



In-depth analysis

Factoring climate risks into housing prices

Risks for (potential) homeowners and possible solutions

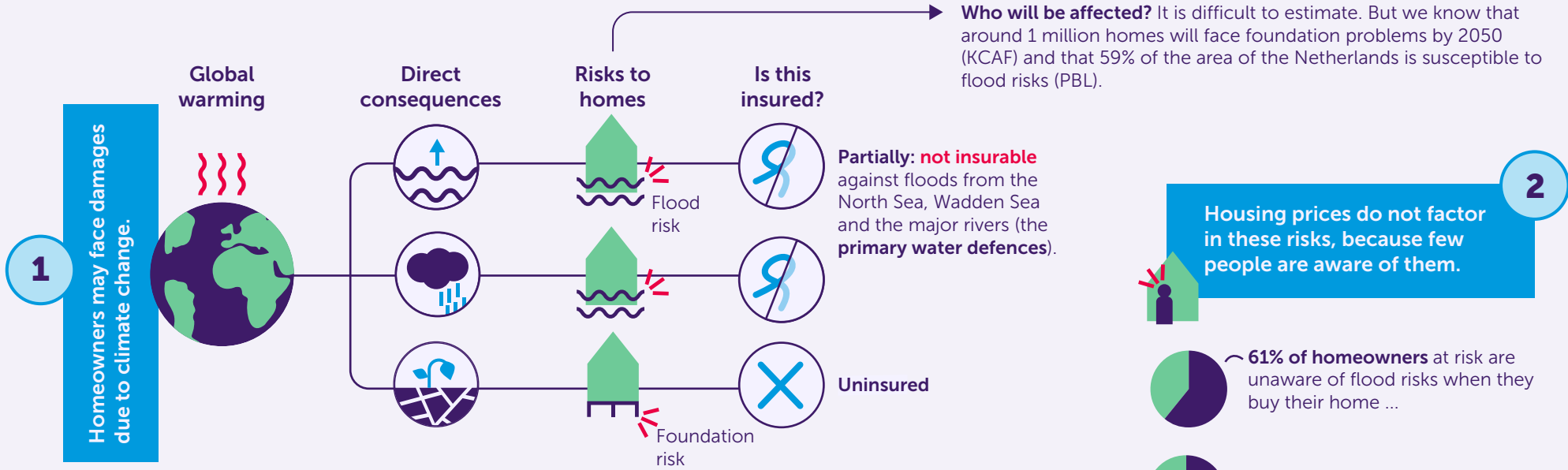


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Visual summary

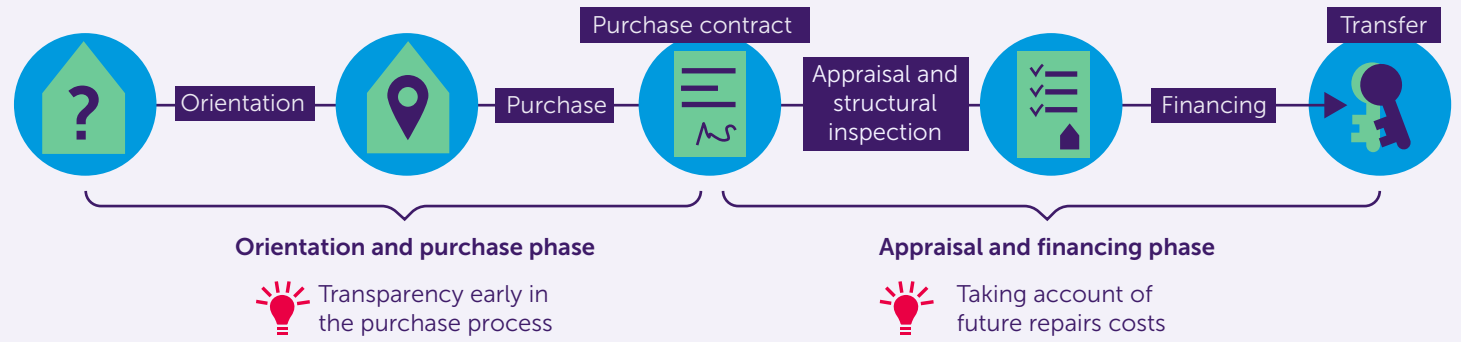
Factoring climate risks into housing prices



3 This has harmful consequences for homeowners.

- You pay too high a purchase price for your house.
- You will face high repair costs in the future.

4 How can these potential damages be factored into the purchase price of a house?





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Executive summary

In the Netherlands, physical climate risks have a significant and growing impact on the housing market. For the Dutch housing market, foundation and flood risks are the most significant climate risks because they have the greatest financial consequences for homeowners. As a result of climate change, extreme weather events such as heavy precipitation and long periods of drought and heat will occur more often. This leads to a growing risk of flooding and damage to the foundation. These risks have potentially major financial consequences for homebuyers and homeowners, as these risks may lead to damages and cause downward pressure on the market values of houses. Foundation damage is not insurable and flood damage is only partially insurable.¹ As a result, homeowners have to bear most of these costs themselves. It is therefore important that house prices reflect these risks. In this paper, the AFM highlights the negative (financial) consequences arising from the insufficient consideration of (incorporating) climate risks from the microeconomic perspective of individual homebuyers and homeowners.

Currently, foundation and flood risks are hardly covered in the house price.

This means that these risks are not or insufficiently part of the property valuation. There are multiple reasons why these risks are not included. Firstly, consumers are not sufficiently aware of these risks. Secondly, sellers are not required to provide information about these risks. Thirdly, the data regarding climate risks are not always considered reliable.

Failure to factor in foundation and flood risks can lead to detrimental financial consequences for (potential) homebuyers and homeowners. First, homebuyers may pay too high a purchase price for the house and, consequently obtain a mortgage that is too high for a house with foundation and flood risks which have not been factored in. If foundation or flood risks only become known later, or

manifest themselves later on, it is likely that the house will decrease in value and that (in hindsight) the buyer overpaid for the house. This means capital loss, where the value of the house can even fall below the mortgage sum. Upon selling the house, homeowners are therefore left with a residual debt. Second, homeowners may suffer financial hardship when they lack the financial means to prevent or repair damage to their house. Currently, the necessary investments for repairing or preventing climate risks are not taken into account during the financing phase of a house. As a result, the situation may arise that homeowners cannot finance these investments, have no action perspective and have to sell the house (possibly at a loss). Third, homebuyers may face unwanted stress and health or safety risks arising from climate risks. Fourth, due to lack of information, homebuyers and homeowners are currently unable to take any precautions.

