



Federal Housing Finance Agency
Request for Input
Climate and Natural Disaster Risk Management

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Office of the Director
Federal Housing Finance Agency
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Ref: RFI Climate and Natural Disaster Risk Management

We are pleased to present you LightBox's response to the Federal Housing Finance Agency's Climate and Natural Disaster Risk Management Request for Input dated January 2021.

We understand that the Agency is seeking information on the current and future climate and natural disaster risk to the housing finance system and to the regulated entities: Fannie Mae and Freddie Mac (the Enterprises) and the Federal Home Loan Banks (the FHLBanks). FHFA also seeks input on opportunities to strengthen its supervision and regulation of the regulated entities' management of and reporting on the physical and transition risks that may arise from natural disasters and changes in climate patterns.

LightBox is a leading provider of property due diligence, valuation, marketing, and location intelligence workflow and data. Through our multiple platforms, we actively support hundreds of thousands of residential, multifamily, and commercial transactions per year on behalf of lenders, environmental professionals, investors, brokers, and appraisers. In addition, we regularly engage with academia and government bodies on issues including flood risks, energy efficiency and environmental contamination. This vast reach allows us to bring a unique perspective to the FHFA's request.

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Sincerely,

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Introduction and LightBox Background

LightBox is a leading provider of due diligence, risk management, location intelligence and workflow solutions that enable decision making for 100,000 real estate brokers and investors, 1,100 real estate lenders, 2,000 property appraisal firms, and 5,000 environmental consulting and engineering firms as well as 1,200 public and private entities, home builders, and land developers all of whom rely on the precision and data analytics of our platform.

At LightBox, we've created an integrated set of capabilities for real estate professionals that help our customers access the best data so they can focus on providing their own value-add and expertise. These capabilities help our customers measurably increase the number and velocity of closed transactions, resulting in a more successful, efficient, and predictable workflow. LightBox also maintains and updates the largest nationwide collection of parcel boundaries and building footprints available in the market and leverages our geo-spatial capabilities to extract unique insights from these and related data sets.

A list of recent LightBox accomplishments relative to our qualifications in climate and natural disaster risk is provided below:

- LightBox is a recognized thought leader within the environmental site assessment (ESA) industry and has championed discussions within the environmental consulting community relative to the ASTM E-1527 standards updates, the growing risks of PFAS, and building resiliency.
- LightBox maintains an active partnership with First Street Foundation and its Flood Lab participants to support development of climate-adjusted flood models and loss estimates and related academic research.
- We are experts in utilizing LiDAR and remote sensing technology to develop proprietary data sets, such as building footprints, first floor elevation, groundwater flow direction, and building height, that support climate risk analysis and potential flood damage calculations.
- LightBox served as an Accelerator to the Department of Energy's UBID (unique building identifier) program to provide comprehensive energy efficiency benchmarking across all structures in the U.S.
- On an ongoing basis, we curate and geo-reference all data sets required to meet California's Natural Hazard Disclosure (NHD) regulations.
- We also developed the LightBox Broadband Address Fabric to support Georgia Technology Authority's mission to identify underserved rural residences
- Finally, LightBox actively participated in Fannie Mae MultiFamily's pilot program for third-party report standardization for environmental site assessments and property condition assessments (ESAs/PCAs), seismic and zoning reports, and has been the provider of parcel fabric for use in Single Family Digital Incubator and Collateral products, Multi-family Credit Research and Greenfield SI Innovations Lab.

Recommendations for FHFA's Climate and Natural Disaster Risk Request

The risks of climate change and its impact on our society continues to increase. The GSEs and balance sheet lenders face growing exposure to flood, earthquake, wind, and wildfire events. LightBox has been actively engaged in dialogue with our lender and real estate investor clients regarding the use of hazard models, estimation of losses and the merits of various resiliency and adaptation measures. When pressed, many of these same clients have expressed reluctance to adopting new tools. This largely stems from an inability to accurately measure ROI or concerns that they may be placed at a competitive disadvantage by being an early adopter of climate risk-based pricing.

