, seasonality represents systematic variation over time within the life cycle of a system, rather than simply variation among the months of the year.

2.1.1.2 SOCIAL AND BEHAVIORAL DIMENSIONS OF SEASONALITY

Seasonality also influences human behavior and economic decision-making. For example:

- People schedule weddings and outdoor events based on expected seasonal weather conditions
- Agricultural planting schedules follow expected climate cycles
- Tourism industries rely heavily on seasonal patterns

Panelists noted that individuals are increasingly noticing subtle seasonal shifts in everyday life. One participant highlighted how people are beginning to recognize longer tick seasons, altered outdoor recreation patterns, and changes in when events such as weddings are scheduled.

These anecdotal observations can sometimes provide early signals of broader environmental changes.

2.2 EVIDENCE OF SEASONALITY SHIFTS

Changes in seasonality that have already been observed are important to document and attribute in order to understand what to expect in the future. If the changes can be tied to climate change, which is expected to continue at some rate at least through the 21st century, then the observed changes may continue. Understanding how the physical weather and climate changes have manifested and what impacts they are having and will continue to have on property values, human health, and the economy, in general, are all important reasons to identify seasonality shifts. In this section the physical evidence is discussed.

2.2.1 OBSERVED CHANGES IN SEASONAL CLIMATE PATTERNS

It is important to keep in mind the meteorological definition of seasons rather than the astronomical definition of them to better appreciate how the seasons are changing. Thus, in many parts of the mid-latitudes, winter is December through February because those months yield the coldest three-month average and summer is June through August because those months yield the warmest three-month average. In between, Spring is therefore defined as March through May and Fall is defined as September through November. Scientific observations indicate that seasonal climate patterns are changing in several ways. Many regions are experiencing:

- Earlier spring onset
- Longer warm seasons
- Shorter winters
- Reduced snowpack
- Shifts in precipitation timing

One panelist noted that long-term climate averages increasingly show longer summers and milder winters, with some regions experiencing more rainfall and less snowfall during winter months.

While seasons are traditionally defined astronomically by 3-month periods, they can also be defined by temperature where the year is split into four parts based on the annual temperature cycle: the 25% coldest days, the 25% warmest days, and two transition "sandwich" seasons. These regional changes reflect the influence of rising global temperatures on atmospheric and hydrological processes. The basic effect is illustrated in Figure 1.

A study by Wang et al. (2021) found that over the period of 1952–2011, the length of summer, defined as the number of consecutive days that daily average temperature exceeds the 75^{th} percentile, has increased from 78 to 95 days, and that of spring, autumn and winter decreased from 124 to 115, 87 to 82, and 76 to 73 days, respectively. They also found that under a business-as-usual climate scenario, summer is projected to last nearly half a year, but winter less than two months by 2100.

Figure 1

CONCEPTUAL SHIFT IN SEASONAL HAZARD TIMING BY LATE 21^{ST} CENTURY

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Traditional Year:    |-------WIN------|-------SPR------|-------SUM------|-------FAL------|

Emerging Pattern:    |----WIN----|------SPR------|-----------SUM-----------|-----FAL-----|
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The expanding warm seasons are permitting extreme weather that occurs in a season to occur earlier and last longer. Several hazards appear to be expanding within their traditional seasons. Examples discussed by panelists include:

Wildfires: Fire seasons in parts of the western United States now begin earlier and last longer due to warmer temperatures and drier vegetation. The LA wildfire in January 2025 is a prime example.

Severe convective storms: Some evidence suggests that severe thunderstorm activity may extend further into summer months and can even extend into fall and winter. The long-track EF5 tornado that went through Kentucky in December 2021 was a prime example.

Flooding: Floods can and do occur around the year, so it is difficult to say that the flood season is getting longer, although there are certain times of the year in certain regions of North America where they are more likely because of a particular mechanism. The intense rainfall and floods that Hurricane Harvey brought to Houston in 2017 are just one example. Because climate change is warming the atmosphere and because warmer air can hold more moisture, with all else being equal, heavier rain will fall. One panelist noted that the average is about 7% per degree Celsius, but extremes can be much more, especially when weather systems move slowly and the very system generating the rainfall is more intense. Climate change is expected to weaken the polar jet stream because of a decreased pole-to-equator temperature gradient, which will lead to slower weather systems and intensified hurricanes, which will squeeze more moisture from the atmosphere.

Tropical Storms: Tropical storms derive their energy from the warmth of underlying ocean water. Even now, the official hurricane season extends from June 1 to November 30. But lately hurricanes have been forming before June (1-in-4 chance from 1970-2000 and 1-in-2 chance since 2000) and after November (1-in-10 chance from 1970-2000 vs 1-in-4 chance since 2000). If this behavior continues, it may prompt a redefining of the official hurricane season, which could then impact vacation plans, migration schedules, and insurance rates! In fact, the official start and end may be ignored in favor of what will actually happen. As oceans warm, tropical storms are also becoming stronger and, sometimes they become so strong so early in the season, that it is considered weird behavior.

2.2.2 WEATHER WEIRDING

One of the most notable concepts discussed during the panel was the idea of “weather weirding.”

This term refers to the increasing occurrence of unusual or unexpected weather events within traditional seasons. An example discussed during the panel was Hurricane Beryl, which intensified from a tropical storm into a Category 5 storm in only 42 hours in the main development region of the Atlantic in late June/early July of 2024. It was the first storm to ever reach Category 5 status so early in the season. Events like this may not represent a complete shift in seasonal boundaries, but they highlight increasing intra-seasonal variability.

