April 19, 2021

Federal Housing Finance Agency
Office of Housing and Regulatory Policy
400 7th Street SW, 9th Floor
Washington, DC 20219

Re: Request for Information on Climate and Natural Disaster Risk Management at the Regulated Entities

Dear Sir or Madam:

Thank you for this opportunity to submit information pertaining to FHFA statutory responsibilities in the face of our changing climate. I personally believe that the FHFA has the single greatest opportunity of any entity in the world to accelerate the adoption of smarter climate risk management by financial markets. In turn, the FHFA holds the keys to confronting market distortion problems that are feeding complacency and an inadequate response to the climate threat. Thank you for your attention to this extremely important matter.

DeltaTerra Capital is an investment research and management firm that is helping clients navigate heightened risks in real estate capital markets related to climate change. I, David Burt, am the Founder and CEO of DeltaTerra and have been analyzing and investing in mortgage securities and other real estate derivatives for nearly 25 years. Most recently prior to founding DeltaTerra in 2019, I was a Partner and Portfolio Manager at Wellington Management Company where I worked from 2010-2018. Prior to Wellington I built investment processes at BlueMountain Capital, BlackRock, State Street Research and Management, and another startup called AlderTree Capital that I created in 2006 to help clients navigate heightened market risk created by the mortgage credit bubble. As a quantitatively oriented investor, I have significant experience analyzing complex fundamental themes like climate change.

My decision to step away from fixed income portfolio management and form DeltaTerra was driven by my team's previous research into deep real estate mispricing issues related to climate risk. The mispricing issues have continued to grow as structural inefficiencies and poorly aligned incentives have confounded rational pricing mechanisms for the increased risk of property damage as the climate warms. Over the last two years my team has been building a new analytical framework (called Klima) for measuring this mispricing and the risk it poses to various capital markets and our financial system. We are humbled by the opportunity to focus our new lens on the US agency mortgage market to help the FHFA navigate this challenging market problem.

Drawing from our many years of quantitative and fundamental real estate research, market study, investment science application, and institutional investment process execution, we have modeled rational mortgage loss expectation impacts in two climate repricing scenarios for 32 million agency backed loans representing more than $6 trillion in principal balances outstanding. Our work drew heavily from the insights of our climate services partner, risQ and their sister geospatial real estate analytics firm, Level11. Here are the results of our analysis aggregated across each agency and bucketed further for Fannie and Freddie into CRT referenced loans and those without CRT protection.

Modeled Agency Loans		Exposure %				Klima Base Loss					Klima Bear Loss				
Book	Current Balance ($ Billion)	Non-SFHA High Flood Risk	SFHA	High Wildfire	**Total Flood & Fire**	Non-SFHA High Flood Risk	SFHA	High Wildfire	**Total Flood & Fire**	**Total Flood & Fire ($ Billion)**	Non-SFHA High Flood Risk	SFHA	High Wildfire	**Total Flood & Fire**	**Total Flood & Fire ($ Billion)**
Freddie (no CRT)	1,028	6.2%	5.8%	6.4%	**18.5%**	0.05%	0.34%	0.12%	**0.51%**	**5.2**	0.22%	0.77%	0.25%	**1.23%**	**12.7**
Freddie (CRT)	856	8.2%	6.4%	5.8%	**20.3%**	0.12%	0.52%	0.26%	**0.91%**	**7.8**	0.45%	1.14%	0.52%	**2.10%**	**18.0**
Fannie (no CRT)	1,860	6.5%	5.9%	6.9%	**19.3%**	0.08%	0.43%	0.16%	**0.67%**	**12.5**	0.30%	0.93%	0.32%	**1.55%**	**28.9**
Fannie (CRT)	597	7.9%	6.2%	5.3%	**19.4%**	0.09%	0.42%	0.19%	**0.70%**	**4.2**	0.36%	0.99%	0.36%	**1.72%**	**10.3**
FHLBanks	1,785	7.9%	6.2%	6.1%	**20.1%**	0.18%	0.67%	0.24%	**1.09%**	**19.5**	0.52%	1.14%	0.44%	**2.10%**	**37.5**
Total	**6,126**	**7.2%**	**6.1%**	**6.3%**	**19.6%**	**0.11%**	**0.50%**	**0.19%**	**0.80%**	**49.2**	**0.38%**	**1.00%**	**0.38%**	**1.75%**	**107.4**

Our geospatial analytics partner, Level11, used an innovative blind linking methodology to measure census tract resolution hazard risk for agency loans without compromising borrower privacy considerations. Approximately $1.6 trillion in outstanding balances lacked disclosure data necessary for the blind linking process to apply, but coverage could be improved by introducing additional data or working with legal experts on additional borrower-safe linking algorithms. In any event, it is likely that the roughly 80% covered sample is representative and can be used to proxy risk characteristics of the overall $7.7 trillion agency book. We include detailed findings in each of 48 states (+ District of Columbia) for each of the agency books as an appendix at the end of this submission.

For additional background, we have submitted our recent U.S. Single-Family Klima Report, which summarizes our recent bottom up analysis of climate risk in the US single-family property markets. The report provides a detailed description of our methodology for measuring asset repricing risk and the impact of this risk on expected mortgage loss calculations. For each census tract defined single-family property market, we estimated current probabilistic expected damages from six climate influenced hazards (wildfire, storm surge, hurricane precipitation, tidal flooding, inland flooding, and hurricane wind), future evolution of those hazard risks in two climate scenarios, expected home value impacts from a repricing in each scenario, and scenario expected loan loss impacts on an example STACR reference pool.

Thank you again for your consideration of our research as well as our comments on the specific questions posed in the RFI.

Regards,

Dave Burt
Founder & CEO
DeltaTerra Capital

I. Identifying and Assessing Climate and Natural Disaster Risk

1. How should FHFA define climate and natural disaster risk?

Natural disaster risk seems straightforward to define. It is the risk that some occurrence in the natural environment like a storm, earthquake, wildfire, drought or extreme temperature change causes damages to property, disruptions to economic activity, and potentially heightened mortgage default rates and losses.

The definition of climate risk is more complex because it is used to describe multiple categories of risk, given an increasing understanding of how our climate is changing and how that change is likely to impact economies, markets, and society. There are three major risks related to climate that FHFA should closely monitor as each has potential financial soundness implications for the agencies.

Physical risk

This is simply the risk that as global warming continues, natural disaster risk will increase. Research has shown a likely connection between rising temperature and natural disaster risk, which is intuitive. Climate science suggests that temperatures will continue to increase over the next 10+ years regardless of mitigation actions taken today so this should be considered by the FHFA as a clear and imminent risk.

Transition risk

There are many companies that would not be viable if carbon fuel profitability fell to much lower levels, in effect making them "stranded assets". However, in order to achieve climate stability, governments need to discourage reliance on fossil fuels through disincentives programs that would make low profitability levels a foregone conclusion, causing many of these companies to fail. Some regional economies are highly reliant on companies that will clearly have to be restructured as the world transitions to net zero greenhouse gas emissions. This puts certain regions at heightened risk of economic disruption, home value declines, and therefore higher rates of mortgage defaults and losses.

Mispricing risk

We see this as the greatest and most imminent threat to the agencies. Many home markets are priced as if costs related to protecting against natural disaster risk will stay constant, despite evidence of historic underinsurance and increasing damage trends resulting from global warming. We estimate that more than 17 million homes (roughly 20% of the continental US stock) are in communities impacted by mispricing of flood and wildfire risks. In order to protect against even greater future mispricing risk and the damage that will inevitably inflict on taxpayers, the government will have to change its messaging practices around climate risk. Consequently, incentives that reward acknowledgement of current and future disaster risks will be implemented and subsidies that misinform and enable complacency will be removed, leading to higher ownership costs and lower home values. In the most mispriced communities, this will impact borrower ability and willingness to pay, leading to higher rates of mortgage defaults and losses.

2. What are the climate and natural disaster risks to the regulated entities, including long- and short-term risks, and how might such risks change over time? To what extent, if any, could such risks now or in the future impede the ability of each regulated entity to operate in a safe and sound manner, fulfill its statutory mission, or foster liquid, efficient, competitive, and resilient national housing finance markets?

It is widely expected that property and economic damages related to natural disasters (physical risk) will continue to increase over time. Hazard risks are expected to increase at least for the next decade, with wide ranging

expected outcomes in the decades and centuries beyond, depending on human ability to reduce green-house gas emissions or effectively engage in carbon sequestration. While flood and wind related damages are expected to increase gradually over time, wildfire risk has increased very rapidly in recent years.

Many damaging historical events have occurred during periods of strong home price appreciation, and indeed, have not produced unmanageable levels of mortgage losses. However, this externality should not be relied upon when thinking about future risk, particularly if the regions most likely to get hit by a hazard are the same ones that are experiencing increasing ownership costs and declining values because of more appropriately priced insurance premiums and other costs.

To illustrate this point, we compare the performance of Freddie Mac loans in the New Orleans Metropolitan Statistical Area (MSA) following Katrina in July 2005 vs. performance in the same region following Gustav in August 2008.

Following Katrina, one of the most devastating natural disasters in history, 37.5% of Freddie Mac borrowers in New Orleans missed at least 2 consecutive payments. However, home prices were accelerating at the time due to the rapid expansion of alternative mortgage products. Between the expanding credit box and billions of dollars of disaster recovery funds flooding into the region, New Orleans home prices were up 17.4% in the two years that followed. 93% of the borrowers that had gone delinquent were able to cure, and balances that did end up going to loss resolution recognized a loss severity of just 26%. Ultimately, Katrina only ended up causing 65bps of losses for the New Orleans Freddie Mac portfolio outstanding when the storm hit.

Gustav was a much less damaging event for New Orleans and lead to a default rate of 3.1% in the months that followed, less than 10% of the Katrina impact. However, the housing market was weak in 2008 and 2009, following the collapse of the alternative lending markets in 2007. New Orleans home prices were down 4.5% in the two years that followed Gustav. Only 47% of delinquent borrowers were able to cure in this environment, and balances that went to loss resolution experienced a loss severity rate of 34%. Ultimately, Gustav ended up causing 52bps of losses on the New Orleans loan portfolio, 80% of the Katrina losses with less than 10% of the delinquencies! If Katrina's delinquencies had resolved in this less constructive way, it would have created a loss in the New Orleans loan portfolio of more than 6.5%.

Unlike direct physical risks that will increase gradually over the long term, we see mispricing risk implications materializing in the very near term. Losses by private insurers related to wildfire, increasing losses and decreasing take-up rates at the NFIP, ongoing challenges in reinsurance markets, and increasing scrutiny by some lenders are all factors creating fatigue in the conditions supporting overvaluation in impacted markets. In our Bear case repricing scenario, we anticipate agency portfolio loss rates that are roughly 2/3 of those experienced following the Great Financial Crisis (GFC). While this level of loss could be absorbed by current capital cushions at the agencies, they would still be challenging for the mortgage finance industry and do not leave much room for other credit events.

3. What methodologies, datasets, variables, assumptions, future climate scenarios, and measurement tools are used to measure and monitor climate risk to the national housing finance markets? Describe any gaps in available data that limit the ability to measure such risks. How could such data gaps be resolved?

There are a number of new science-led efforts to measure risk related to climate change, although we believe ours is the first attempt to measure mortgage credit risk implications directly. We consider four key areas of research output that need to be considered in the development of applicable tools for measuring and monitoring climate risk in the national housing finance markets.

a) **Historic weather and climate data** – plentiful availability from NOAA, etc.

b) **Location-based climate science predictions** – "downscaled" simulation data from CMIP5 (and soon CMIP6) from IPCC pre-defined scenarios have become reasonably accessible standards.

c) **Hazard damage forecasts** – Answers questions about how a future hypothetical hazard event is likely to interact with the natural topography and built environment to produce property damages. There are several new data offerings in the private sector for these climate-conditioned expected damage estimates but much of the modeling work is nascent, creating widespread concerns about reliability. Traditional hazard modeling approaches used by insurers are based on actuarial techniques that assume risk is static over time, leading to underestimation of current risks and no ability to predict risk levels in the future. We see this gap in reliable hazard damage projections as the most significant obstruction to climate risk analytics adoption.

We substantiated climate-conditioned damage predictions from risQ by comparing current damage expectations to estimated historical damages over the last twenty years. The lack of detailed historic damage data is one of the biggest gaps standing in the way of climate-conditioned damage forecasting improvements. We closed this gap by combining data from the SBA, FEMA IA, NFIP and private claims payments estimates from Verisk PCS as well as risQ estimates of risk distributions across geographic borders to impute historic damages from wind, flood and fire at different levels of geographic granularity. This allowed us to identify opportunities to bolster damage forecasts based on historic evidence. We are encouraging other climate services firms to conduct similar calibrations and expect that these techniques will become more standardized over the time, just as CMIP data interpretation and downscaling have over the last few years. The problem is particularly acute when it comes to analyzing flood risk because so much of the damage goes uninsured and therefore unrecorded. We provide a detailed description of our historic flood damage imputation calculation beginning on page 15 of the U.S. Single-Family Klima Report.

d) **Financial risk models –** Unfortunately, because of well-founded skepticism around the robustness of early climate-conditioned hazard damage forecasts, as well as negative incentives amongst those most capable of getting the job done, we have seen very little in the way of risk measurement tools that apply directly to housing finance risk measurement and monitoring. DeltaTerra Capital exists, in large part, to help solve this gap between a growing body of applied physical climate risk research and the capital markets that need to assimilate it. The Klima Report included with the RFI describes in detail our method for closing the financial modeling gaps. First, we substantiate hazard forecast inputs by comparing against estimated historical damages, then we use a traditional asset valuation model to arrive at intrinsic value impact. We then use traditional mortgage credit modeling techniques to measure the impact of rationalizing home values on expected pool losses.

4. What risk management strategies or approaches—including but not limited to those related to pricing, insurance, credit risk transfers (CRT), loss mitigation, and disaster response—do industry participants use to address climate and natural disaster risk?

Pricing – Some lenders on the commercial side have rate incentives for LEED certifications and the like. We've had discussions with CMBS bankers about creating ESG-tailored conduit pool carveouts that could increase these discounts depending on market take-up. LEED certifications have more to do with emissions than protection from physical risks, however, so this is not a direct physical risk mitigant (although presumably operators that seek LEED certification are also more focused on resiliency than others).

We are unaware of any loan pricing mechanisms on the residential side that are being used to address climate risks. We believe that risk-based pricing mechanisms could help mitigate risk without reducing mortgage

availability for borrowers who can afford their loans and who will not be put into an overleveraged position by mortgage debt on an overvalued property. Agency LLPA's or qualification thresholds that reference LTVs adjusted for property repricing risk and DTIs indexed for projected insurance rate increases could help smooth market disruptions relative to risk mitigation mechanisms that result in binary outcomes for credit availability.

Insurance – This is the primary method of climate risk protection for lenders, who almost all require hazard insurance (and the ability to force place insurance if a borrower fails to renew). There are two major shortfalls with this risk mitigation strategy, however:

a) Insurers reset premiums annually, to the extent they are allowed by regulators. If the insurer is unable to obtain the rate they think is required to offset an increasing risk situation, they can usually make the decision to walk away from a market. The lender on the other hand is locked into the exposure for the life of the loan. Because of this difference in exposure tenor, insurance does little to protect a lender against a reset in long term hazard damage expectations.

b) Flood risk is underinsured. Flood damage is not covered by standard homeowner insurance and borrowers are only required to obtain NFIP protection if they reside in a designated SFHA. Also, there is ample evidence suggesting that the flood insurance mandate is not always being enforced by the agencies beyond the first year of the loan term.