LightBox applauds the actions of the FHFA. Given the regulated entities' aggregate exposures to climate risk, it is critical for the FHFA to be proactively positioned to better understand and assess the risk. The FHFA is also in a position to uniquely drive positive policy change that will reverberate across the entire lending market.

Over the past 12-18 months, there has been significant progress in the development of models and data to identify and measure climate and natural disaster risk. The FHFA can take a leadership role in promoting usage and adoption on these models. There is value in leveraging an ensemble of the many datasets and models available, as each considers a unique set of assumptions and could lead to meaningful differences when contemplating future property implications.

LightBox makes five general recommendations with further detail provided in the body of this RFI.

1. Climate resiliency as a due diligence requirement

For multifamily financings, the GSEs maintain a strong posture regarding environmental diligence. This includes requiring full environmental site assessments (ESAs) and property condition assessments (PCAs) for large balance loans and Record Search Risk Assessments (RSRAs) for small balance loans. In certain geographies and lending programs, seismic and zoning reviews also are commonly conducted. These procedures have allowed GSEs to pro-actively identify environmental and structural risks, and the sponsors to understand their obligations. The current due diligence process works very well.

Expanding diligence requirements to include climate resiliency assessments is a logical extension of these risk assessment practices with limited added costs to the sponsors. As with the ESA/PCA, the environmental engineering industry has a robust process through the ASTM to define reasonable standards and procedures for such a review. The Building Resiliency Assessment is being designed to complement the output from a climate stress model by providing tangible risk mitigation recommendations. In particular, the standard is expected to include guidance for professionals to use in address property risks resulting from drought, extreme heat and flood.

In the future, we would expect the standard due diligence package to include an ESA, a Green PCA inclusive of water consumption and energy efficiency analyses, a seismic review, and the Building Resiliency Assessment covering climate and natural hazard risks. LightBox encourages FHFA to lend its support to the ASTM work group WK 62996 for Building Resiliency Assessment. By performing the climate evaluation prior to loan funding, FHFA can limit the GSEs and FHLBanks from unnecessary risk.

For residential loans, the existing structure of California's NHD process provides a good basis. Extending these to consider climate change and more localized conditions (e.g., potential for riverine flooding) could be implemented in a relatively short period as the data and reporting infrastructure already exists as does the capacity to cover the residential market on a national scale.

2. Performing a climate stress test and loss estimate prior to loan funding or acquisition and as part of a routine portfolio level review

Several climate change risk-based loss models have been released to the market in recent months. Adoption by the GSEs and FHLBanks will protect from loan losses and demonstrate to the broader lending community the value of these models. As usage becomes commonplace, there will no longer be a disadvantage for balance sheet lenders to price climate risk into their funding quotes. Research conducted by Delta Terra quantifies potential mispricing in the property markets, first estimating price rationalization for flood and wildfire protection that could generate highly impactful value losses.

LightBox does not opine on which of these models is best, but makes the following recommendations:

- Models should be forward-looking and make use of multiple RCP curves.
- Models should support inclusions of local, property-specific nuances such as existing resiliency features and ground level elevation as well as community scale adaptations.
- Flood and fire are the most critical perils to support in the near term, however heat, seismic, water stress and wind models should also be considered in order to provide a fully comprehensive view.
- Loss estimates should consider interruption and damage risk during the life of the loan, but also future potential declines in property value that may affect the in-place LTV or the future ability to refinance.

On annual basis, each GSE and FHLBank can be required to run a portfolio level climate stress test on its entire lending book. Results could be easily stratified by loan sponsor, geography, and risk type. This will enable an updated view on aggregate risk and highlight any individual lenders that are taking risks outside of normal levels.