A downside of factoring in climate risks is that incumbent homeowners face capital loss/lower capital gains and homeowners who recently bought their property with a relatively high mortgage, with the loan to value (LTV) exceeding 100%. This will have to be taken into consideration when drafting policy, for example by helping homeowners finance damage repair. Initiatives already exist, such as the Sustainable Foundation Recovery Fund to help homeowners in certain municipalities finance repairs to their foundation. In the long term, however, it remains important to factor in the risks, as this prevents a new owner from facing the price correction shortly after purchase. Factoring in climate risks is expected to adaptively affect the housing price, so that homeowners do not suddenly face large drops in value. In the event that the seller has been the owner for a long period of time, the accumulated price increase over the past years will also considerably exceed the anticipated price correction and will therefore be manageable for the seller. Finally, foundation and flood risks increase over time. This necessitates timely awareness among owners, giving them the opportunity to anticipate it in good time, and thus preventing risks from escalating.

¹ ['Impact of Climate Change on Non-Life Insurance'](#), AFM, October 2021



To mitigate the harmful effects for potential homebuyers and owners and to effectively factor in these risks, it is recommended that foundation and flood risks are taken into account during the entire house purchase process.

We distinguish two phases: the orientation and buying phase, and the valuation and financing phase. Firstly, information about foundation and flood risks should be known to homebuyers during the orientation and buying phase. This is a requirement such that potential buyers can make an informed purchasing decision that includes foundation and flood risks. The seller or (selling) estate agent must inform the buyer about this. This is how the information will affect the purchase price. This is successively reflected in the appraised market value of the present house and of comparable houses. As a result, the risks become more and more widely factored in after some time. In addition, as long as and to the extent that climate risks are not yet (fully) factored in, it is imperative that valuers further define foundation and flood risks in an understandable, building-specific and unambiguous way in the valuation report as a counterbalance to the market value. Secondly, it is important to ensure during the valuation and financing phase that homebuyers have sufficient financing scope for investments to mitigate climate risks or repair damage. This requires that these costs are taken into account in a consistent manner when determining the maximum mortgage amount.

In order to be able to factor in foundation and flood risks, data must be complete, reliable, standardised and understandable for all stakeholders.

Effectively factoring in these risks must rely on accurate, standardised and reliable underlying data and methodologies. In addition, it is very important that these risk assessments are understandable to consumers and that the information offers action perspective. This enables consumers to adjust their behaviour accordingly. This is important because consumers are not always able to adjust their behaviour based on the information provided. This is certainly the case when the risks and their impact are difficult to estimate or to imagine concretely, such as foundation and flood risks.

Effectively factoring in foundation and flood risks requires an active, coordinating and facilitating role of the government.

Factoring in foundation and flood risks is a complex topic involving many stakeholders and interests. Valuers, lenders, estate agents, government agencies, industry organisations, data parties, knowledge institutes and interest groups all have an important role. Several parties are already working on processes to factor in these risks and to raise awareness of these risks. It requires effective cooperation and coordination to ensure that these processes reinforce each other and that the problem is addressed integrally. The government could take a coordinating and facilitating role where stakeholders, trajectories and policy options come together. We propose multiple policy options for consideration (see section 3.3.).



Introduction

Climate change has a growing impact on the housing market in the form of increasing physical climate risks. In the Netherlands, these effects mainly manifest themselves in the form of increased risks of foundation and flood damage caused by the more frequent occurrence of extreme weather conditions such as heavy rainfall and prolonged drought or heat. These potential damages are in many cases abstract and therefore difficult to comprehend. However, when these extreme phenomena do occur, they can have a major impact on homes. The severe floods of summer 2021 caused a €1.8 billion damage in Limburg² and €36 billion in Belgium and Germany³. Due to persistent drought, among other things, approximately 1 million homes in the Netherlands will be facing foundation problems. The costs for repairing foundations are considerable, with average amounts of €54,000 to even €100,000 per home.⁴

Since insurance against these risks is not possible in most cases, these damage items often have direct financial consequences for homeowners. That is why it is important that these risks are properly factored in. This is not or hardly done at present, with adverse consequences for homebuyers and homeowners. It requires active intervention by multiple stakeholder groups to ensure that foundation and flood risks are effectively factored in. In this paper we highlight the negative (financial) consequences of insufficiently factoring in climate risks from the microeconomic interest of individual homebuyers and owners.

In addition to the fact that climate change results in physical risks, it also leads to transition risks. A relevant transition risk is that homeowners are confronted with rising energy costs and unexpected operational costs due to insufficiently energy-efficient homes. In contrast to physical climate risks, significant steps have already been taken to factor in this transition risk. When selling homes, owners are obliged to provide an energy label. In addition, the Ministry of Finance has proposed to make energy labels a permanent part of the mortgage standards system in 2024 so that energy costs are taken into account when determining the maximum mortgage amount.⁵ As a result, consumers are informed about and protected against this transition risk when buying a home and taking out a mortgage. Chapter 1 describes the impact of foundation and flood risks on homebuyers and owners. Chapter 2 highlights the insufficient factoring in of foundation and flood risks, the underlying reasons, and the corresponding harmful effects for homebuyers and owners. Chapter 3 focuses on solutions and the necessary tools.

² [‘Schadeafhandeling Limburg laat op zich wachten’](#), Binnenlands Bestuur, February 2022.

³ [‘Overstromingen in Limburg en buurlanden op één na duurste natuurramp van 2021’](#), NOS, December 2021.

⁴ [‘De Nationale Funderingsramp \(deel 2\): Funderingsherstel vraagt een lange adem’](#), KCAF, July 2019.

⁵ [‘Wijzigingsregeling hypothecair krediet 2024’](#)



01 Climate risks for the housing market

1.1 Marjor and growing impact of climate change on the housing market

Climate change increases the risk of damage to houses due to drought, heat and flooding. Due to global greenhouse gas emissions, the earth is warming at an accelerated rate, causing the climate to change dramatically. As a result, extreme weather phenomena will occur more often, also in the Netherlands. Climate change manifests itself in particular in the form of (i) more frequent, prolonged and extreme degrees of precipitation, (ii) more frequent, and longer periods of drought and heat, (iii) sea level rise.

These effects affect all aspects of our physical living environment, including housing. The risk of flooding increases significantly. This happens on the one hand due to frequent, prolonged and extreme periods of precipitation that occasionally put a heavy burden on the rivers and waterways and on the other hand due to the steady rise in sea levels, which threatens a large part of the Netherlands in the long term. In addition, the deterioration of foundations due to subsidence and pile rotting increases due to more frequent and longer periods of drought. These problems occur because drought disrupts the stability and support of foundations, in particular due to a lowered groundwater level. Finally, the higher frequency of periods of extreme heat leads to an increase in wildfire risks and heat stress. All these physical climate risks have an impact on property valuation. In the Netherlands, foundation and flood risks are particularly important as they are most likely to occur given our geographical location, will cause the greatest financial damage, and are largely uninsurable (see section 1.2).