2.2.3 WEATHER WHIPLASH

Related to the concept of weather weirding is weather whiplash, which is a reference to weather changing abruptly, not necessarily from one day to the next and back, but in terms of regime changes. In late December 2022, the eastern third of the U.S. had below normal temperatures with a bomb cyclone and over 50 inches of snow falling in Buffalo. By early January, the same region was experiencing temperatures of 20-30 Fahrenheit above average (NASA, 2023). Weather whiplash is expected to increase with climate change because reduced pole-equator temperature differences will slow the jet stream, allowing the weather systems (e.g., lows and highs) that it transports to deform (amplify) it more so that, when the other half of the jet stream wave moves through a region, there will be a more dramatic transition from one weather type to an opposite one: from cold and wet to hot and dry. The increased variance (variability) that accompanies the whiplash will impact freeze-thaw cycles among others.

Panelists emphasized that not all hazards respond to climate change in the same way. Some hazards may shift seasonally, while others may primarily increase in intensity, and some exhibiting a little of both. One panelist cautioned against broad generalizations, noting that each hazard must be analyzed individually.

2.2.4 THE ROLE OF HUMAN INFLUENCE

Climate variability has always existed. Seasonal cycles have always existed. While orbital changes like the eccentricity of the earth’s orbit, and a wobbly axis of rotation (precession of the equinoxes) influence seasonality, the recent seasonal changes discussed by the panelists have occurred on far shorter time scales – decades – not deca-millenia. The observed changes in climate and seasonality are backed by a theoretical understanding that increasingly suggests human activity—particularly greenhouse gas emissions—is altering the climate system in ways that affect seasonal patterns.

2.3 FUTURE EXPECTATIONS

Changes in climate and seasonality are expected to continue through this century. Even if Carbon Dioxide (CO_2) emissions are shut-off today, a certain amount of climate change is already built into the atmosphere and the oceans – a reservoir of future changes that will continue to unfold in the coming decades. Unfortunately, the news is not even that good, as global emissions continue unabated – following a business-as-usual trajectory that was noted as dangerous even in the last century. As a result, there will be continued if not accelerated climate change, with more changes in seasonality and more weather weirding. The magnitude of the changes will vary by region and likely by decade depending on the appearance of other climate-influencing factors (e.g., volcanic eruptions).

2.3.1 REGIONAL CHANGES

Because North America itself spans a huge latitudinal range and climate change is affecting polar regions three times more than mid-latitude regions, the changes anticipated in Canada will likely be much more severe than those in the U.S. except for Alaska.

In the northeast/mid-Atlantic region (of the U.S.), there will be a longer warm season. Warm can be defined in a number of ways but by all metrics – there will be: more days over 90 Fahrenheit, more continuous days between the last winter freeze and first fall freeze, etc. Winters, which are characterized by regular snowfall with many days to weeks of continuous snow cover, will evolve to more of a mixed bag – more rain and fewer snow events, more mixed-precipitation (ice) events, and perhaps more dry periods in-between.

In the southeast/Gulf Coast region, there will be an expanded hurricane season window on both ends, with increased rainfall intensity outside traditional peak months. And there will likely be more severe weather starting earlier in the calendar year. Also, as the dry, subtropical belt is expanding both northward towards mid-latitudes and southward towards the tropics, parts of the southern tier of U.S. states could become drier overall.

In the Midwest, severe convective season will also start earlier in the calendar year, with increased spring flooding risk.

In the western U.S., there will be less snow with earlier spring melt leading to more mid-year drought. There will be an increase in fire risk, both from the intensified drought as well as extending across more months. Winter wildfires (as was the case with the January 2025 LA wildfires) will become more common.

In Canada, changes in seasonality will mimic those in the U.S., especially the northern U.S, based on longitude. However, because of arctic amplification, which is causing northern latitudes to change more than mid-latitude regions, northern extents of Canada will experience dramatic changes in seasonality. Western Canada will see less snow, earlier snowmelt, and increased risk of wildfire – just like the western U.S.

Central Canada will experience dramatic temperature shifts with shifts in freeze-thaw cycles and many more hot days. Severe convective storm activity will also increase and begin earlier in the summer. Tornadoes could become more of a threat.

The Atlantic Provinces of Canada will also eventually see less snow with more mixed precipitation systems, even in winter. During summer, there will be an increased risk from tropical cyclones/hurricanes.

Compound Events

Compound events can occur in several different ways (Zscheischler et al., 2020). One way is that two or more meteorological events occur simultaneously. A good example is a hurricane that has damaging winds, but which can also have heavy rainfall and even tornadoes. Another type is two events that occur sequentially such that the net effect is greater than what would have occurred if the events were separated more in time. There are others but a complete discussion is outside the scope of this report. The panelists did discuss how compound events would change in the future and the possible implications from them. One expected effect is that seasonal shifts will increase the overlap between hazard windows. Snow season will morph into severe convective storm season. Severe convective storm season will morph into hurricane season. Hurricane season will morph into wildfire season, and wildfire season will morph into convective storm season.

The panelists also talked about a different type of compound event that involved weather-related events causing property damage and subsequent health impacts. Examples were given like wildfire, the smoke from which could pose health hazards many hundreds and even thousands of kilometers away from the actual fire. Such was the case with the Canadian wildfires during the summer of 2024, with fires burning in northern Alberta (e.g., western Canada) and Quebec (eastern Canada), causing poor air quality for much of the summer and respiratory issues for people as far away as Boston, New York, and Philadelphia (Chen et al. 2025, Jain et al. 2024).