CRT – CRT is an effective means of mitigating loan losses resulting from hazard events, but it is only available when markets are receptive. This challenge can get exacerbated when rates fall because of some economic shock like we witnessed in 2020 due to the COVID 19 pandemic. There was an enormous amount of borrower demand for loans given the sharp decline in mortgage rates, and for a time there was no market appetite for CRT because of concerns over sharply increasing delinquency rates related to COVID 19 driven disruptions. Since CRT sometimes is not an option, particularly at times when credit risk management is most needed, it should only be thought of as a partial solution and should be paired with risk management efforts that utilize pricing and underwriting.

Loss mitigation and disaster response – Loss mitigation practices that take advantage of low-cost resiliency opportunities may become more important for risk mitigation if market pricing of these features becomes more pronounced. Disaster response in the way of forbearance offerings are essential for protecting communities from widespread economic fallout following severe weather events. However, long-term loss outcomes have historically been determined by other regional housing market factors as described above in the Katrina vs. Gustav comparison.

5. How, if at all, should FHFA incorporate into its assessment of the regulated entities' climate and natural disaster risk the potential for abrupt repricing of real estate properties exposed to acute natural hazards?

An abrupt repricing of real estate properties exposed to acute natural hazards is very likely in the near future, given current challenges in hazard protection markets for wind, fire, and flood and the growing disconnect between current property buyer expectations for insurance costs and a more rational estimate for future costs based on evidence-grounded scientific predictions. This is the largest risk to the soundness of the regulated entities in our opinion, so we believe it is imperative for the FHFA to incorporate measurement of this risk into its assessments, despite the significant challenges in doing so.

In the attached U.S. Single-Family Klima report, we detail our methodology for measuring this risk using an intuitive four step process:

a) Assess current homeowner expectations for insurance and other costs.

b) Assess scientific estimates of future costs that incorporate climate trends in different scenario outcomes.

c) Assess the impact of a reset in these expectations on intrinsic property values.

d) Assess the impact on expected loan losses if the property experienced a rapid repricing to the new intrinsic value.

There are many assumptions involved in this analysis, some of which draw from a limited amount of historical evidence. However, none of the models we used in our measurement framework should feel foreign to sophisticated mortgage finance market participants and the overall framework is no more complex than those used in other regulatory processes (Basel, NAIC RBC, TCFD, Dodd Frank Margin Requirements for CDS, etc.).

The biggest challenge we have come across when suggesting that institutions heed this risk is not a denial that the risk exists, but a lack of reliable and applicable scientific projections for hazard damages, given the nascency of this modeling discipline. Traditional hazard modeling techniques can only consume historic data and mistakenly assume that risk is static over time. New efforts, while based in science and often peer reviewed in academic circles, fail to integrate historical evidence in their model calibrations or quality assurance processes, allowing a potential glitch in any of the many modeled dynamics (that may not be caught in an academic peer review) to throw off end results dramatically.

We believe the market will coalesce around a standard for these measurement efforts over time, and therefore see our ability to marry the disciplines of climate science and investment science towards the construction of reliable and applicable risk metrics as our most important contribution to the acceleration of smart climate risk management adoption by the market. Adoption by the FHFA of our (or any) approach to incorporating these measurements into agency risk assessment could meaningfully accelerate adoption, creating a virtuous cycle of de-risking by the industry that may be even more impactful to agency soundness over time than any direct oversight actions.

A major challenge in closing the gap between evidence-based models with no forecast ability (like those used by insurers) and forecasting models that are not grounded in evidence (like those used by climate services firms) is the lack of available historic damage data. Some of this data is privately held, and some of it simply does not exist. We describe our methodology for *estimating* historic damages for flood and fire in the attached U.S. Single-Family Klima Report and will soon be performing a similar exercise for wind.

We are advising new academically grounded climate services firms to produce charts that blend forecasted damages with estimates of historical realized damages as we show in our Klima report for fire and flood. This is the first thing we, and probably most financial risk managers, would want to see before plugging damage estimates into financial risk models. For mortgage finance professionals who are accustomed to using forecast analytics like CPRs and CDRs relative to various recent periodic performance, the absence of this capability can be particularly grating. To the extent the FHFA, perhaps in collaboration with the NAIC, NOAA and other government efforts, can work towards creating a public data set of these historic damage estimates, it could go a long way towards accelerating these measurement capabilities and de-risking mortgage finance.

6. With respect to the foregoing questions, FHFA invites interested parties to submit any studies, research, data, or other qualitative or quantitative information that supports a commenter's response or is otherwise relevant to the regulated entities' climate and natural disaster risk.

Thank you for this opportunity to submit our most recent analysis of climate risk in the U.S. single-family property markets ("US Single-Family Klima Report"). We have also included our detailed model estimates of climate risk at each of the regulated entities, by state, as an appendix at the end of this submission.

II. Enhancing FHFA's Supervisory and Regulatory Framework

7. How should FHFA evaluate the adequacy of a regulated entity's ability to assess and manage the impacts of climate and natural disaster risk, particularly in light of the significant uncertainties and data limitations?

The FSB-established Task Force on Climate-Related Financial Disclosure (TCFD) makes recommendations on climate-related financial disclosures that could provide a useful template (https://www.fsb-tcfd.org/recommendations/.) They suggest (and make specific recommendations on) the development of disclosure requirements that address four key elements of an organization's operations: Governance, Strategy, Risk Management, and Metrics and Targets. We could not agree more with their specific recommendations, and model nascency caveat, about the importance of requiring at least an attempt at scenarios analysis:

> "The Task Force recognizes the use of scenarios in assessing climate-related issues and their potential financial implications is relatively recent and practices will evolve over time, but believes such analysis is important for improving the disclosure of decision-useful, climate-related financial information."

8. What specific processes and systems of a regulated entity should FHFA examine in its supervision of the regulated entities' climate and natural disaster risk management?

Hazard Insurance Requirement – The FHFA needs to examine if current processes related to the hazard insurance mandate are working. There is significant evidence suggesting that many agency loans in Special Flood Hazard Areas are currently uninsured for flood risk. This is a major oversight problem, particularly given the potential repricing of NFIP premiums later this year through FEMA's Risk Rating 2.0 initiative. Homeowners who have let their policies lapse will not receive the cap and phasing benefits given to existing policy holders and future buyers could see dramatic increases in premiums relative to what they would have in the past.

Borrower Ability to Pay – Processes that manage risk through DTI requirements and pricing should be examined for accommodation of future premium hikes based on more rational assessments of property risk.

Borrower Leverage – Processes that manage risk through LTV requirements should be examined for accommodation of potential value declines driven by a reassessment of future insurance costs by home buyers.

9. How should FHFA prioritize the various climate and natural disaster risks to the regulated entities?

We believe flood risk, and specifically flood risk for properties within FEMA defined SFHAs, represents both the largest risk and largest opportunity for risk mitigation amongst the various hazards of concern. In our Bear repricing scenario, which anticipates $107 billion in losses across $6.1 trillion in modeled agency loan balances, 79% of agency book losses are a result of flood risk repricing. 57% of the total risk is derived from loan balances that we suspect are in SFHAs, representing a tremendous opportunity for immediate progress on new risk mitigation strategies that rely on scenario analytics.

FEMA recently onboarded an Average Annual Loss (AAL) estimation processes for properties in support of the NFIP's Risk Rating 2.0 initiative to align premiums in SFHAs with hazard risk estimates that take advantage of recent advances in hazard modeling. AAL estimates, essentially the rational price of insurance, are key inputs to climate risk analysis and adoption by the NFIP will help to bring standardization to measurement practices, particularly for the covered SFHA properties. While this does not solve the problem of forecasting future damage risk increases because of further global warming, a significant share of losses in our model are due to a repricing of *current* risks that have become misvalued over time due to dated flood maps, obsolete hazard models, a subsidy-driven pricing framework at the NFIP, and low take-up rates by homeowners in SFHAs.

The next most pressing issue from our perspective is wildfire risk. Wildfire repricing may occur more quickly than flood because of the rapid retreat by insurers in impacted regions. Regulators in California have put non-renewal moratoriums in place for zip codes impacted by wildfires containing nearly 3 million homes in the last few years, but the moratoriums are only for a year and are not renewable. Our Bear repricing scenario anticipates that the 6.3% of agency backed balances deemed to have high wildfire risk exposure will incur losses at a rate of 6%, contributing 38bps of losses to the modeled agency portfolio.

Flooding risk outside of SFHAs, and particularly inland flooding risk, is also mispriced but the problem is not as acute as wildfire risk and the likely repricing catalysts are further out than flood risk in SFHAs (Risk Rating 2.0) and wildfire risk (continuing insurance exodus and expiring moratoriums). We see wind risk as a lower priority, given the more robust coverage and pricing of *current* risk through private insurers, although challenges in reinsurance markets may force some near-term challenges and long-term wind risk increases are expected but not priced.

10. Some government programs and interventions that mitigate disaster-related credit losses at the regulated entities are not available to all mortgage market participants and may not be available to the regulated entities in the future. How, if at all, should FHFA consider current risk mitigants and their uncertain future availability in its supervision and regulation of each regulated entity's management of climate and natural disaster risk?

The most direct credit risk mitigation tool, the Credit Risk Transfer market, falls into this category. Banks have had a difficult time making CRT work for their purposes and now even Fannie Mae has stepped away from the market. While Fannie's failure to return to the CRT market is largely attributable to their assessment of its use under The Enterprise Capital Rule, the lack of market appetite in March and April 2020, when credit risk protection was highly desired, probably played a part as well. Sadly, Fannie's choice has led to greater absorption by taxpayers of climate risk. We estimate that Freddie Mac has protected loans containing 59% of their overall book's climate exposure through CRT. Fannie Mae has only protected 26% leading to a difference of $13 billion in bear case losses that would have to be borne by taxpayers because Fannie didn't keep up.

We think CRT needs to be paired with mechanisms that lead to reduction for new originations. Also, for CRT to be truly effective, it will need support in becoming a more functional market. A primary reason for CRT is to get support from market discipline in the pricing and management of credit risks. It is difficult to expect that to occur in a market with one or two sellers and two to three hundred buyers who are almost all compensated based on how much CRT they buy.

11. What risks to the regulated entities' critical service providers and other third parties—including but not limited to mortgage servicers and insurers—should FHFA consider when assessing each regulated entity's management of climate and natural disaster risk?

Home insurance companies are in an increasingly difficult position. Their models are based on historical damages, and in no way address the fact that climate change is already impacting results and will continue to get worse. As

an example, in both 2017 and 2018, and probably 2020 once results are tallied, California home insurers paid out more wildfire-related claims than they received in total premiums.

This issue is compounded by regulators limiting increases on premiums, leaving insurers in a position where they must hope these worsening results don't continue into the future. If they are unable to generate profits in these high climate risk areas, they will either go out of business or stop offering coverage. This is almost a greater risk to lenders than the insurers themselves given the mismatch between a one-year insurance liability versus a 30-year mortgage.

Even if regulators let insurers charge the appropriate amount (or try to manage high-risk properties through state backstop programs like the CA FAIR program), there is a high likelihood that the borrower won't be able to cover these new costs. Please see page 11 of the U.S. Single-Family Klima Report for an example of price increases in a high fire risk or high flood risk area calculated by our models. These cost jumps would severely hamper a borrower's ability to pay and would ultimately lead to increasing mortgage losses as borrowers are either unable to pay or walk away after being unable to sell an uninsurable property.

Mortgage servicers are also at risk when these scenarios come to pass. Whether it is a default from a borrower unable to afford a much larger insurance payment, or a natural disaster occurring in an area where insurance became impossible to obtain at an artificially low rate, they will be required to forward principal and interest. And with FEMA being over-encumbered by the increase in occurrence and severity of natural disasters, and a potential lack of willingness the federal government to carry the increased burden, response times could be slower for these larger events exacerbating the problem. Servicers are already facing increased advancing obligations from COVID-19 forbearance programs which would be compounded in the face of a large natural disaster.

12. What differences between the Enterprises and the FHLBanks should FHFA consider in tailoring its supervision and regulation of each regulated entity's management of climate and natural disaster risk?

Given our experience as credit focused investors, we are more familiar with processes related to supervision and regulation of the Enterprises (who issue CRT bonds) than those pertaining to the FHLBanks. There may be special governance considerations applying to the FHLBanks, but we would need to become more educated on the specific governance processes to add anything here. Given the number of independent FHLBanks, developing clearly defined objectives and requirements, and providing informational resources to help members fulfill those requirements is probably important. Also, FHLBanks do not issue CRT so do not have the same opportunity to utilize market support in risk pricing.

The needs of FHLBank borrowers are also different, as the federal lending programs are geared to support homeowners that often have less money for down payments, and less income stability on average relative to Enterprise borrowers. FHLBank borrowers are more likely to be impacted by unintentional equity issues arising from risk mitigation strategies so should be prioritized when offsets to unintended consequences are developed. Interestingly, wildfire risk is more prevalent in FHLBank loans because of a higher propensity of USDA loans originated in rural western geographies.

13. Should FHFA implement a stress testing, scenario analysis, or similar program to assess the regulated entities' climate and natural disaster risk? If so, what factors should FHFA consider in defining the purposes, design, and scenarios of any such programs?

An FHFA implemented stress test and/or scenario analysis program would serve to provide a climate risk measurement benchmark for the mortgage finance industry and clarify risk management goals and expectations for the regulated entities. A standardized measurement methodology for lending risk would accelerate the

adoption of smart climate risk management, resulting in a more resilient mortgage finance ecosystem overall. This should be the purpose of any such stress testing initiative and the design factors should be targeted to fulfill that purpose.

We think the most important factors in designing a scenario analysis framework that could serve as a guiding light for the regulated entities are as follows.

a) Applicable – The analysis should result in metrics that are familiar and actionable for mortgage market participants. We calculate expected pool loss impacts in our analysis because those are the most broadly useful metrics in the management of a theme like climate change that has a primary impact on credit risk. We are also able to produce CPR/CDR/Sev/Delinquency curves for sophisticated users who consider climate impacts on other analytics and simulation results.
b) Substantiated – New hazard models that are critical inputs for a climate risk analysis need to be grounded in historical evidence. Charts of historic estimated damages for a hazard should not be disconnected by magnitudes from the first forecast estimate for broad geographic definitions like the continental U.S. Drawing these charts is the first step in building a credible and reproducible analysis.
c) Transparent – Data and methodology should be fully disclosed, such that any participant could calculate the analysis results at some higher level of geographic resolution than what could be made available in order to protect borrower anonymity.
d) Complete – Every effort should be made to ensure consistent application across every loan, such that no unintended biases are created for loans with incomplete or differently defined data.
e) Compatible – The market has coalesced around the IPCC CMIP projects as the standard source for climate scenarios. To maximize the use and impact of any climate, it will be important to adopt this standard practice and others.

Please refer to the included U.S. Single-Family Klima Report for a detailed description of our scenario analysis framework. This framework was designed to bridge the gap between new scientific techniques and mortgage finance risk in order to encourage smarter risk management. We believe that the most decision-useful scenario factors for assessing expected loan loss impacts due to a rationalization of climate risk by real estate markets are:

a) Estimates of current homeowner expectations for insurance and other costs.

b) Substantiated scientific predictions of future costs that incorporate climate trends in different scenario outcomes.

c) Estimates of the extent to which property buyers include increased cost expectations and demand higher risk premiums when valuing properties with high exposure.

d) Understanding of the relationship between property repricing magnitude and mortgage losses, given loan credit characteristics and other factors.

We have also included the results of our scenario analysis at the state level for each of the major agency books as an appendix and would welcome an opportunity to discuss our methodology and results in greater detail.

14. Are there alternative risk mitigation strategies, including but not limited to insurance or insurance-based financial instruments, that could transfer risk from the regulated entities' portfolios or products or assist with the market pricing of climate and natural disaster risks?

