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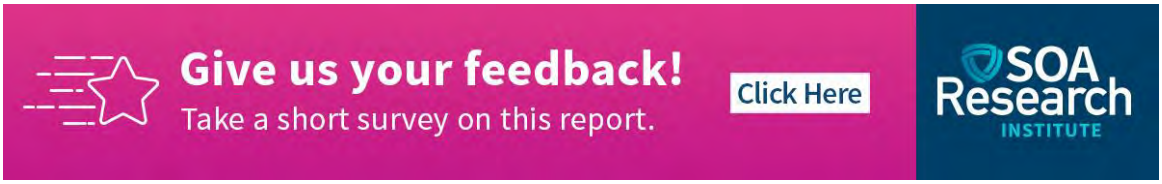

Focus on Terminology: Anthropocene – Easy for you to say!

By Max J. Rudolph, Didier Serre and Steve Bowen

With this Bonus edition of the Climate Committee Newsletter, we wrap up the year 2021. which appears to be the fourth for those actuaries who desire to become more active in climate awareness activities, there are times when language becomes an issue. Terms that have been used for decades in each specialty are used in ways that mean something different to the other group. Terms and definitions may mature over time. This column will rotate between inconsistent terms, evolving terms and terms that need a few extra words or examples to become commonplace in the actuarial space. It is a recurring feature of this newsletter, so please let us know (max.rudolph@rudolph-financial.com) if you have a term that you think actuaries, climatologists or people working in sustainability areas use in different ways. The format will be to introduce and define commonly used terminology used in multiple fields that need to work together. The hope is that having vocabulary awareness will improve communications between these professionals.

INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC) DEFINITION - ANTHROPOCENE[1]

The 'Anthropocene' is a proposed new geological epoch resulting from significant human-driven changes to the structure and functioning of the Earth System, including the climate system. Originally proposed in the Earth System science community in 2000, the proposed new epoch is undergoing a formalization process within the geological community based on the stratigraphic evidence that human activities have changed the Earth System to the extent of forming geological deposits with a signature that is distinct from those of the Holocene, and which will remain in the geological record. Both the stratigraphic and Earth System approaches to defining the Anthropocene consider the mid-20th Century to be the most appropriate starting date, although others have been proposed and continue to be discussed. The Anthropocene concept has been taken up by a diversity of disciplines and the public to denote the substantive influence humans have had on the state, dynamics and future of the Earth System.

IPCC DEFINITION – HOLOCENE

The Holocene is the current interglacial geological epoch, the second of two epochs within the Quaternary period, the preceding being the Pleistocene. The International Commission on Stratigraphy defines the start of the Holocene at 11,650 years before 1950.

IPCC DEFINITION - BIODIVERSITY

Biological diversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems (UN, 1992).

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[1] IPCC, 2021: Annex VII: Glossary [Matthews, J.B.R., V. Möller, R. van Diemen, J.S. Fuglestvedt, V. Masson-Delmotte, C. Méndez, S. Semenov, A. Reisinger (eds.)]. In Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press. In Press. https://www.ipcc.ch/report/sr15/glossary/

CLARIFICATION – ANTHROPOCENE

Previous epochs have been set to start with times rounded to the near 100,000 years, and while scientists agree that the Holocene is ending, they don't agree on the time. Early possibilities include the time of the megafauna extinctions and more recent choices tie in with the first industrial revolution. The period must include the transformation of ecosystems for human use and the rapid erosion of species richness[2].

Putting a value on biodiversity could bring economic methods and decision making into the discussion. This seems a natural area for actuaries to participate in the conversation. Much like fossil fuel extraction, biodiversity loss has no formal loss in the accounting system but creates a feedback loop that could spiral into a sixth mass extinction for Earth.

Two references may be of interest for additional reading:

- Biodiversity Risk landing page of the Institute and Faculty of Actuaries (IFoA) https://www.actuaries.org.uk/learn-and-develop/sustainability-and-lifelong-learning/biodiversity
- Dasgupta Review on biodiversity https://www.gov.uk/publications/final-report-the-economics-of-biodiversity-the-dasgupta-review

SUMMARY

As actuaries become more aware of tools like attribution event analysis and the value of biodiversity, these concepts can be incorporated into modeling techniques that form policy. The conversation needs participants who can speak the language of economists as well as climate and statistics.

By seeking out terms that need clarification, actuaries can help to improve the overall process as well as improve their own work product.

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Didier Serre is a Director and Consulting Actuary, Climate Risk and Resilience at Clearsum.

Steve Bowen is a Meteorologist and the Head of Catastrophe Insight at Aon.