Another type of property-people compound event is when power goes out from hurricane activity and subsequent heat builds back into a region, preventing air-conditioners from providing relief. There are many other examples.

These types of property-people compound events are expected to increase as climate change continues as hazard seasons morph from one into another.

Section 3 Bio-Socio-Economic Aspects

3.1 COMMUNITY PLANNING, PREPAREDNESS, AND INFRASTRUCTURE

Seasonal shifts can create new challenges for infrastructure systems designed around historical climate patterns. There is existing evidence that changes are impacting existing infrastructure and stressing emergency preparedness procedures that have been in place for decades and that is a foreshadowing of what is to come. For example:

- freeze-thaw cycles can damage roads
- heavier rainfall can overwhelm stormwater systems
- drought-to-flood cycles stress water infrastructure

One panelist noted that communities in New England are already experiencing infrastructure degradation due to repeated cycles of salt exposure and extreme weather conditions.

3.1.1 INFRASTRUCTURE

Rising sea levels that increase salinity and acidity in the water table are affecting foundations. This may have been a factor in the collapse of the Champlain Towers in Miami-Dade County FL back in 2021. While rising sea levels are more related to climate change rather than changes in seasonality, the effect exacerbates flood events both along the coast and inland. And it is not going away.

Along coastal urban centers in the northeast U.S. and Canada, the combination of rising seas and more erratic freeze-thaw cycles is taking its toll on roadways: Snow melts from warm conditions and salt and water pours into small cracks in roads and the next hard freeze causes the ice to expand and widen the crack. Car and truck traffic and the next thaw-freeze make it that much worse. The salt and other winter road treatments are finding their way into the aquifers and water supply (Zao et al., 2025).

Another impact related to greater extremes in temperature and weather weirdness is the deformation of bridges, the warping of railroad tracks, and the buckling of roadways. When such infrastructure was designed and put in place decades ago, it was done based on engineering designs consistent with the climate (extremes) at the time. But the extremes are changing – growing. Smooth asphalt can only expand so much from heat before it buckles and breaks. A similar phenomenon can happen with metal bridges. If they don't break, they may at least become inoperable. Drawbridges designed to open or close can stick either way causing cars on top or boats below to grind to a halt. Railroad tracks can also expand causing train derailments, which has implications for supply-chain business interruption and public safety.

Electric grids can go down because of increased usage during hot spells. At the same time that more electricity is needed, it moves through transmission lines less effectively because resistance increases with temperature. Additionally, wires can elongate and sag, making them more susceptible to breaking against trees or other obstacles because of high winds. If not monitored, this can be a recipe for wildfire – causing even more stresses on first responders.

3.1.2 DISASTER PREPAREDNESS

Disaster preparedness – first responders – can be impacted because infrastructure has failed and impedes their ability to get to victims or to get them to hospitals for treatment. When Hurricane Helene devastated Asheville, NC – destroying the very pipes that carry water to homes and offices – trucks were not even able to bring in water because roadways were so badly damaged.

Another impact of changing seasonality is that communities hire seasonal help, e.g., firefighters, whose contracts end on a certain date that is determined by how long the typical fire season is. Longer than normal seasons mean that communities can be unexpectedly shorthanded in critical ways.

As the hazard windows continue to expand or shift, emergency management agencies may need to dynamically adjust readiness planning.

The uptick in extreme weather and changing seasonality is forcing people to think how they can build new and retro-fit existing communities with more resilience - not just to be able to recover quickly after the fact – but to also prevent damage in the first place.

One panelist noted FEMA's community rating system as an example of a methodology developed to reward communities for taking preventative action. It is an insurance-tied incentive where the greatest efforts will yield reduced insurance rates from 5% to 45% to policyholders (FEMA, 2023).

The panelist noted its effectiveness as a government-led program but wondered if such programs could be developed within the private sector.

3.2 HUMAN HEALTH

The expected general impacts of climate change on human health (morbidity and mortality) have been known for some time. With high confidence, it is expected that cold-related deaths will decrease and heat-related ones will increase. A recent report by Bell (2021) noted more emergency room visits as temperatures rise. A more recent report by Grover-Kopec et al. (2026) found that poor and middle-income countries would suffer nine times more heat-related deaths than rich countries from climate change. Across Canada, short-term cold-related fatalities would decrease more than the increase of heat-related fatalities, but net fatalities would increase across much of the U.S. with the peak affected region being the Central Great Plains.

Cold-related deaths continue to outnumber heat-related deaths by a large margin, about nine to one (Madaniyazi et al. 2024). Cold-related includes not only direct exposure but also respiratory illnesses and cardiovascular-related fatalities (e.g., from snow shoveling). But that is changing – as winters become shorter and less severe in many places – even in North America, and as summers become longer and more intense. The shift is particularly affecting the elderly. There are more emergency room visits for heat-related illnesses – particularly for the elderly in mid- and northern-latitude urban areas because a) the climate changes are greater at high latitudes; urban centers at such latitudes are less-prepared for such extremes; and 3) the extremes can last longer because weather systems are expected to move more slowly (Bell, 2021). Heat-related morbidity and mortality is further exacerbated by the facts that 1) air-conditioning loads stress the power grid, transmission wires sag and can break or be turned off because of extreme heat; and 3) electrical resistance increases with air temperature making transmission of electricity less efficient during heat waves.

