



# **Nature Risks Equal Financial Risks: A Systematic Literature Review**

**Prof. Dr. A. Bassen; Prof. Dr. T. Busch; Prof. Dr. K. Lopatta; E. Opoku Ph.D**

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# Agenda

1. Research Question
2. Nature Risks and Financial Risks
3. Methodology
4. Results
5. Conclusion

# 1. Research Question

**Top 5 risks in terms of likelihood (WEF, 2019)**

- 1 Extreme weather events
- 2 Failure of climate-change mitigation and adaptation
- 3 Natural disasters
- 4 Data fraud or theft
- 5 Cyber-attacks

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Financial Risks

Categories:

- Environmental
- Technological

Source: The Global Risks Report 2019, 14th Edition, World Economic Forum.

## 2. Nature Risks and Financial Risks

### 2.1. Definitions

#### **Nature Risk**

Nature risk is a potential future environmental change that results in catastrophic situations or the destruction of natural capital (IFRC, 2019).

#### **Natural Capital**

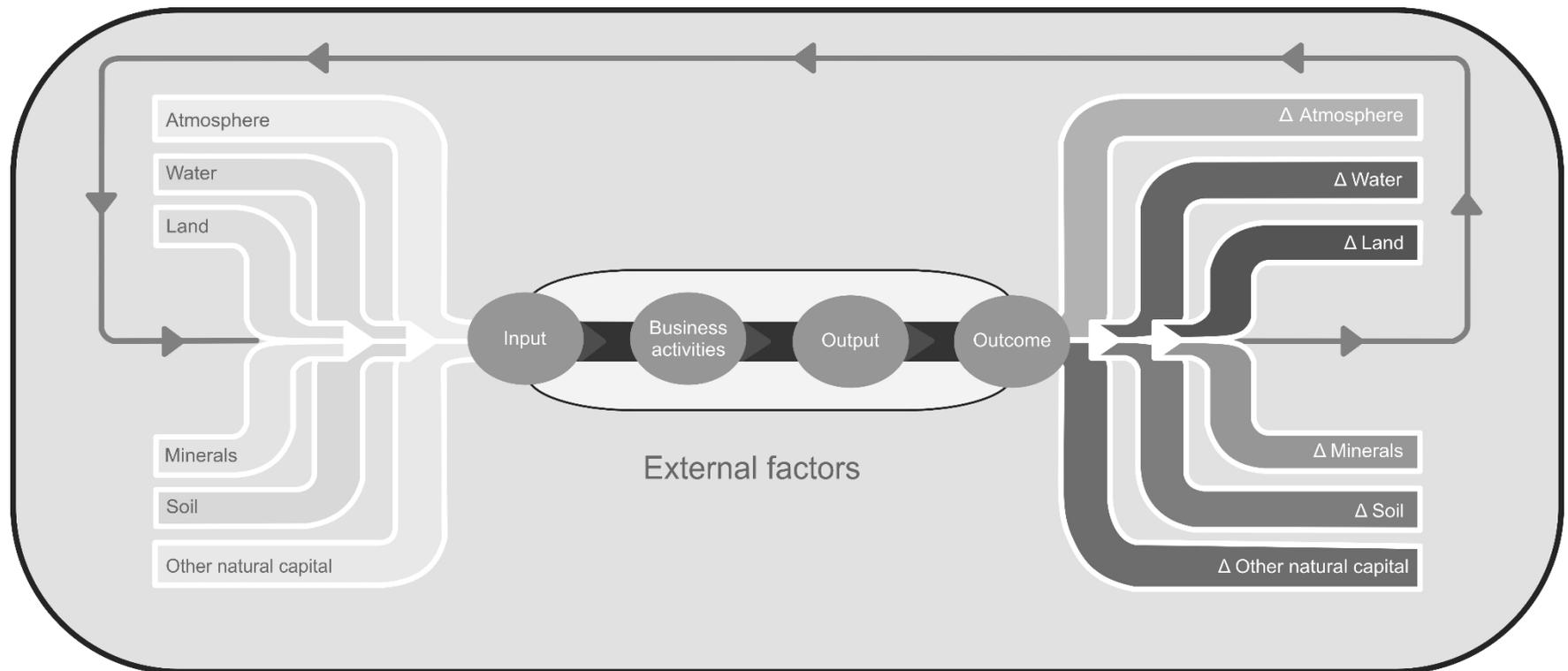
Natural capital is the amount of either renewable or non-renewable resources, provided by nature, that is able to provide utility for its users (NCC, 2018).