[2] Seddon N, Mace GM, Naeem S, Tobias JA, Pigot AL, Cavanagh R, Mouillot D, Vause J, Walpole M. 2016 Biodiversity in the Anthropocene: prospects and policy. Proc. R. Soc. B 283: 20162094. https://royalsocietypublishing.org/doi/10.1098/rspb.2016.2094

Pandemic Modeling

By Max J. Rudolph, FSA CFA CERA MAAA

When COVID-19 became real to many actuaries, in March 2020, models were quickly built to answer questions about exposure and potential severity. How many in the profession thought to look first to the SOA website to see if a tool was available that had been previously built? The proactive few likely were aware of a great resource developed by Jim Toole, FSA CERA MAAA over ten years ago[3]. In 2007 he published a paper sharing a model for life insurers that showed industry data, but also walked the reader through the variables that drive the results and made the model open source. His model allows the user to vary the severity of a pandemic along with the age distribution of deaths. The author of this update added the recent mortality curve to the mix and discussed the likely impact for the life insurance industry in a paper released in 2021[4]. The key takeaways of that paper were:

1. Since the original paper was written, the U.S. population has grown by about 10% and is older demographically.
2. The excess mortality curve is heavily weighted to older ages.
3. The life insurance industry has changed, with a heavier profitability weighting to asset-based products and less to life insurance products.
4. A recent tax law change reduced the tax rate, dominating the other results financially.

Toole also developed a model for health insurance in a separate project in 2010, which is not as specific to an individual company but lays out the key points to consider[5].

Don't forget to check the SOA website for past research projects that might save time as you get up to speed. Let the editor know if you have a favorite research paper or article tied to the catastrophe and climate theme that has held up well over the years. Future actuaries will thank you.

[3] Toole, Jim. Potential Impact of Pandemic Influenza on the U.S. Life Insurance Industry. May 2007. https://www.soa.org/resources/researchreports/2007/research-impact-pan-influ-life-ins/

[4] Rudolph, Max J. Life Pandemic Model Updates to U.S. Life Insurance Industry Moderate Scenario. Society of Actuaries. 2021. https://www.soa.org/resources/research-reports/2021/life-pandemic-model/

[5] Toole, Jim. Potential Impact of Pandemic Influenza on the U.S. Health Insurance Industry Report. Society of Actuaries. 2010. https://www.soa.org/resources/research-reports/2010/research-pandemic

SOA Featured Research Project

In January, the SOA Research Institute published two of its latest works:

HEALTH AND HURRICANES, STUDYING DISPARATE HEALTH IMPACT OF EXTREME CLIMATE EVENTS, 2017-2020

Cody Webb, Melody Craff, Molly Barth, Larry Baeder, Dale Skinner, Thomas Pu

Conducted by Milliman Inc., this research studies the effects of hurricanes on human health with key focus on whether there is a relationship between hurricanes and the observed prevalence of healthcare utilization or certain health conditions among the affected population. Also, studying whether this relationship can be observed through a healthcare utilization dataset, and whether there is an interaction between this observation and metrics of socioeconomic vulnerability.

Health and Hurricanes, Studying Disparate Health Impact of Extreme Climate Events, 2017-2020 | SOA

MUNICIPALITIES AND CLIMATE CHANGE - SUCCESSFUL STRATEGIES DEPEND ON CIRCUMSTANCES

Max J. Rudolph, FSA, CFA, CERA, MAAA

This paper is a recent addition to our ongoing Environmental risk series: Environmental Risk Series | SOA

"Cities are at risk as climate change increases their risk from hazards like sea level rise, drought, heat waves, storms and wildfire. There is a need to improve the resilience of cities to reduce frequency or severity of losses. No two cities are alike, and local knowledge and buy-in are important considerations for developing successful adaptation and mitigation strategies."

There are several strategies that cities and regions can take to address the changing climate. Nature-based solutions include building coastal buffers and planting trees. Awareness of the physical risk impact can be built by working with insurers to manage private insurance plans or with government to create risk assessments. Early warning systems can be built, and proactive planning processes developed.

In the News

By Priya Rohatgi, ASA

Here are some recent events that are at the intersection of Climate change, the evolving environmental risks and policy initiatives and regulatory framework to mitigate its impact. As you click through the articles below, we invite you to consider how these events may impact actuarial applications, and to note any associations to economic and insured losses

1. Climate Model Forecasts: Clouds on the horizon
   https://www.wsj.com/climate-change-global-warming-computer-model

   "I think the climate models are the best tool we have to understand the future, even though they are far from perfect," said Dr. Gettelman. "I'm not worried that the new models might be wrong. What scares me is that they might be right."

   > Climate Scientists Encounter Limits of Computer Models, Bedeviling Policy
   >
   > While vital to calculating ways to survive a warming world, climate models are hitting a wall. They are running up against the complexity of the physics involved; the limits of scientific computing; uncertainties around the nuances of climate behavior; and the challenge of keeping pace with rising levels of carbon dioxide, methane and other greenhouse gases.
   >
   > Despite significant improvements, the new models are still too imprecise to be taken at face value, which means climate-change projections still require judgment calls.
   > www.wsj.com

2. 'Planned retreat' from expanding flood zones
   https://www.corporateknights.com/is-it-time-for-a-planned-retreat-from-building-near-flood-plains/
   The alternative is "planned retreat" – a rolling back of urbanized or settled zones away from rising seas or widening flood plains, as happened after Hurricane Hazel and the New Zealand earthquake, and perhaps now should be an option in places like the Fraser River delta.