Because temperature-related deaths far outnumber those from other weather types, as shown in Figure 2, the net results will be fewer weather-related deaths overall. But because extreme weather is expected to increase – e.g., more floods in some locations – deaths are expected to increase regionally at least in absolute numbers.

Somewhat directly related to the weather – longer seasons with conditions conducive for the ignition, spread and longevity of wildfires – in tandem with more persistent airflow patterns – will likely lead to more respiratory illnesses – even thousands of miles away from the actual fire(s) as was witnessed with the Canadian wildfires in the early 2020s. Air stagnation – even without wildfire smoke, ozone and other pollutants trapped in the boundary layer – will likely also increase the number of respiratory illness cases (Sousounis et al. 2002). In the Pacific Northwest, increases in childhood asthma, cardiovascular disease, kidney disease, premature births, and then, of course, COPD complications during the fall season or, as one participant referred to it, the *smoke* season, are already being seen in the data.

There are other indirect effects as well – from animal migrations, changes in growing seasons, and how weather systems develop within and across seasons – will have more impacts. Longer spring (bloom) seasons will likely increase pollen-induced allergy cases (EPA, 2017).

Here is a breakdown of the health effects driven by changing seasons:

Lengthened Pollen and Wildfire Seasons: Warmer temperatures and, for example, rising carbon dioxide levels (EPA, 2017) accelerate plant growth and expand pollen seasons, increasing allergic reactions and asthma attacks. Simultaneously, longer dry seasons create drought conditions and fuel more intense wildfires, creating hazardous air quality and cardiovascular issues.

Increased Vector-Borne Diseases: Shorter, milder winters mean pests like mosquitoes and ticks that normally would die from the freeze now survive in higher numbers and expand into new, northern territories and higher altitudes. This significantly boosts the transmission of diseases such as the West Nile virus, Lyme disease, and potentially Zika.

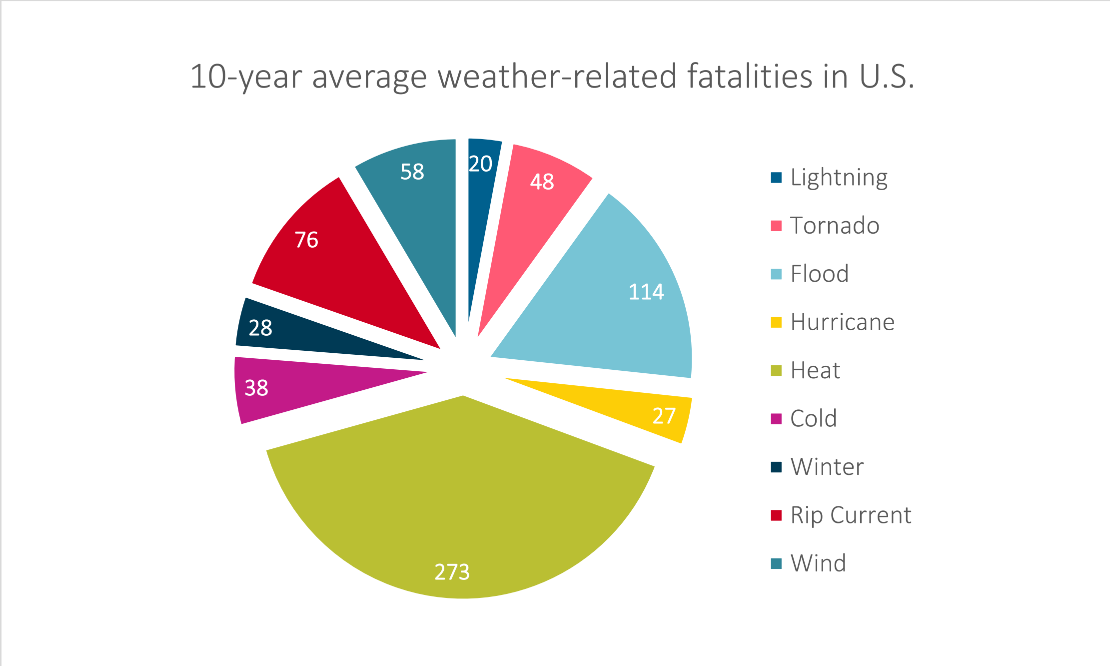
Water and Food-Borne Infections: Changes in precipitation and warmer water temperatures contribute to the rapid proliferation of pathogens, increasing cases of diseases like cholera or Giardia and increasing food insecurity.

Mental Health Strains: Increased frequency of environmental disasters, such as floods and fires, drives significant mental distress, including anxiety and depression. In many locations, outdoor winter weather enthusiasts may struggle to find snow conditions to satisfy their recreational interests. Winters will be too warm to ski or ice-fish but too cold to golf – leading to more time trapped indoors and can lead to increased incidences of Seasonal Affective Disorder or SAD (Sousounis, 2000).

Long-term Effects: Increased variability in temperature from climate change (Liu et al., 2024), rather than just mean temperature changes, is linked to higher long-term mortality rates (Weidmann et al., 2025).

These impacts often disproportionately affect vulnerable populations, including the elderly, low-income communities, and those with pre-existing conditions.

Figure 2
RELATIVE CONTRIBUTIONS TO WEATHER RELATED FATALITIES IN THE U.S. BY WEATHER TYPE FOR THE PERIOD 2015-2024



Source: NWS Hazard Statistics (2025)

3.3 ECONOMIC IMPACTS

Changes in seasonality impact the economy by affecting labor productivity, consumer spending, and industry-specific operations like tourism and agriculture. While these cycles are typically managed through "seasonal adjustment" in economic data, shifts in typical weather patterns or milder winters can cause both positive and negative economic ripples. Effects can be positive or negative depending on the season and region.