More frequent and prolonged periods of drought affect the foundations of houses, and the cost of foundation repair is significant. During periods of drought, the groundwater level can drop. Due to the lower groundwater levels, peat and clay layers may settle, possibly not only causing cracks in walls and facades, but also increasing the risk of rotting wooden foundation piles. This can lead to the subsidence and even collapse of houses. Various estimates by the Knowledge Centre for Tackling Foundation Problems (KCAF) show that there are about one million houses in the Netherlands that have or will develop foundation problems, including one in four houses built before 1970.⁶ The cost of foundation repair varies but averages €54,000 and can be as high as €100,000.⁷ The KCAF estimates that the total amount of damage could amount to €60 billion in 2050.⁸ It should be noted that the risks of climate change are closely intertwined with other interventions in the physical environment. A new groundwater level decision in a polder and the repair or construction of a sewage system could have a major impact on the quality of foundations.⁹ The balance between nature, industries, agriculture and housing is precarious and subject to (future) policy. This has major consequences for the groundwater level, for example. Where farmers benefit from low water levels, homeowners have an interest in high water levels to protect their foundations. The impact of climate change will therefore always have to be taken into account along with other interventions in the physical living environment that are highly dependent on policy decisions. The interests of the housing market and, for example, those of nature or agriculture may conflict.

6 'Omvang funderingsproblematiek', KCAF.

7 'De Nationale Funderingsramp (deel 2): Funderingsherstel vraagt een lange adem', KCAF, July 2019.

8 'Gemelde funderingsschade leidt tot forse prijskorting bij woningverkoop', ESB, January 2023.

9 'Impact droogte op funderingen', Deltares, September 2020.



The risk of flooding increases, possibly resulting in substantial damage to houses.

About 59%¹⁰ of the Netherlands is vulnerable to flooding, with potentially major damage as a result. For example, the total damage after the floods in Limburg in 2021, caused by exceptional rainfall causing the rivers to overflow their banks, was estimated at €1.8 billion.¹¹ European figures indicate that damage caused by flooding will grow sharply. In the first decade of this century, flood damage in the EU averaged €4 billion per year. It is estimated that this will rise to €23 billion per year by 2050, almost a sixfold increase.¹² EIOPA has calculated that the Netherlands runs one of the highest risks of flood damage in Europe.¹³ The development of the actual risk partly depends on measures such as dyke reinforcements. In addition to flood risks, the risk of flooding due to heavy precipitation increases as well. This risk will increase towards 2050.¹⁴ Damage as a result of extreme precipitation is partly insurable. When we refer to uninsurable flood risks below, this includes uninsurable flooding due to rainfall.

In addition to flood and foundation risks, there are other risks for houses, such as the aforementioned risk of wildfires and heat stress due to extreme periods of heat and drought. As these are as yet insurable, real, but less pressing risks, they are beyond the focus of this paper.

1.2 Limited insurability against foundation and flood risks

When analysing climate change in the housing market, it is relevant to distinguish between insurable and non-insurable climate risks. Insurable risks are easier for the consumer to calculate financially and can be included in mortgage advice. However, homeowners are not insured against foundation risks and certain flood risks, so the cost of this is entirely borne by the homeowner.

Foundation risks are not insurable and it is unlikely that insurance will become available in the future. Only uncertain events of which the cause is clear are insurable. In the case of foundation damage, it is often not clear what the exact cause is. In addition, foundation damage is not an uncertain occurrence in many houses. Foundation damage is an imminent and increasing problem for one in eight homeowners. It is clear that these houses will need foundation repair, and that this especially applies to houses built on wooden foundation piles.

In the Netherlands, there is no private insurance for damage caused by flooding of primary flood defences. In the case of flood risks, homeowners are either insured or they are not, depending on the cause. In the Netherlands, a distinction is made between flooding of primary and secondary/tertiary flood defences. The primary flood defences offer protection against flooding in the event of high water from the North Sea, the Wadden Sea and the major rivers and lakes. This is the system of dykes, dunes, dams and special storm surge barriers. Secondary and tertiary flood defences protect against inland waters of the many small lakes, rivers and canals in our country. Flooding of primary flood defences has the potential to cause many casualties and major economic damage. Although there is no insurance for flooding of primary flood defences, the central government will, under certain conditions, compensate the damage suffered that is not covered by insurers. This is the case when a flood is formally declared a disaster and the Disasters (Compensation) Act (Wet tegemoetkoming schade bij rampen; Wts) comes into force. However, this Act will not apply to all floods, meaning that homebuyers and owners cannot rely on damage caused by flooding of primary flood defences to always be compensated.

10 26% is below sea level, 29% can flood if rivers overflow their banks en masse and 4% is located outside the dikes. see: '[Kleine kansen, grote gevolgen](#)', PBL.

11 '[Overstromingen in Limburg en buurlanden op één na duurste natuurramp van 2021](#)', NOS, December 2021.

12 Jongman, B., et al. (2014). Increasing stress on disaster-risk finance due to large floods. *Nature Climate Change*, 4(4), 264-268.

13 '[Discussion paper on non-life underwriting and pricing in light of climate change](#)', EIOPA, December 2020.

14 '[Klimaatverandering en intergenerationele verdeling van financiële lasten](#)', CPB, September 2023.



For example, research commissioned by the Ministry of Justice and Security shows that the details of the compensation scheme were not clear for the victims of the floods in Limburg in 2021.¹⁵

In 2021, the AFM urged the sector and the government to look at ways to address flood risk.¹⁶ We still consider better insurability of flood risks a good solution to protect homeowners from such losses. The Dutch Association of Insurers also has ideas to make damage caused by the breach of primary flood defences insurable.¹⁷ In addition, the Dutch Association of Insurers has also called on the government to cooperate with insurers on a compensation system for floods from large rivers and/or the sea.¹⁸ However, there are currently no concrete plans for this, which means that primary flood defences are and remain uninsurable at the moment. In this paper we will therefore explore other solutions. At the same time, such insurability will lead to rising and house-specific premiums (as is already common with a house with a thatched roof). If the premium differences increase, this will also have to be factored into the property value due to the difference in monthly costs, as is now also the case with the mandatory energy label.

1.3 Impact of foundation and flood risks on houses

As foundation and flood risks are largely uninsurable, they have a significant financial impact on certain houses. The fact that these risks can lead to high costs that are to be borne by the homeowners themselves means that these risks can have a strong negative effect on the market value of a house. As extreme weather events due to climate change increase, the likelihood of such damage and depreciation will increase in the coming decades.