   > Is it time for a 'planned retreat' from building near flood plains?
   >
   > Two days after an "atmospheric river" dumped an almost Biblical quantity of water on B.C.'s lower mainland last November, landscape architect Kees Lokman, director of the University of British Columbia's Coastal Adaptation Lab, mulled over the complicated and uncomfortable lessons that floods leave in their muddy aftermath.
   >
   > Many municipalities have not updated flood maps created in the 1970s in fear that revisions could expose them to liability for damages
   >
   > www.corporateknights.com

3. 2021 "an exceptional year" for climate-related litigation
https://www.insurancejournal.com/news/international/2022/02/02/651089.htm
Climate litigation will continue to pose a risk to businesses and countries that are not deemed to be acting well – or quickly – enough.

> Climate Change Litigation: Why Better Disclosure is Vital as Cases Rise
>
> With the effects of climate change becoming more palpable, a rise in climate litigation cases could have significant financial and reputational repercussions for corporates. Thomas Englerth, associate director at S&P Global Ratings, explores how the potential risks associated with this emerging issue can be identified and managed.
>
> www.insurancejournal.com

4. Forest-thinning: cut trees to save the forest
https://www.bloomberg.com/to-save-western-u-s-forests-cut-them-way-back-study-suggests
Cutting back trees by as much as 80% could help them withstand wildfire, drought and infestations

> To Save Western U.S. Forests, Cut Them Way Back, Study Suggests
>
> For the past century, U.S. foresters have largely aimed to maximize the number of trees they can grow in an area and guard them from flames. Yet decades of suppressing wildfires in ecosystems that have adapted to regular, low-severity burns have left many forests thickly overgrown – creating more fuel and intensifying blazes. As West Coast wildfires break records year after year, policymakers have recently paid more attention to the issue and are funding more forest-thinning treatments.
>
> www.bloomberg.com

5. Eco-anxiety therapy
https://www.nytimes.com/health/climate-anxiety-therapy.html
Ten years ago, psychologists proposed that a wide range of people would suffer anxiety and grief over climate. Skepticism about that idea is gone.

> Climate Change Enters the Therapy Room
>
> That skepticism is fading. Eco-anxiety, a concept introduced by young activists, has entered a mainstream vocabulary. And professional organizations are hurrying to catch up, exploring approaches to treating anxiety that is both existential and, many would argue, rational.
>
> A 10-country survey of 10,000 people aged 16 to 25 published last month in The Lancet found startling rates of pessimism. Forty-five percent of respondents said worry about climate negatively affected their daily life. Three-quarters said they believed "the future is frightening," and 56 percent said "humanity is doomed." www.nytimes.com

6. Social cost of GHG poised to go up?

https://www.axios.com/carbon-emissions-social-cost-damages

Many economists view the current social cost of carbon too low which was temporarily pegged in Feb 2021 at the pre-2017 level, $51 per metric ton and argue for a far higher social cost of carbon, tailored to meet the administration's goals.

> The social cost of carbon is about to get an update
>
> The social cost of carbon ('SCC'), a crucial metric that helps shape government regulations on everything from methane emissions regulations to fuel economy standards, is set to be updated by the end of February.
>
> The paper published recently by prominent economists, Joseph Stiglitz and Nicholas Stern recommends to use *target-consistent approach* which aims to produce a price pathway that efficiently moves policy and economic activity toward a given target, ensuring the value of the SCC is in line with internationally set targets.
>
> The SCC is expected to be adjusted upwards — which will have ripple effects throughout the federal government and economy at large, making high-polluting activities more expensive and regulations that crack down on emissions economically justifiable.
>
> www.axios.com

7. Climate adaptation with supporting policies and strategies Study

https://insidescience.org/climate-change-will-shift-farming-landscape-coffee-cashews-and-avocados

How climate change will shift the farming landscape for Coffee, Cashews and Avocados. Some countries will gain farmland while other countries will lose it.

> Expected global suitability of coffee, cashew and avocado due to climate change
>
> To find out where the best growing conditions for coffee, cashews and avocados are today, environmental systems scientist Roman Grüter and his colleagues combined information about what conditions these crops prefer with maps of current climate data and different soil or land types. Then, by incorporating climate models, they predicted where conditions would improve and where they would decline. The final maps were precise enough that Grüter, affiliated with the Zurich University of Applied Sciences and an author of the new study, could zoom in to less than a square kilometer in resolution.
>
> Earlier studies indicated that the global area suitable for producing coffee will decrease. The new study is the first to look at cashews and avocados on a global scale, and found that the areas suited to growing cashews may actually increase, while avocados are predicted to lose much of their best-suited land but may see an increase in areas of moderate suitability.
>
> www.insidescience.org

8. Crop insurance misaligns incentives

https://insideclimatenews.org/flood-drought-crop-insurance

Alarmed by the ballooning costs, environmentalists and other critics also say crop insurance discourages farmers from adapting to a rapidly warming planet.

