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Climate resilient development index: theoretical framework, selection criteria and fit-for-purpose indicators

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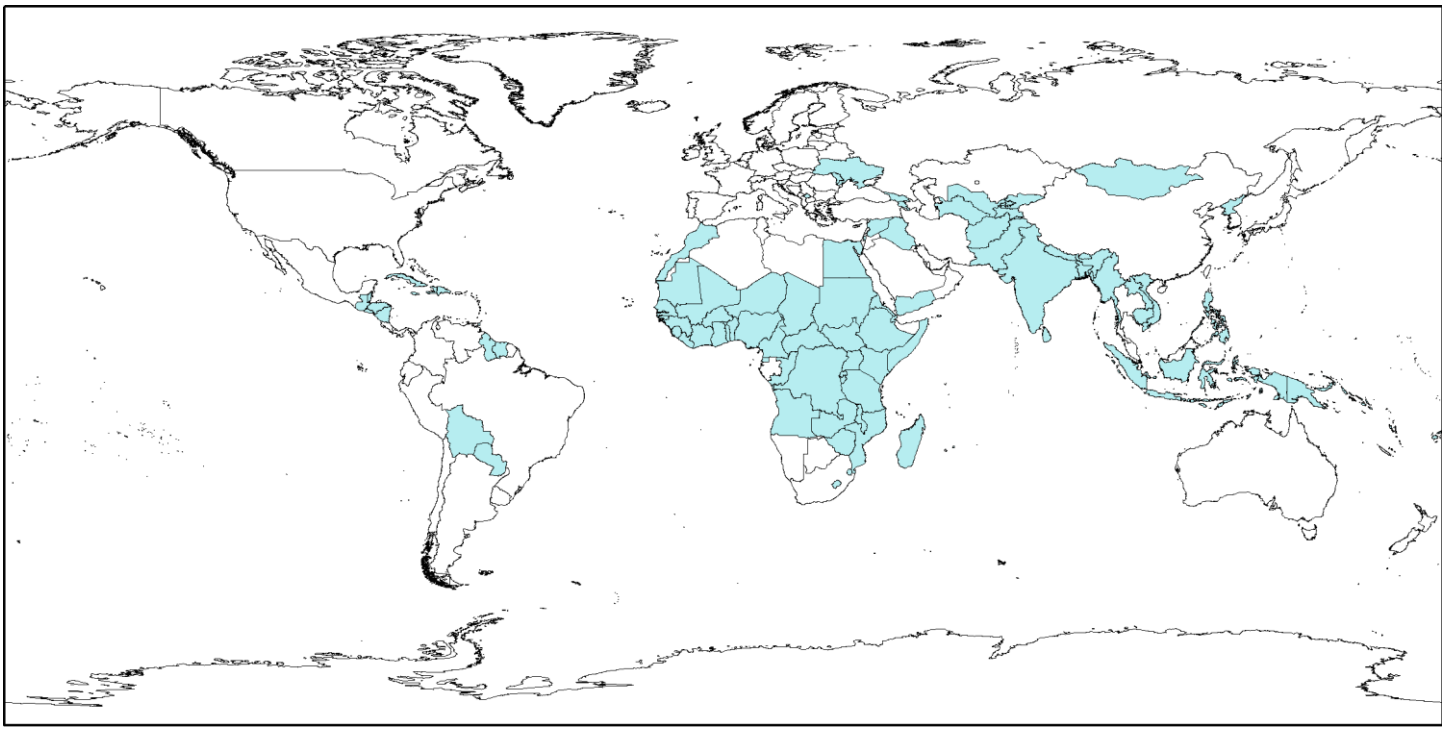