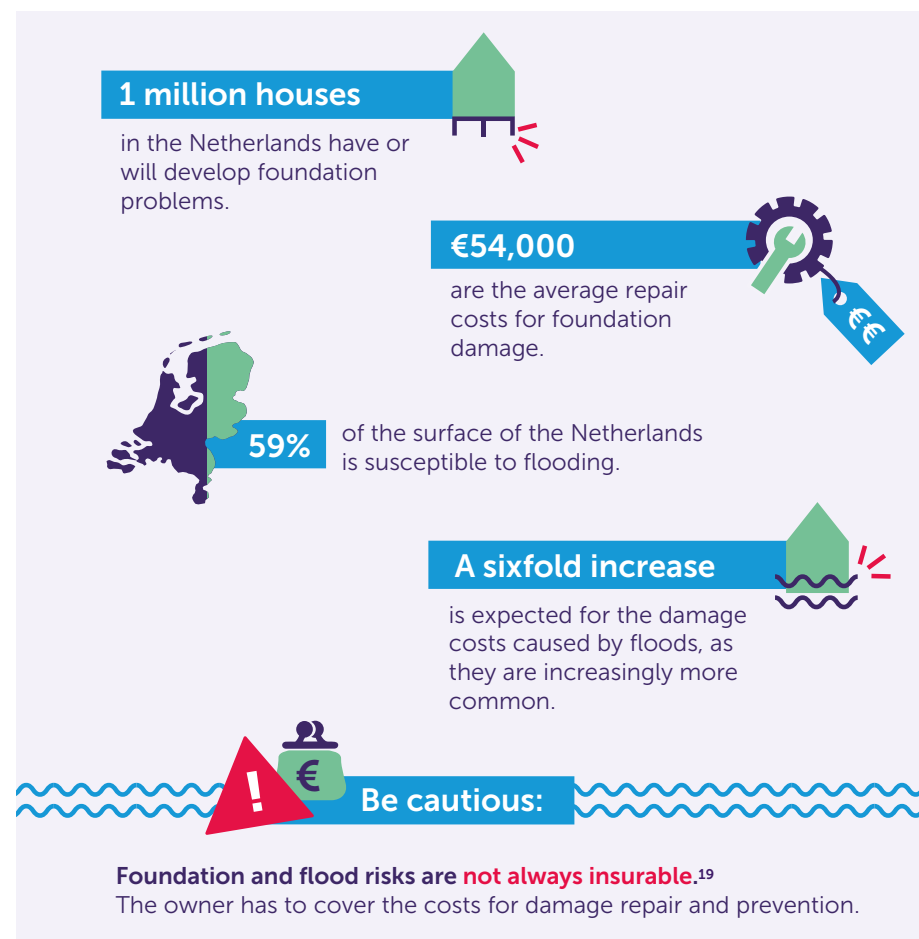
¹⁵ 'Procesevaluatie afhandeling waterschade Zuid-Nederland', AEF, January 2023.

¹⁶ 'Impact of Climate Change on Non-Life Insurance', AFM, October 2021.

¹⁷ 'Insurers take next step in insuring flooding by large river or sea', Verbond van Verzekeraars, December 2022.

¹⁸ 'Oproep aan overheid: werk samen met verzekeraars aan solidair systeem voor compensatie bij overstrooming door grote rivier of zee', Verbond van Verzekeraars, February 2022.

Figure 1. Did you know that...



Source: Rijkswaterstaat, OECD, KCAF.

¹⁹ Flooding of primary flood defences is not insurable, but flooding of secondary and tertiary flood defences is (partly) insurable.



Despite the fact that foundation and flood risks differ in nature and size, they are taken together in this exploration under the heading of 'uninsurable risks'.

Foundation risks are more predictable in terms of the likelihood and possible damage or (if addressed in time) costs for repair. Once repair is done, the chance of future damage is nil. Flood damage can amount to the rebuilding value of the house and after repairing the damage (without mitigating measures) the risk of recurrence remains. The scope required to maintain action perspective can be reasonably calculated for foundation risks (expected repair costs with a small spread), whereas for flood risks it has a lower expectation, but has a much greater spread and chance of recurrence. We are aware of these differences.





02 Insufficiently factoring in climate risks

Given the impact of foundation and flood risks on property value, it is important that these risks are sufficiently factored in. When factoring in flood and foundation risks, all already occurring and foreseeable effects of future climate risks and possible costs to the house must be taken into account in the price formation and valuation of the house. In the case of foundation and flood risks, this means that the existence of these damages, or the risk of their occurrence, are priced. Because foundation and flood risks in most cases involve non-visible damage and future risks, factoring in these risks often has to be based on data-driven risk assessments.

2.1 Foundation and flood risks are insufficiently factored in

Flood risks are currently insufficiently factored into the property value. In the Netherlands, buyers do not, or only to a limited extent, take flood risks into account when determining the property value, unless a flood has actually occurred in the recent past. By studying characteristics of houses sold between the 1999-2011 period, it appears that there is only a small price difference between two houses that are comparable in all aspects except their flood risk.²⁰ The price difference is only 1% of the value (about €2,400 at the time, now €4,300). Researchers at ABN AMRO seem to have come to a similar conclusion with more recent data.²¹ They do present their findings with some caution because of the methodological challenges associated with the analytical technique used.

The value effect disappears the longer the flood has passed. After the floods of the Meuse in 1993 and 1995, researchers temporarily found a negative effect on house prices. According to Daniel et al. (2009), this effect was still present ten years after the flood.²² However, Mutlu et al. (2023)²³ show that over time this effect became smaller and in the absence of new flooding it disappeared after 9 to 12 years.

Foundation risks are also insufficiently factored in, despite the significant impact on property value. Hommes et al. (2023) have analysed the sales texts on Funda for the period between January 2019 and June 2022 using text mining. This shows that only 2.2% of the sales texts so much as mention the quality of the foundation.²⁴ If foundation risks are mentioned, they are partly included in the purchase price, but it is unclear whether this effect is in good proportion to the actual repair costs. The researchers found that the sales value of houses with a poor foundation appears to be on average 12% lower than comparable houses without knowledge about the condition of the foundation. With a repaired foundation listed on Funda, the sales value is 2% higher.²⁵ Other research by Willemsen et al. (2020)²⁶ compared house prices in Gouda and Rotterdam (higher risk of subsidence) with house prices in Arnhem (lower risk of subsidence). They find a price difference of about 6% between houses with a higher and lower risk of subsidence.

