Climate related risks generate significant economic, social and humanitarian losses, rising in 2018 to US$ 160bn for overall losses and US$ 80bn for insured losses (Löw 2019). In a 2 °C degree warmer world, the climatic risks are highly likely to increase and thus, the losses associated with those risks (e.g. decrease in crop production due to low rainfall and the inherent eutrophication of inland waters) are expected to raise up to 50%. Caisse Centrale de Réassurance estimates that climate related risks will be responsible for a rise of 35% of average annual losses and 15% due to concentration of assets in risk-prone areas (Moncoulon et al 2016).

Because economic and human losses might increase in a changing climate, the question of insurability of risks and affordability of insurance become key. High risks might become uninsurable and the costs of insurance contracts might upsurge. Simultaneously, the protection gap, the discrepancy between economic losses and the claims covered by insurance, has increased. The economic growth of developing and developed countries has boosted the emergence of insurance policies as well as the rise of insured values (Staib and Puttaiah 2018). The resilience of our societies to both frequent and extreme events require to close the protection gap through strong risk transfer mechanisms. The threats of climate change can lead to opportunities by the (re)insurance sector through their involvement into nature-based loss prevention for climate change adaptation (CCA). The opportunities are framed within the sustainable flywheel business model for the (re)insurance future (figure 1). The flywheel is a virtuous circle that leverages on (re)insurers’ risk modelling expertise to increase knowledge on the consequences of climate change on hazards and on nature-based solutions (NBS). This will maintain affordability of insurance by limiting increasing damage and the industry further participates in investments and partnerships for loss prevention.

1. From grey to green loss prevention: how (re)insurers are considering insurance value of NBS?

There are actually several engineering measures for disaster risk reduction and CCA: grey, green and hybrid measures. Traditional ‘grey’ engineered measures are widely used, tested and relatively trusted to protect climate related high-risk areas. All over the world, there are examples of grey measures mitigating the impacts of natural hazards: large dike areas against storm surges in Japan (450 km of concrete walls), levees against floods (Mississippi 3,800 km of floodwalls, dams and levees (in Paris) against river flooding or coastal flooding (New Orleans, 570 km of levees) etc. Those engineering measures protect people, buildings and lands deeply exposed to repeated floods. Academics have also demonstrated that those measures decrease people’s risk perception and generate a false sense of security (Jongman 2018). Grey measures aiming at e.g. protecting against riverine floods are also no longer seen as the only suitable option for climate risk protection because they cut the river from its natural flows and biodiversity habitat (Cohen-Shacham et al 2016).

DRR policies and adaptation research are increasing considering NBS to cope with risks and enhance CCA. In the literature they have been referred to as green infrastructure as opposed to grey infrastructure. NBS mainly support the functions of the ecosystem and have been defined ‘as any transition to a use of ecosystem services with decreased input of non-renewable natural capital and increased investment in renewable natural processes’ (Maes and Jacobs 2017). Emerging research demonstrates the role of NBS in supporting ecosystem functions, avoiding damage and reducing risk exposure. NBS
Figure 1. When assessing climate change, two main things come to light: (a) an increase in hazards or (b) a degradation of ecosystems. In both cases this means an increase of the damage costs if not accounted properly. This will affect the affordability of insurance coverage, in which case (re)insurance companies have to assess the risk and the effectiveness of NBS as prevention measures (including the multi-hazard impacts and the co-benefits, supported by scientists). The knowledge improvement and the reduction of hazards will ensure affordability of (re)insurance premiums and insurability of risks.

are gaining in importance in climate risk planning. The main advantage of NBS over other risk reduction and prevention strategies is their capability to address multiple hazards while simultaneously providing co-benefits to the social-ecological system. For example, restoring or protecting coastal wetlands can reduce the impact of storm surges by reducing water heights and dissipate wave and wind energy. Moreover, coastal wetlands can act as a natural water reservoir during drought periods. Additionally, they may deliver additional benefits (co-benefits) such as fish provision, carbon sequestration or job creation (Gómez Martín et al 2020). NBS can also be coupled with grey measures to act as hybrid measures. A good example is the implementation of retention ponds in strategic locations of an irrigation system. If applied correctly, they increase the percolation of water in the groundwater reservoirs as a measure to face droughts (Liquete et al 2016, Nesshöver et al 2017). Prevention through NBS saves more money than post-disaster compensation. Notably, NBS are low-cost interventions compared to grey measures to reduce the impact of natural hazards (Kabisch et al 2017, Nesshöver et al 2017).