Some economic impacts that panelists discussed include:

Agriculture: A shorter winter can allow farmers to plant earlier, potentially adding a second crop, increasing yields and revenue. The drawback is that late season cold-snaps (from weather weirdness) can damage the growth and precipitation patterns may change. And, while milder winters may seem beneficial, a lack of deep cold can reduce the "chill hours" required by many fruit and nut trees to yield fruit and can also lead to increased pest populations. In the summer, hot conditions can lead to reduced hours in the fields. Extreme heat worsened by climate change has surpassed pesticide exposure to become the current primary concern facing agricultural workers. Additionally, extreme heat can cause food/produce to spoil more quickly – i.e., before it is sold to consumers. More on this topic is included below.

Construction: Warmer winters boost construction and employment; higher winter temperatures reduce the need for snow removal, allowing construction projects to continue and lowering heating costs for households and businesses. This reduces fossil fuels burned in the winter, while air conditioner use in hotter summers does the opposite. Construction slows when wet bulb temperatures exceed healthy limits for working during the hottest parts of the day.

Infrastructure and Property Repair: Warmer winters and intense rain events can trigger flooding and damage to infrastructure like roads, bridges, and power lines. Impacts to infrastructure from thermal expansion are also costly to repair. Other extreme weather events cause damage to private property – that may or may not be fully insured.

Labor / Employment: Hotter Summers Reduce Labor Productivity: Extreme heat in summer can lead to reduced labor hours in agriculture and construction (as noted above), hurting productivity. Extreme heat worsened by climate change has surpassed pesticide exposure to become the current primary concern facing agricultural workers and, at the same time, has made the impact of pesticides worse (Union of Concerned Scientists, 2019).

Retail / Tourism: Milder seasons can increase tourism, as milder temperatures in cold regions enhance tourism in winter sports areas. Similarly, increased summer temperatures can boost sales of products like sunscreen, while reducing heating costs. Higher winter temperatures increase private sector employment growth (Nguyen 2024). Less snowfall directly harms the ski industry and related businesses, which are dependent on snow for revenue, particularly during high-demand periods like Christmas. Reduced predictability of extreme weather can reduce big/planned vacations to faraway locations, and/or increase purchase of trip insurance, and / or increase tendency to take shorter, closer, more flexible vacations – e.g., camping, where reservation costs are less. For retail, inventories of seasonal items may be difficult to predict, causing shortages or surpluses on some goods as well as on seasonal hires (workers).

Supply Chain: Changes in seasonality drive significant supply chain fluctuations, requiring flexible inventory management, altered production schedules, and adapted transportation strategies to prevent bottlenecks or stockouts. Peak seasons (e.g., holidays) cause demand surges, while off-peak times (e.g., Q1) slow down, leading to increased logistics costs and labor needs.

Key impacts include:

- Inventory Management Challenges**:** Companies face the risk of overstocking during low-demand periods or suffering from stockouts when demand spikes unexpectedly.
- Transportation & Logistics**:** Increased shipping volumes during peak seasons often lead to carrier shortages, freight congestion, and rising transportation costs. Reduced winter weather and drought, especially in mountain areas, can lead to improved supply chain environments as roads remain open.
- Production Scheduling**:** Manufacturers must ramp up or slow down production, often needing to hire temporary labor to handle seasonal workload increases.
- Capacity Constraints**:** Warehouses and distribution centers must plan for increased storage capacity to handle inventory surges, such as holiday goods or increased agricultural produce.
- Weather Risks**:** Weather changes during different seasons can affect transportation, such as, for example, trucks facing engine issues in spring heat or road hazards in winter.

Proactive planning, such as using accurate forecasting and establishing flexible supplier partnerships, is essential to mitigate these disruptions.

Estimating a dollar amount attributable to climate-changed induced changes in seasonality is challenging. Impacts from events that are typical of the season but with unprecedented intensity (e.g., the 42” of snow reported at T.F. Green Airport in Providence, RI from the February 2026 Blizzard in the northeastern U.S.) may just be chalked up to an intense event, although a fraction of the cost may be attributable using techniques described by Otto (2023). Other impacts, like a warm winter that typically yields lower snowfall totals and reduces ski-tourism activity, are also challenging to tease out but can be based on how the probability of such long-lasting events is changing. Outright weather weirdness may be easiest to quantify – being defined as weather or weather-related events completely outside what characterizes a season. One example would be a Category 1 or 2 (or higher) hurricane hitting the U.S. in January. While this has yet to happen, there have been (Atlantic) hurricanes in January, the most recent one being

Hurricane Alex in 2016. Another example of weirdness would be major wildfires, which did happen in LA in January 2025.

3.4 IMPACTS ON RETIREES

Seasonality influences many aspects of retirement planning, including:

- migration patterns (snowbirds who spend winters in Florida)
- outdoor activities
- health risks
- finances

While these aspects are not exclusive to retirees, they can have more of an impact given fixed income considerations, reduced mobility and more compromised health issues. Some of these have already been noted in other sections.

A panelist noted that retirees may adjust the timing of seasonal relocation as climate conditions change, heading for Florida later in the fall but returning earlier the next year to avoid oppressive heat and humidity.