Hazard insurance alone is not an effective climate risk mitigation strategy for mortgage finance because of the exposure term mismatch between a one-year insurance policy and a 30-year mortgage. This limited coverage term issue also applies to all of the other catastrophe risk transfer instruments we are aware of, like weather derivatives, ILWs, catastrophe bonds and even new technology specifically focused on insuring against mortgage defaults caused by a catastrophe event (https://www.artemis.bm/news/mortgage-investor-bayview-returns-for-second-parametric-quake-cat-bond/). The longest term transfer agreements typically only last 3-4 years while a mortgage has exposure to climate change impacts even beyond the term of the loan because it is secured by an asset that has value based on utility and cost over a very long horizon (the useful life of the property).

The existing Credit Risk Transfer (CRT) market structure could offer an effective mechanism for assisting market pricing of climate risk in mortgage finance but would require some significant enhancements to be truly effective:

a) Loan-level disclosure of transparently defined climate scenario analytics

b) Regulatory enhancements that offer more appropriate capital relief on transferred risks

c) Expanded market access for both buyers and sellers. Seller incentives, retail products and liquid derivatives products are all potential paths towards a richer market mosaic capable of driving market discipline and efficient risk pricing.

With the assistance of enhanced loan-level scenario analysis disclosure, it would be possible to create CRT for pricing and transferring specific hazard risks. Given that we have already calculated risk exposure to wildfire, SFHA flood, and non-SFHA flood for 80% of the agency portfolio, it would be a trivial exercise to construct reference pools targeting specific hazards. CRT market depth at this point is currently inadequate to support this level of financial engineering, but we are hoping that the CFTC's ongoing attempts to improve the use of market forces for climate risk pricing could make this solution less of a pipe dream over the long run.

While a combination of insurance and CRT can mitigate significant risk for the regulated entities, we believe it is still essential to implement solutions that better inform a borrower about climate risk at the point of origination as well. We propose implementation of risk-based pricing (LLPAs) and underwriting thresholds that reference climate risk indexed estimates of DTI and LTV.

15. How might the regulated entities support their housing finance missions while minimizing the impact of climate and natural disaster risk?

Minimizing the risks posed to the mortgage finance ecosystem by climate change and natural disasters can be achieved by either not lending to high-risk areas, which would run counter to the regulated entities mission, or by offering risk-based pricing if a borrower chooses to reside in high-risk areas. The risk-based pricing option could smooth out inevitable regional value corrections and prevent severe value outcomes that might come about from a complete withdrawal of credit availability. Severe market moves of this nature could cause more incremental damage to existing loans than the risk mitigation a high-risk loan prohibition would achieve.

We suggest two risk mitigation actions the agencies could take that would help to minimize risk without being too damaging to the overall housing finance mission.

First, LLPAs could be put in place based on a "climate indexed LTV" that subtracts some formulaic amount of projected climate costs for a property from the property value before computing leverage. We also include consideration of potential risk premia changes when measuring property value repricing risk. There could be a cap on the allowable climate indexed LTV to make sure the very worst risks, which effectively cannot be priced, are not eligible for a loan. While the goal should be to minimize the number of properties that become ineligible for financing, a growing number of properties that fall into the uninsurable category may need to be referred to HUD demolition programs to minimize overall market damage as sea levels rise.

Second, we recommend payment ability qualification based on a "climate indexed DTI" that includes expected hikes in annual insurance payments based on future hazard risk estimates. Qualifying borrower payment ability for an adversely exposed home based on current insurance premium rates is bad for both the borrower and lender. This is akin to qualifying borrower payment ability based on a low introductory "teaser period" rates, a practice that was banned following the massive subprime default wave that was responsible for the Great Financial Crisis (GFC).

Both gradual risk mitigation strategies require modeled inputs that come with a high degree of uncertainty. This creates a high bar for methodology testing, transparency, and reproducibility of the analytics that are used. We believe our Klima analytics already exceed these requirements.

16. Market discipline could potentially supplement FHFA's supervision and regulation of the regulated entities' climate and natural disaster risk appetite and management. Market discipline depends in part on the information that is available to shareholders, creditors, and other counterparties. Is the existing publicly available information sufficient for shareholders, creditors, CRT and other investors, and other counterparties to understand and exercise market discipline over a regulated entity's appetite for and management of climate and natural disaster risk? If not, what changes are needed? Should each regulated entity be required to disclose additional information, including but not limited to the extent to which its underwriting practices take into account climate and natural disaster risk?

To optimize chances for market discipline to have a meaningful impact, regulated entities should be required to disclose how climate and natural disaster risk is taken into account by underwriting practices as well as other risk management mechanisms. This requirement will become more important to market discipline in the future as underwriting practices evolve. Most market participants know the current standard practice of requiring hazard insurance for all properties, and flood hazard insurance for properties in SFHAs, to be the only underwriting practice that takes disaster risk into account today.

A more pressing disclosure requirement to enable better market discipline by counterparties would be disclosure by each regulated entity of servicer supervisory practices intended to ensure that the contractual insurance mandate is enforced each year. Loan level disclosure on the ongoing condition of hazard insurance requirements should also be required, giving market participants the ability to differentiate based on the one existing risk management practice.

The biggest data gap standing in the way of market discipline aspirations is the MSA-granularity limitation of geographic disclosure that protects borrower privacy. Climate risk can vary greatly within an MSA (even after enforcing disclosed zip3 constraints), making it difficult for a market participant to independently measure risk based on MSA-level disclosure. While we were able to infer census tract-level risk for most loans without interfering with borrower privacy, this required a massive investment in data science technology, legal resources, and data itself for our geospatial analytics partner Level11 to execute. As most market participants will not have the resources to integrate analysis of this complexity, the agencies can only solve this market discipline

enablement problem by incorporating scenario analysis results, like those derived in our Klima framework, upstream and making scenario analytics disclosures with clearly telegraphed methodology.

17. What, if any, additional periodic or episodic reporting requirements for the regulated entities should FHFA consider to improve the publicly available information on the regulated entities' management of climate and natural disaster risk?

TCFD recommends climate-related scenario analysis to help organizations and stakeholders understand potential implications of climate change on the organization, given its belief that "such analysis is important for improving the disclosure of decision-useful, climate-related financial information."

We believe that annual or semi-annual reporting of scenario analysis results describing portfolio risk in familiar mortgage finance terms (risk-based insurance premiums, asset repricing risk, implications on credit loss expectations) would be ideal for improving publicly available information on climate risk at the regulated entities. We hope that FHFA will use our arms-length portfolio risk reports for each agency book at the end of this submission as a template for a mandatory disclosure.

This may take time to implement so we would suggest an initial and immediate reporting requirement addressing proof of insurance compliance, with additional disclosure of flood specific compliance for homes in SFHAs.

18. Policies to manage climate and natural disaster risk could increase the cost of housing, making it more difficult for lower income households in some areas to obtain affordable housing. Are there policies the regulated entities could pursue to mitigate such adverse effects for lower income households in vulnerable areas without undermining efforts to manage climate and natural disaster risk?

Our climate science partner, risQ, has found a strong selection bias underneath the relationship between high-climate-risk areas and lower-income and predominantly minority households. They have done compelling work on the socioeconomic implications of climate risk and equity challenges associated with various risk mitigation solutions. We have included their expert commentary on questions 18 and 19 verbatim. DeltaTerra fully supports their conclusions and will be partnering with risQ on equity challenge and opportunity measurement as we refine our econometric models and focus our lens directly on social outcomes.

"The fundamental problem is that no one in the housing system -- the GSEs, borrowers, originators or correspondent lenders, developers, municipal regulatory and zoning agencies, or even the PMI and property and casualty (P&C) insurers -- has sufficient or consistent disclosure data about accelerating climate risks over a ten-year horizon. Changing the required disclosures or risk thresholds for any component of the system -- e.g., repricing high-risk loans on the secondary markets by altering GSE purchasing policies -- will flow unpredictably and inequitably to existing homeowners, their lenders, and the local governments that collect property taxes and maintain infrastructure.

We expect the outcome of increasing risk disclosures to be a series of feedback loops. Home value losses in high-risk areas will be compounded by lower mortgage liquidity, hesitation on lending to new borrowers, thinning of the market for home buyers that pushes existing homeowners into negative equity, and in many cases municipal disinvestment as service costs rise and property tax revenues decline. The consequences for inequality and housing affordability will be exacerbated by partial disclosures within select parts of the broader housing markets. Policies that pair loan- and portfolio-level risk reduction for the GSEs with incentives for other actors to increase housing to lower-risk areas are more likely to succeed in reducing systemic risk while simultaneously increasing housing supply and thus affordability.

Key categories with potential policy levers are:

- **Insurance Reform:** Insurance costs are a substantial part of a borrower's monthly obligation, but the contracts are repriced annually. P&C insurers and reinsurers are not currently accounting for climate change in their forward loss estimation, preferring instead to reset policy pricing and "insure/do not insure" decisions annually in accordance with local market changes and shifting risk. This is, from the perspective of the GSEs and mortgage markets, comparable to the damaging effects of Option ARMs and other complex mortgages of years past. A borrower may qualify for a fixed-rate 30-year loan at a specific home price, only to find that insurance rate hikes in future years drive up monthly payments considerably. To the borrower, a payment hike from insurance costs or interest rate adjustments does not matter: it is the same loss of discretionary income. The FHFA and GSEs may be among the only American institutions to have the incentives and leverage to demand better behavior from insurers or state insurance regulators, e.g. in the form of multi-year policies that offer a more comprehensive assessment of the true risk on a property during the expected lifespan of a mortgage loan. In some parts of Florida, insurance costs have reached an astonishing 50% of mortgage principal/interest payments. At a time when national benchmark interest rates have dropped to 3% or lower -- implying virtually no risk of loss on the loan -- the insurers have taken the opposite bet, with prices implying a much greater risk of loss.

  On the public side, the FHFA should be strong advocates of FEMA's National Flood Insurance Program (NFIP) Risk Rating 2.0. As currently planned, this policy will roll out later this year and would be a much more progressive and equitable policy than the current instantiation, which effectively massively subsidizes wealthy homeowners at the expense of lower income communities. FHFA should advocate to ensure that RR2.0 indeed rolls out as planned (since backlash from affluent communities have politically stymied the roll out in the past and threaten to do so again).

- **Housing Development Policy**: A significant source of climate risk increase has been new housing development in areas with higher exposures -- e.g., flood zones in suburban Houston, or expansion of low-density housing in California wildfire-prone areas. Developers have access to cheap initial financing but bear the holding costs of high-risk development sites for just a few short years. Substantial changes to mortgage pricing are likely to flow upstream to developers and restrict the range of projects that are financially feasible, further constraining housing supply. The FHFA should advocate for policies that incentivize development in lower risk areas and/or disincentivize development in higher risk areas.

- **Municipal Zoning:** Reducing development or lending in high-risk areas will drive property values upward in low-risk areas. Municipalities must be willing to up-zone or re-zone lower-risk sites for new housing to affect affordability. This may entail higher capital costs for new development, at the same time property tax revenues are threatened and existing infrastructure becomes more costly to maintain. Pairing incentives for municipalities with rezoning and climate risk reporting requirements -- e.g., access to grant programs for moving at-risk borrowers into new housing, conditional on demonstrated progress in re-zoning and net reductions in risk exposure for residents -- would be a powerful series of levers for federal action.

- **Housing Density:** closely related to zoning, policies at federal, state, and municipal levels that incentivize density are important for at least two crucial reasons. First, supply in low climate risk urban areas is largely constrained by zoning laws, artificially boosting property values -- which decreases access to housing for mid to low income housing. Related, this in turn encourages suburban and rural sprawl that increases car commuting and hence carbon dependence. Thus, policies that encourage low risk urban housing density can at once mitigate carbon transition risk and increase equitable access to housing.

- **Climate Risk Disclosure:** The FHFA and GSEs have led the way on standardizing borrower disclosures to promote fairness in lending, especially in examples like the Loan Estimate and Closing Disclosure forms. In the climate change case, forcing disclosures for one component of the housing finance system (e.g. requiring that loan sellers provide a detailed location for climate risk estimates) may protect the GSEs from elevated risk. Without policy guidance and support for standard disclosure data elsewhere in the system -- for example, with municipal zoning agencies, housing developers, mortgage and P&C insurers, etc. -- there will be no common language from which to start the flywheel for mitigating systemic risk. The emerging climate services sector provides an avenue for the FHFA to explore objective resources for disclosure.

Finally: it is worth noting that climate change is a fundamentally new challenge for the FHFA and GSEs. A central policy goal of the GSEs, and for many decades their chief effect on secondary mortgage markets, has been to reduce the spread of housing costs across the whole United States by standardizing loan products and making a loan on any specific home into an acceptable substitute for a loan on any other home. The goal and effect of mass securitization is a boost to affordability in places that would not be, on their own, affordable mortgage markets. Because of the GSEs, borrowers in rural West Virginia, coastal Delaware, and urban San Francisco have the same access to mortgage markets, regardless of the variability in their local housing finance markets. This flattening in the spreads on housing costs is an important pathway to homeownership across the country. It is a unique and critical feature of American housing policy. It also runs directly counter to the accelerating problem of climate change.

Housing in a high-climate-risk area will not be an acceptable substitute for other home collateral as securitization requires. Losses to flooding and wildfire can be permanently destructive to home values. The costs of insurance hikes, heat stress and electricity consumption, and other indirect drains on borrower income will be durable. It is critical for the GSEs to backstop local housing markets that are in cyclical expansion and decline patterns, such as the stabilization of housing markets in many of the US Midwest cities where employment and other structural changes would have severely impacted borrowers without the effects of loan securitization. The problem of climate change is not cyclical. Many important housing markets will experience hurricanes, floods, wildfires, and enduring drought and heat stress that damage property values and drive away the most mobile of their residents to more promising locations. This will have permanent consequences for the ability of local governments to afford infrastructure maintenance and climate resilience programs.

With this distinction between cyclical backstop and permanent losses in mind, the question of housing affordability must be answered at a regional and national scale. Much of the US housing stock at high climate risk exposure is maintaining its value only because no one knows what the true risk is and/or because insurance markets are inappropriately pricing risk. When insurance rates reset, or new climate events lead to destruction and outward migration, that loss in value will not be recoverable in the short term. Housing affordability as a US policy goal must adapt to the permanent, not cyclical, nature of climate-driven housing market declines."

19. Minority borrowers exhibit higher rates of delinquencies for longer durations following natural disasters. Are there policies the regulated entities could pursue to mitigate such adverse effects for minority borrowers exposed to climate and natural disaster risk?

risQ answer below:

"There are strong selection biases underneath the relationship between high-climate-risk areas and lower-income and predominantly-minority households. For a multitude of historically explicit and implicit discriminatory reasons, neighborhoods at higher direct climate risk (e.g., flood or wildfire exposure) or higher risk in other

environmental cases (proximity to polluting industrial sites, fossil fuel plants) are often the same neighborhoods that were redlined or regulated into being predominantly communities of color. There are several policy realms that the FHFA can explore to ensure climate justice in the process of also reducing systemic risk that the GSEs hold on their balance sheets.

- **Increased access to disaster insurance:** Minority communities on average have relatively lack access to FEMA resources like flood insurance and servicer forbearance programs in the immediate aftermath of disasters. The FHFA should advocate for expanding simpler accessibility to these types of programs at a federal level. The GSEs themselves could explore requiring and subsidizing disaster insurance for homeowners that fall under certain wealth / income levels -- even (for example) for homeowners that fall in FEMA's 500-year flood plains in addition to its standard 100-year floodplains, where insurance is required.