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Abstract
This report aims to contribute to the debate on climate change policies and their link to development. A climate resilient perspective is adopted to understand how climate change policy objectives can be reconciled with development goals. The report reviews the main theoretical concepts that characterise the scientific literature on climate risk and vulnerability assessments, and identifies climate resilient fit-for-purpose indicators accordingly. This makes it possible to build the theoretical foundations to improve understanding of the implications of climate aid financing. The novelty of this report lies in the emphasis given to economic aspects of climate risk, most notably: the concepts of loss and damage, the understanding of factors that enhance economic resilience, the links between climate change policies and development (besides economic growth) and the acknowledgment of the role of natural capital in pursuing development policies. By reviewing grey and peer-reviewed literature, 102 suitable indicators are identified and grouped into six components. A case study is proposed which involves building three climate resilient development indices. The three indices are built for climate resilient development using the same components and indicators but adopting different political perspectives. Our case study demonstrates that although there is some agreement on which indicators should be included in an index for climate resilient development, a single approach to building a global index for climate resilient development does not exist. The high number of differences between the scores of the three indices indicates that a single index in the climate resilient development domain is a sort of chimera. Any index should address a specific policy request with a clear objective. This is a first step to building a fit-for-purpose index.

Executive Summary

Despite the proliferation of alternative indicators, most existing measures do not capture the multidimensional aspects of climate resilient development. Most climate risk indices have some limitations, as their theoretical framework is vaguely (or not at all) defined and, as a result, the indicators used are not always relevant and tend to focus on current climate risk as opposed to future hazards. Moreover, the economic and ecological aspects are often neglected or ill defined. Most importantly, none of the most popular climate risk assessment indices are informed by the latest developments in the international policy debate, especially with respect to the loss and damage concept and climate resilient development. This report aims to fill this gap.

Chapter 2 gives an account of the main climate risk concepts. Special attention has been given to defining resilience and adaptive capacity from an economic perspective, and how the preservation of natural capital contributes to adaptation and development.

The debate on climate resilient development is reviewed and the building blocks of our theoretical framework are identified in Chapter 3. Any approach taken to assess climate risk depends on a coherent understanding of the underlying concept of risk and the interplay of hazard, exposure, vulnerability and resilience.

Chapter 4 describes the criteria that should be considered to screen indicators of climate resilient development. Findings from the relevant literature are presented, along with insights from the use of existing climate risk indices to understand how indicators can be identified consistently with the theoretical framework we adopt.

Chapter 5 proposes relevant fit-for-purpose indicators that can be selected to construct an index for climate resilient development. In reviewing the relevant grey and peer-reviewed literature, the impacts of climate-related and weather-driven hazards on the following sectors are considered: households, livelihood and poverty, agriculture and fisheries, industry, infrastructure, energy, trade, transport, tourism, human health and human security, the economy and ecosystem services.

The final part of the report proposes a case study. In Chapter 6, three indices using the same components and indicators are built for a sample of countries, including Least Developed Countries (LDC), Small Island Developing States (SIDS), low income countries, lower middle income countries and territories from the DAC list of Official Development Assistance (ODA) Recipients (excluding Tokelau, Singapore, and Bahamas). Our case study demonstrates that although there is some agreement on which indicators should be included in an index for climate resilient development, a single approach to building a global index for climate resilient development does not exist. The high number of differences between the scores of the three indices indicates that a single index in the climate resilient development domain is a sort of chimera. Any index should address a specific policy request with a clear objective. This is a first step to building a fit-for-purpose index.

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List of Acronyms

BCR – Benefit Cost Ratio
COP – Conference of the Parties
CRI – Germanwatch Global Climate Risk Index
DEVCO – Directorate-General for International Cooperation and Development
DFID – Department for International Development (UK)
EBA – Ecosystem-Based Adaptation
ECHO – Directorate-General for Humanitarian Aid and Civil Protection (ECHO)
EEA – European Environment Agency
EPI – Environmental Performance Index
EVI – Environmental Vulnerability Index
FAO – Food and Agriculture Organization of the United Nations
GCCA – Global Climate Change Alliance
GDP – Gross Domestic Product
GHG – Greenhouse Gases
HDI – Human Development Index
INFORM - Index for Risk Management
IPCC – Intergovernmental Panel on Climate Change
JRC – Joint Research Centre
LDC – Least Developed Countries
MDG – Millennium Development Goals
ND-GAIN – University of Notre Dame Global Adaptation Index
ODA – Official Development Assistance
OECD – Organisation for Economic Co-operation and Development
PPP – Purchasing Power Parity
REDD – Reducing Emissions from Deforestation and forest Degradation
SDG – Sustainable Development Goals
SIDS – Small Island Developing States
SREX – Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation
UN – United Nations
UNDP – United Nations Development Programme
UNEP – United Nations Environment Programme
USAID – United States Agency for International Development
VA – Vulnerability Assessment
WHO – World Health Organization
WRI – World Risk Index