> Increased Flooding and Droughts Linked to Climate Change Have Sent Crop Insurance Payouts Skyrocketing
>
> A new analysis based on government data finds that insurance payments to farmers have risen more than 400 percent for drought-related losses and nearly 300 percent for losses from rains and flooding, from 1995 to 2020. In that time, farmers received $143 billion in indemnity payments—settlements of claims—more than two-thirds of which were for drought and rain that destroyed crops or prevented farmers from planting them in the first place.
>
> "What we're seeing is that climate change is likely increasing costs to this program, and we also know that crop insurance discourages farmers from adapting to climate change," said Anne Schechinger, a director with the Environmental Working Group, an advocacy organization that conducted the new analysis and has long tracked government subsidies to farmers. "We think the program needs to be reformed to encourage farmers to become more resilient to extreme weather from climate change."
>
> www.insideclimatenews.com

9. Dirty assets disappearing from public view.. into private hands!

https://www.economist.com/who-buys-the-dirty-energy-assets-public-companies-no-longer-want

Fossil-fuel assets are moving from the floodlit world of listed markets to shadier surroundings .

> Who buys the dirty energy assets public companies no longer want?
>
> The Fossil -fuel assets of the public companies are now ending up in the hands of private-equity (PE) firms. In the past two years alone these bought $60bn-worth of oil, gas and coal assets, through 500 transactions—a third more than they invested in renewables (see chart). Some have been multibillion-dollar deals, with giants such as Blackstone, Carlyle and KKR carving out huge oilfields, coal-fired power plants or gas grids from energy groups, miners and utilities. Many other deals, sealed by smaller rivals, get little publicity. This sits uncomfortably with the credo of many pension funds, universities and other investors in private funds, 1,485 of which, representing $39trn in assets, have pledged to divest fossil fuels. But few seem ready to leave juicy returns on the table..
>
> www.economist.com

10. Warming begets warming: a surprising driver of rising methane emissions

https://www.nature.com/articles/d41586-022-00312-2

As global methane concentrations soar over 1,900 parts per billion, some researchers fear that global warming itself is behind the rapid rise.

> Scientists raise alarm over 'dangerously fast' growth in atmospheric methane
>
> Methane concentrations in the atmosphere raced past 1,900 parts per billion last year, nearly triple preindustrial levels, according to data released in January by the US National Oceanic and Atmospheric Administration (NOAA). Scientists says the grim milestone underscores the importance of a pledge made at last year's COP26 climate summit to curb emissions of methane, a greenhouse gas at least 28 times as potent as CO2.
>
> The growth of methane emissions slowed around the turn of the millennium but began a rapid and mysterious uptick around 2007. The spike has caused many researchers to worry that global warming is creating a feedback mechanism that will cause ever more methane to be released, making it even harder to rein in rising temperatures.
>
> www.nature.com

11. Reinsurance premiums – price reset

https://www.ft.com/content/e6faddfa-4cdf-46cc-9672-05ff3a7c9be1

European prices already on the rise after floods in Germany last year

> Climate fears are driving up demand for disaster insurance, says Munich Re
>
> Reinsurance giant Munich Re is expecting a sustained rise in Europe's relatively low levels of property catastrophe insurance — and in the cost of cover — following last summer's disastrous floods on the continent.
>
> www.ft.com

12. Decarbonizing our Economy

https://theactuarymagazine.org/decarbonizing-our-economy/

Insurers and reinsurers, as leading experts in risk management and the second-largest institutional investors, play an essential role in supporting the development of solutions for the transition to a resilient, low-carbon economy.

> Factors to extend the scope and accelerate deployment of new climate technologies
>
> As the world mobilizes to scale the development and implementation of new climate tech, it is important to recognize that new technologies and processes come with myriad untested risks, particularly when deployed at scale and in the form of sustainable infrastructure systems. Such untested risks span a wide range of operational and safety risks, environmental and disposal risks, construction risks, future liabilities and rising climate litigation, professional mistakes, supply chain and, of course, impacts of adverse weather and changing climatic conditions, which need to be managed while considering the entire life cycle.
>
> www.theactuarymagazine.com

13. Agricultural Insurance must adapt

https://theactuarymagazine.org/agricultural-insurance-must-adapt/

A key question for agricultural insurance policy is how programs can evolve to address climate change risk and preserve the financial viability of the agriculture industry. From an actuarial perspective, an added challenge will be to price the risk.