- **Disaster recovery:** Net household wealth in minority communities is (on average and in specific neighborhoods/cities at highest risk exposure) substantially lower -- smaller cushions in a disaster require faster and more flexible aid to be useful. Speed and accessibility may be more important than amount in the wake of disasters. Limit how badly the initial impact hurts borrowers, expect faster recovery times. The FHFA could directly develop a forbearance/forgiveness program aimed at historically marginalized and economically vulnerable communities in the wake of disasters. Forbearance/forgiveness programs could be developed with relatively simple triggers to ensure speed. Similarly, financial aid programs should be targeted at those same communities and homeowners that qualify based on straightforward loan level attributes that characterize homeowners as parametrically vulnerable - debt-to-income ratio, loan-to-value ratio, and credit score thresholds. These will universally serve low income homeowners that are consistently and disproportionately communities of color.

- **Community / Homeowner Grant programs**: Using similar parameters outlined in the previous bullet, the FHFA should explore policies that grant money to socioeconomically vulnerable homeowners that are exposed to climate risks. Grants could simply be intended as reasonable financial cushions for homeowners that are likely to have little savings to lean on in the wake of disasters. Alternatively, they could be distributed as grants/rebates to vulnerable communities or homeowners directly for relatively "hardening/resilience" investments. These will universally serve low income homeowners that are consistently and disproportionately communities of color."

20. What type of organizational structures should FHFA and the regulated entities consider adopting for themselves to support the management of climate and natural disaster risk?

We applaud the agency's initiative in issuing this request for information and support ongoing oversight of climate and natural disaster risk by dedicated organizational structures with responsibility for implementing the suggestions received. We suggest the creation of Climate and Natural Disaster Risk committees at the FHFA and each of the regulated entities. These committees should ideally consist of senior leadership from the agency and entities themselves in addition to independent experts from the fields of climate science, hazard insurance, and related government agencies (i.e. FEMA). A transparent reporting process on the agenda, discussions and suggestions of these committees is crucial to ensuring that the regulated entities can continue to operate in a safe and sound manner. This transparency is key to allow market participants to adjust to any forthcoming regulatory changes.

21. What specific issues or topics should FHFA consider for future research on climate and natural disaster risk to the regulated entities and the national housing finance markets?

The highest priority research item is determining a process for systematic assessments of 1) Average annual loss (AAL) expectations from flooding and wildfire hazards both currently and in commonly understood scenarios in

the future 2) present value impact of these predictions on asset values and 3) price rationalization risk contribution to expected loan loss. These should serve as the basis for any near-term policy enhancements.

Additional research topics that are worth considering –

a) Degree to which external economic factors have contributed to low loss realization following historic disaster events.

b) Sources of model error in climate conditioned hazard estimates and methods for resolving errors based on historical evidence.

c) Degree to which future expected costs increases are already baked into pricing.

d) Potential for realized tail events resulting from non linear warming effects

e) Insurance market dynamics that could catalyze major changes in cost expectations (Risk Rating 2.0, Wildfire risk aversion, reinsurance pricing hikes, etc..)

22. What data or housing market information would be beneficial for FHFA to make available, to the extent permitted by privacy considerations, to researchers and other interested parties to support the assessment of climate and natural disaster risk to the regulated entities or the national housing finance markets?

Having greater visibility into the following would allow for an acceleration in credible model development by various modeling efforts which is critical;

a) Loan level disclosure on whether or not loan is in an SFHA

b) Monthly disclosure data on last known homeowners insurance policy expiration date

c) Monthly disclosure data on last known Flood insurance policy expiration date if property in SFHA

d) While we're not sure exactly at what level of geographic granularity this item would be permitted given privacy considerations – some disclosure on reported annual insurance premiums for loan originations would be useful. Flood separated out would be good as well.

e) While this also may be limited in terms of privacy considerations – some regional average appraisal value implied by mortgage originations (origination amount/original LTV) would be useful in complementing home price estimates derived from MLS and public records.

23. What factors should FHFA consider in determining whether to formally participate in or informally partner with organizations or groups focused on climate and natural disaster risk management?

The FHFA has a fairly specific mandate so would probably benefit from collaborations with groups that are focused on risk management by key stakeholders (borrowers, lenders, and investors). Ceres is potentially a good organization to partner with given their specific focus on capital markets, including mortgage finance.

24. Are there existing or potential government agencies or programs that FHFA could partner with to enhance the Agency's supervision and regulation of climate and natural disaster risk to the regulated entities?

One promising development on the supervision and regulation side is an effort by the CFTC to form a "Climate Risk Unit" to combine their own internal initiatives with those of the Treasury, SEC and Federal Reserve. The focus of this effort on risk pricing is particularly relevant to the mortgage agencies (given their potential exposure to asset mispricing), so involvement by the FHFA in this effort would be desirable.

FEMA recently undertook a robust initiative (Risk Rating 2.0) to integrate more up-to-date hazard modeling techniques with a government administered risk pricing program and likely learned many lessons to draw from in the process. Because the NFIP and other FEMA programs like individual assistance and directed SBA loans are such important parts of agency risk mitigation processes, consultation with FEMA on supervisory plans may enhance outcomes.

HUD will play a role in this effort as well and many agencies have some bearing on the overall discussion around climate risk. 13 government agencies contributed to the last National Climate Assessment through USGCRP membership (another program that the FHFA might draw from).

25. What, if any, other enhancements should FHFA consider to its supervision and regulation of each regulated entity's management of climate and natural disaster risk? Other enhancements could include but need not be limited to: (i) regulatory capital requirements or other loss absorbing capacity requirements that ensure each regulated entity has the capacity to absorb impacts of climate and natural disaster risk; (ii) disclosure requirements to provide shareholders, creditors, CRT or other investors, and other counterparties with appropriate information about a regulated entity's climate and natural disaster risk; and (iii) changes to FHFA's supervisory program to enhance examination of or reporting on each regulated entity's infrastructure and processes for identifying, assessing, mitigating, and monitoring the regulated entity's management of climate and natural disaster risk.

The ideas mentioned above cover the key enhancement elements; capital requirements to withstand potential risk events and disclosures so that all market participants have the tools they need to manage and price the risk.

i) Regulatory capital requirements that, combined with other loss absorption mechanisms (like CRT), would protect taxpayers from losses in a rational repricing scenario, would be a powerful regulatory enhancement. While the required scenario analysis is difficult and fraught with potential moral hazard issues, we believe this to be the most important regulatory opportunity that cannot be missed. Sadly, it is the agencies themselves that are creating the mispricing that could be their downfall by providing massive amounts of capital to fund purchases of at-risk properties. This needs to become a priority at the agencies, and a regulatory objective would make the mandate clear. We demonstrate in the included analyses that a complete risk audit can be performed using entirely intuitive financial modeling grounded in historical evidence. The challenges associated with the nascency of climate adjusted hazard modeling technology do not make this effort impossible, just difficult.

ii) Disclosure requirements are also essential, particularly if they help to clarify capital setting processes and the metrics involved. SASB recommends disclosure of exposure to SFHAs, descriptions of underwriting and origination processes that incorporate climate risk, and an actual attribution of credit risk to catastrophe driven defaults. We think additional disclosure on assumed "AAL" or average annual loss (a commonly used insurance industry risk metric), methodology for home value stress based on future cost expectations, and impact on mortgage pool loss expectation would be valuable.

FEMA's recent Risk Rating 2.0 initiative is a good template for the incorporation of new hazard modeling technology to influence pricing policy at a government agency. The modeling technology (from Millman) involved in that work only covers current risk which is all is needed to price one year NFIP policies. Agencies are generally exposed for 30 years and have exposure to even later years through home value. This requires an additional modelling layer involving expectations analysis which is more complex. It may make sense to start with current risk assessment requirements (leveraging the FEMA solution for flood perhaps and adding a wildfire solution), and address issues related to future risk in a 2nd phase.

iii) Incorporating scenario driven capital requirements and potentially new risk mitigation mechanisms in pricing and underwriting is a difficult undertaking so enhanced examination and reporting of entity infrastructure and processes will be important. Initially, FHFA should focus on examination and reporting of processes related to the primary existing risk mitigation tool, proof of continuous hazard insurance requirement (particularly with regard to flood insurance for properties in SFHAs).

26. To what extent, if any, should FHFA support efforts to develop standards of classification and data reporting on climate and natural disaster risk to the financial performance of companies, such as those by the Sustainability Accounting Standards Board, domestic and foreign government agencies, or others?

We do think it makes sense for FHFA to support SASB in the development of climate risk disclosure standards. Disclosure standards will enable more informative analysis by investors, thereby bolstering liquidity and efficiency in the mortgage market. If FHFA required that agencies adopt SASB standards, many other mortgage finance players would likely follow. Mortgage finance is one of 77 industries that SASB is involved with, so supporting them increases the probability that developed standards are applicable in cross-sector analysis as well.

For the Mortgage Finance industry, SASB currently suggests three material sustainability topics and accounting metrics related to Environmental Risk to Mortgage Properties (in addition to 10 others related to social and governance considerations). These are 1) number and amount of loans in SFHAs, 2) description of how climate change and environmental risk are incorporated in origination and underwriting and 3) amount and percentage of credit risk attributable to default risk from "weather-related natural catastrophes". We think it would be useful to amend the default risk metric to include credit risk attributable to possible *repricing* of properties due to anticipated cost increases in the future.

The FHFA should also support the TCFD which establishes higher-level principles and recommendations for disclosing climate risk. The CDSB (Climate Disclosure Standards Board) is another potential leader in climate risk reporting standards and should also be supported.

Summary by Agency Book

Book	Loan Count	Current Balance ($ Billion)	Loan Age	FICO	Original LTV	Current HPI LTV	Exposure % Non-SFHA High Flood Risk	Exposure % SFHA	Exposure % High Wildfire	Exposure % **Total Flood & Fire**	Klima Base Loss Non-SFHA High Flood Risk	Klima Base Loss SFHA	Klima Base Loss High Wildfire	Klima Base Loss **Total Flood & Fire**	**Total Flood & Fire ($ Billion)**	Klima Bear Loss Non-SFHA High Flood Risk	Klima Bear Loss SFHA	Klima Bear Loss High Wildfire	Klima Bear Loss **Total Flood & Fire**	**Total Flood & Fire ($ Billion)**
Freddie Mac (non-CRT)	5,806,302	1,027.9	40	756	60	40	6.2%	5.8%	6.4%	**18.5%**	0.05%	0.34%	0.12%	**0.51%**	**5.24**	0.22%	0.77%	0.25%	**1.23%**	**12.67**
Freddie Mac (CRT)	3,825,735	855.7	32	751	80	62	8.2%	6.4%	5.8%	**20.3%**	0.12%	0.52%	0.26%	**0.91%**	**7.75**	0.45%	1.14%	0.52%	**2.10%**	**18.00**
Fannie Mae (non-CRT)	9,005,983	1,860.5	26	753	64	49	6.5%	5.9%	6.9%	**19.3%**	0.08%	0.43%	0.16%	**0.67%**	**12.46**	0.30%	0.93%	0.32%	**1.55%**	**28.89**
Fannie Mae (CRT)	3,330,446	597.0	60	753	78	48	7.9%	6.2%	5.3%	**19.4%**	0.09%	0.42%	0.19%	**0.70%**	**4.18**	0.36%	0.99%	0.36%	**1.72%**	**10.26**
FHL Banks	10,107,670	1,785.0	42	700	91	68	7.9%	6.2%	6.1%	**20.1%**	0.18%	0.67%	0.24%	**1.09%**	**19.52**	0.52%	1.14%	0.44%	**2.10%**	**37.53**
Total	**32,076,136**	**6,126.2**	**37**	**738**	**72**	**53**	**7.2%**	**6.1%**	**6.3%**	**19.6%**	**0.11%**	**0.50%**	**0.19%**	**0.80%**	**49.16**	**0.38%**	**1.00%**	**0.38%**	**1.75%**	**107.35**

1. Loans located in geographic areas where we currently have no underlying scientific climate risk estimates (i.e. AK, HI, PR) have been excluded from the above calculations.
2. Current HPI LTV reflects both the amortization of principal balance and home price indexing from loan origination to December 2020 at the the CBSA (for CRT collateral) or state level provided by Zillow.
3. Losses are presented as a percentage of total current balance (not exposed balance).
4. Loan-level FICO, original balance and current balance characteristics were rounded to preserve anonymity for non-CRT collateral. Aggregate calculations above were computed on the rounded underlying data.
5. Statistics apply to modeled loans only. Approximately $500 billion in Freddie Mac balances, $800 billion in Fannie Mae balances and $250 billion in FHLBank balances were unmodeled due to insufficient data or model coverage.