The results can also be cross-referenced versus current insurance requirements to identify where the GSEs and FHLBanks may have further exposure. A recent study by First Street Foundation estimates 14.6 million U.S. homes face flooding conditions versus 8.7 million homes classified by FMEA flood maps.¹

3. New lending programs to encourage resiliency projects

In recent years, the GSEs have launched extremely successful green lending programs. The programs encouraged funding thousands of projects for multifamily owners to invest in upgraded HVAC systems, energy efficient windows and numerous water conservation measures. Important to the underwriting was evidence that the projects had a positive ROI and the increase in debt service was offset by a reduction in utility and maintenance spend. This enabled the DSCR of the loans to remain stable.

A similar program can be launched for flood and other resiliency projects. Given the relative infrequency and uncertain timing of a natural disaster, the ROI for a single project is more difficult to calculate and it may be necessary to evaluate at the pool level. Only the GSEs possess the potential volume to make a program successful at scale. One proposed idea is establishment of a second mortgage program where proceeds are specifically dedicated to flood resiliency adaptations.²

4. Insurance coverage requirements must consider climate change, but also property value and income levels

The GSEs should continue to require natural disaster insurance to be in place. However, the level of required insurance can potentially be based upon results from climate adjusted models as opposed to the current practice of relying on pre-drawn boundary layers. Pre-drawn boundaries such as FEMA flood zones do not consider sea-level rise and other forward-looking metrics. Also, the update process can be subject to lengthy reviews and challenges. First Street Foundation points to several examples where FEMA maps mischaracterize flood risk, likely due to politics. For example, an examination of FEMA maps vs. actual inundation during Super Storm Sandy in 2012 revealed that large areas of NYC experienced serious flooding, yet were not considered in FEMA flood zones. The Risk Rating 2.0 initiative FEMA is currently pursuing should help address this issue by incorporating new data and methods into the process.

Generally, the results of these new models will drive insurance rates sharply upwards. The new FEMA Risk Rating 2.0 model for pricing flood risk is anticipated to set new premiums based on individual property exposure. In some instances, this will result in repricing of insurance for homes already in the NFIP program and in Special Flood Hazard Areas (SFHAs). There is also a considerable set of properties that don't currently fall within SFHAs, but have substantial climate-adjusted flood risk. For these properties,

¹ <https://www.politico.com/news/2020/06/29/study-flood-risks-federal-estimates-344442>

² <https://www.frbsf.org/community-development/publications/community-development-investment-review/2019/october/flood-risk-and-structural-adaptation-of-markets-an-outline-for-action/>

flood insurance likely isn't currently required so premiums will be net new in many situations. For existing homeowners, this may cause a decline in their home values. For purchasers, this may raise their monthly debt to income (DTI) level beyond a reasonable limit. LightBox suggests creating tiers of required insurance levels based on the homeowners' income level and the value of their property. This will enable the GSEs to continue to fulfill their affordable housing mission while allowing the more well-off homeowners to fund the insurance pool and more equitably share the overall risks.

5. Understand the limitations of existing climate risk data and property characteristic data sets when evaluating models and policies and the need for a robust national address fabric

Many climate and disaster risk models are not run at the local property boundary level and make broad assumptions across entire neighborhoods or larger areas, diminishing the precision of the models. In selecting models, it is important for the GSEs and FHLBanks to understand the methodology. For example, the relocation of an HVAC system from the basement to a higher floor reduces potential damages.

This begins with understanding the precise location of the building footprint on the property. If the structure is located away from river's edge and at higher elevation, the potential risk is much less. The model should geocode to the lowest elevation point of the footprint boundary as opposed to the center of the property. Combined with the footprint, the first-floor elevation is another critical data point that impacts the potential damage. Many of the necessary data points can be gathered routinely as part of the current PCA review.

A robust address fabric and geo-spatial expertise is also critical. The FHFA will need precise information about property location on the parcel, elevation and topography, seismic and underground waterflow, the ability to synthesize all this in mass; and the ability to seamlessly align with other data sets such as income and race.