> How programs can evolve to address climate change risk and preserve the financial viability of the agriculture industry
>
> Although traditional actuarial approaches have been applied in agricultural insurance for decades, this may be coming to an end. The paradigm of historical losses as a fair indicator of future losses may no longer hold. As a result, programs that have worked well to date may need to adapt to a new future.
>
> www.theactuarymagazine.com

14. Climate change fight comes to urban parks – Central Park in New York leads the way
https://www.bloomberg.com/news/central-park-is-opening-a-lab-to-study-climate-change
New York's most famous park is leveraging its brand and its data to fight against the deterioration of urban forested areas.

> Central Park Is Opening a Lab to Study Climate Change
>
> The Central Park Climate Lab — a new research facility that will leverage decades of Conservancy data recorded about the health of its wildlife, vegetation and soil to study climate change-induced deterioration of urban parks and natural forested areas. The Central Park Conservancy, the nonprofit organization responsible for the park's maintenance and major restorations, is partnering with the Yale School of the Environment and New York City's Natural Areas Conservancy on the lab to help other urban parks implement mitigation and adaptation solutions. www.bloomberg.com

15. Rising groundwater – the unseen risk
https://www.technologyreview.com/climate-change-rising-groundwater-flooding/
Higher sea levels will push the water table up with them, causing flooding, contamination, and all manner of unseen chaos.

> How rising groundwater caused by climate change could devastate coastal communities
>
> Unlike rising seas, where the dangers are obvious, groundwater rise has remained under the radar. Groundwater rise is only briefly mentioned in the most recent edition of the National Climate Assessment, released in 2018; it's absent from many state and regional climate adaptation plans, and even from flood maps.
>
> www.technologyreview.com

16. Rethink and reevaluate policy decision
https://e360.yale.edu/features/its-not-just-climate-are-we-ignoring-other-causes-of-disasters
Focusing only on climate can end up absolving policymakers of their failures to climate-proof their citizens.

> It's Not Just Climate: Are We Ignoring Other Causes of Disasters?
>
> Climate change is increasingly seen as the cause of natural catastrophes, from floods to famines. But a growing number of scientists are cautioning that blaming disasters solely on climate overlooks the poor policy and planning decisions that make these events much worse.
>
> www.e360.yale.edu

Studies/Research Published Outside the SOA

By Priya Rohatgi, ASA

In this section we try to direct our readers to some of the work done by fellow actuarial societies and other professional associations/institutions in the US and around the world. The risks related to climate instability and loss of biodiversity are not only global in scale but are long term, uncertain and highly complex. Therefore, we feel the need to collaborate, share knowledge and tap into the research and developments that are happening around the world and across disciplines.

INEQUITABLE PATTERNS OF US FLOOD RISK IN THE ANTHROPOCENE

By Oliver E. J. Wing, William Lehman, Paul D. Bates, Christopher C. Sampson, Niall Quinn, Andrew M. Smith, Jeffrey C. Neal, Jeremy R. Porter & Carolyn Kousky

https://www.nature.com/articles/s41558-021-01265-6

Current flood risk mapping, relying on historical observations, fails to account for increasing threat under climate change. Incorporating recent developments in inundation modelling, here we show a 26.4% (24.1–29.1%) increase in US flood risk by 2050 due to climate change alone under RCP4.5. Our national depiction of comprehensive and high-resolution flood risk estimates in the United States indicates current average annual losses of US$32.1 billion (US$30.5–33.8 billion) in 2020's climate, which are borne disproportionately by poorer communities with a proportionally larger White population. The future increase in risk will disproportionately impact Black communities, while remaining concentrated on the Atlantic and Gulf coasts. Furthermore, projected population change (SSP2) could cause flood risk increases that outweigh the impact of climate change fourfold. These results make clear the need for adaptation to flood and emergent climate risks in the United States, with mitigation required to prevent the acceleration of these risks.

TRENDS IN SURFACE EQUIVALENT POTENTIAL TEMPERATURE: A MORE COMPREHENSIVE METRIC FOR GLOBAL WARMING AND WEATHER EXTREMES

By Fengfei Song, Guang J. Zhang, V. Ramanathan, and L. Ruby Leung

https://www.pnas.org/content/119/6/e2117832119/tab-figures-data

Trends in surface air temperature (SAT) are a common metric for global warming. Using observations and observationally driven models, we show that a more comprehensive metric for global warming and weather extremes is the trend in surface equivalent potential temperature (Thetae_sfc) since it also accounts for the increase in atmospheric humidity and latent energy. From 1980 to 2019, while SAT increased by 0.79°C, Thetae_sfc increased by 1.48°C globally and as much as 4°C in the tropics. The increase in water vapor is responsible for the factor of 2 difference between SAT and Thetae_sfc trends. Thetae_sfc increased more uniformly (than SAT) between the midlatitudes of the southern hemisphere and the northern hemisphere, revealing the global nature of the heating added by greenhouse gases (GHGs). Trends in heat extremes and extreme precipitation are correlated strongly with the global/tropical trends in Thetae_sfc. The tropical amplification of Thetae_sfc is as large as the arctic amplification of SAT, account-ing for the observed global positive trends in deep convection and a 20% increase in heat extremes. With unchecked GHG emissions, while SAT warming can reach 4.8°C by 2100, the global mean The- tae_sfc can increase by as much as 12°C, with corresponding increases of 12°C (median) to 24°C (5% of grid points) in land sur- face temperature extremes, a 14- to 30-fold increase in frequency of heat extremes, a 40% increase in the energy available for tropi-cal deep convection, and an up to 60% increase in extreme precipitation.