20 Garretsen, J., Marlet, G., Bosker, M., & van Woerkens, C. (2019). Nether Lands: Evidence on the Price and Perception of Rare Natural Disasters. *Journal of the European Economic Association*, 17(2), 413-453.

21 'Is flood risk already affecting house prices?', ABN Amro, February 2022

22 Daniel, V. E., Florax, R. J., & Rietveld, P. (2009). Flooding risk and housing values: An economic assessment of environmental hazard. *Ecological Economics*, 69(2), 355-365.

23 Mutlu, A., Roy, D., & Filatova, T. (2023). Capitalized value of evolving flood risks discount and nature-based solution premiums on property prices. *Ecological Economics*, 205, [107682].

24 Hommes, S. et al. (2023) *ESB*, 108(4819), 136-139.

25 Hommes, S. et al. (2023) *ESB*, 108(4819), 136-139.

26 Willemsen, W., Kok, S., & Kuik, O. (2020). The effect of land subsidence on real estate values. *Proceedings of the International Association of Hydrological Sciences*, 382, 703-707.

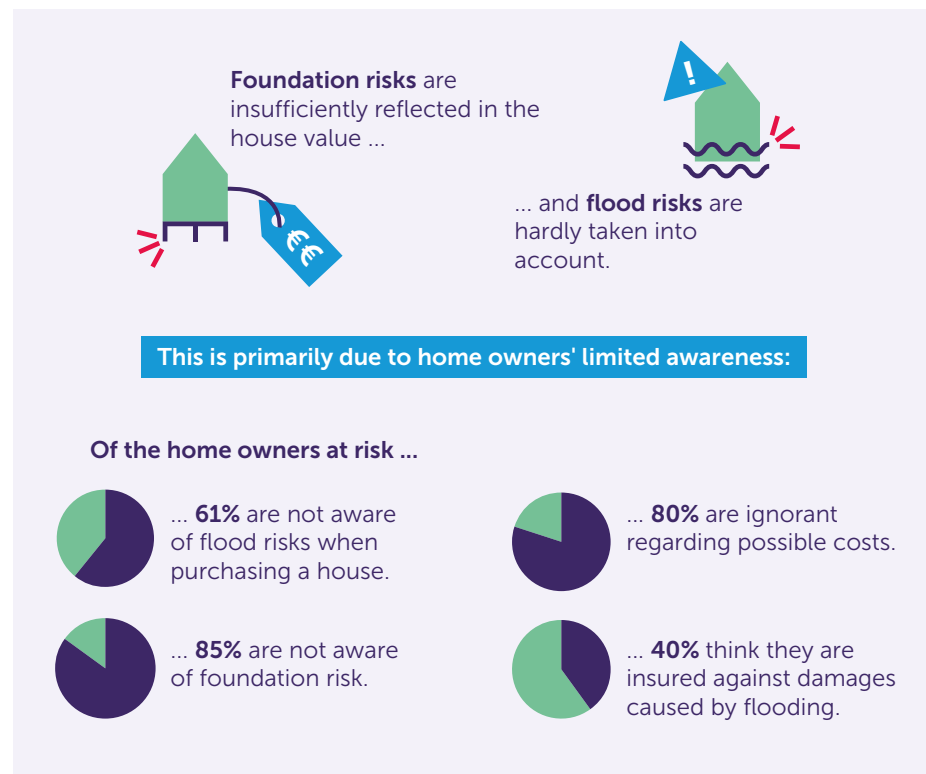


2.2 Reasons why risks are insufficiently factored in

The AFM observes three reasons why foundation and flood risks are currently not factored in:

1. Low awareness among homebuyers about foundation and flood risks and potential repair costs,
2. absence of incentives for homesellers to investigate foundation and flood risk,
3. insufficient confidence in data on these risks.

Figure 2. Blind spots...



Source: Vereniging Eigen Huis, Dutch Association of Insurers

First, homebuyers are often unaware of the impact of foundation and flood risks on property value and potentially high repair costs. Research by Vereniging Eigen Huis (Homeowners' Association) shows that 85% of homeowners at risk of foundation damage and 61% of homeowners with a risk of flood damage were not aware of this when they bought the house. The survey also shows that 80% of homeowners have no idea about the possible costs.²⁷ Finally, research by the Dutch Association of Insurers shows that more than 40% of consumers are under the mistaken assumption that flood damage is covered by the insurer.²⁸ On top of that, homebuyers often receive too little guidance to assess risks with small probability and high impact, so that any concerns about possible future events remain low. People often rely on the policy conditions of the insurance and/or the role of the government in the event of uninsurable damage. This while foundation damage in almost all cases must be borne by the residents themselves. Another factor is that the housing market is tight, which means that homebuyers have little choice and little time to make a choice.

Second, homesellers are not obliged to have a foundation survey carried out or to make data regarding foundation or flood risks available to potential homebuyers.

Homesellers rarely benefit economically from gathering and sharing this information about foundation or flood risks. Research shows that if foundation damage is reported, the asking price is on average 12% lower than the estimated value that the model made without knowledge about the foundation's condition. Since the average house price in September 2023 is €416,000,²⁹ and foundation repair costs an average of €54,000, this comes to about 13% of the average house value. With mention of a repaired foundation, the selling price came out 2% higher on average, amounting to about €13,500. Thus, the increase in the selling price does not increase proportionally with the cost of foundation repair. From a purely economic point of view, the seller therefore does not benefit from having a survey carried out if the risk of existing foundation damage is high, as this has a negative effect on the price. And conversely, if there is almost no chance of foundation damage, there is no 'profit' for the seller to provide insight into this as this risk has hardly been factored in and the costs may

²⁷ 'Onderzoek in risicogebieden wijst uit: Huizenbezitters onvoldoende bewust van risico's klimaatverandering', Vereniging Eigen Huis, February 2023.

²⁸ 'Hoofd boven water: Verzekeren van schade in een veranderend klimaat', Dutch Association of Insurers, November 2016.

²⁹ 'Dashboard woningmarkt', CBS (CBS' housing market dashboard).



not outweigh the benefits. In addition, a foundation survey is often too expensive and time-consuming to have it carried out by a potential buyer before the buyer proceeds to purchase the house. Moreover, buyers cannot have a foundation survey carried out for every house they want to bid on. There is also currently no obligation to share any flood risk information with potential buyers.

Third, data relating to these foundation and flood risks are often still considered too coarse or unreliable.