Importantly, address components must contain secondary addresses for both residences and businesses, therefore all units associated with a primary address for multi-dwelling and multi-tenant units are captured in the file. Relying on parcel address data alone will not allow for identification of secondary addresses and will have a single address representing the parcel in which the multiple dwelling units exist. This will exacerbate challenges in tying models to different property-specific data sets.

Identifying and Assessing Climate and Natural Disaster Risk

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

The FHFA can very simply define climate and natural disaster risk as the credit loss exposure to the GSEs and FHLBanks that can occur due to natural perils that cause a borrower to default. The exposure can be measured by an arms-length climate model that considers climate change and sea-level rise. Then, losses endured by insurance providers and CRT holders can also be included in the estimation.

For multi-family loans, exposure should consider both term defaults and balloon refinance risk. To the latter, a property may not incur any actual damage during the life of the loan, but increased climate risk may impact the ability of the borrower to refinance at loan maturity.

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?

Given their insurance requirements, the Enterprises currently recognize the risks from wind and fire events as well as flood events in defined hazard areas. In LightBox's view, additional risks include the following:

- Flood – given climate change and sea level rise, greater risks exist both within and outside current designated flood zones.
- Fire – similar to flood, the annual threat of wildfire damage continues to increase and a forward looking model can be employed.
- Heat – over time, increases in average temperature will put additional stress on to the physical structures of buildings and necessitate upgrades of HVAC systems. While properties in the southern portion of the U.S. have been designed to consider high heat, this is less true in more temperate, but vulnerable areas in the Mid-West.

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?

One key consideration when evaluating the universe of methodologies and datasets representing climate risk is the granularity of the model. Some providers target capturing global climate risk, usually sacrificing geospatial resolution, while others aim to create the highest resolution data possible at the expense of wide

coverage. Most model providers point to the Intergovernmental Panel on Climate Change³ (IPCC) for best practices, adding some degree of proprietary input from either a compute perspective (deploying open source science on the cloud to make climate simulations easily distributable), or by combining internationally accepted science with peril specific breakthroughs. Organizations like Jupiter Intelligence⁴, which offers a suite of cloud hosted climate models for many perils fit in the former category, while others like Fathom⁵ deploy proprietary research on a specific peril (flood in this case) adjusted for climate change according to IPCC standards.

The first series of these models focused purely on making climate change data across perils more readily available. These data focus on the climate science, as opposed to quantifying the resulting risk to various asset types. Using flood as an example, the first phase of data available was raster data capturing geospatial inundation boundaries under various climate change scenarios. While a necessary component for quantifying risk, there was a disconnect between understanding the potential for inundation now and into the future, and the impact of those scenarios on physical, financial and transition risk to property. LightBox participated in the next stage of advancing these models to get closer to understanding property specific impact, via our partnership with First Street Foundation⁶. LightBox supplied First Street with the geospatial containers (property boundaries) to compute forecasted inundation levels targeted to the lowest elevation point of physical structures. This fundamental data set then enabled the calculation of risk factors that are actually meaningful to institutions like insurance companies, such as average annual loss to a property, by intersecting property-specific flood models with damage curves, such as those created by the Army Corps of Engineers.

The state of flood modeling has advanced significantly over the past several years, where climate adjusted estimates to property damage can be estimated with some confidence. For residential properties and the FHFA, this level of data is already in a form that can be translated to portfolio risk, because the physical risk here is insurable (questions on insurance mispricing aside). Since residential properties are more homogenous than commercial properties – any two adjacent residential properties are more likely to share similar physical and financial characteristics than two adjacent commercial ones – the property damage estimate models are more reliable than those created for commercial structures. There are still remaining gaps, however. For example, to accurately estimate damage from water events under different inundation levels, it's important to know features of a property such as the first floor elevation, whether a structure has a basement or not, the construction material, and whether any mitigating adaptations have been installed to protect the property.

³ <https://www.ipcc.ch/assessment-report/ar6/>. The IPCC is currently in the 6th assessment cycle of methodology refinement and reporting.