RISING SEAS AND SHIFTING SANDS: COMBINING NATURAL AND GREY INFRASTRUCTURE TO PROTECT CANADA'S EASTERN AND WESTERN COASTAL COMMUNITIES (DECEMBER 2021):

by Joanna Eyquem.

https://www.intactcentreclimateadaptation.ca/UoW_ICCA_2021_12_Coastal_Protection_Grey_NbS.pdf

This report outlines the range of practical measures that can be used to protect coastal communities on Canada's East and West coasts from flooding and erosion. Coastal protection measures include (1) Grey Infrastructure (hard, engineered coastal protection measures); and (2) Nature-Based Solutions (measures that depend on, or mimic, natural systems to manage flood and erosion risk).

The report also describes how Canada can scale-up the use of nature-based solutions, in tandem with grey infrastructure, to protect communities with 3 courses of actions:

- Develop national standards to support consistent evaluation of the benefits of nature-based solutions when comparing infrastructure options, including for coastal protection.
- Develop national monitoring standards for coastal protection measures, focused on nature-based solutions.
- Build capacity to finance and deliver nature-based solutions by engaging the private sector – with primary focus on the role of the Insurance industry as a facilitator helping with deployment and scaling-up of these solutions.

USING SCENARIO ANALYSIS TO ASSESS CLIMATE TRANSITION RISK - FINAL REPORT OF THE BOC-OSFI CLIMATE SCENARIO ANALYSIS PILOT

The Bank of Canada and the Office of the Superintendent of Financial Institutions (OSFI) completed their climate scenario analysis pilot in collaboration with six Canadian federally regulated financial institutions. The pilot has fully met its goals of (i) building the capability of authorities and participating financial institutions to do climate transition scenario analysis, (ii) supporting the Canadian financial sector in improving its assessment and disclosure of climate-related risks and (iii) contributing to the understanding of the potential exposure of the financial sector to climate transition risk. Furthermore, it has improved authorities' understanding of financial institutions' governance and risk management practices around climate-related risks and opportunities. To learn more please refer to the link below.

https://www.bankofcanada.ca/BoC-OSFI-Using-Scenario-Analysis-to-Assess-Climate-Transition-Risk.pdf

Questions for Actuaries – New!

"**Questions for Actuaries**", this is a new section of the Newsletter starting 2022. Here we will be conducting a series of interviews with actuaries in different stages of their career, who are at the frontlines addressing Climate risk and managing the shift towards a more sustainable and resilient future for their respective organizations. Like many of us, if you feel overwhelmed by the pace of information in this domain, please keep an eye out for subsequent editions of our Newsletter. We hope you find answers to some of your questions and benefit from the experience of fellow actuaries in this evolving and exciting area.

Also, if you have questions that you would like us to include or if you would like to participate and share your own journey, please reach out to us at research@soa.org

For our first interview, we didn't have to look too far. ***Timothy Cheng, ASA*** *is our new Climate, Environmental and Sustainability research committee (CESRC) member. Most recently working with GlobeScan, a sustainability insights and advisory consultancy. Having a keen interest in exploring actuarial work in wider fields, he has spoken in several sustainability webinars on predictive analytics and ESG trends in the insurance industry.*

Could you please introduce yourself and share your background and practice area?

I am Timothy Cheng and have been part of the Climate and Environmental Sustainability Research Committee in the SOA since 2021. Currently based in Hong Kong, I am an ASA practicing in the sustainability field. I work with corporates and NGOs to guide their decision-making and build strategies that contribute to a sustainable and equitable future.

My typical tasks at work revolve around sustainability strategy design, benchmarking, materiality assessment and disclosure. I am also specialized in predictive analytics, utilizing techniques like topic modelling and linear models (GLM) on climate and sustainability research data.

What prompted you transition into this new area of Climate risk and Sustainability and what was the path to your current role?

I have been actively seeking opportunities since my high school years to create societal impact, from joining youth volunteering associations to working in NGOs and social enterprises during internship, tackling social issues like recycling, disability inclusion, and youth development. Honestly, I have been struggling hard to find a way to merge my career aspirations as an actuary and my passion to serve the society. I thought it was impossible.

Without a clear path, I first started my career at Mercer in an actuarial role when I graduated. I felt "secured" to take actuarial exams, handle work related to employee insurance and pension, just like an ordinary actuary in the making. However, we all know that climate change got worse every year, and large inequalities still exist. It did not take long before I feel restless and tried new ways to pursue my passion. I started attending online courses on sustainability, joining local hackathons, and leading the company's volunteering initiatives. By accumulating my knowledge in the field slowly, I finally made the biggest jump in 2019 – switching my career entirely as a sustainability consultant at GlobeScan.