In many cases, sellers, estate agents and valuers are still hesitant to base their judgment on these data due to the perceived unreliability of data about the risks. This is a bigger problem in the case of foundation risks than in the case of flood risks. In addition, there is currently no uniform definition and standard method to estimate foundation and flood risks unambiguously and in a structured way, and to translate them into a risk classification for houses, as is currently the case with energy labels. According to the KCAF's foundation research guideline, foundation qualities are, however, being ranked. The risk analyses of the KCAF are also translated into categories. In the Netherlands, valuers do not yet take flood risks into account. These are not part of the model valuation report.³⁰ It is a good step that foundation risks have become part of the model valuation report. However, the extent to which valuers consider and rely on foundation risk data is not clear yet. It is important that valuers take foundation data into account if sufficiently reliable data are available.

2.3 Harmful effects on homebuyers and homeowners

Failure to factor in foundation and flood risks leads to four harmful effects for homebuyers and homeowners.

First, homebuyers may pay too high a purchase price and obtain an excessive mortgage for a house faced with foundation and flood risks.

If foundation and flood risks are present, but have not been factored in, this results in an overestimated purchase price. It is expected that due to the higher price formation, the appraised value is higher and the buyer can then borrow more money. After all, a person can

borrow up to 100% of the value of the house (LTV). However, if foundation or flood risks become known later on, or if they manifest themselves at a later stage, it is likely that a price correction will take place on the property. The resulting decrease in value then leads to a financial setback for the buyer. This has additional negative consequences when the homeowner wants or has to sell the property and has taken out the mortgage with a high LTV. This leaves the homeowner with a residual debt.

Second, homeowners may suffer financial hardship when they lack the financing capacity to prevent or repair damage to their house.

Repairing or preventing damage to the property may require significant investments. Think of replacing or repairing a foundation, repairing damage to the house after a flood or taking precautions to prevent this type of damage. If the homeowner has borrowed the maximum amount based on income (100% loan-to-income, LTI) and the value of the collateral (100% loan-to-value, LTV), this means that there are no additional financing options for this. The lending standards (LTI and LTV), elaborated in the Temporary Mortgage Credit Scheme (Trhk), only offer extra borrowing scope in some specific exceptional cases, such as in the case of a municipal scheme for necessary house improvement. Because the necessary investments for repairing or preventing climate risks during the financing phase of a house are currently not taken into account, the situation may arise that homeowners cannot finance these investments, have no action perspective and have to sell the house (possibly at a loss and with residual debt).

Third, homebuyers may suffer from housing stress and health and safety risks arising from climate risks.

In addition to financial consequences, foundation repair also has a major (temporary) impact on the living situation of consumers. Floods can have a very large physical and mental impact on people's lives. For example, during the flood of 2021, more than 200 people died in Belgium and Germany and thousands of people in the Netherlands had to leave their houses temporarily.

³⁰ [Taxatierrapport woonruimte](#), NWWI, July 2022.



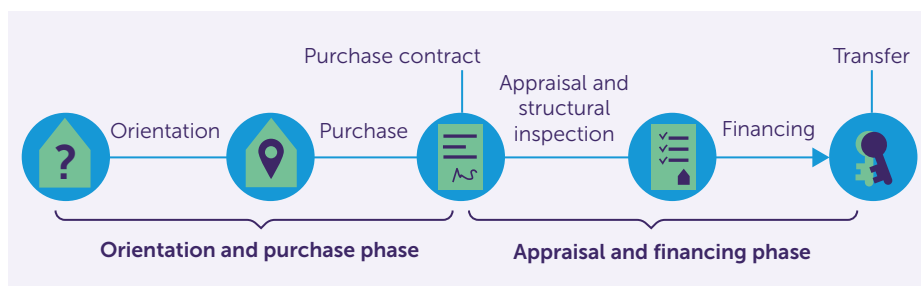
Fourth, due to lack of information, homebuyers and homeowners are also unable to take precautionary measures at this time. As homebuyers and homeowners are not aware of the possible risks, they are not in a position to act preventively. As a result, the costs due to flood and foundation damage can be higher and increase further, thus only adding to the problem.

A downside of factoring in these risks is that incumbent homeowners face capital loss/lower capital gains and short-term homeowners with a relatively high mortgage see the LTV exceed 100%. This will have to be taken into consideration when drafting policy, for example by helping homeowners finance damage repair. Initiatives already exist, such as the Sustainable Foundation Recovery Fund to help homeowners in certain municipalities finance foundation repair. In the long term, however, it remains important that the risks are priced in. This prevents a new owner from being confronted with a price correction shortly after purchase. Pricing in is also expected to enter prices adaptively so that homeowners do not suddenly have to deal with large drops in value. In the event that the seller has been the owner for a long time, the accumulated price increase over the past years will also be considerably more than the expected price correction and can therefore be overseen by the seller. Finally, foundation and flood risks increase over time. This necessitates timely awareness among owners, gives them time to anticipate, and prevents the risks from increasing unnecessarily.



03 Possible solutions and required tools

As long as climate risks are not insurable, it is important that foundation and flood risks are effectively factored in. For this we consider it necessary that these risks are taken into account during the entire house purchase process. We distinguish two phases: the orientation and buying phase, and the valuation and financing phase



3.1 Transparency on foundation and flood risks during the orientation and buying phase

Information about foundation and flood risks should already be known to homebuyers during the orientation and buying phase. This is a requirement for potential buyers to make an informed purchasing decision that includes foundation and flood risks. It is important that sellers, estate agents, valuers and lenders provide openness about foundation and flood risks. The sooner that information is known in the buying process, the better the potential buyer can factor these risks into the price formation and the purchase decision. It is important that if there is a risk, the seller or estate agent will inform the buyer about this. Estate agents can distinguish themselves by providing good advice about this. Through this channel,

this information will have an effect on the purchase price and then on the appraised market value of the house and comparable houses, and thus become more widely factored in. In order to facilitate factoring the risks, we prefer for homebuyers in the Netherlands to be (mandatorily) informed about possible foundation and flood risks early on in the buying process. Also, as long as and to the extent that climate risks have not yet been factored in (in full), valuers must describe foundation and flood risks in an understandable, building-specific and unambiguous way in the valuation report³¹ as a counterbalance to the market value. If this happens, it ensures that lenders are able to provide a more responsible mortgage amount.

Research into and experience with such information rules are available. By comparing different states in the United States with strict and less strict disclosure rules, Hino & Burke (2021) concluded that making mandatory information available about the flood risk, the expected damage and insurability can have an impact on the purchase price.³² In other countries, information obligations already exist regarding foundation or flood risks. In Belgium, for example, there is an obligation to provide information on flood sensitivity. Here, when selling or renting, homeowners must inform the buyer or tenant when the property is located in a flood-prone area.³³

Behavioural studies show that consumers do not always adapt sufficiently when given more information. Factoring in foundation and flood risks during the orientation and buying phase by informing potential buyers may therefore have a limited effect. This is reinforced when it concerns abstract topics such as foundation and flood risks. For the effective factoring in of foundation and flood risks, it is

³¹ Flood risks are not part of the standard valuation model, foundation risks are, but the interpretation is too brief.