#### **Financial Risk**

Financial risk represents potential future financial losses resulting from uncertainties (e.g. increase in asset prices, future asset returns and the making of assets less desirable) (Han, 2010; Moles, 2013).

## 2. Nature Risks and Financial Risks

### 2.2. Natural Capital and Nature Risks



Source: Following International Integrated Reporting Council (IIRC).

## 3. Methodology

### 1. Step: Identification and Selection

- 120 keywords; Title search
- 5 major scientific databases: ABI/INFORM (ProQuest), EBSCO, JSTOR, Scopus and the Web of Science
- Broad fields: accounting, business & management, economics, finance & investment, environmental and development studies



### 2. Step: Inclusion Criteria

- Written in English
- Publication in peer reviewed journal

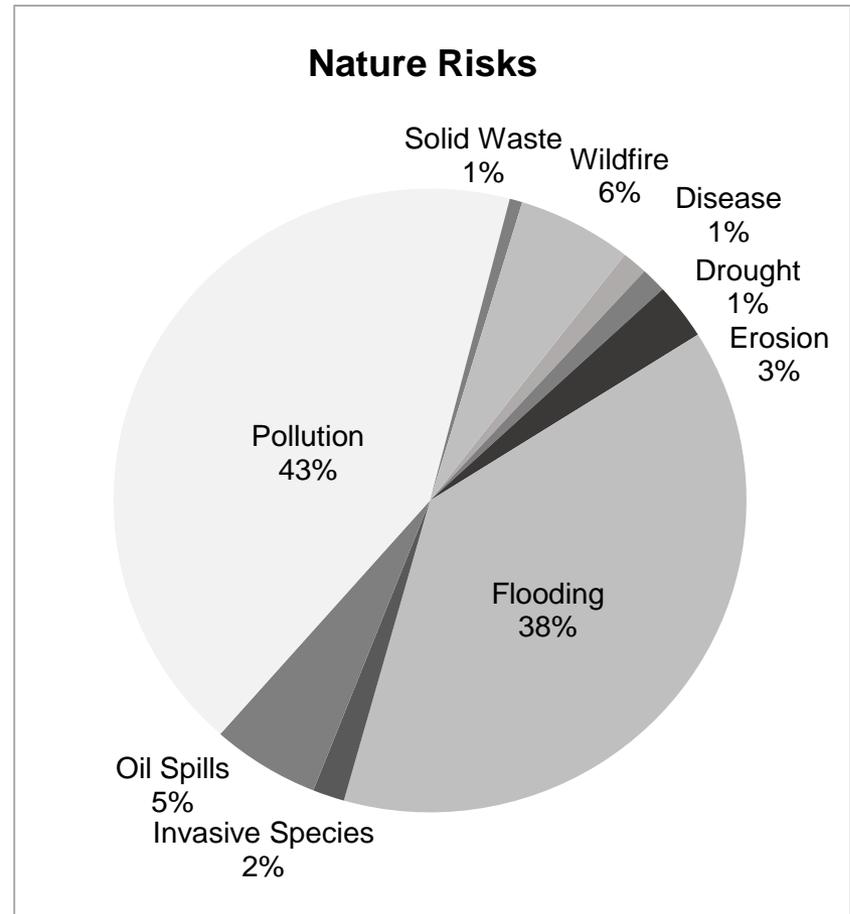
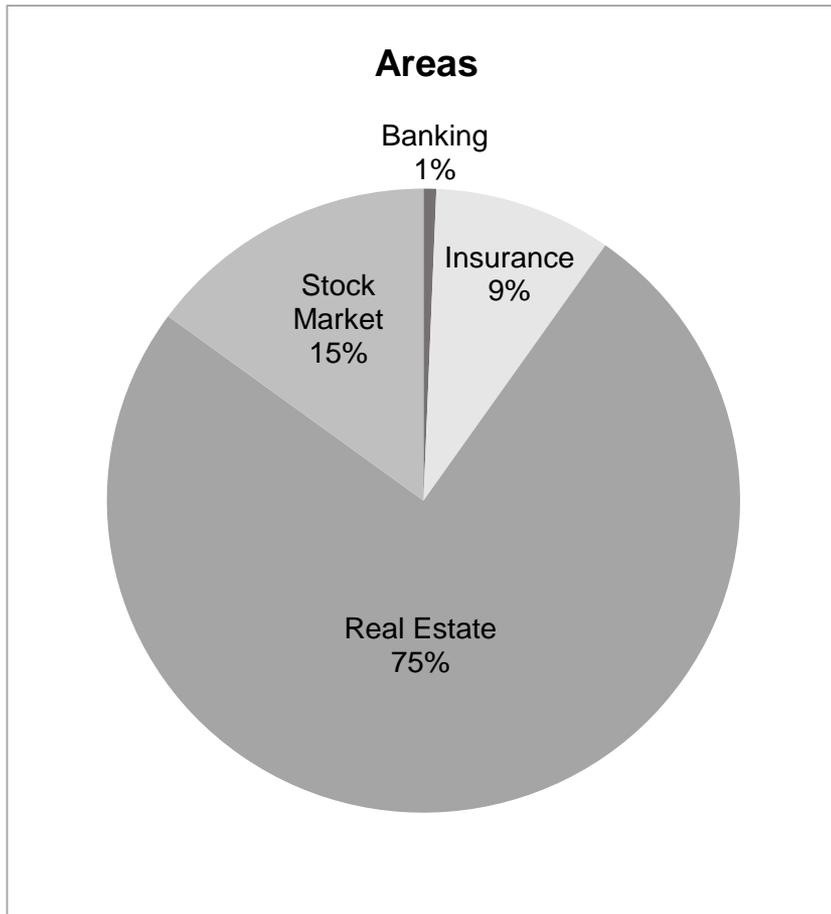