⁴ <https://jupiterintel.com/>

⁵ <https://www.fathom.global/>

⁶ <https://www.lightboxre.com/resources/news/2020/05/19/lightbox-and-first-street-foundation-partner-to-provide-a-new-model-for-flood-data/>

Flood risk in particular is the most important type of risk to tie to property boundaries, since very minor changes in topography and location can lead to significant changes in flood risk. For other perils, like wildfire, heat stress, water stress, and wind events, the precise position of a property is less critical to accurate risk assessments, but property characteristic data is of utmost importance. For each of these perils, a handful of critical property data points are listed below:

- Fire: proximity to fire hydrants, proximity to interface of the wild, construction type, proximity to neighboring homes.
- Heat stress: presence of HVAC system, energy efficiency, construction type, stability of energy grid.
- Water stress: location, source watershed.
- Wind stress: opening protections (door and window quality), roof type, construction type.

LightBox either possesses or knows how to source each of the characteristics described above.

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?

Several equity market participants are taking portfolio level views of climate and natural disaster risk. This typically begins with a high-level scoring algorithm being applied to all assets in the portfolio. This effectively allows an investor to risk rank their holdings, while also identifying areas of undue concentration risks. The properties with the highest risks then undergo more thorough resiliency review. The outcome of the review is typically a menu of potential mitigation projects. These can range from the purchase of less-intrusive removable flood barriers to more substantial projects that may include the installation of permanent flood barriers or relocation of equipment.

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?

LightBox recommends the FHFA require disaster risk assessments both prior to funding a loan and annually as part of a portfolio level stress test. The portfolio level reviews should allow for analysis by peril and location as well as by individual sponsors.

Ongoing work by Delta Terra Capital seeks to answer this question. Their early findings conclude with high conviction that there will be a significant price correction. By examining the wedge between current insurance prices and potential risk alone, the repricing of insurance to adequately cover risk could be sufficient to instigate defaults and a commensurate decline in property values. These forecasts don't contemplate harder-to-quantify and forecast effects of climate change, such as migration and the livability or desirability of a location. LightBox recommends that FHFA not just estimate the easier-to-quantify risk like changes to

insurance pricing, but also conduct stress tests via simulation on other data points like migration and livability to at least establish some bounds on worst and best case scenarios under an array of assumptions.

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.

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?*

- Review the current programs in place, including thresholds for requiring insurance
- For multi-family, require resiliency assessments as part of up-front due diligence requirements
- For residential, consider broad adoption of a program like California's NHD requirements
- Partner with the environmental consulting community to expand data that is gathered as part of the PCA and other scopes of diligence

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?*

- See response to #7

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

LightBox suggests the following prioritization:

- Flood and fire – these are growing in incidence and the impacts of climate change are most pronounced and already recognizable
- Heat – this is perhaps least understood today, but affects HVAC systems, water supplies and areas of the country that today don't currently consider these risks
- Wind, seismic, and environmental/ man-made – these are generally more understood and a robust diligence process is already in place

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?*

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?*

- Experience of those third-parties in understanding climate risk

- Review of the size, staffing and qualifications of their existing ERM (environmental risk management) teams
- Understanding the purview of those teams and where they are in the reporting structure
- Evidence of documented climate risk policies

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?

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?

Yes, LightBox believes the FHFA can implement a climate and natural disaster risk stress testing process. We believe such an analysis is suitable prior to the initial origination of a mortgage and periodically at the aggregate portfolio level. Third-party models are already readily available for these purposes.

LightBox does not opine on which of these models is best, but makes the following recommendations:

- Models should be forward looking and make use of multiple RCP curves
- Models should support inclusions of local, property specific nuances such as existing resiliency features and ground level elevation as well as community scale adaptations
- Flood and fire are the most critical perils to support in the near term, but heat, seismic and wind models should be considered to provide a fully comprehensive view

Loss estimates should consider interruption and damage risk during the life of the loan, but also future potential declines in property value that may affect the in-place LTV or the future ability to refinance. Loss figures should also consider the impact of insurance and CRT provisions.