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1. Introduction

Many initiatives are in place, or have been announced by governments, companies, investors and public-private coalitions to support climate adaptation and resilience for the world's most vulnerable countries. Global efforts to set the world on a climate change resilient development pathway require an understanding of the relationships between climate change and development, as well as metrics for the identification of the countries, groups of people and sectors most seriously threatened by climate change. Despite the proliferation of alternative indicators, most existing measures do not capture the multidimensional aspects of climate resilient development.
Most climate risk indices often show some limitations, as their theoretical framework is vaguely defined (or even completely missing) and, as a result, the indicators used are not always relevant and focus on current climate risk as opposed to future hazards. Moreover, the economic and ecological aspects are often neglected, or ill defined.
Most importantly, none of the most popular climate risk assessment indices are informed by the latest developments in the international policy debate, especially with respect to the loss and damage concept and climate resilient development.

This report aims to fill this gap. It starts by reviewing the key concepts used in climate risk assessments, in order to clarify the foundations of our theoretical framework. Any approach taken to assess climate-related risk depends on a coherent understanding of the underlying concept of risk and the interplay of hazard, exposure, vulnerability and resilience. We will then discuss how adaption can be put into practice following the international debate on loss and damage, and how adaptive capacity is dependent on development pathways. The main focus will be the identification of criteria and fit-for-purpose indicators to construct an index that prioritizes the allocation of funding to the poorest developing countries. Special attention has been given to defining resilience and adaptive capacity from an economic perspective, and how the preservation of natural capital contributes to adaptation and development.
The debate on climate resilient development is then reviewed.
The final part of the report proposes relevant and fit-for-purpose indicators that can be used to construct an index for climate resilient development.
As a case study, three indices using the same components and indicators are built for a sample of countries.
The main outcome of this case study is the identification of the main challenges to building an index for climate resilient development, which is fit for purpose.

2. Defining concepts from a socio-economic perspective: exposure, vulnerability, resilience and adaptive capacity

This section will review the evidence currently available on climate hazards, vulnerability and exposure, and how adaptation and mitigation policies can tackle climate change impacts. It will clarify the conceptual foundations for considering exposure, vulnerability and adaptive capacity in risk assessment.

2.1 From biophysical hazards to macroeconomic and microeconomic impacts

There is scientific evidence that the climate is changing. Observations of the Earth's average surface air temperature indicate evidence of planetary–scale warming (IPCC, 2013; National Academy and Royal Science, 2014).

According to the Intergovernmental Panel on Climate Change (IPCC, 2013), some events are directly related to climate change, namely ocean warming, ice loss from glaciers, sea-level rise (over the period 1901 to 2010, the global mean sea level rose by 0.19 [0.17 to 0.21] m), and change in the global water cycle. The climate-related and weather-driven hazards considered in this report are flooding, storms, droughts, heat waves, sea-level rise, and alpine hazards (Table 1). These hazards each bring different risks with different impacts on economic, social and natural systems.