Freddie Mac (non-CRT) Book by Geographic Region

Geographic Region	Loan Count	Current Balance ($ Billion)	Loan Age	FICO	Original LTV	Current HPI LTV	Exposure % Non-SFHA High Flood Risk	Exposure % SFHA	Exposure % High Wildfire	Exposure % **Total Flood & Fire**	Klima Base Loss Non-SFHA High Flood Risk	Klima Base Loss SFHA	Klima Base Loss High Wildfire	Klima Base Loss **Total Flood & Fire**	**Total Flood & Fire ($ Billion)**	Klima Bear Loss Non-SFHA High Flood Risk	Klima Bear Loss SFHA	Klima Bear Loss High Wildfire	Klima Bear Loss **Total Flood & Fire**	**Total Flood & Fire ($ Billion)**
Alabama	52,019	6.9	47	752	67	43	2.6%	7.3%	0.1%	**10.0%**	0.02%	0.18%	0.00%	**0.20%**	**0.01**	0.11%	0.53%	0.00%	**0.64%**	**0.04**
Arizona	164,359	29.0	29	756	63	47	9.1%	3.3%	14.5%	**26.9%**	0.05%	0.02%	0.14%	**0.21%**	**0.06**	0.07%	0.03%	0.30%	**0.41%**	**0.12**
Arkansas	35,495	4.4	42	753	68	44	2.6%	5.6%	6.1%	**14.2%**	0.04%	0.06%	0.03%	**0.13%**	**0.01**	0.15%	0.10%	0.03%	**0.28%**	**0.01**
California	825,398	217.2	36	760	50	35	1.7%	3.3%	17.7%	**22.8%**	0.01%	0.04%	0.37%	**0.41%**	**0.89**	0.02%	0.06%	0.70%	**0.78%**	**1.69**
Colorado	146,697	32.5	28	762	58	43	1.5%	2.5%	8.5%	**12.5%**	0.00%	0.02%	0.02%	**0.04%**	**0.01**	0.01%	0.02%	0.07%	**0.10%**	**0.03**
Connecticut	62,024	10.3	58	754	61	34	6.4%	7.2%	0.0%	**13.7%**	0.02%	0.18%	0.00%	**0.21%**	**0.02**	0.03%	0.61%	0.00%	**0.64%**	**0.07**
Delaware	21,745	3.6	48	756	62	39	10.9%	10.5%	0.0%	**21.4%**	0.08%	1.31%	0.00%	**1.39%**	**0.05**	0.30%	4.78%	0.00%	**5.08%**	**0.18**
District of Columbia	14,306	4.2	40	761	54	37	2.6%	0.4%	0.0%	**3.0%**	0.00%	0.01%	0.00%	**0.01%**	**0.00**	0.00%	0.01%	0.00%	**0.02%**	**0.00**
Florida	335,540	54.0	38	751	63	44	48.9%	25.0%	9.7%	**83.6%**	0.55%	3.69%	0.13%	**4.37%**	**2.36**	3.01%	6.79%	0.26%	**10.06%**	**5.44**
Georgia	150,803	20.9	54	751	67	40	1.8%	5.1%	2.2%	**9.1%**	0.01%	0.08%	0.01%	**0.10%**	**0.02**	0.01%	0.27%	0.01%	**0.29%**	**0.06**
Idaho	34,720	5.7	32	754	63	46	5.9%	3.5%	19.2%	**28.6%**	0.03%	0.03%	0.21%	**0.27%**	**0.02**	0.04%	0.05%	0.67%	**0.75%**	**0.04**
Illinois	287,064	43.3	42	757	65	41	1.2%	3.2%	0.0%	**4.4%**	0.01%	0.03%	0.00%	**0.03%**	**0.02**	0.01%	0.04%	0.00%	**0.05%**	**0.02**
Indiana	140,025	15.9	40	753	67	43	1.6%	5.3%	0.0%	**7.0%**	0.01%	0.06%	0.00%	**0.07%**	**0.01**	0.01%	0.09%	0.00%	**0.10%**	**0.02**
Iowa	49,309	5.6	43	760	67	41	2.8%	4.1%	0.0%	**6.9%**	0.01%	0.04%	0.00%	**0.05%**	**0.00**	0.02%	0.08%	0.00%	**0.09%**	**0.01**
Kansas	46,251	5.8	43	756	68	42	3.6%	3.7%	0.4%	**7.7%**	0.03%	0.04%	0.00%	**0.07%**	**0.00**	0.05%	0.06%	0.00%	**0.11%**	**0.01**
Kentucky	70,438	8.0	48	753	65	39	1.6%	4.9%	1.5%	**8.0%**	0.01%	0.05%	0.01%	**0.07%**	**0.01**	0.02%	0.08%	0.01%	**0.11%**	**0.01**
Louisiana	51,619	7.3	44	747	65	42	38.1%	25.9%	0.7%	**64.7%**	0.55%	1.78%	0.00%	**2.33%**	**0.17**	2.10%	3.30%	0.01%	**5.41%**	**0.40**
Maine	22,206	3.3	46	755	61	38	20.4%	8.8%	0.0%	**29.2%**	0.10%	0.41%	0.00%	**0.51%**	**0.02**	0.18%	1.53%	0.00%	**1.71%**	**0.06**
Maryland	136,387	27.4	45	756	62	39	6.3%	3.8%	0.1%	**10.2%**	0.06%	0.39%	0.00%	**0.45%**	**0.12**	0.22%	1.10%	0.00%	**1.32%**	**0.36**
Massachusetts	158,539	35.9	38	756	56	38	4.4%	6.6%	0.0%	**11.0%**	0.01%	0.23%	0.00%	**0.24%**	**0.09**	0.02%	0.77%	0.00%	**0.78%**	**0.28**
Michigan	212,001	26.4	38	752	67	44	1.5%	3.9%	0.0%	**5.4%**	0.01%	0.04%	0.00%	**0.04%**	**0.01**	0.01%	0.05%	0.00%	**0.07%**	**0.02**
Minnesota	148,369	22.7	42	760	66	42	2.7%	4.1%	0.2%	**7.0%**	0.01%	0.04%	0.00%	**0.05%**	**0.01**	0.02%	0.06%	0.00%	**0.09%**	**0.02**
Mississippi	17,073	2.1	50	742	68	42	4.4%	10.2%	6.2%	**20.8%**	0.03%	0.28%	0.03%	**0.34%**	**0.01**	0.05%	0.79%	0.04%	**0.87%**	**0.02**
Missouri	113,228	14.4	42	756	66	42	1.1%	3.5%	0.0%	**4.7%**	0.01%	0.04%	0.00%	**0.04%**	**0.01**	0.01%	0.07%	0.00%	**0.08%**	**0.01**
Montana	18,634	3.0	40	759	60	40	8.3%	3.9%	13.2%	**25.4%**	0.03%	0.04%	0.07%	**0.14%**	**0.00**	0.04%	0.09%	0.26%	**0.39%**	**0.01**
Nebraska	29,463	3.6	36	759	66	43	3.6%	4.5%	0.0%	**8.1%**	0.02%	0.05%	0.00%	**0.07%**	**0.00**	0.03%	0.10%	0.00%	**0.13%**	**0.00**
Nevada	58,836	10.6	32	752	65	48	4.2%	2.1%	16.4%	**22.7%**	0.02%	0.02%	1.18%	**1.22%**	**0.13**	0.04%	0.04%	1.74%	**1.83%**	**0.19**
New Hampshire	30,757	5.3	39	754	64	42	6.5%	6.3%	0.0%	**12.8%**	0.03%	0.29%	0.00%	**0.31%**	**0.02**	0.04%	0.79%	0.00%	**0.83%**	**0.04**
New Jersey	179,849	38.1	40	755	60	39	3.0%	9.8%	1.2%	**13.9%**	0.03%	0.65%	0.00%	**0.69%**	**0.26**	0.10%	2.28%	0.01%	**2.40%**	**0.91**
New Mexico	28,616	4.0	49	752	64	40	1.0%	5.3%	16.6%	**22.9%**	0.01%	0.04%	0.27%	**0.31%**	**0.01**	0.01%	0.05%	0.58%	**0.64%**	**0.03**
New York	208,053	39.3	56	749	55	33	5.9%	5.4%	0.0%	**11.3%**	0.03%	0.41%	0.00%	**0.45%**	**0.18**	0.10%	1.36%	0.00%	**1.45%**	**0.57**
North Carolina	193,450	28.3	46	757	64	40	3.5%	6.8%	0.5%	**10.9%**	0.03%	0.43%	0.00%	**0.46%**	**0.13**	0.08%	1.42%	0.00%	**1.50%**	**0.43**
North Dakota	11,718	1.7	37	760	67	43	28.4%	12.7%	0.0%	**41.1%**	0.17%	0.21%	0.00%	**0.38%**	**0.01**	0.31%	0.62%	0.00%	**0.93%**	**0.02**
Ohio	224,397	27.0	39	755	68	43	1.0%	3.0%	0.0%	**3.9%**	0.01%	0.03%	0.00%	**0.04%**	**0.01**	0.01%	0.04%	0.00%	**0.05%**	**0.01**
Oklahoma	42,950	5.2	44	751	69	44	0.4%	4.9%	9.5%	**14.8%**	0.00%	0.05%	0.05%	**0.10%**	**0.01**	0.00%	0.06%	0.08%	**0.14%**	**0.01**
Oregon	105,289	20.4	36	762	60	42	1.0%	3.4%	4.8%	**9.2%**	0.00%	0.04%	0.02%	**0.06%**	**0.01**	0.01%	0.07%	0.04%	**0.13%**	**0.03**
Pennsylvania	199,589	28.6	47	755	65	40	0.9%	3.3%	0.0%	**4.2%**	0.01%	0.04%	0.00%	**0.04%**	**0.01**	0.01%	0.07%	0.00%	**0.08%**	**0.02**
Rhode Island	18,956	3.2	43	754	61	40	4.4%	7.7%	0.0%	**12.2%**	0.01%	0.43%	0.00%	**0.45%**	**0.01**	0.02%	1.44%	0.00%	**1.46%**	**0.05**
South Carolina	83,250	12.2	42	755	64	42	7.6%	17.8%	0.7%	**26.1%**	0.03%	0.69%	0.00%	**0.73%**	**0.09**	0.06%	2.54%	0.00%	**2.60%**	**0.32**
South Dakota	8,620	1.1	39	760	64	41	6.3%	4.8%	13.3%	**24.3%**	0.04%	0.07%	0.04%	**0.16%**	**0.00**	0.09%	0.24%	0.07%	**0.39%**	**0.00**
Tennessee	98,698	15.1	36	753	65	44	1.4%	4.5%	0.1%	**5.9%**	0.01%	0.05%	0.00%	**0.06%**	**0.01**	0.01%	0.09%	0.00%	**0.10%**	**0.02**
Texas	366,275	57.5	37	750	65	43	13.7%	6.9%	1.7%	**22.3%**	0.08%	0.14%	0.01%	**0.23%**	**0.13**	0.15%	0.38%	0.02%	**0.55%**	**0.32**
Utah	81,253	16.9	25	758	62	47	0.4%	1.6%	34.5%	**36.5%**	0.00%	0.01%	0.99%	**1.01%**	**0.17**	0.01%	0.01%	2.72%	**2.75%**	**0.46**
Vermont	10,560	1.3	77	755	59	30	13.1%	4.6%	0.0%	**17.6%**	0.05%	0.03%	0.00%	**0.08%**	**0.00**	0.06%	0.07%	0.00%	**0.13%**	**0.00**
Virginia	184,608	38.1	41	762	61	40	3.2%	4.6%	0.0%	**7.8%**	0.01%	0.17%	0.00%	**0.18%**	**0.07**	0.03%	0.51%	0.00%	**0.54%**	**0.21**
Washington	188,343	43.4	32	760	58	42	1.9%	2.9%	2.9%	**7.7%**	0.01%	0.05%	0.02%	**0.08%**	**0.03**	0.04%	0.13%	0.06%	**0.23%**	**0.10**
West Virginia	16,010	1.7	57	746	67	39	11.8%	6.3%	0.4%	**18.5%**	0.08%	0.09%	0.00%	**0.17%**	**0.00**	0.10%	0.22%	0.00%	**0.32%**	**0.01**
Wisconsin	115,285	14.5	45	758	64	39	2.7%	4.1%	0.0%	**6.8%**	0.01%	0.04%	0.00%	**0.05%**	**0.01**	0.02%	0.07%	0.00%	**0.08%**	**0.01**
Wyoming	7,228	1.2	38	756	58	39	2.1%	4.1%	3.2%	**9.4%**	0.01%	0.03%	0.01%	**0.05%**	**0.00**	0.02%	0.05%	0.01%	**0.07%**	**0.00**
Total	5,806,302	1,027.9	40	756	60	40	6.2%	5.8%	6.4%	**18.5%**	0.05%	0.34%	0.12%	**0.51%**	**5.24**	0.22%	0.77%	0.25%	**1.23%**	**12.67**

1. Loans located in geographic areas where we currently have no underlying scientific climate risk estimates (i.e. AK, HI, PR) have been excluded from the above calculations.
2. Current HPI LTV reflects both the amortization of principal balance and home price indexing from loan origination to December 2020 at the state level provided by Zillow.
3. Losses are presented as a percentage of total current balance (not exposed balance).
4. Loan-level FICO, original balance and current balance characteristics were rounded to preserve anonymity. Aggregate calculations above were computed on the rounded underlying data.