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?

In addition to the use of insurance and CRT instruments, a program to provide low-cost funding for resiliency projects would be another potential risk mitigation strategy. Programs similar to the successful green lending initiatives can be launched for flood and other resiliency projects.

Given the relative infrequency and uncertain timing of a natural disaster, the ROI for a single project is more difficult to calculate and it may be necessary to evaluate at the pool level. Only the GSEs possess the potential volume and geographic breadth to make a program successful at scale. Projects could be funded both at the individual property level and also at the municipal level for large scale flood barriers and the like.

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

The entities' housing finance mission can be readily extended to help mitigate climate and natural disaster risk in a large-scale manner. Creation of lending programs for resiliency projects as described in the question 14 is one such concept.

Modification of insurance requirements based on income levels and property values is another idea. Specifically, for lower income borrowers, if anticipated mortgage payments plus insurance payments would bring a borrower's aggregate debt to income (DTI) ratio above a certain threshold, then the entities could potentially reduce the insurance requirement. At the same time, for higher earning borrowers, the Entities can explore a cap on the amount of insurance. This would ensure a level of shared risk and offset some of the additional exposure taken by the insurance reductions for lower income borrowers.

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?

Yes, each regulated entity should be required to disclose additional information about climate and natural disaster risks. This should leverage existing market practices for other data fields prior to securitization.

For example, in multi-family securitizations, the "Annex A" contains property level data points such as DSCR, NOI, LTV as well as many physical property characteristics. Investors can then review each property and loan individually or review stratification or concentration reports for each pool. Inclusion of climate scores for each major peril type are logical additions to the current Annex A file, while concentration tables are already published in the prospectus supplements. For single family securitizations, similar property and loan level disclosures exist.

The entities already work closely with industry trade organizations such as CREFC to modify the Annex A and other on-going disclosure reports on a regular basis. Both of the GSEs host robust disclosure web sites where this information can be posted to the market

Importantly, disclosure of these climate risks will help drive differentiated pricing of these assets as the market will have a means to gauge risks. It is logical that balance sheet lenders will then adopt similar risk-based

pricing. Currently, some balance sheet lenders are reluctant to price climate risks as they fear being uncompetitive versus their peers.

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?

Climate scores should become part of the standard monthly reporting disclosures. One idea is to publish the At Issuance peril scores plus inclusion of annually updated climate scores. Updating of the scores should be the responsibility of the mortgage servicer with a requirement that they leverage an industry standard climate model. Similar to the Annex A tables and the charts in the prospectus supplements, standard industry monthly reporting mechanisms and formats already exist and are routinely enhanced to support additional disclosures.

From an episodic perspective, it is necessary to look beyond initial structural claims and examine the broader environmental conditions associated with natural disasters. Some of the worst natural disasters since the 1990's serve as poignant examples:

- Spoil and groundwater releases created , or exacerbated, by flood and storm-related physical damage, such as breaches of containments, equipment failures, compromised storage facilities in the vicinity. This was particularly problematic with damage caused by Hurricane Katrina. Initially, the State and Federal agencies will suspend rules related to reporting and clean-up so they don't impede first responders. The goal is to stabilize the area, conduct rescues, assess damages, and complete general demolition of total losses. After the fact, particularly for properties that are damaged but not total losses, there are a wide range of impacts commensurate with the presence of nearby industrial facilities, refineries, hazardous waste TSDFs, landfills, gas stations and similar in the impact zone.
- Black/grey water, mold and other microbial contamination due to water intrusion. This is not limited to housing but it is a huge problem for multi and residential properties that are not condemned. The extent of the loss is generally the result of presence in flood areas or lack of fortification from high winds. Depending on insurance types and levels, the risks for recovery may be mitigated, but for commercial properties insurance may not cover large portions of the loss. Down time can extend years after a major event. Even simple cleanup, drying and restoration projects can take months due to lack of resources.
- Fire risks. LightBox is researching the impacts to groundwater caused by PFAS associated with firefighting events. One research partner, EnviMetric, has a database of thousands of plumes and models that suggest these impacts spread further than the worst chlorinated solvent plumes.