NBS are able to alleviate the impacts of climate related extreme events and therefore intrinsically represent a high value for society. It can be exemplified by coastal protection; a study shows that NBS were estimated to be two to five times more cost-effective than grey engineered solutions (Narayan et al 2016). Another example is the Coral Reef insurance in Mexico where the insurance industry had a strong interest in valuing reduced average annual property losses in areas with and without mangroves. The study suggests that thanks to mangroves the avoided damage were estimated at 1.5 bn$ during Hurricane Irma (category 5, large fast-onset event) (Ferrario et al 2014, TNC 2019). Additionally, the operational and maintenance cost of NBS have financial advantages in comparison to grey infrastructure (European
Commission 2015). When implementing NBS as part of a wider strategy to respond to climate change, NBS support reduction of future costs of climate risks and represent a real protective value in prevention. The value is understood as an insurance value to assess the capability of a human-made or a natural ecosystem to buffer shocks—e.g. a reduction in premiums related to avoided damage and co-benefits (Baumgärtner and Strunz 2014). The (re)insurance industry is evolving towards ex-ante preventive measure assessments and promoting measures in the field of NBS. This is mainly driven by the increase amount of research on NBS for DRR. The day-to-day business of the insurance industry has evolved from being just a compensation payment instance, to additional efforts on innovation programs such as in risk modelling under climate change scenarios, track exposed assets, early warning information, and hazard behavior analysis to know more about possible exposure and prevention effectiveness. Marchal et al (2019) demonstrated that 38% of the surveyed companies have knowledge on eco-DRR and have started including it in their planning even if still NBS integration within (re)insurers models is a challenge. The insurance sector has taken longer time to consider their intervention in loss prevention for natural hazards, compared to fire or thefts prevention because loss prevention measures are collective (grey, green or hybrid) and not individual ones.

For insurance companies, the insurance value refers to the replacement cost value. The replacement cost refers to the amount an insurance company might pay to replace the value of a damage or loss asset after a disruptive climatic event. In the context of NBS, the insurance value refers to the costs that a healthy ecosystem might avoid when a disruptive climatic related event happens. (Re)insurers raised their interest for NBS related to their capacity to buffer intensity of climatic multihazards, frequent and small events. The later are costlier for the insurance industry within the current claims than extreme large events. (see figure 1, assessing in a complementary manner climate change impacts on natural hazards and effectiveness of loss prevention).

2. (Re)insurance industry and NBS: how to unlock the flywheel?

We assume that NBS reduce the risk of hazards in the long term (Ruangpan et al 2020). Therefore, the assessment of the dynamics of risk redistribution will help the (re)insurance industry to reduce the cost of insurance and support the creation of NBS supportive insurance schemes. This means that when NBS are implemented their effectiveness on hazard reduction and then on damage reduction will be visible within the insurance premiums pricing in a long-term perspective. This will support the maintenance of affordable insurance due to the implementation of protective measures.

Taking the example established by Cremades et al (2018) of the adaptive cycle of decision-making by the insurance sector, we argue that if the insurance value of nature is recognized, the (re)insurance industry could be interested in quantifying this value with the aim to lower damage cost (Cremades et al 2018) (see figure 1). The (re)insurance industry has the tools to assess the avoided damage (the catastrophe risk model) but still the assessment of the co-benefits of NBS is only doable in collaboration with scientists for co-production of knowledge.

The concept of natural assurance schemes (NAS) might fit the purpose very well. NAS are NBS strategies to internalize the insurance value of ecosystems (Denjean et al 2017). NAS represent a type of insurance against climate related extreme events, that will most frequently happen. These elements are the structure of the sustainable flywheel to address global challenges. At the center of the flywheel, three pillars are represented, in which the industry could intervene.

NBS can and should be considered by (re)insurers on the asset side. As institutional investors, the (re)insurance industry is committed to invest more in a low-carbon economy. NBS contribute to this not just by mitigating the impact of natural hazards, but also by mitigating climate change in the long-term, e.g. through carbon storage. When acknowledging NBS projects as green assets, the (re)insurance industry could finance it through green finance mechanisms (green, blue, cat bonds etc.). Investment options in natural infrastructures are one of the ways for the industry to participate in the ecological transition.

One key question is how NBSs can be integrated into overall risk management and CCA measures, and how stakeholders and (re)insurers can collaborate to fund such preventive measures. When looking at the natural hazard insurance schemes in Europe, the French scheme is linking insured compensation with prevention through the Barnier Funds3 It is financed by discharging 12% of each natural hazard insurance premium issued in France. The fund is based on proactive prevention measures implemented in France and overseas territories. This raises the possibility for the different insurance schemes to achieve their aims of moving towards prevention while maintaining insurance affordability. In the rest of the world, insurance companies are slowly starting to support NBS as preventive measures within adaptive plans (Marchal et al 2019).

3 For more information please visit: www.ccr.fr/fonds-publics.
3. Conclusion

NBS as preventive measures offer a sound way of anticipating climate change risks in areas of increasing future climate risk. Considering that NBS reduce the consequences of frequent localized events, which are very expensive and recurrent, NBS is beneficial for the industry.

We suggest changes in the insurance business model representing them as a virtuous flywheel in which to integrate loss prevention in the day-to-day job of the (re)insurance industry. Prevention policies require long-term schemes, such as NAS, reducing risk and leading to the ability to maintain affordable insurance coverages in high-risk areas (Cremades et al. 2018). Greater innovation programs and collaborations for co-production of knowledge among diverse affected stakeholders, involving the (re)insurance industry and scientists, are a cornerstone for assessing the effectiveness of NBS (risk modelling) and the new socio-economic possibilities for investing in them. To correctly assess the insurance value of NBS it is necessary to account for the cost and benefits produced by NBS over a certain period of time and though different spatial scales. There are already several frameworks developed to evaluate the impact of NBS and their co-benefits (Gómez Martín, Martín E G, Giordano R, Pagano A, van der Keur P and Cremades R, Surminski S, M Schwerdtner M 2020).

Mobilizing diverse funds for systematic and smart investment in nature is key. It is a win-win situation fostering the implementation of natural infrastructures adequately adapted to the local challenges and keeping risk insurances affordable.

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Data availability statement

No new data were created or analysed in this study.

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