How relevant have been the classic actuarial skills, tools and techniques to your current role?

As you could imagine, classic actuarial techniques like insurance pricing and loss reserving are no longer applicable to my current role. However, I am very grateful to have completed Exam PA, which provided me with predictive analytics and programming skills. These are very valuable as data is everywhere, and I can use R to analyze and predict consumers and industry behaviors, leading to implications for sustainability strategy building. As an actuary, our robust data skills and visualization tools are also valuable in communicating complex data analysis to a wider audience.

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For real-life examples, please check out my article Applying Predictive Analytics in *The Actuary* December 2021 Edition, where I explained how I applied predictive analytics on projects like biodiversity conservation, green shopping and more.

If you are taking the enterprise risk management (ERM) track in attaining your fellowship, you will know that a comprehensive risk management framework for insurers includes climate risk management. Topics in the curriculum such as scenario analysis, emerging risk identification and aggregation could be used in the company's strategic planning, which includes environmental, social and governance (ESG) aspects.

Are there any initiatives related to these emerging risks that you are engaged with at your organization or elsewhere that you would like to share? Are there any resources you would recommend that can help prepare the Actuarial community for these evolving risks?

I think the insurance industry has started to step up in the sustainability space, with a lot of exciting developments in recent years. Some examples include the establishment of Net-Zero Asset Owner Alliance (AOA), which a lot of insurers have joined and committed to net zero by 2050; the introduction of Task Force on Climate-Related Financial Disclosures (TCFD), with 50% surveyed insurers in TCFD status report disclosed information on climate risks and opportunities regularly. As ESG reporting obligations are becoming compulsory and there is an increasing concern from investors and regulators, actuaries have to be ready to incorporate climate risk management in daily work, no matter it is related to pricing, reserving or reporting.

There are a lot of useful resources online to get ourselves well equipped. To start, we could review the guidelines of the main sustainability reporting frameworks to understand how to properly manage climate risks, like scenario analysis, assumption adjustments, carbon data collection etc. We could also review sustainability reports from other insurers to learn best practices and initiate conversations within the company. Attending webinars from think tanks, NGOs and industry collations is also a great way to connect with experts and be aware of new trends. The latest initiatives include Taskforce on Nature-related Financial Disclosures (TNFD), which was announced in late 2020 and aims to require companies disclose financial information related to nature and biodiversity loss.

The SOA Research Institute has been providing useful climate and extreme weather data to the actuarial community. You could find experienced actuaries contributed thought leadership pieces and podcasts on impact of new extreme weather events, COVID-19 and latest ESG reporting standards etc. I encourage you to check them out regularly.

What would be your advice to young actuaries who want to focus on Climate risk and Sustainability? Do you have a view as to how they should plan and prepare for such a career?

If you have the passion to do more for the society or hope to make sure there is still winter for generations to come, I encourage you to start exploring more on climate risk and sustainability at large. I am always a believer of baby steps, and it is best to start small – initiate a conversation within your team about climate risk and disclosure, join relevant ESG committee in the company and engage in decision making. It is also a good way to gain exposure and experience through volunteering opportunities outside work. Do not hesitate if you think you lack the relevant knowledge. The sustainability space is still evolving, and new challenges will emerge, so it is better to have more like-minded actuaries and learn together.

> *"The sustainability space is still evolving and new challenges will emerge, so it is better to have more like-minded actuaries and learn together."*

This responsibility falls onto everyone, no matter how young or experienced you are. You will definitely benefit from it!

Book reviews

BOOK REVIEW OF DISASTEROLOGY: DISPATCHES FROM THE FRONTLINES OF THE CLIMATE CRISIS *BY DR. SAMANTHA MONTANO*

By Max J. Rudolph, FSA CFA CERA MAAA

Dr. Montano's book is a combination memoir (despite being a fairly recently minted Ph.D. so not very old) and review of the Emergency Management System in the United States. She has been volunteering at disasters like Katrina since she was a teen and brings a boots-on-the-ground mentality to her narratives.

Throughout the book she shares examples she has witnessed of environmental racism. She has seen economically disadvantaged residents be challenged to work through the bureaucracy at every turn while other groups are gentrifying their former neighborhoods through a term Naomi Klein introduced called disaster capitalism. She ties together responses to disparate events like the BP Deepwater Horizon event and indigenous protests over oil pipelines in North Dakota. She compares large events with overlooked disasters that are persistent and repetitive, wearing down communities but receiving little national media attention and left on their own to suggest, and pay for, solutions.

While some events receive media coverage, like Katrina, and volunteers flock to help (the Cajun Navy is a great example), most disasters are dealt with by local residents and local volunteers. Moving forward, as global warming increases the number of events, federal responses are likely to become even more diluted and less helpful. Each survivor has unique needs, and a standardized response will not work for all of them.