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?

Yes. As the National Flood Insurance Program (NFIP) phases in Risk Rating 2.0, insurance payments are expected to rise sharply over time. While NFIP has capped the annual increases at 16%, the aggregate increases over several years may create a substantial burden on low income borrowers and also increase mortgage default risks. Specifically, the Entities can explore reduction of insurance requirements when the combined mortgage and insurance payments result in DTI ratios over an agreed upon threshold for lower income borrowers.

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?

In addition to the policy described in question 18, the entities could review their forbearance procedures in event of natural disasters. For multi-family, the Entities can consider creation of forbearance protocols similar to those being employed now during the COVID pandemic. That is, forbearance is directly tied to not evicting minority and low-income tenants.

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?

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?

A number of recent research papers have quantified potential flood exposure of the GSEs under various climate change scenarios. First Street Foundation launched an average annual loss product in February 2021⁷, which could serve as a guide for future research. Additionally, Delta Terra Capital has conducted some of the most detailed research in this area, which can be contemplated before choosing a future research direction. By providing the academic and research communities more streamlined access to loan level data, this can be readily extended to consider a broader set of perils including fire and wind exposures.

Further, hosting a roundtable discussion on the costs and benefits of mitigation projects can help inform potential new lending programs

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?

⁷ https://firststreet.org/press/aal_launch/

Additional data fields that are currently not readily available include insurance payment amounts and the aggregate borrower DTIs as well as climate adaptation features that may have been reported in the Property Condition Assessments (PCAs).

Other data sets such as building footprints, first floor elevation, seismic maps, and so forth are widely available via third-parties and industry is already well served.

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?

To start, the robustness of each of the climate models is important. This includes the impact of multiple climate change scenarios as well property specific details such as first floor elevation and location of the structure on the property itself.

A robust address fabric and geo-spatial expertise is crucial. The FHFA will need precise information about property location on the parcel, elevation and topography, seismic and underground waterflow, the ability to synthesize all this in mass; and the ability to join with other data sets such as income and race.

Our Address Fabric contains 184 million locations with the highest level of confidence (primarily rooftop accuracy, with parcel centroid accuracy as a fallback). Importantly, our address components contain secondary addresses for both residences and businesses, therefore all units associated with a primary address for multi-dwelling and multi-tenant units are captured in the file. Models relying solely on parcel address data will not be able to identify secondary addresses and will have a single address representing the parcel in which the multiple dwelling units exist. Similarly, models relying on parcel-based data cannot identify coordinates at the structure level.

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?

For ESAs and PCAs, the GSEs currently rely on the expertise of qualified environmental professionals that follow stringent consensus-based industry standard practices developed in partnership with the ASTM. Expanding diligence requirements to include climate resiliency assessments is a logical extension of these established due diligence practices with limited added costs to the sponsors. A new ASTM work group has recently formed to begin defining the first industry standard in this area. The Building Resiliency Assessment is being designed to complement the output from a climate stress model by providing tangible risk mitigation recommendations. In particular, the standard is expected to include guidance for professionals to use in address property risks resulting from drought, extreme heat and flood.

In the future, we would expect the standard due diligence package to include an ESA, a Green PCA inclusive of water consumption and energy efficiency analyses, a seismic review, and the Building Resiliency Assessment

covering climate and natural hazard risks. LightBox encourages FHFA to lend its support to the ASTM work group WK 62996 for Building Resiliency Assessments.

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.

LightBox agrees with the concepts presented on this question. We also support development of climate stress tests that would be run prior to loan origination and disclosed as part of the securitization process. Finally, as stated in question 24, we suggest partnering with the ASTM in creation and adoption of Building Resiliency Assessment standards.

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?