Wildfire smoke may discourage seasonal travel, and extreme heat may affect outdoor recreation. In the winter, decreasing amounts of snowfall in favor of rainfall can take its toll on ski enthusiasts, increasing loneliness and limiting social interaction.

Depending on location, season, and fitness level of the retiree, opportunities for outdoor activities may increase or decrease. Retirees are typically 65+ and, thus, whether health risks increase may be a mixed bag as well. Aging bodies struggle to regulate temperature, making seniors more vulnerable to heatstroke in longer summers and hypothermia in winter. Extreme weather events can also interrupt medical care and access to electronic health equipment. Increasing frequency of extreme heat will make it harder to stay active, which is particularly important for seniors, leading to worsened chronic illnesses and weight gain. Paradoxically, shorter, milder winters in some areas may lead to more, not fewer, injuries, while in other areas, erratic, extreme conditions increase the risk of falls due to icy, unpredictable surfaces. In short, it is a mixed bag.

The need to evacuate ahead of or during weather-related emergencies is particularly impactful to retirees who are for the most part less mobile (Matsuo et al. 2025). Katrina 2005 and the Northwest Heat Wave in 2023 are good examples of the difficulties that seniors (retirees) face during weather-related emergencies. The elderly may not want to evacuate in the first place for a variety of reasons. Power outages can adversely impact necessary actions like getting in-home oxygen supply, using power-assist staircases, and opening power garage doors. The stress of an emergency situation can also impact retirees' ability to think clearly and make good decisions. Finally, the physical limitations of older muscles to move quickly mean that it just takes longer to evacuate.

Regarding finances, costs to heat or cool a home will always increase. In addition, climate-related damage from extreme events can threaten homes. Rising insurance premiums are prompting some retirees to move away from popular, but increasingly risky, locations.

3.5 IMPLICATIONS FOR PLANT GROWTH AND FOOD SUPPLY

An important aspect of human health is food and the crops used to make it. The impact on plants (and animals) in terms of their ability to grow and thrive is being challenged in many areas of the world including North America.

As an anecdote, one panelist highlighted a striking example: historical records of cherry blossom bloom dates in Kyoto, Japan. These records remained stable for centuries but have shifted significantly earlier in recent decades.

Closer to home, the cherry blossoms in Washington DC now bloom earlier by nearly a full week since early last century and tree roots are being damaged by higher salinity in the water table because of rising sea levels.

Shorter, warmer winters do cause budding, flowering, and blooming to occur earlier. While this may be perceived as a good thing with respect to crops, it can certainly backfire – from weather weirdness. While it is not atypical for killing frosts to occur after an initial early spring warm spell, such events are happening more frequently. It is not so much that there are more cold snaps early in the spring season so much as it is there are more warm pops late in the warm season. The early warm is causing the growing season to begin as much as 50 days earlier (e.g., in Europe) than it did 50 years ago.

Other regional changes in seasonality are causing earlier snow melt, which can lead to mid-summer drought, which can also compromise plant (crop) growth. Earlier in the year, the potential for heavy rain on top of snow-melt saturated soil can also kill crops.

In short, there are a multitude of ways that changes in seasonality have been affecting crops. In 2024, an AFBF analysis (Indiana Farm Bureau, 2025) showed that extreme weather led to over $20 billion in U.S. crop loss, which was over 10% of the total economic impact from disastrous weather.

3.5.1 PHENOLOGY AND ECOLOGICAL TIMING

Changes in seasonal timing can disrupt ecological relationships through a process known as phenological mismatch. For example:

- Plants may bloom earlier due to warmer temperatures.
- Migratory birds may continue to arrive at traditional times based on cues tied to the day’s length.

If these processes become misaligned, ecological systems may experience disruptions.

One panelist explained that when plants respond to temperature but migratory animals respond to solar cycles, timing mismatches can occur that affect food availability and ecosystem stability.

There are numerous examples from both a plant and animal perspective but the panelists had more to discuss on other topics! A less obvious impact that changes in seasonality are having is on infrastructure.

Section 4 Impacts to the Insurance Industry

The changes in seasonality, primarily driven by climate change, are fundamentally upending the insurance industry's traditional business models. Historically, insurers have relied on predictable seasonal cycles—such as defined hurricane or wildfire seasons—to manage staffing, pricing, and capital reserves. The shifting "new normal" of year-round volatility and intensified weather events is creating several critical implications for both property and casualty insurers, as well as life and health insurers.

4.1 AFFORDABILITY, AVAILABILITY, AND ADEQUACY OF INSURANCE

The general topics of affordability, availability, and adequacy for property insurance were discussed by a previous SOA expert panel (2024). But some aspects related to seasonality changes were not and so are provided here. Lengthening seasons (e.g., wildfire, hurricane, severe convective storm) with more, stronger events and more risk are causing insurers to align by raising rates to maintain their sustainability but which, unfortunately, is making insurance less affordable. The longer seasons and growing risk are also causing some insurers to pull out. Other strategies insurers are using to still provide some coverage include providing less coverage for the same risk or even greater premiums. Reduced coverage is coming in the form of more exclusions (e.g., an aged roof may not be covered against a hailstorm), higher deductibles, and non-renewals for properties in vulnerable areas.

One panelist mentioned that, because of climate change and changes in seasonality, some states are now allowing insurers to use prospective assumptions (models) instead of just historical records to estimate the risk and price it accordingly. This better aligns expected costs with premiums and makes insurance more sustainable, leaving a greater number of insurers to profitably remain in the market.