These disasters are not from our future – they are occurring today. We see high-tide flooding along the east coast of the U.S., increased hurricane frequency and changing weather patterns, lengthening droughts combined with freshwater shortages and wildfires. Event attribution is a tool actuaries need to learn about and apply to all types of projections. Anticipating events and recognizing mispricing due to climate change may not impact this year's results but may avoid future insolvency.

As with any event, preparation costs much less than reaction and the process of developing a plan for response and recovery is more important than the plan itself. Unfortunately, no one seems to have interest in this game plan. An honest assessment of risks and capabilities is needed, and communication capabilities during a disaster need to be improved.

As Dr. Montano gains expertise in the policy forum beyond her bottom-up experience, she will hopefully enjoy a long career implementing useful emergency management solutions. For now, her inexperience causes her to get excited about her solutions when she may not recognize the full range of options. For example, should New Orleans be rebuilt or should buyouts become mandatory? Do we have money to burn as homeowners rebuild multiple times in the path of floods and fire? Are there countries who do emergency management well? Dr. Montano refers several times to how she is still learning. She might start with a broader dive into Herbert Hoover's time prior to serving as Secretary of Commerce and President when he was referred to as The Great Humanitarian.

This book is interesting and an easy read. For those interested in exposure to these topics it is very good, but I would be hesitant to rely on it as my only source. Dr. Montano is someone to watch in the future. She has a monthly blog that can be accessed from her twitter account (@SamLMontano).

If you have seen a good book about catastrophic events, whether related to climate, pandemics, earthquakes or anything else you found interesting please share it with others by offering a book review in this newsletter. You can follow my reading history on the Goodreads app, and I can be reached at max.rudolph@rudolph-financial.com.

Glossary

By Priya Rohatgi, ASA

In this section we explain terms that appear across climate research and related news articles. You might be familiar with some of them as they are probably common to your practice area or have seen it a number of times recently but would be good to add to our repository. In addition, we'll also direct you to the resources that we feel can be helpful in enhancing our understanding of Climate modeling, science and other related phenomena.

Nature-based solutions to climate change, sometimes called "natural climate solutions," involve conserving, restoring, or better managing ecosystems to remove carbon dioxide (CO_2) from the atmosphere. Examples include allowing forests to regrow, restoring coastal wetlands, and switching to restorative agricultural practices, such as cover crop rotation, that support healthy soils. These ecosystems reduce climate change by capturing CO_2 from the air and sequestering it in plants, soils, and sediments. They also provide a wide range of other important benefits, such as cleaner air and water, economic benefits, and increased biodiversity.

Some nature-based solutions, such as conserving existing wetlands, serve mainly to prevent greenhouse gas emissions. Others, such as restorative agriculture and regrowing clear-cut forests, actively remove CO_2 from the atmosphere. This makes them a form of carbon removal. (Many nature-based solutions both prevent emissions and remove carbon, so the distinction is fuzzy.) Nature-based approaches to carbon removal are often portrayed as distinct from "engineered" approaches, such as bioenergy with carbon capture and storage (BECCS), direct air capture with carbon storage (DACCS), and ocean alkalinization. The distinction between nature-based solutions and engineered approaches, which some scholars have contested, has important implications for the politics of carbon removal: publics are generally more supportive of approaches perceived as "natural."https://www.american.edu/sis/centers/carbon-removal/fact-sheet-nature-based-solutions-to-climate-change.cfm

Eco-anxiety refers to persistent worries about the future of Earth and the life it shelters. Eco-anxiety': fear of environmental doom weighs on young people

About the Society of Actuaries Research Institute

Serving as the research arm of the Society of Actuaries (SOA), the SOA Research Institute provides objective, data-driven research bringing together tried and true practices and future-focused approaches to address societal challenges and your business needs. The Institute provides trusted knowledge, extensive experience and new technologies to help effectively identify, predict and manage risks.

Representing the thousands of actuaries who help conduct critical research, the SOA Research Institute provides clarity and solutions on risks and societal challenges. The Institute actuaries, academics, employers, the insurance industry, regulators, research partners, foundations and research institutions, sponsors and non-governmental organizations, building an effective network which provides support, knowledge and expertise regarding the management of risk to benefit the industry and the public.

Managed by experienced actuaries and research experts from a broad range of industries, the SOA Research Institute creates, funds, develops and distributes research to elevate actuaries as leaders in measuring and managing risk. These efforts include studies, essay collections, webcasts, research papers, survey reports, and original research on topics impacting society.

Harnessing its peer-reviewed research, leading-edge technologies, new data tools and innovative practices, the Institute seeks to understand the underlying causes of risk and the possible outcomes. The Institute develops objective research spanning a variety of topics with its strategic research programs: aging and retirement; actuarial innovation and technology; mortality and longevity; diversity, equity and inclusion; health care cost trends; and catastrophe and climate risk. The Institute has a large volume of topical research available, including an expanding collection of international and market-specific research, experience studies, models and timely research.

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