Freddie Mac (CRT) Book by Geographic Region

Geographic Region	Loan Count	Current Balance ($ Billion)	Loan Age	FICO	Original LTV	Current HPI LTV	Exposure % Non-SFHA High Flood Risk	Exposure % SFHA	Exposure % High Wildfire	Exposure % **Total Flood & Fire**	Klima Base Loss Non-SFHA High Flood Risk	Klima Base Loss SFHA	Klima Base Loss High Wildfire	Klima Base Loss **Total Flood & Fire**	**Total Flood & Fire ($ Billion)**	Klima Bear Loss Non-SFHA High Flood Risk	Klima Bear Loss SFHA	Klima Bear Loss High Wildfire	Klima Bear Loss **Total Flood & Fire**	**Total Flood & Fire ($ Billion)**
Alabama	43,553	8.0	31	752	83	65	2.4%	7.0%	0.1%	**9.6%**	0.03%	0.22%	0.00%	**0.25%**	**0.02**	0.15%	0.65%	0.00%	**0.80%**	**0.06**
Arizona	106,084	23.0	26	751	80	59	14.6%	3.1%	15.5%	**33.2%**	0.10%	0.03%	0.26%	**0.40%**	**0.09**	0.16%	0.05%	0.66%	**0.87%**	**0.20**
Arkansas	29,909	4.9	33	751	83	65	2.5%	6.1%	10.4%	**19.0%**	0.06%	0.08%	0.06%	**0.20%**	**0.01**	0.21%	0.15%	0.08%	**0.43%**	**0.02**
California	371,745	121.8	34	751	76	57	2.8%	3.5%	19.0%	**25.2%**	0.02%	0.06%	1.15%	**1.24%**	**1.51**	0.07%	0.10%	2.13%	**2.31%**	**2.81**
Colorado	100,654	27.8	28	755	79	61	2.0%	2.6%	7.4%	**12.0%**	0.01%	0.03%	0.07%	**0.11%**	**0.03**	0.02%	0.04%	0.26%	**0.32%**	**0.09**
Connecticut	44,917	10.2	37	752	82	66	7.4%	7.3%	0.0%	**14.7%**	0.06%	0.39%	0.00%	**0.44%**	**0.04**	0.08%	1.20%	0.00%	**1.28%**	**0.13**
Delaware	13,248	3.0	33	755	81	65	10.9%	10.4%	0.0%	**21.3%**	0.20%	3.08%	0.00%	**3.28%**	**0.10**	0.67%	7.44%	0.00%	**8.10%**	**0.24**
District of Columbia	9,375	3.6	36	763	79	63	4.1%	0.3%	0.0%	**4.4%**	0.01%	0.01%	0.00%	**0.02%**	**0.00**	0.01%	0.01%	0.00%	**0.03%**	**0.00**
Florida	262,942	54.0	31	748	81	62	48.0%	25.1%	11.0%	**84.1%**	0.96%	3.90%	0.24%	**5.09%**	**2.75**	4.67%	7.27%	0.48%	**12.42%**	**6.71**
Georgia	119,965	24.7	30	750	82	62	2.1%	5.4%	2.3%	**9.9%**	0.02%	0.21%	0.02%	**0.25%**	**0.06**	0.04%	0.59%	0.04%	**0.67%**	**0.16**
Idaho	26,327	5.5	27	749	80	56	8.3%	3.6%	17.3%	**29.1%**	0.07%	0.04%	0.49%	**0.61%**	**0.03**	0.12%	0.07%	1.35%	**1.55%**	**0.09**
Illinois	179,323	35.1	34	753	82	66	1.8%	3.2%	0.0%	**4.9%**	0.01%	0.05%	0.00%	**0.06%**	**0.02**	0.02%	0.09%	0.00%	**0.11%**	**0.04**
Indiana	97,711	15.1	30	748	83	64	2.3%	5.7%	0.0%	**8.0%**	0.02%	0.08%	0.00%	**0.10%**	**0.01**	0.02%	0.13%	0.00%	**0.16%**	**0.02**
Iowa	33,598	5.4	33	752	83	66	3.2%	4.4%	0.0%	**7.6%**	0.03%	0.08%	0.00%	**0.11%**	**0.01**	0.05%	0.16%	0.00%	**0.21%**	**0.01**
Kansas	35,195	5.9	34	752	83	63	4.3%	3.9%	0.8%	**8.9%**	0.05%	0.05%	0.01%	**0.11%**	**0.01**	0.08%	0.09%	0.02%	**0.19%**	**0.01**
Kentucky	50,495	8.2	33	751	82	63	2.0%	5.5%	1.9%	**9.5%**	0.03%	0.08%	0.02%	**0.12%**	**0.01**	0.04%	0.14%	0.03%	**0.21%**	**0.02**
Louisiana	40,259	7.8	33	746	82	69	38.6%	28.1%	1.2%	**67.9%**	1.32%	2.83%	0.03%	**4.19%**	**0.33**	4.61%	5.01%	0.09%	**9.70%**	**0.76**
Maine	16,935	3.4	33	754	80	60	20.1%	8.8%	0.0%	**28.9%**	0.18%	0.80%	0.00%	**0.98%**	**0.03**	0.30%	2.30%	0.00%	**2.60%**	**0.09**
Maryland	81,412	21.9	35	755	81	66	7.1%	4.1%	0.2%	**11.3%**	0.14%	0.67%	0.00%	**0.81%**	**0.18**	0.44%	1.57%	0.01%	**2.01%**	**0.44**
Massachusetts	89,626	25.7	34	751	79	60	5.4%	7.0%	0.0%	**12.4%**	0.03%	0.45%	0.00%	**0.48%**	**0.12**	0.04%	1.41%	0.00%	**1.46%**	**0.37**
Michigan	135,654	22.2	30	748	82	62	1.9%	3.9%	0.0%	**5.8%**	0.02%	0.05%	0.00%	**0.06%**	**0.01**	0.03%	0.07%	0.00%	**0.10%**	**0.02**
Minnesota	97,979	20.4	33	754	82	63	4.4%	4.1%	0.3%	**8.8%**	0.04%	0.06%	0.00%	**0.10%**	**0.02**	0.07%	0.12%	0.01%	**0.20%**	**0.04**
Mississippi	14,172	2.5	32	745	83	66	5.1%	11.2%	5.5%	**21.8%**	0.06%	0.42%	0.04%	**0.52%**	**0.01**	0.11%	1.14%	0.05%	**1.30%**	**0.03**
Missouri	81,323	13.6	33	753	82	64	1.9%	3.9%	0.0%	**5.8%**	0.03%	0.06%	0.00%	**0.09%**	**0.01**	0.06%	0.14%	0.00%	**0.20%**	**0.03**
Montana	14,834	3.2	34	755	80	61	10.2%	4.1%	13.6%	**27.9%**	0.07%	0.07%	0.23%	**0.37%**	**0.01**	0.10%	0.16%	0.62%	**0.88%**	**0.03**
Nebraska	18,555	3.1	31	752	82	64	4.3%	4.8%	0.0%	**9.1%**	0.04%	0.08%	0.00%	**0.12%**	**0.00**	0.08%	0.19%	0.00%	**0.27%**	**0.01**
Nevada	40,744	9.4	27	748	80	61	6.2%	2.1%	15.0%	**23.3%**	0.05%	0.03%	1.45%	**1.53%**	**0.14**	0.10%	0.07%	1.82%	**1.99%**	**0.19**
New Hampshire	22,040	4.9	33	751	81	62	8.1%	6.6%	0.0%	**14.7%**	0.07%	0.41%	0.00%	**0.48%**	**0.02**	0.09%	1.02%	0.00%	**1.11%**	**0.05**
New Jersey	102,473	27.8	34	751	80	65	3.9%	9.5%	1.2%	**14.6%**	0.09%	1.37%	0.01%	**1.47%**	**0.41**	0.26%	3.29%	0.04%	**3.59%**	**1.00**
New Mexico	18,006	3.4	33	751	81	62	1.7%	5.7%	13.5%	**20.8%**	0.02%	0.05%	0.61%	**0.68%**	**0.02**	0.02%	0.07%	1.13%	**1.23%**	**0.04**
New York	148,295	37.9	39	749	79	62	7.5%	5.5%	0.0%	**13.0%**	0.11%	1.00%	0.00%	**1.11%**	**0.42**	0.30%	2.20%	0.00%	**2.50%**	**0.95**
North Carolina	127,475	25.3	33	755	82	61	3.9%	6.8%	0.7%	**11.5%**	0.07%	0.77%	0.00%	**0.84%**	**0.21**	0.15%	2.18%	0.01%	**2.34%**	**0.59**
North Dakota	10,286	2.1	35	752	83	67	29.2%	12.5%	0.1%	**41.8%**	0.29%	0.34%	0.00%	**0.64%**	**0.01**	0.60%	1.12%	0.00%	**1.72%**	**0.04**
Ohio	155,362	24.1	32	751	83	63	1.4%	3.1%	0.0%	**4.5%**	0.01%	0.04%	0.00%	**0.05%**	**0.01**	0.02%	0.07%	0.00%	**0.08%**	**0.02**
Oklahoma	36,986	6.3	31	750	84	67	0.4%	5.1%	11.7%	**17.2%**	0.00%	0.06%	0.09%	**0.15%**	**0.01**	0.00%	0.08%	0.16%	**0.24%**	**0.02**
Oregon	70,897	18.2	31	756	79	60	1.5%	3.7%	5.5%	**10.7%**	0.01%	0.05%	0.04%	**0.11%**	**0.02**	0.03%	0.12%	0.10%	**0.26%**	**0.05**
Pennsylvania	132,268	25.0	36	754	82	64	1.4%	3.4%	0.0%	**4.8%**	0.01%	0.05%	0.00%	**0.06%**	**0.02**	0.02%	0.11%	0.00%	**0.12%**	**0.03**
Rhode Island	13,234	2.9	34	752	80	61	4.7%	7.5%	0.0%	**12.2%**	0.03%	0.58%	0.00%	**0.61%**	**0.02**	0.04%	2.22%	0.00%	**2.26%**	**0.07**
South Carolina	61,309	11.8	31	752	82	64	10.7%	16.3%	1.0%	**28.0%**	0.09%	1.14%	0.01%	**1.23%**	**0.15**	0.14%	4.04%	0.01%	**4.19%**	**0.49**
South Dakota	6,705	1.3	27	753	82	66	5.4%	5.2%	18.5%	**29.1%**	0.07%	0.10%	0.18%	**0.35%**	**0.00**	0.14%	0.28%	0.31%	**0.73%**	**0.01**
Tennessee	76,594	15.2	30	751	82	62	1.8%	4.7%	0.1%	**6.5%**	0.01%	0.07%	0.00%	**0.08%**	**0.01**	0.02%	0.14%	0.00%	**0.16%**	**0.03**
Texas	302,608	64.9	31	747	82	64	17.0%	7.2%	2.5%	**26.8%**	0.15%	0.21%	0.02%	**0.38%**	**0.25**	0.33%	0.57%	0.04%	**0.95%**	**0.61**
Utah	59,446	15.1	25	753	80	60	0.6%	1.7%	29.7%	**32.0%**	0.01%	0.02%	2.52%	**2.54%**	**0.38**	0.02%	0.02%	5.81%	**5.85%**	**0.89**
Vermont	11,435	2.2	42	756	80	60	16.8%	4.6%	0.0%	**21.4%**	0.14%	0.08%	0.00%	**0.22%**	**0.00**	0.19%	0.19%	0.00%	**0.38%**	**0.01**
Virginia	112,250	30.3	34	758	81	64	4.2%	5.0%	0.1%	**9.3%**	0.04%	0.33%	0.00%	**0.37%**	**0.11**	0.08%	0.85%	0.00%	**0.94%**	**0.28**
Washington	109,314	31.5	28	753	79	58	2.7%	3.2%	3.5%	**9.4%**	0.03%	0.08%	0.05%	**0.17%**	**0.05**	0.11%	0.22%	0.21%	**0.54%**	**0.17**
West Virginia	12,202	1.9	38	748	82	65	15.3%	7.2%	0.7%	**23.2%**	0.18%	0.19%	0.01%	**0.38%**	**0.01**	0.26%	0.53%	0.01%	**0.80%**	**0.02**
Wisconsin	74,077	12.9	34	754	81	61	3.4%	4.2%	0.0%	**7.6%**	0.03%	0.06%	0.00%	**0.09%**	**0.01**	0.04%	0.12%	0.00%	**0.16%**	**0.02**
Wyoming	5,939	1.3	33	749	81	64	3.7%	3.5%	5.4%	**12.6%**	0.05%	0.05%	0.03%	**0.13%**	**0.00**	0.08%	0.10%	0.04%	**0.22%**	**0.00**
Total	3,825,735	855.7	32	751	80	62	8.2%	6.4%	5.8%	**20.3%**	0.12%	0.52%	0.26%	**0.91%**	**7.75**	0.45%	1.14%	0.52%	**2.10%**	**18.00**

1. Loans located in geographic areas where we currently have no underlying scientific climate risk estimates (i.e. AK, HI, PR) have been excluded from the above calculations.
2. Current HPI LTV reflects both the amortization of principal balance and home price indexing from loan origination to December 2020 at the CBSA level provided by Zillow.
3. Losses are presented as a percentage of total current balance (not exposed balance).

Fannie Mae (non-CRT) Book by Geographic Region

Geographic Region	Loan Count	Current Balance ($ Billion)	Loan Age	FICO	Original LTV	Current HPI LTV	Exposure % Non-SFHA High Flood Risk	Exposure % SFHA	Exposure % High Wildfire	Exposure % **Total Flood & Fire**	Klima Base Loss Non-SFHA High Flood Risk	Klima Base Loss SFHA	Klima Base Loss High Wildfire	Klima Base Loss **Total Flood & Fire**	Klima Base Loss **Total Flood & Fire ($ Billion)**	Klima Bear Loss Non-SFHA High Flood Risk	Klima Bear Loss SFHA	Klima Bear Loss High Wildfire	Klima Bear Loss **Total Flood & Fire**	Klima Bear Loss **Total Flood & Fire ($ Billion)**
Alabama	89,844	13.7	31	749	72	52	3.6%	8.2%	0.1%	**11.8%**	0.03%	0.27%	0.00%	**0.31%**	**0.04**	0.24%	0.77%	0.00%	**1.01%**	**0.14**
Arizona	299,641	59.6	21	752	68	55	10.0%	3.0%	13.9%	**27.0%**	0.07%	0.03%	0.16%	**0.26%**	**0.16**	0.11%	0.05%	0.38%	**0.53%**	**0.32**
Arkansas	52,988	7.8	25	752	71	54	2.6%	5.6%	7.0%	**15.1%**	0.06%	0.08%	0.04%	**0.18%**	**0.01**	0.20%	0.13%	0.05%	**0.38%**	**0.03**
California	1,362,324	399.5	25	757	54	42	1.7%	3.3%	18.5%	**23.5%**	0.01%	0.04%	0.44%	**0.50%**	**1.98**	0.02%	0.07%	0.85%	**0.95%**	**3.80**
Colorado	285,107	71.9	19	759	64	52	1.4%	2.5%	7.5%	**11.4%**	0.00%	0.02%	0.02%	**0.05%**	**0.04**	0.01%	0.03%	0.09%	**0.13%**	**0.10**
Connecticut	79,427	14.6	40	749	67	45	6.4%	7.1%	0.0%	**13.5%**	0.03%	0.24%	0.00%	**0.27%**	**0.04**	0.04%	0.79%	0.00%	**0.83%**	**0.12**
Delaware	33,107	6.2	31	753	68	50	10.5%	9.8%	0.0%	**20.4%**	0.12%	1.79%	0.00%	**1.91%**	**0.12**	0.40%	5.45%	0.00%	**5.85%**	**0.37**
District of Columbia	21,745	7.1	28	760	59	45	2.7%	0.4%	0.0%	**3.1%**	0.00%	0.01%	0.00%	**0.01%**	**0.00**	0.01%	0.03%	0.00%	**0.04%**	**0.00**
Florida	604,785	111.9	27	745	70	54	48.5%	24.6%	9.3%	**82.4%**	0.77%	4.19%	0.14%	**5.10%**	**5.70**	3.69%	7.45%	0.28%	**11.42%**	**12.78**
Georgia	206,269	35.1	34	747	71	51	1.5%	4.9%	1.7%	**8.1%**	0.01%	0.12%	0.01%	**0.14%**	**0.05**	0.02%	0.33%	0.01%	**0.36%**	**0.13**
Idaho	75,314	14.5	19	753	68	56	5.5%	3.3%	18.1%	**26.9%**	0.03%	0.04%	0.29%	**0.36%**	**0.05**	0.06%	0.06%	0.85%	**0.96%**	**0.14**
Illinois	370,514	62.5	28	753	70	52	1.3%	3.2%	0.0%	**4.5%**	0.01%	0.04%	0.00%	**0.05%**	**0.03**	0.01%	0.07%	0.00%	**0.08%**	**0.05**
Indiana	159,142	22.5	23	750	71	55	1.5%	5.0%	0.0%	**6.5%**	0.01%	0.07%	0.00%	**0.08%**	**0.02**	0.02%	0.12%	0.00%	**0.13%**	**0.03**
Iowa	93,515	13.3	24	757	71	54	1.7%	4.3%	0.0%	**6.0%**	0.01%	0.06%	0.00%	**0.07%**	**0.01**	0.02%	0.11%	0.00%	**0.13%**	**0.02**
Kansas	53,905	8.6	24	755	71	55	2.1%	3.4%	0.3%	**5.8%**	0.02%	0.05%	0.00%	**0.07%**	**0.01**	0.04%	0.07%	0.01%	**0.11%**	**0.01**
Kentucky	67,545	9.8	27	748	71	53	0.6%	4.6%	0.6%	**5.8%**	0.01%	0.07%	0.00%	**0.08%**	**0.01**	0.01%	0.11%	0.01%	**0.12%**	**0.01**
Louisiana	82,347	13.3	29	745	68	50	37.5%	26.0%	0.8%	**64.3%**	0.69%	1.90%	0.01%	**2.60%**	**0.35**	2.50%	3.56%	0.02%	**6.08%**	**0.81**
Maine	22,891	3.8	31	751	65	48	17.5%	8.4%	0.0%	**25.9%**	0.09%	0.52%	0.00%	**0.61%**	**0.02**	0.15%	1.66%	0.00%	**1.81%**	**0.07**
Maryland	197,432	46.0	29	753	69	51	6.6%	4.0%	0.1%	**10.7%**	0.12%	0.58%	0.00%	**0.70%**	**0.32**	0.39%	1.40%	0.00%	**1.79%**	**0.83**
Massachusetts	212,440	52.7	27	754	60	45	4.4%	6.6%	0.0%	**11.0%**	0.02%	0.30%	0.00%	**0.32%**	**0.17**	0.02%	0.95%	0.00%	**0.97%**	**0.51**
Michigan	306,422	45.3	25	750	70	53	1.3%	3.8%	0.0%	**5.2%**	0.01%	0.04%	0.00%	**0.06%**	**0.02**	0.02%	0.06%	0.00%	**0.08%**	**0.04**
Minnesota	235,799	44.7	23	758	71	55	2.7%	4.1%	0.2%	**7.0%**	0.02%	0.05%	0.00%	**0.07%**	**0.03**	0.04%	0.09%	0.00%	**0.13%**	**0.06**
Mississippi	35,598	4.9	34	742	71	50	4.0%	10.0%	5.1%	**19.1%**	0.03%	0.34%	0.03%	**0.40%**	**0.02**	0.06%	0.87%	0.04%	**0.97%**	**0.05**
Missouri	157,221	23.8	24	754	70	54	1.1%	3.5%	0.0%	**4.7%**	0.01%	0.05%	0.00%	**0.06%**	**0.01**	0.02%	0.10%	0.00%	**0.12%**	**0.03**
Montana	32,323	6.3	24	757	65	51	7.8%	4.0%	11.2%	**23.0%**	0.04%	0.06%	0.07%	**0.17%**	**0.01**	0.06%	0.14%	0.20%	**0.39%**	**0.02**
Nebraska	62,340	9.2	24	758	71	54	2.4%	4.4%	0.0%	**6.8%**	0.02%	0.06%	0.00%	**0.08%**	**0.01**	0.03%	0.11%	0.00%	**0.15%**	**0.01**
Nevada	121,476	25.6	21	747	70	57	4.6%	2.1%	15.9%	**22.6%**	0.03%	0.03%	1.22%	**1.28%**	**0.33**	0.06%	0.06%	1.75%	**1.87%**	**0.48**
New Hampshire	38,771	7.5	27	750	68	51	5.6%	6.2%	0.0%	**11.8%**	0.03%	0.36%	0.00%	**0.39%**	**0.03**	0.04%	0.96%	0.00%	**1.00%**	**0.07**
New Jersey	267,829	62.2	29	751	65	48	3.3%	10.0%	1.2%	**14.5%**	0.06%	0.94%	0.01%	**1.00%**	**0.62**	0.16%	2.78%	0.02%	**2.96%**	**1.84**
New Mexico	50,594	8.2	29	750	69	52	0.8%	4.9%	14.7%	**20.4%**	0.01%	0.05%	0.33%	**0.38%**	**0.03**	0.01%	0.06%	0.66%	**0.74%**	**0.06**
New York	289,550	65.0	38	748	58	40	6.1%	5.6%	0.0%	**11.7%**	0.05%	0.60%	0.00%	**0.65%**	**0.42**	0.14%	1.67%	0.00%	**1.81%**	**1.18**
North Carolina	287,974	53.5	24	756	69	54	2.9%	6.5%	0.4%	**9.9%**	0.04%	0.58%	0.00%	**0.62%**	**0.33**	0.09%	1.65%	0.00%	**1.74%**	**0.93**
North Dakota	16,494	3.0	23	761	68	52	28.6%	13.1%	0.0%	**41.7%**	0.19%	0.25%	0.00%	**0.44%**	**0.01**	0.36%	0.74%	0.00%	**1.10%**	**0.03**
Ohio	250,198	34.1	27	749	73	54	0.7%	3.0%	0.0%	**3.7%**	0.01%	0.04%	0.00%	**0.05%**	**0.02**	0.01%	0.06%	0.00%	**0.07%**	**0.02**
Oklahoma	67,247	9.7	28	750	72	52	0.3%	4.8%	8.4%	**13.5%**	0.00%	0.05%	0.05%	**0.11%**	**0.01**	0.00%	0.07%	0.08%	**0.16%**	**0.02**
Oregon	164,122	38.2	22	759	65	52	1.1%	3.5%	5.0%	**9.7%**	0.01%	0.05%	0.03%	**0.08%**	**0.03**	0.02%	0.10%	0.07%	**0.20%**	**0.07**
Pennsylvania	289,938	48.9	30	753	69	50	0.9%	3.2%	0.0%	**4.1%**	0.01%	0.05%	0.00%	**0.06%**	**0.03**	0.01%	0.10%	0.00%	**0.11%**	**0.05**
Rhode Island	26,177	5.1	29	750	67	50	4.3%	7.4%	0.0%	**11.7%**	0.02%	0.45%	0.00%	**0.47%**	**0.02**	0.03%	1.67%	0.00%	**1.70%**	**0.09**
South Carolina	130,571	22.7	25	753	69	53	8.0%	17.6%	0.9%	**26.5%**	0.05%	0.83%	0.00%	**0.89%**	**0.20**	0.08%	3.05%	0.00%	**3.14%**	**0.71**
South Dakota	19,789	2.9	28	758	68	50	7.1%	4.9%	10.1%	**22.0%**	0.05%	0.10%	0.05%	**0.20%**	**0.01**	0.12%	0.31%	0.08%	**0.51%**	**0.01**
Tennessee	155,516	28.4	22	752	70	55	1.5%	4.4%	0.0%	**6.0%**	0.01%	0.07%	0.00%	**0.07%**	**0.02**	0.02%	0.12%	0.00%	**0.14%**	**0.04**
Texas	653,016	119.1	26	746	69	52	12.6%	6.9%	1.8%	**21.3%**	0.10%	0.19%	0.01%	**0.30%**	**0.35**	0.21%	0.47%	0.02%	**0.70%**	**0.84**
Utah	144,234	34.0	16	756	67	56	0.5%	1.5%	34.1%	**36.1%**	0.01%	0.02%	1.36%	**1.38%**	**0.47**	0.01%	0.02%	3.53%	**3.56%**	**1.21**
Vermont	8,463	1.2	48	746	65	41	15.9%	4.3%	0.0%	**20.2%**	0.11%	0.07%	0.00%	**0.18%**	**0.00**	0.14%	0.15%	0.00%	**0.29%**	**0.00**
Virginia	266,728	62.0	27	759	66	50	3.1%	4.6%	0.0%	**7.8%**	0.02%	0.25%	0.00%	**0.27%**	**0.17**	0.05%	0.67%	0.00%	**0.71%**	**0.44**
Washington	315,101	83.5	20	757	63	51	1.9%	2.9%	2.7%	**7.5%**	0.02%	0.06%	0.02%	**0.11%**	**0.09**	0.07%	0.17%	0.08%	**0.32%**	**0.27**
West Virginia	17,896	2.3	34	743	71	50	10.4%	6.1%	0.3%	**16.8%**	0.10%	0.13%	0.00%	**0.23%**	**0.01**	0.14%	0.30%	0.00%	**0.44%**	**0.01**
Wisconsin	209,419	32.0	25	756	70	53	2.7%	4.0%	0.0%	**6.7%**	0.02%	0.05%	0.00%	**0.07%**	**0.02**	0.03%	0.10%	0.00%	**0.13%**	**0.04**
Wyoming	14,895	2.7	27	753	66	49	2.8%	3.4%	3.2%	**9.3%**	0.02%	0.04%	0.01%	**0.07%**	**0.00**	0.04%	0.06%	0.01%	**0.11%**	**0.00**
Total	9,005,983	1,860.5	26	753	64	49	6.5%	5.9%	6.9%	**19.3%**	0.08%	0.43%	0.16%	**0.67%**	**12.46**	0.30%	0.93%	0.32%	**1.55%**	**28.89**