³² Hino, M., & Burke, M. (2021). The effect of information about climate risk on property values. Proceedings of the National Academy of Sciences, 118(17).

³³ 'Informatieplicht overstroomingsgevoeligheid, watertoets en signaalgebieden', Flanders Environment Agency.



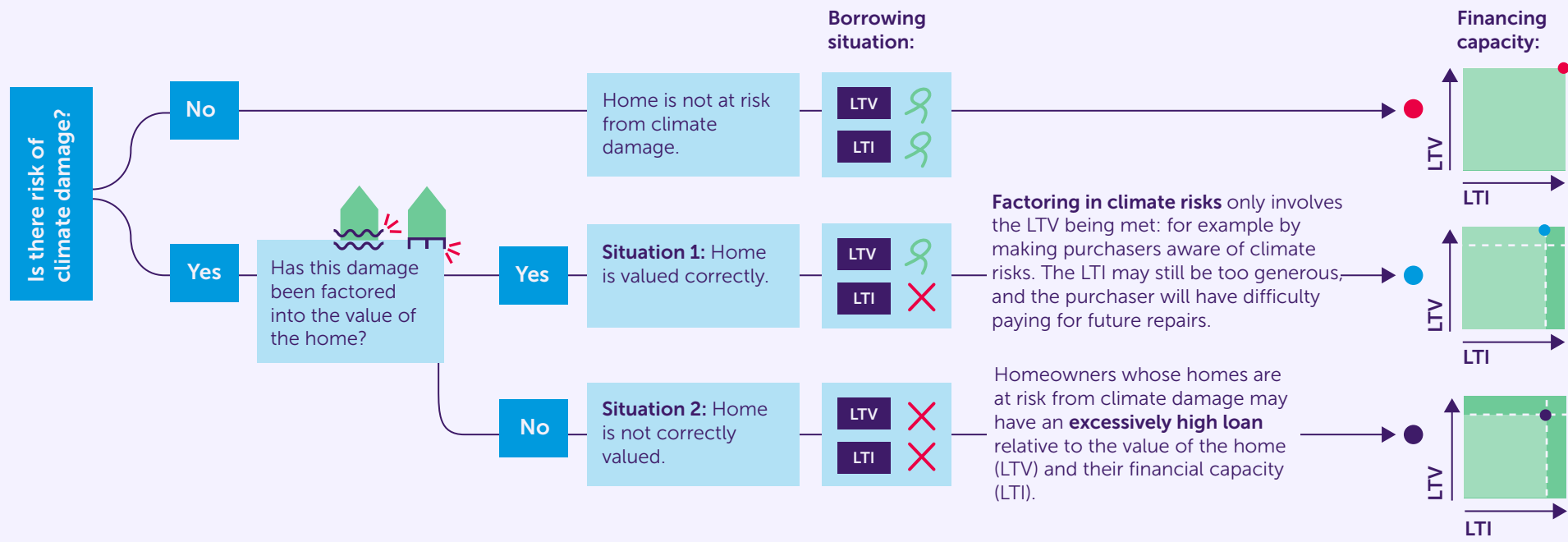
therefore necessary that factoring in risks during the orientation and buying phase is combined with the inclusion of these risks during the valuation and financing phase.

3.2 Sufficient financing space for mitigation and damage repair during the valuation and financing phase

In addition to the fact that house buyers must be informed during the orientation and purchase phase, it is important that house buyers have sufficient financial capacity for investments during the valuation and financing phase to mitigate climate risks or repair damage. If foundation and flood risks are factored in as a result of disclosure, this results in fairer property values. Nevertheless, homebuyers can run into financial difficulties if they do not have sufficient financial scope to mitigate climate risks or repair damage. To this end, these costs should be taken into account in a consistent manner when determining the maximum mortgage amount. Valuers must provide information about the existence of these risks and provide a clear and comprehensible description of these risks. This means that it is important that in addition to foundation risks, flood risks also become part of the model valuation report. These costs can then be taken into account during the financing phase. It is little appealing for individual lenders to take this into account if competitors refuse to do so and continue to offer higher mortgage amounts. It is therefore more effective to agree to a uniform approach so that investments needed to mitigate climate risks or repair damage are consistently taken into account. We recommend that policy options be explored in order to achieve this. This could include (legal) changes, including a possible adjustment of the lending standards.



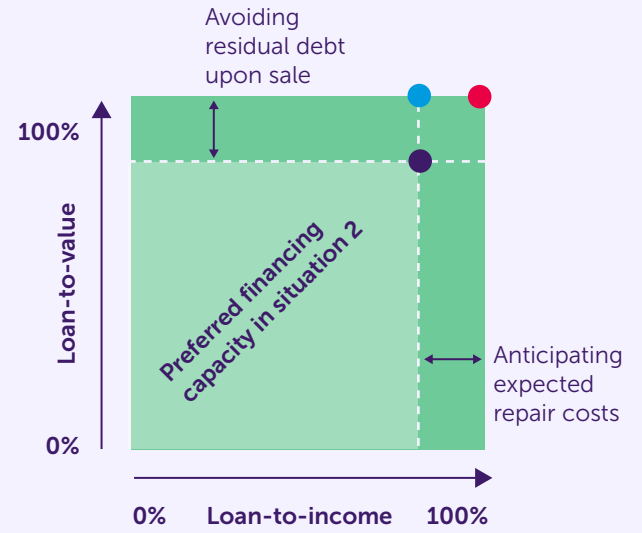
1 Factoring in climate risks is not sufficient for a safe loan ...



2 ... also ensure that there is sufficient borrowing capacity for future repairs as a result of climate damage.

Financing capacity explained

- Preferred financing capacity in:**
- Situation without climate risks
 - Situation with home correctly valued
 - Situation with borrowing limits that take account of climate risks





Situation 1

In the first situation, the climate risk is factored in and the purchase price is €410,000. Factored in here means that the planned repair costs are included in the purchase price. The buyer takes out a mortgage with LTV of 100% and borrows the maximum amount based on their income. The required gross income with a mortgage interest rate of 4.5% is in this case €85,000 per year. If the damage must be remedied shortly afterwards, this does not affect the market valuation and the LTV is still 100%. But the buyer has no opportunity to finance the necessary repair by increasing the mortgage (unless income has increased). In this situation, sale is the only option left, with or without residual debt as a result. The buyer has no action perspective after the damage occurs, despite factoring in these risks into the purchase price.