Despite its ubiquitous nature, floods pose some unique challenges owing to the fact that flood insurance may not be required unless a dwelling is in a special flood zone. One panelist noted that unless everyone pays into the system (e.g., like in states which mandate health insurance), it’s not going to work as only higher risk properties will pay for protection and prices spiral as those with lower risk in the remaining cohort continue to non-renew. Other restrictions within FEMA (like only covering up to $250,000 in damage) make it an inadequate solution that is becoming more so because climate change is increasing flood risk absent mitigation efforts.

The absence of big-name property insurers in some markets, the increasing costs, and reduced coverage that companies that remain are providing are causing some homeowners to either forego insurance altogether or obtain policies through so-called insurers of last resort, which is also not cheap but provides coverage where it otherwise does not exist.

As private options disappear, more homeowners may need to utilize state-mandated programs like the California FAIR Plan or Florida's Citizens Property Insurance.

Panelists noted insurer incentives in the form of premium discounts would be good to have, as well as the importance of building codes.

In addition to general climate change-related insurance stressors, several factors that affect insurance premiums related to changing seasonality include:

Secondary properties (e.g., vacation homes): when the risk of bad weather is greater, vacation homes may be occupied less. Most standard homeowners' policies void or limit coverage if a property is vacant for more than 30–60 consecutive days, because of increased risk for theft and delayed damage detection. Properties left vacant for long periods, such as summer homes or ski cabins, often see premiums 15%–25% higher than primary residences.

Business Interruption: Seasonal businesses rely on "peak" windows for the majority of their revenue. A disaster during these months resulting in prolonged down time can be financially fatal without robust business interruption insurance.

Peak Season Endorsements: Businesses with fluctuating inventory (e.g., retail during holidays or farms during harvest) often need these add-ons to increase coverage limits by up to 50% during high-value periods.

Liability Exposure: Changes in weather can increase physical risks, such as customer slips on icy walkways or injuries from seasonal activities like skiing.

Claims processing: Unpredictable "seasonal" spikes in claims can overwhelm staff, leading to slower response times, increased errors, and employee burnout. To maintain service standards, insurers are increasingly adopting flexible/elastic staffing models and AI-powered tools for rapid claims processing and flood/fire detection.

4.2 HEALTH AND LIFE INSURANCE SHIFTS

Changing seasonality is also shifting and changing the seasons for certain types of medical coverage. The panelists noted how flu and tick seasons are changing.

- **Deductible Reset**: Health insurance often sees a "January dip" in non-urgent visits as patients wait to meet new annual deductibles, impacting provider revenue cycles.
- **Increased Morbidity**: Shifts in seasonal weather can worsen pre-existing conditions or lead to spikes in seasonal illnesses (like the flu) and sports-related injuries, increasing the volume of medical claims.
- **Flexible Policies**: Some insurers offer "pay-as-you-go" or adjustable policies for seasonal businesses, allowing them to scale coverage up or down based on operational status.

4.3 LIFE AND HEALTH INSURANCE IMPLICATIONS

Health actuaries often rely on historical claims patterns to estimate seasonal factors. However, climate change is altering the timing and intensity of seasonal health risks. One panelist noted that seasonal healthcare patterns used to be relatively straightforward—for example, flu season typically occurred during winter months.

Changing seasonality is causing health and life insurance to be impacted in a number of ways. Today, seasonal health drivers may overlap and extend across longer periods. Shifts in seasonal weather can worsen pre-existing conditions or lead to spikes in seasonal illnesses (like the flu) and sports-related injuries, increasing the volume of medical claims. In some cases, typically as cold climates warm, the impact reduces medical claims.

Warmer, longer summers and poorer air quality from wildfires now occur outside traditional seasons and are driving up claims for respiratory, cardiovascular, and cerebrovascular diseases. Claims are higher among the elderly, young children, and those with pre-existing conditions, which challenge insurers to manage surging health claims.

Increased exposure to climate-related events—including extreme heat, natural disasters, and chronic stressors like drought and food insecurity—are driving higher incidences of Post-Traumatic Stress Disorder (PTSD), anxiety, and depression (Walinski et al., 2023) leading to increased psychiatric emergencies, treatment costs, and mental health claims.

Warmer (hotter) summers are affecting mortality rates and, hence, the pricing of life insurance. While winters in some northern areas might marginally reduce cold-related deaths, extreme summer heat is causing significant, disproportionate spikes in premature mortality.

Insurers are updating mortality tables to account for climate-driven risks, increasing premiums to reflect higher probabilities of death linked to severe weather events, and longer-term changes in the environment such as drought and heat waves.

Insurers who hold massive investment portfolios are facing risks from investments in assets that are also vulnerable to changing climate patterns, including seasonality. Portfolio managers must consider changes to future cash flows due to climate change and the increased uncertainty of returns. One option to reduce uncertainty would be to consider a shift towards net-zero portfolios. Recent investments in data centers may have implications for climate feedback loops that increase riskiness to lenders.

Section 5 Challenges and Opportunities for Actuaries

Observed and future changes in seasonality—driven by climate change—are fundamentally altering the actuarial profession by making traditional risk assessment methods less reliable. The number one concern expressed by insurers is whether the catastrophe models they have been using in the past reflect changes in climate, which include changes in seasonality (SOA, 2024). Another concern is how to deal with greater uncertainty, especially at higher return periods. As climate evolves, pricing and projection models for both assets and liabilities need to change to compensate over extended time horizons. Emerging or expanding risks are also worrisome. The challenges have important implications concerning how actuaries will perform their jobs. These topics were addressed by the panel and are discussed below.