### 3. Step: Methodological Screening

- Keywords, abstracts, conclusions (and if necessary content)
- Areas: **banking**, credit, investment, **insurance**, **real estate**, bond and **stock market**

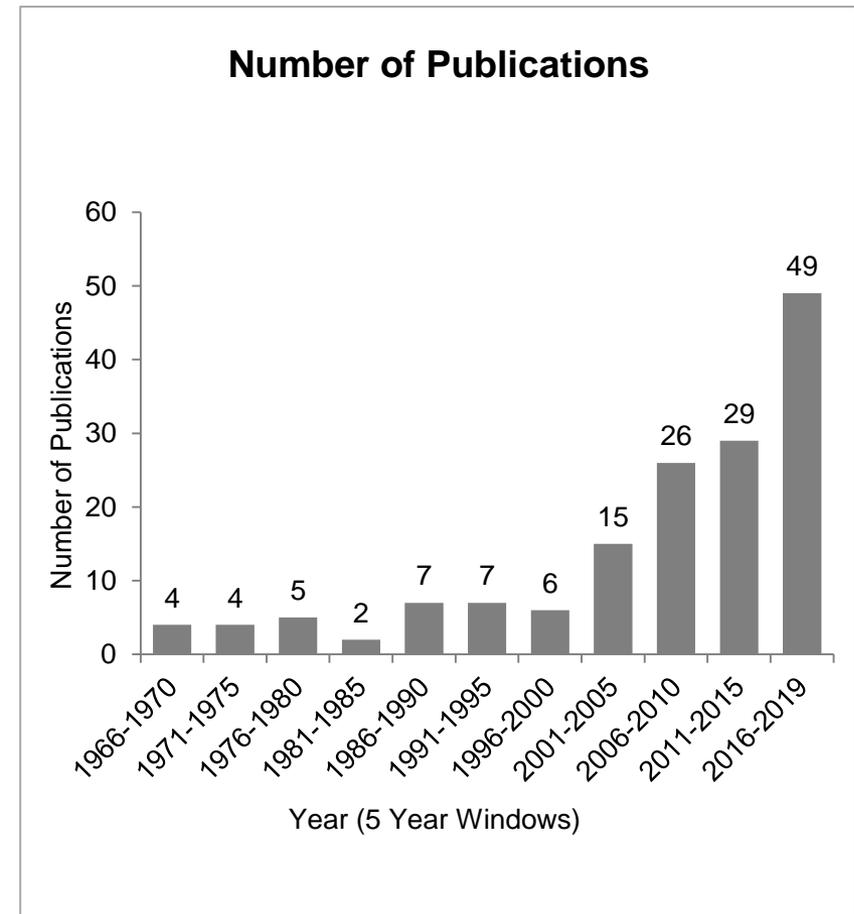
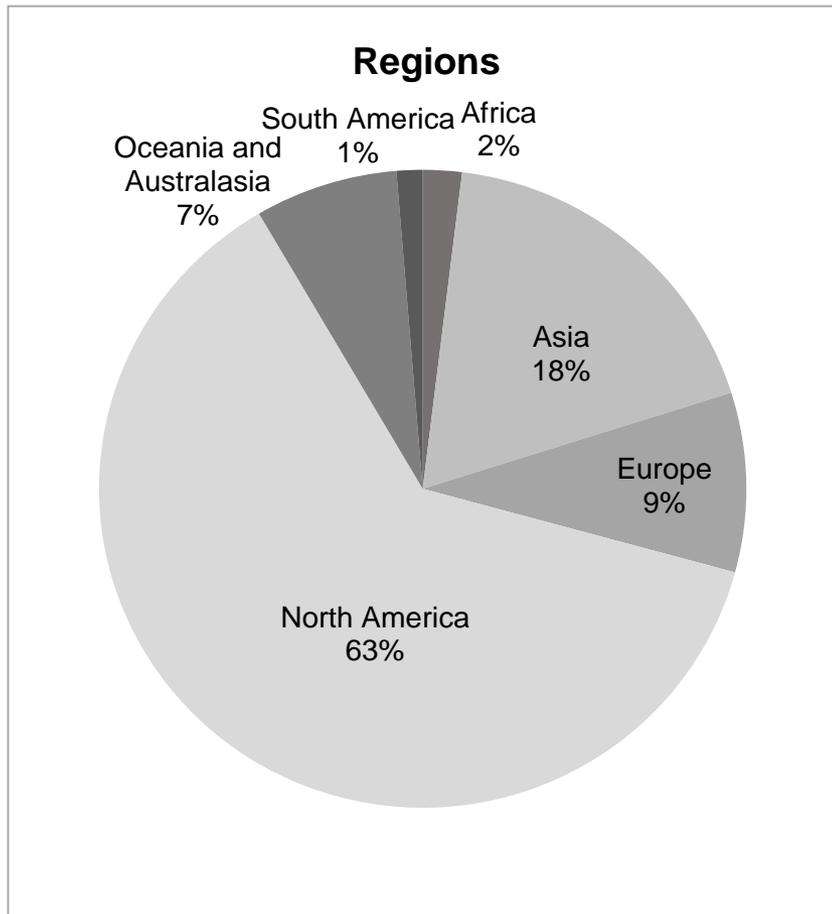
## 4. Results

### 4.1. Sample Description (1/2)



## 4. Results

### 4.1. Sample Description (2/2)



## 4. Results

### 4.2. Banking

One study analyzing the impact of nature risk on banking, in particular on micro finance institutes.

- Droughts as exogenous nature risk (Rural Africa).
- Results: decrease in borrowers ability to pay back loans.
  - Increase in institution's default risk.
  - Effect on the institution's capital reserves.
  - Decrease in credit supply and access.

## 4. Results

### 4.3. Stock Market

- 70% of 23 analyzed stock market related studies show negative effects of nature risks:
  - **Regulatory risk:** Concerns about reduced cash flows, due to mandatory commitment to nature-friendly technologies, products and services.
  - **Physical risk:** Accidents causing disasters in nature result in excessive value decreasing cash outflows.
    - Ferraro & Uchida (2007): Investors react negatively to water pollution in public sewage system → negative cumulated abnormal returns
    - Lee & Garza-Gomez (2012): BP lost ~US\$68 bn in MCAP. (deep-water horizon)
  - **Other nature risks** (e.g. air pollution) have psychological and emotional negative effects on future investor decisions and hence on market returns (mostly China).
    - Levy & Yagil (2011): Air pollution negatively affects stock returns.
- 30% of the 23 analyzed stock market related studies show mixed or insignificant effects:
  - Disease outbreaks in South Korea and Taiwan.
  - Bushfires and flooding in Australia