Yes, the FHFA should be supportive of these efforts. Given the nuances of real estate, partnering with domain specific trade organizations including CREFC, MBA and the ASTM is also recommended.

Summary

LightBox applauds the FHFA's objectives to better measure and reduce the GSEs and FHLBanks exposure to climate and natural disaster risks. We make five general recommendations for the FHFA's consideration:

1. Including climate resiliency as a due diligence requirement.
2. Performing a climate stress test and loss estimate prior to loan funding or acquisition and as part of a routine portfolio level review.
3. Creating new lending programs to encourage resiliency projects.
4. Encouraging insurance coverage requirements to consider climate change, but also property value and income levels.
5. Understanding the limitations of existing climate risk data and property characteristic data sets when evaluating models and policies and need for a robust national address fabric.

We believe our extensive expertise and broad client base allows us to offer a unique perspective to FHFA on potential solutions in this dynamic area of study and we welcome the opportunity to discuss the subject in more detail.

Select Biographies

Eric Frank, Chief Executive Officer

In March 2018, Mr. Frank Founded and was named Chief Executive Officer of Lightbox, LLC, and operating company funded by Silver Lake and Battery Ventures that has acquired and integrated seven companies focused on real estate location data, analytics and GIS software. From 2014 until 2017, Mr. Frank served as Managing Director of DMGI/DMGT PLC, overseeing their portfolio of US commercial real estate information companies. From 2012 to 2014, he served as a director at AGDATA, LP, a provider of payment facilitation, information services, and software. Mr. Frank was at Thomson Reuters, a news and information company, from 2006 through 2012, most recently as President, managing a \$2.3 billion investment advisory division that was a combination of Thomson Financial and Reuters. Mr. Frank began his career at Morgan Guaranty, helping create the award winning ADR.com portal, which he later sold to Thomson Financial. Mr. Frank received a Bachelor of General Studies from the University of Michigan.

Dan Gottlieb, Chief Strategy Officer

Dan is Chief Strategy Officer at LightBox. He is responsible for market positioning and identifying and evaluating new markets, opportunities, and strategic partnerships. Dan also provides leadership and direction

to LightBox's Data Science and R&D teams. He has spent over two decades developing industry leading data and software products for the real estate and structured finance markets.

Prior to the formation of LightBox, Dan served as Chief Strategy Officer at Environmental Data Resources (EDR). He led the development of EDR's expansion strategy to move beyond environmental assessments into the broader commercial real-estate (CRE) market and raised its profile throughout the CRE lending community. Before joining EDR, Dan was Chief Operating Officer at the CRE and fixed income technology and data firm Trepp. He oversaw Product Management and Software Development and played a leading role to build Trepp to be the industry standard data provider in CMBS. During his career, Dan has been an active participant in the real estate technology industry as a member of numerous trade organizations, a frequent speaker, and as a board member at of Mercatus, Inc., a workflow solutions provider to the energy finance industry.

Zach Wade, Vice President Data Science

Zach is Vice President, Data Science at LightBox where he is responsible for creating new services that leverage structured and unstructured data, remote sensing and machine learning. He holds an MSc. in Economics & Management from the London School of Economics, with Distinction and the Award for Best Dissertation. Zach has held numerous quantitative research positions, including at: the Paul Milstein Center for Real Estate at Columbia University where he contributed to financial economics research on the mortgage crisis of 2008; Deutsche Asset & Wealth Management (now DWS) where he focused on global quantitative research for commercial real estate, infrastructure and commodities securities and real assets; BuildFax where he led data science and created new products from building permit data for the investment and insurance industries; and a CRE data startup he co-founded as head of data science.

Caroline Stoll, Vice President Sales

Caroline Stoll has 19 years' experience in big data and spatial technology and leads all go to market for LightBox Location Intelligence. She manages the overall growth and strategy of the company's data and platform commercial engagements and is responsible for leading a team that empowers government, real estate, and engineering firms with GIS mapping solutions and comprehensive data and analytics solutions.