1. Loans located in geographic areas where we currently have no underlying scientific climate risk estimates (i.e. AK, HI, PR) have been excluded from the above calculations.
2. Current HPI LTV reflects both the amortization of principal balance and home price indexing from loan origination to December 2020 at the state level provided by Zillow.
3. Losses are presented as a percentage of total current balance (not exposed balance).
4. Loan-level FICO, original balance and current balance characteristics were rounded to preserve anonymity. Aggregate calculations above were computed on the rounded underlying data.

Fannie Mae (CRT) Book by Geographic Region

Geographic Region	Loan Count	Current Balance ($ Billion)	Loan Age	FICO	Original LTV	Current HPI LTV	Exposure % Non-SFHA High Flood Risk	Exposure % SFHA	Exposure % High Wildfire	Exposure % **Total Flood & Fire**	Klima Base Loss Non-SFHA High Flood Risk	Klima Base Loss SFHA	Klima Base Loss High Wildfire	Klima Base Loss **Total Flood & Fire**	**Total Flood & Fire ($ Billion)**	Klima Bear Loss Non-SFHA High Flood Risk	Klima Bear Loss SFHA	Klima Bear Loss High Wildfire	Klima Bear Loss **Total Flood & Fire**	**Total Flood & Fire ($ Billion)**
Alabama	41,151	6.2	59	752	80	53	3.0%	7.2%	0.1%	**10.3%**	0.02%	0.15%	0.00%	**0.17%**	**0.01**	0.11%	0.52%	0.00%	**0.63%**	**0.04**
Arizona	90,585	14.8	59	752	82	46	13.9%	3.0%	15.0%	**31.8%**	0.07%	0.02%	0.19%	**0.28%**	**0.04**	0.10%	0.03%	0.46%	**0.59%**	**0.09**
Arkansas	24,064	3.2	60	753	80	53	2.8%	5.8%	9.0%	**17.5%**	0.05%	0.06%	0.04%	**0.14%**	**0.00**	0.19%	0.10%	0.05%	**0.34%**	**0.01**
California	375,453	93.0	65	754	73	41	2.7%	3.2%	16.3%	**22.2%**	0.01%	0.04%	0.85%	**0.90%**	**0.84**	0.04%	0.07%	1.52%	**1.63%**	**1.52**
Colorado	83,135	17.4	57	756	77	46	2.0%	2.5%	6.8%	**11.3%**	0.01%	0.02%	0.03%	**0.06%**	**0.01**	0.01%	0.03%	0.11%	**0.15%**	**0.03**
Connecticut	41,865	7.8	65	752	77	56	6.9%	6.8%	0.0%	**13.7%**	0.04%	0.26%	0.00%	**0.30%**	**0.02**	0.06%	0.91%	0.00%	**0.97%**	**0.08**
Delaware	13,515	2.5	63	756	79	55	12.1%	10.5%	0.0%	**22.6%**	0.14%	2.34%	0.00%	**2.49%**	**0.06**	0.58%	7.03%	0.00%	**7.62%**	**0.19**
District of Columbia	7,164	2.2	62	760	75	52	3.5%	0.3%	0.0%	**3.8%**	0.01%	0.01%	0.00%	**0.01%**	**0.00**	0.01%	0.02%	0.00%	**0.02%**	**0.00**
Florida	231,606	38.8	55	748	82	50	45.0%	23.5%	10.1%	**78.7%**	0.67%	3.10%	0.17%	**3.94%**	**1.53**	3.63%	6.05%	0.33%	**10.01%**	**3.89**
Georgia	105,344	17.4	57	751	81	48	2.1%	5.0%	2.4%	**9.5%**	0.01%	0.14%	0.01%	**0.16%**	**0.03**	0.03%	0.48%	0.02%	**0.52%**	**0.09**
Idaho	25,006	4.0	54	753	81	43	7.2%	3.2%	16.6%	**27.0%**	0.04%	0.02%	0.29%	**0.35%**	**0.01**	0.07%	0.04%	0.89%	**1.00%**	**0.04**
Illinois	142,940	21.4	66	751	80	54	1.8%	3.1%	0.0%	**5.0%**	0.01%	0.04%	0.00%	**0.05%**	**0.01**	0.02%	0.07%	0.00%	**0.08%**	**0.02**
Indiana	58,682	7.4	57	749	81	52	1.9%	5.1%	0.0%	**7.1%**	0.01%	0.05%	0.00%	**0.06%**	**0.00**	0.02%	0.08%	0.00%	**0.09%**	**0.01**
Iowa	36,705	4.8	58	755	81	56	2.8%	4.3%	0.0%	**7.1%**	0.02%	0.06%	0.00%	**0.08%**	**0.00**	0.03%	0.11%	0.00%	**0.14%**	**0.01**
Kansas	21,620	3.0	57	754	81	52	3.3%	3.6%	0.6%	**7.5%**	0.03%	0.03%	0.00%	**0.07%**	**0.00**	0.04%	0.06%	0.01%	**0.11%**	**0.00**
Kentucky	27,289	3.8	57	751	80	52	1.4%	4.8%	1.4%	**7.7%**	0.01%	0.05%	0.01%	**0.07%**	**0.00**	0.02%	0.09%	0.01%	**0.12%**	**0.00**
Louisiana	38,989	6.2	60	746	79	58	35.7%	25.4%	1.2%	**62.4%**	0.92%	2.35%	0.03%	**3.30%**	**0.20**	3.42%	4.13%	0.08%	**7.64%**	**0.47**
Maine	9,108	1.5	61	751	78	48	19.7%	8.2%	0.0%	**27.9%**	0.12%	0.45%	0.00%	**0.57%**	**0.01**	0.17%	1.69%	0.00%	**1.86%**	**0.03**
Maryland	72,403	15.3	66	753	79	54	6.6%	3.9%	0.2%	**10.7%**	0.13%	0.56%	0.00%	**0.69%**	**0.11**	0.50%	1.52%	0.01%	**2.03%**	**0.31**
Massachusetts	69,595	15.6	62	752	77	49	5.3%	6.4%	0.0%	**11.7%**	0.02%	0.28%	0.00%	**0.31%**	**0.05**	0.03%	1.02%	0.00%	**1.06%**	**0.16**
Michigan	112,646	14.3	60	750	83	46	1.7%	3.6%	0.0%	**5.2%**	0.01%	0.03%	0.00%	**0.04%**	**0.01**	0.02%	0.04%	0.00%	**0.06%**	**0.01**
Minnesota	83,608	14.0	59	759	82	51	4.6%	3.9%	0.4%	**8.8%**	0.03%	0.04%	0.00%	**0.07%**	**0.01**	0.05%	0.08%	0.01%	**0.14%**	**0.02**
Mississippi	19,286	2.8	60	747	80	53	4.5%	10.1%	4.8%	**19.4%**	0.03%	0.24%	0.03%	**0.30%**	**0.01**	0.06%	0.72%	0.03%	**0.81%**	**0.02**
Missouri	63,199	8.5	58	754	80	52	2.4%	3.8%	0.0%	**6.2%**	0.02%	0.05%	0.00%	**0.07%**	**0.01**	0.05%	0.12%	0.00%	**0.17%**	**0.01**
Montana	14,428	2.5	58	756	78	51	9.1%	4.0%	12.2%	**25.3%**	0.05%	0.05%	0.14%	**0.23%**	**0.01**	0.06%	0.09%	0.42%	**0.58%**	**0.01**
Nebraska	24,944	3.4	56	757	81	52	4.1%	4.6%	0.0%	**8.7%**	0.03%	0.05%	0.00%	**0.08%**	**0.00**	0.06%	0.11%	0.00%	**0.16%**	**0.01**
Nevada	39,449	7.2	54	746	83	49	5.7%	2.0%	13.4%	**21.1%**	0.04%	0.02%	1.35%	**1.41%**	**0.10**	0.07%	0.04%	1.67%	**1.78%**	**0.13**
New Hampshire	15,717	2.8	60	751	80	50	6.9%	6.0%	0.0%	**13.0%**	0.04%	0.27%	0.00%	**0.32%**	**0.01**	0.05%	0.80%	0.00%	**0.86%**	**0.02**
New Jersey	99,468	20.9	67	752	76	51	3.8%	9.7%	1.4%	**14.9%**	0.08%	1.04%	0.01%	**1.13%**	**0.24**	0.23%	3.05%	0.03%	**3.31%**	**0.69**
New Mexico	21,616	3.3	62	753	79	51	1.1%	5.1%	13.8%	**20.0%**	0.01%	0.04%	0.38%	**0.43%**	**0.01**	0.01%	0.04%	0.72%	**0.78%**	**0.03**
New York	147,817	32.4	64	754	73	49	7.6%	5.4%	0.0%	**13.0%**	0.08%	0.79%	0.00%	**0.86%**	**0.28**	0.21%	2.08%	0.00%	**2.29%**	**0.74**
North Carolina	102,237	16.9	57	755	79	50	3.8%	6.6%	0.7%	**11.1%**	0.06%	0.56%	0.00%	**0.62%**	**0.10**	0.13%	1.89%	0.00%	**2.02%**	**0.34**
North Dakota	6,722	1.2	57	755	80	57	23.3%	10.5%	0.1%	**33.9%**	0.18%	0.21%	0.00%	**0.38%**	**0.00**	0.33%	0.63%	0.00%	**0.96%**	**0.01**
Ohio	105,820	13.1	58	751	82	51	1.2%	2.9%	0.0%	**4.1%**	0.01%	0.03%	0.00%	**0.04%**	**0.00**	0.01%	0.04%	0.00%	**0.05%**	**0.01**
Oklahoma	34,631	5.0	57	751	81	56	0.4%	4.8%	10.9%	**16.0%**	0.00%	0.04%	0.07%	**0.11%**	**0.01**	0.00%	0.05%	0.11%	**0.16%**	**0.01**
Oregon	59,148	11.5	60	759	77	45	1.5%	3.7%	5.4%	**10.6%**	0.01%	0.04%	0.03%	**0.07%**	**0.01**	0.02%	0.09%	0.08%	**0.18%**	**0.02**
Pennsylvania	125,540	19.9	61	756	79	53	1.3%	3.2%	0.0%	**4.5%**	0.01%	0.04%	0.00%	**0.04%**	**0.01**	0.01%	0.08%	0.00%	**0.09%**	**0.02**
Rhode Island	10,329	1.9	63	754	79	50	4.3%	7.0%	0.0%	**11.3%**	0.02%	0.33%	0.00%	**0.35%**	**0.01**	0.03%	1.57%	0.00%	**1.60%**	**0.03**
South Carolina	53,523	8.5	56	753	80	54	10.6%	15.5%	1.0%	**27.1%**	0.07%	0.68%	0.00%	**0.75%**	**0.06**	0.10%	2.91%	0.00%	**3.01%**	**0.25**
South Dakota	9,170	1.3	57	756	81	53	6.1%	5.0%	13.9%	**25.0%**	0.05%	0.07%	0.07%	**0.18%**	**0.00**	0.09%	0.17%	0.11%	**0.37%**	**0.00**
Tennessee	57,984	9.2	55	753	80	50	1.9%	4.3%	0.1%	**6.3%**	0.01%	0.04%	0.00%	**0.05%**	**0.00**	0.01%	0.09%	0.00%	**0.10%**	**0.01**
Texas	264,045	46.0	54	746	80	52	15.8%	6.7%	2.5%	**25.0%**	0.11%	0.15%	0.02%	**0.28%**	**0.13**	0.25%	0.42%	0.04%	**0.70%**	**0.32**
Utah	39,655	7.6	56	754	80	45	0.6%	1.4%	25.7%	**27.7%**	0.00%	0.01%	1.41%	**1.43%**	**0.11**	0.01%	0.01%	3.69%	**3.71%**	**0.28**
Vermont	5,559	0.9	60	754	78	51	17.1%	4.3%	0.0%	**21.4%**	0.10%	0.06%	0.00%	**0.16%**	**0.00**	0.13%	0.14%	0.00%	**0.27%**	**0.00**
Virginia	95,229	19.7	64	759	77	52	4.3%	4.8%	0.1%	**9.2%**	0.04%	0.27%	0.00%	**0.32%**	**0.06**	0.08%	0.84%	0.00%	**0.93%**	**0.18**
Washington	105,560	22.4	61	756	77	41	2.6%	2.9%	3.1%	**8.6%**	0.02%	0.04%	0.02%	**0.08%**	**0.02**	0.06%	0.14%	0.09%	**0.29%**	**0.07**
West Virginia	8,673	1.1	59	747	81	57	13.4%	7.0%	0.7%	**21.1%**	0.13%	0.16%	0.01%	**0.29%**	**0.00**	0.19%	0.41%	0.01%	**0.61%**	**0.01**
Wisconsin	80,912	11.1	61	758	80	50	3.9%	4.0%	0.0%	**7.8%**	0.02%	0.04%	0.00%	**0.06%**	**0.01**	0.03%	0.08%	0.00%	**0.11%**	**0.01**
Wyoming	7,312	1.3	60	752	79	51	3.9%	3.2%	6.8%	**14.0%**	0.03%	0.03%	0.03%	**0.09%**	**0.00**	0.05%	0.07%	0.04%	**0.15%**	**0.00**
Total	3,330,446	597.0	60	753	78	48	7.9%	6.2%	5.3%	**19.4%**	0.09%	0.42%	0.19%	**0.70%**	**4.18**	0.36%	0.99%	0.36%	**1.72%**	**10.26**