Situation 2

In the second situation, the climate risk is not factored in and the purchase price is therefore higher, namely €450,000. The buyer again takes out a mortgage with LTV of 100% and borrows the maximum amount based on their income. This amount and the same interest level as in situation 1, requires a gross annual income of €90,000. If the damage has to be repaired shortly afterwards, additional financing is not an option, because the customer is already borrowing the maximum amount based on their income. At the same time, the house receives a write-down of €40,000 to €410,000 (in direct proportion to the repair costs) and the LTV rises towards 110%. In this case, the purchase price is incorrect, which means that the loan is de facto too high, based on both property value and financial capacity. Assuming a situation in which recovery is necessary in the short term, sale is the only option left, resulting in residual debt. Even if the write-down takes place and the recovery can still wait, the customer will remain in this situation for some time. According to the annuity repayment schedule, it takes about 9 years before additional financing space of €40,000 can be used.

Desired situation

This shows that the current lending standard system, which does not explicitly take these foreseeable risk factors into account, can put customers under pressure. This simple example illustrates the interaction between the LTV and income requirements in the loan standard system and shows that it is not enough to tackle market valuation only. To protect home buyers in the event of climate risks, an adjustment of both LTV and income requirements is needed. The example does not take into account changing house prices or a changed income situation, but that is also the case in the current loan standard system.

3.3 Required tools

Supporting tools are needed to factor in foundation and flood risks by including them during both phases.

3.3.1 Complete, reliable, standardised, and understandable information

First, complete and reliable data must be available. Data quality varies per risk. Reliable flood information is available at a detailed level indicating the different flood risks. The Climate Impact Atlas³⁴ has detailed flood information on specific areas. However, certain types of flood risks are not yet available, such as data on major flooding during downpours and on ditches/streams coming out of the banks in the vicinity of residential areas (surface water and drainage problems).

Data collection related to foundation risks is less developed than data collection of flood risks and will therefore require further effort. Data on foundation issues have been greatly improved in recent years, enabling better data-driven risk assessments. Nevertheless, further development is needed to make building-specific foundation data available for all houses. As an independent national foundation desk, the KCAF is taking solid steps in collecting data from municipalities and is currently able to map foundation risks very reliably for approximately 35-40% of the houses. The KCAF can make data-driven estimates of the other 60%-65% of the houses. It is currently possible to provide valuable information about the foundation risk based

³⁴ See [Klimaateffectatlas](#).



on these data-driven estimates. However, the reliability levels of data should be taken into account in the risk assessment and its communications. The KCAF is committed to high-reliability foundation risk mapping for more houses. Given the public interest of further developing information on floods and foundations, this deserves further support.

Second, it is important that structured and unambiguous data definitions are used and that the subsequent data modelling and risk assessment are uncontroversial and uniform. This requires coordination between different initiatives in order to prevent different, contradictory risk assessments being produced and referenced.

Third, it is very important that this information is presented in an insightful manner to consumers, estate agents, (selling) platforms, valuers and lenders.

This transparency is especially important for consumers. It is known from conduct-of-business supervision that consumers take in limited information and adjust their actions accordingly. The challenge is therefore to design the newly accessible information in such a way that the information matches the capabilities and inabilities of the consumer. It is important that the information to be presented excels in simplicity, convenience and user-friendliness, that the risks are clearly displayed, jargon is avoided, little prior knowledge is required, and that graphic support is provided.

3.3.2 Active, coordinating and facilitating role of the government

The effective factoring in of foundation and flood risks requires an active, coordinating and facilitating role of the central government. Factoring in foundation and flood risks is a complex topic that involves many stakeholders and interests. Valuers (organisations), lenders, estate agents, government agencies, industry organisations, data parties, knowledge institutes and interest groups all have an important role. Several parties are already working on processes to factor in these risks and to raise awareness.³⁵ Ensuring that these processes reinforce each other and that the problem is addressed integrally requires effective cooperation and coordination. The government could take a coordinating and facilitating role in which stakeholders, trajectories and policy options come together.

³⁵ The municipality of Zaanstad takes steps to inform consumers about foundation risks and also provides information about foundation repair. See '[Funderingen in Zaanstad](#)'.

This could include the following roles and actions:

- a** Setting up and coordinating a national platform where, among others, consumers, selling and buying estate agents, valuers, lenders and data parties are brought together to focus on better information provision about the impact of climate risks on houses;
- b** The formulation of a standardised and understandable climate label so that consumers, selling and buying estate agents, valuers and lenders can rely on the same information (single point of truth);
- c** Making it mandatory for sellers, selling estate agents and platforms to report foundation and flood risks (in the form of a climate label) to the buyer or buying estate agent prior to the sale of a house;
- d** Formulating uniform principles for unambiguous data definitions, data modelling and risk assessment with respect to climate risks;
- e** Exploring and considering policy options, including adaptation of the lending standards, to ensure consistent consideration of the investments needed to mitigate climate-related risks or repair damage during the financing phase;
- f** Promoting the further expansion of (publicly) available foundation and flood data to improve the reliability and accuracy of this data at house level;
- g** Expanding the role of the Dutch Municipalities Housing Fund NL (SVn), which is currently tied to municipal regulations instead of a national scheme in terms of foundation repair;
- h** The further development of solutions to make flood risks insurable under a wider range of events for private individuals.³⁶

³⁶ In 2021, the AFM provided four solutions. The first option is to specify the role of the legal possibilities for compensation from the government in addressing the damage burden. Another option is to require certain coverage or participation in insurance, as is the case for flood insurance in some other countries. Yet another possibility is the international reinsuring of some damage (as far as possible given the global nature of climate change). Finally, attention to prevention can help to limit the total damage burden.



Foundation and flood risks require an integrated approach that fully takes into account the growing impact of climate change. The risks of climate change are closely intertwined with other interventions in the physical living environment. The balance between nature, industry, agriculture and housing is precarious and subject to (future) policy. Climate risks will also become an increasingly important factor from a prudential perspective.³⁷ For example, banks will thus take this into account in their risk management. As a result, this urgent and important matter must be addressed carefully. We believe that foundation and flood risks must be taken into account consistently throughout the house buying process. This requires action from multiple stakeholders including estate agents, valuers, lenders and the government. The policy on energy labels may be used as a blueprint here. Based on our responsibility as market regulator, we feel the duty to bring this topic to the attention of the entire housing market and are open to discussing this with stakeholders.

³⁷ ['Guide on climate-related and environmental risks'](#), ECB, November 2020.



Any questions or comments about this publication?

Send an email to: redactie@afm.nl



The Dutch Authority for the Financial Markets

PO Box 11723 | 1001 GS Amsterdam

Telephone

+31 20 797 2000

www.afm.nl

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