## 4. Results

### 4.4. Real Estate

- 84% of 116 analyzed real estate related studies show negative effects of nature risks:
  - Reduction in property value.
  - Decrease in quality of life.
- Catastrophes reduce the utility of land and properties thus lowering their values:
  - **Pollution/environmental contamination** (air, water, land) decreases quality of life.
    - Carriazo & Gomez-Mahech (2018): Particulate matter increases → decrease in average monthly house rentals.
  - **Flooding and erosion** have a direct negative impact on property values.
    - Beltran et al. (2019): Inland flooding results in a 24.9% price drop for houses affected.
  - **Invasive species** affect real estate property negatively
    - Zhang & Boyle (2010): Eurasian watermilfoil infestation results in a decrease of property value of about 1% - 16%.
  - **Bushfires** destroy value of land and buildings.



Source: <https://www.sleloinvasives.org/about-invasives/target-species/eurasian-water-milfoil/>.

## 4. Results

### 4.5. Insurance

- 93% of 14 analyzed insurance related studies show positive effects of nature risks:
  - Increase in insurance premiums.
  - Increase in intake of insurance (e.g. individuals are more likely to take in insurance after having experienced a nature risk).
- One study shows negative effects of nature risk:
  - Private individuals underestimate the likelihood of nature risks (e.g. burglary insurances are preferred over flooding insurances) (Browne et al.,2015).
- Two arguments for additional consideration:
  - Individuals terminate their insurance contracts as soon as they consider the risk of natural hazards to be lower.
  - Overall, the cost perspective for insurance firms has not yet been taken into account in the academic studies

## 5. Conclusion

Due to the mixed results of existing research we propose the following research fields for future investigation:

- Effects of nature risks on the cost structures of insurance companies.
- Exposure of banks in connection with nature risks: mechanisms through which nature risks translate into financial risks.
- Extension of previous questions to countries that have not yet been investigated.
- Extension of previous questions to areas that have not yet been investigated.

**“biodiversity”**, “biodiversity crisis”, “biodiversity decline”, “biodiversity degradation”, “biodiversity loss”, “biodiversity-related risks”, “biomass destruction”, “change in land use”, contamination, conversion, deforestation, degradation, “degradation of biodiversity”, “degradation of ecosystems”, “degradation of nature”, desertification, “discharge of untreated effluents”, “untreated effluents”, “sewage discharge”, “disease\*”, “domestic construction”, “ecological collapse”, “ecological crisis”, “ecological decline”, “ecological overshoot”, “ecological uncertainty”, ecosystem, **“ecosystem collapse”**, “ecosystem degradation”, “ecosystem destruction”, “ecosystem loss”, “ecosystem degradation”, “environment\* degradation”, “environment\* pressure”, “exotic species”, “exploitation of natural capital”, extinction, “extinction crisis”, “forest conversion”, “forest loss”, grazing, “habitat alteration”, “habitat conversion”, “habitat degradation”, “habitat destruction”, “habitat fragmentation”, “habitat loss”, “habitat modification”, “habitat shift\*”, “human modification”, “modification of genetic material”, “human movement”, “industrial construction”, “intensive agriculture”, “intensive aquaculture”, interbreeding, hybridization, “invasive alien species”, “alien species”, “land conversion”, “land degradation”, “land use”, “land use change”, landslide\*, litter\*, “loss of ecosystem\*”, “ecosystem\* loss”, “mass extinction”, migration, monoculture, “natural capital”, “natural capital degradation”, “natural capital depletion”, “natural capital destruction”, “natur\* degradation”, “nature destruction”, “natural capital exploitation”, “nature pressure”, “nature risk”, “nature related risk”, “ocean acidification”, overconsumption, overexploitation, “ecosystem\* overexploitation”, “overexploitation of ecosystem\*”, “overexploitation of fish stock”, **“fish\* overexploitation”**, “overexploitation of fish\*”, overfishing, overharvesting, overhunting, parasite\*, pest\*, “population change\*”, “protected area\*”, salinization, “seepage from mining”, “mining seepage”, “sixth great extinction”, “soil contamination”, “soil degradation”, “species collapse”, “species decline”, “species destruction”, “species extinction”, “stratospheric ozone depletion”, “ozone depletion”, subsidence, “waste water” “waste water run-off”, “water abstraction”, “wildlife depletion”, “wildlife extinction”, “wildlife destruction”



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