1. Loans located in geographic areas where we currently have no underlying scientific climate risk estimates (i.e. AK, HI, PR) have been excluded from the above calculations.
2. Current HPI LTV reflects both the amortization of principal balance and home price indexing from loan origination to December 2020 at the CBSA level provided by Zillow.
3. Losses are presented as a percentage of total current balance (not exposed balance).

FHL Banks Book by Geographic Region

Geographic Region	Loan Count	Current Balance ($ Billion)	Loan Age	FICO	Original LTV	Current HPI LTV	Exposure % Non-SFHA High Flood Risk	Exposure % SFHA	Exposure % High Wildfire	Exposure % **Total Flood & Fire**	Klima Base Loss Non-SFHA High Flood Risk	Klima Base Loss SFHA	Klima Base Loss High Wildfire	Klima Base Loss **Total Flood & Fire**	**Total Flood & Fire ($ Billion)**	Klima Bear Loss Non-SFHA High Flood Risk	Klima Bear Loss SFHA	Klima Bear Loss High Wildfire	Klima Bear Loss **Total Flood & Fire**	**Total Flood & Fire ($ Billion)**
Alabama	202,560	27.2	51	700	92	66	1.2%	5.4%	0.1%	**6.7%**	0.02%	0.25%	0.00%	**0.28%**	**0.08**	0.07%	0.48%	0.00%	**0.54%**	**0.15**
Arizona	282,904	52.2	34	702	90	71	10.0%	2.9%	16.1%	**29.0%**	0.15%	0.07%	0.28%	**0.51%**	**0.26**	0.24%	0.10%	0.58%	**0.92%**	**0.48**
Arkansas	123,046	14.7	50	700	93	67	3.1%	6.2%	6.8%	**16.1%**	0.15%	0.17%	0.08%	**0.40%**	**0.06**	0.34%	0.26%	0.10%	**0.70%**	**0.10**
California	724,718	212.3	33	704	87	70	2.1%	3.5%	25.5%	**31.2%**	0.02%	0.11%	1.02%	**1.16%**	**2.46**	0.06%	0.15%	2.01%	**2.23%**	**4.73**
Colorado	209,948	52.1	31	708	88	71	0.7%	2.3%	5.7%	**8.7%**	0.01%	0.05%	0.04%	**0.10%**	**0.05**	0.01%	0.06%	0.14%	**0.22%**	**0.12**
Connecticut	98,543	18.3	52	697	92	64	3.5%	5.9%	0.0%	**9.4%**	0.04%	0.32%	0.00%	**0.36%**	**0.07**	0.05%	0.72%	0.00%	**0.77%**	**0.14**
Delaware	45,752	8.6	48	697	92	66	4.8%	5.7%	0.0%	**10.5%**	0.11%	1.38%	0.00%	**1.49%**	**0.13**	0.25%	2.95%	0.00%	**3.20%**	**0.27**
District of Columbia	7,417	2.6	46	720	86	63	2.6%	0.7%	0.0%	**3.3%**	0.00%	0.02%	0.00%	**0.03%**	**0.00**	0.01%	0.04%	0.00%	**0.05%**	**0.00**
Florida	816,701	152.0	34	698	92	72	44.9%	19.4%	8.8%	**73.1%**	1.17%	4.35%	0.16%	**5.68%**	**8.63**	3.98%	6.43%	0.27%	**10.68%**	**16.23**
Georgia	396,338	57.7	52	693	92	65	1.7%	5.0%	1.9%	**8.5%**	0.02%	0.25%	0.02%	**0.29%**	**0.17**	0.03%	0.50%	0.03%	**0.56%**	**0.32**
Idaho	62,667	10.5	41	702	90	68	5.7%	3.0%	16.6%	**25.3%**	0.09%	0.07%	0.54%	**0.70%**	**0.07**	0.15%	0.11%	1.51%	**1.78%**	**0.19**
Illinois	338,593	50.1	47	692	92	66	1.2%	3.5%	0.0%	**4.7%**	0.02%	0.11%	0.00%	**0.13%**	**0.07**	0.03%	0.17%	0.00%	**0.20%**	**0.10**
Indiana	282,478	33.9	45	690	93	68	1.3%	4.9%	0.0%	**6.1%**	0.02%	0.16%	0.00%	**0.18%**	**0.06**	0.03%	0.24%	0.00%	**0.27%**	**0.09**
Iowa	74,372	8.7	52	697	93	65	2.2%	4.2%	0.0%	**6.4%**	0.03%	0.14%	0.00%	**0.17%**	**0.01**	0.05%	0.24%	0.00%	**0.29%**	**0.02**
Kansas	87,758	11.0	51	701	92	65	4.1%	4.3%	0.4%	**8.7%**	0.08%	0.11%	0.00%	**0.20%**	**0.02**	0.13%	0.18%	0.01%	**0.31%**	**0.03**
Kentucky	146,798	18.4	49	693	93	66	0.8%	5.0%	0.7%	**6.5%**	0.02%	0.15%	0.01%	**0.18%**	**0.03**	0.03%	0.23%	0.02%	**0.27%**	**0.05**
Louisiana	172,817	25.2	47	691	93	68	42.8%	26.0%	0.5%	**69.3%**	1.87%	2.99%	0.01%	**4.87%**	**1.23**	5.19%	4.98%	0.01%	**10.19%**	**2.56**
Maine	36,213	5.8	45	701	92	68	10.3%	7.3%	0.0%	**17.6%**	0.15%	0.57%	0.00%	**0.73%**	**0.04**	0.23%	1.21%	0.00%	**1.44%**	**0.08**
Maryland	265,326	64.9	44	703	91	68	5.0%	3.7%	0.1%	**8.8%**	0.05%	0.50%	0.00%	**0.55%**	**0.36**	0.10%	1.03%	0.01%	**1.14%**	**0.74**
Massachusetts	111,527	28.0	42	696	90	68	3.0%	6.1%	0.0%	**9.1%**	0.03%	0.52%	0.00%	**0.55%**	**0.15**	0.04%	1.16%	0.00%	**1.20%**	**0.34**
Michigan	286,458	34.9	44	691	92	68	1.5%	4.0%	0.0%	**5.5%**	0.03%	0.12%	0.00%	**0.16%**	**0.06**	0.05%	0.18%	0.00%	**0.23%**	**0.08**
Minnesota	162,663	26.8	47	703	92	66	4.0%	3.7%	0.2%	**7.8%**	0.06%	0.11%	0.00%	**0.17%**	**0.05**	0.10%	0.19%	0.01%	**0.29%**	**0.08**
Mississippi	99,096	12.6	52	694	93	66	3.7%	10.9%	6.5%	**21.1%**	0.07%	0.64%	0.07%	**0.78%**	**0.10**	0.14%	1.35%	0.09%	**1.58%**	**0.20**
Missouri	246,078	31.9	45	697	92	68	0.6%	3.6%	0.0%	**4.2%**	0.02%	0.11%	0.00%	**0.13%**	**0.04**	0.04%	0.17%	0.00%	**0.21%**	**0.07**
Montana	29,007	5.1	46	711	90	66	7.9%	4.2%	11.0%	**23.0%**	0.07%	0.13%	0.13%	**0.33%**	**0.02**	0.11%	0.25%	0.30%	**0.66%**	**0.03**
Nebraska	58,978	7.6	51	709	91	64	2.7%	4.4%	0.0%	**7.1%**	0.05%	0.12%	0.00%	**0.17%**	**0.01**	0.07%	0.24%	0.00%	**0.31%**	**0.02**
Nevada	118,523	24.5	36	704	90	70	6.3%	2.5%	17.9%	**26.7%**	0.06%	0.06%	3.60%	**3.72%**	**0.91**	0.11%	0.09%	4.62%	**4.81%**	**1.18**
New Hampshire	39,961	8.1	42	702	92	69	5.4%	5.9%	0.0%	**11.3%**	0.07%	0.41%	0.00%	**0.48%**	**0.04**	0.10%	0.81%	0.00%	**0.91%**	**0.07**
New Jersey	230,314	50.7	45	694	90	66	3.9%	7.3%	1.0%	**12.2%**	0.10%	1.06%	0.01%	**1.17%**	**0.59**	0.21%	2.21%	0.02%	**2.44%**	**1.24**
New Mexico	84,837	12.7	50	702	91	65	1.1%	5.9%	7.0%	**13.9%**	0.02%	0.11%	0.31%	**0.45%**	**0.06**	0.03%	0.13%	0.52%	**0.68%**	**0.09**
New York	293,282	56.3	54	697	90	62	4.9%	4.9%	0.0%	**9.8%**	0.07%	0.69%	0.00%	**0.76%**	**0.43**	0.17%	1.56%	0.00%	**1.73%**	**0.97**
North Carolina	386,436	58.5	45	703	91	68	4.1%	5.3%	1.3%	**10.7%**	0.07%	0.83%	0.01%	**0.92%**	**0.54**	0.14%	1.71%	0.01%	**1.87%**	**1.09**
North Dakota	13,435	2.3	44	709	92	67	18.5%	9.3%	0.0%	**27.8%**	0.27%	0.38%	0.00%	**0.65%**	**0.02**	0.49%	0.96%	0.00%	**1.45%**	**0.03**
Ohio	423,850	50.7	47	694	92	66	0.6%	3.1%	0.0%	**3.7%**	0.01%	0.09%	0.00%	**0.11%**	**0.05**	0.02%	0.14%	0.00%	**0.15%**	**0.08**
Oklahoma	171,094	21.4	51	699	93	66	0.1%	4.9%	10.0%	**15.0%**	0.00%	0.11%	0.13%	**0.25%**	**0.05**	0.00%	0.13%	0.20%	**0.33%**	**0.07**
Oregon	105,309	22.6	39	709	89	68	1.2%	4.3%	6.1%	**11.7%**	0.02%	0.13%	0.07%	**0.21%**	**0.05**	0.04%	0.23%	0.14%	**0.41%**	**0.09**
Pennsylvania	377,970	53.1	52	698	92	64	1.0%	3.4%	0.0%	**4.4%**	0.02%	0.11%	0.00%	**0.13%**	**0.07**	0.03%	0.19%	0.00%	**0.22%**	**0.12**
Rhode Island	33,671	6.8	42	697	92	69	1.9%	4.9%	0.0%	**6.8%**	0.02%	0.49%	0.00%	**0.51%**	**0.03**	0.03%	1.21%	0.00%	**1.24%**	**0.08**
South Carolina	206,032	32.1	41	698	92	69	4.5%	8.1%	0.3%	**12.9%**	0.05%	0.61%	0.00%	**0.66%**	**0.21**	0.08%	1.52%	0.00%	**1.60%**	**0.51**
South Dakota	22,318	3.2	49	713	93	66	3.0%	4.9%	20.7%	**28.7%**	0.05%	0.12%	0.14%	**0.30%**	**0.01**	0.09%	0.23%	0.22%	**0.53%**	**0.02**
Tennessee	262,334	39.5	43	700	92	68	0.8%	4.2%	0.1%	**5.1%**	0.01%	0.13%	0.00%	**0.14%**	**0.06**	0.02%	0.20%	0.00%	**0.22%**	**0.09**
Texas	1,027,691	168.5	40	694	93	71	11.8%	6.7%	2.6%	**21.0%**	0.21%	0.36%	0.02%	**0.59%**	**1.00**	0.40%	0.71%	0.04%	**1.15%**	**1.94**
Utah	99,563	20.8	38	701	91	69	0.8%	1.5%	32.2%	**34.5%**	0.02%	0.03%	2.43%	**2.48%**	**0.52**	0.04%	0.04%	5.44%	**5.52%**	**1.15**
Vermont	8,591	1.4	62	708	93	62	13.1%	4.2%	0.0%	**17.4%**	0.16%	0.13%	0.00%	**0.29%**	**0.00**	0.22%	0.27%	0.00%	**0.49%**	**0.01**
Virginia	398,361	92.9	42	717	90	68	4.5%	5.2%	0.0%	**9.7%**	0.05%	0.45%	0.00%	**0.50%**	**0.46**	0.09%	1.00%	0.00%	**1.08%**	**1.01**
Washington	242,011	58.9	36	709	89	69	2.2%	3.3%	2.6%	**8.1%**	0.06%	0.16%	0.04%	**0.26%**	**0.16**	0.16%	0.33%	0.11%	**0.60%**	**0.35**
West Virginia	43,854	5.6	53	697	93	65	8.6%	6.2%	0.3%	**15.1%**	0.18%	0.28%	0.00%	**0.46%**	**0.03**	0.26%	0.58%	0.01%	**0.85%**	**0.05**
Wisconsin	128,411	18.1	44	698	92	67	1.9%	3.6%	0.0%	**5.6%**	0.03%	0.12%	0.00%	**0.15%**	**0.03**	0.05%	0.19%	0.00%	**0.24%**	**0.04**
Wyoming	21,066	3.8	47	706	92	67	2.0%	3.0%	1.7%	**6.8%**	0.03%	0.07%	0.01%	**0.10%**	**0.00**	0.05%	0.10%	0.01%	**0.16%**	**0.01**
Total	10,107,670	1,785.0	42	700	91	68	7.9%	6.2%	6.1%	**20.1%**	0.18%	0.67%	0.24%	**1.09%**	**19.52**	0.52%	1.14%	0.44%	**2.10%**	**37.53**

1. Loans located in geographic areas where we currently have no underlying scientific climate risk estimates (i.e. AK, HI, PR) have been excluded from the above calculations.
2. Current HPI LTV reflects both the amortization of principal balance and home price indexing from loan origination to December 2020 at the state level provided by Zillow.
3. Losses are presented as a percentage of total current balance (not exposed balance).
4. Loan-level FICO, original balance and current balance characteristics were rounded to preserve anonymity. Aggregate calculations above were computed on the rounded underlying data.