5.1 UPDATING MODELS

The tools – the catastrophe models that actuaries use to help quantify risk – are built with long periods of historical data under the assumption of stationarity, assuming the prediction of future climate does not change. But it has and because it has, the models reflect an outdated climate and the risks are not accurately represented in the assets and liabilities. Frequencies and intensities have been changing. Compound events occur more frequently, which means that the cross-correlation of perils needs to be updated if not outright incorporated. Assumptions for mortality and morbidity interact with climate and change over the lifetime of an insurance product. Time horizons must be consistent between assets and liabilities when pricing or cash flow mismatches become likely. Developing forward-looking models by incorporating climate-adjusted historical observations or through some other type of detrending is important for creating forward-looking risk models.

5.2 REDUCING UNCERTAINTY

Greater uncertainty exists even now because models, techniques, adjustment factors and multipliers are all calibrated on a climate that is no longer constant. The uncertainty regarding climate change impacts on health are even greater than those for property and casualty. Fatalities from excess heat, as well as other extreme weather events, are difficult to assess even now, as many times the cause of death will be listed as something like “cardiac arrest.” Panelists suggested that one way to address the growing uncertainty would be to introduce more parametric solutions such as catastrophe bonds or parametric insurance. Payouts would be triggered-based on hazard metrics rather than indemnity-based. As an example of a trigger for payout, one panelist suggested extreme heat for a period of 20 days. But hazard-based does not obviate the need for a better understanding about how more frequent or more intense extreme events will become for the insurance industry to price its products sustainably.

The challenge for actuaries will still be to develop estimation techniques (new factors) using existing data – be it from observations or other quantitative models.

Scenario analysis is another strategy actuaries may use to help reduce uncertainty, allowing conscious acceptance of risk and hedging strategies. Considering extreme, but plausible, disasters can give an upper bound on how much capital to reserve.

5.3 LOCALIZING RISK

One size rarely fits all – as panelists noted with respect to how changes in seasonality will influence risk in the future. When it comes to property and people, in space or time, risk is rarely if ever homogeneous. Adding granularity to risk assessments and, hence, to risk transfer solutions both in space as well as time will become increasingly important.

More Frequent Rate Adjustments: Volatile seasonal patterns and increasing exposures often lead to more frequent requests for premium rate increases or, in extreme cases, recommending that insurers withdraw from certain high-risk markets. Implementing more frequent rate adjustments is one way to keep pace with the uncertainty of climate change to align with sustainable pricing practices.

More Granularity: Climate change impacts can differ on small city-block scales because local factors that affect risk exist on such scales. Elevation, slope, soil, surrounding vegetation, building characteristics – all affect the risk and need to be carefully incorporated into any risk assessment tools for property risk. Location impacts mortality and morbidity exposure so may need to be added to life and health insurance risk factors like sex and smoker status.

5.4 EXPANDING HORIZONS

Climate change is causing disasters where they haven't occurred in the past. From hurricanes on the west coast, to increasing hail and tornado risk in the southeastern U.S., to wildfires in Hawaii, to heatwaves in British Columbia – climate change is causing an expansion of risk both across the continent, as well as across the calendar. These expansions are even more challenging for actuaries to address because these are relatively new locations where certain risk exposures before climate change were almost non-existent.

Property Actuaries must adjust for shifting "hazard zones" as events like convective storms and wildfires occur in new regions or during atypical seasons. Health Actuaries now must account for shifts in "disease vectors" (like mosquitoes) and the impact of extreme heat on chronic diseases in aging populations. Life and Pension Actuaries are beginning to evaluate how environmental instability and trends affect asset values and long-term mortality/longevity risk.

Table 3 summarizes some of the challenges and opportunities provided by changing seasonality.

Table 3
POTENTIAL ACTUARIAL RESPONSES TO NON-STATIONARY SEASONALITY

Actuarial Area	Traditional Approach	Challenge	Adaptation Strategy
Pricing	Historical seasonal factors	Shifting hazard timing	Dynamic climate adjustments
Reserving	Stable claim reporting cycles	Changing claim timing	Monitor development trends
Catastrophe Modeling	Historical hazard distribution	Expanded seasons	Use climate scenarios
Enterprise Risk Management	Seasonal capital allocation	Overlapping hazards	Stress testing

5.5 COLLABORATING FOR SOLUTIONS

Actuaries may now wish to collaborate with climate scientists, biologists, and engineers to name a few groups for the optimal understanding and integration of climate data and environmental, social, and governance (ESG) criteria into risk pricing. Fully understanding the nuances of specific datasets requires collaborating with subject matter experts to understand the financial impacts of seasonal and trend changes to assumptions.

Section 6 Conclusion

Seasonality has long served as a foundation for understanding climate, ecosystems, and economic activity. However, climate change is altering the timing and characteristics of seasonal patterns in ways that have important implications for risk management.

For actuaries and insurers, these changes challenge traditional assumptions about the stability of hazard seasons and the reliability of historical data. As seasonal boundaries shift and extreme events become more variable, actuarial models may need to incorporate forward-looking climate information, scenario analysis, and new data sources.

At the same time, shifting seasonality may influence a wide range of societal outcomes, including health risks, agricultural productivity, infrastructure resilience, and retirement behavior. Addressing these challenges will require collaboration across scientific, financial, and policy communities.

By integrating climate science with actuarial expertise, the insurance industry can play a critical role in helping society understand and manage the evolving risks associated with a changing climate.

Section 7 Panelists

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