Table 1 - Climate-related and weather-driven hazards considered in this report

Hazards	Description
Flooding	When water covers land that is not normally covered by water, different types of flooding might occur depending on the sources of excess water: coastal floods (sea); fluvial floods (river), pluvial floods (heavy rain events) and groundwater floods (water collecting below the surface). Direct economic impacts originate from damage caused to buildings, infrastructure, transport networks, etc. Flood events can also trigger indirect effects due to interruptions to production processes, disruption to businesses, or other ripple effects. Finally, health impacts range from fatalities to psychological consequences of the extreme event. The main factors that determine the severity of losses are water depth, flood duration, building/object type, building age, social class of the occupants, warning time (Bubeck et al., 2011).
Storms	Storms are characterised by strong winds and heavy precipitation. Their economic impacts are similar to those of flooding.
Droughts	Droughts are caused by a deficit in rainfall. The severity and duration of their impacts can be exacerbated by high air temperatures, heat-waves, high rates of evapotranspiration (Bubeck et al., 2011) and human activities. In contrast with other extreme events, they have mainly non-structural consequences. Droughts affect crop production and ecosystem services. If water levels become too low, this can negatively impact navigation or the cooling of power plants. The severity of economic impacts depends on the length and time of the drought (Bubeck et al., 2011).
Heat waves	Heat waves are characterised by continuous spells of abnormally hot weather. They are normally of shorter duration periods than droughts. Heat waves are often accompanied by droughts, in which case the effects of the two extreme events are difficult to disentangle. The main consequences of heat waves are related to health. Whilst the incidence of mortality is well documented, morbidity, injury and illness associated with heat waves and excessive heat are still not well understood. Economic impacts include those on human productivity, transportation (e.g. aircrafts lose lift at high temperatures), livestock and dairy production and ecosystem services, energy and water services (due to increased demand).
Sea-level rise	Rising sea levels increase the risk of coastal flooding. Vulnerability to coastal hazards may increase strongly due to an accumulation of people and economic assets in risk-prone coastal areas (Bubeck et al., 2011). The severity of impacts depends on building type, flow velocity, wave action and inundation.
Alpine hazards	Alpine hazards are caused by the thawing of permafrost at high altitudes, and consist of landslides, avalanches, rock falls and flooding. Flood events can occur as flash floods, which are typically rapid and intense, or river floods (see above). The economic risk of alpine hazards has increased in recent years, as the growing demand for land has led to the extension of urban developments into areas that are prone to alpine hazards. Avalanches and flash floods can cause severe economic and human losses due to their kinetic energy and high pressure (Bubeck et al., 2011).
Ocean acidification	Ocean acidification is a global problem that results from the increase in carbon dioxide (CO_2) released into the atmosphere, primarily from burning fossil fuels. Excess CO_2 in the air dissolves in seawater and forms carbonic acid which, through a series of other reactions, reduces the amount of carbonate in seawater. Sea creatures that use carbonate and calcium to build their shells or skeletons are affected[1]. Acidification will affect the production cycle of the oceans because marine organisms have a very low capacity to deal with changes in pH (acidity or alkalinity). Reproduction is most sensitive, and disturbed reproduction will have direct impacts on stocks of fish, shellfish, etc.

[1] In seawater containing high levels of CO_2, corals have difficulty making new skeletons and their existing skeletons may dissolve away, many calcifying plankton struggle, molluscs such as oysters and scallops find it harder to build and maintain shells, and juvenile molluscs grow more slowly and have more abnormalities and lower survival rates. Among calcifying organisms, only crustaceans such as crabs and lobsters appear to tolerate low carbonate levels; some even make thicker exoskeletons under such conditions.

The literature on the economics of natural disasters provides different taxonomies that can be used to classify the impacts of extreme events and natural hazards.

The most widely used taxonomy is based on the distinction between direct and indirect economic effects, where the former are economic losses that occur due to a direct physical impact of a hazard on humans, economic assets or any other receptor, and the latter occur outside the hazard area, for instance, due to a loss of business turnover when supplies are disrupted (Hallegatte, 2007; Bubeck and Kreibich, 2011). Table 2 shows some examples of direct and indirect impacts that can be further classified as tangible and intangible (Penning-Rowsell et al., 2003), depending on whether they are traded in a market and can thus be easily expressed in monetary terms.

Table 2 - Examples of direct and indirect impacts of natural hazards

Direct Impacts	Indirect Impacts
Primary direct impacts	***Primary indirect impacts***
Physical damage to buildings and infrastructure	*Loss of production due to direct damage*
Physical damage to production equipment	*Loss of production due to infrastructure disruptions*
Physical damage to agricultural land	*Loss of production due to supply-chain disruption*
Physical damage to raw materials	
Physical damage to products in stock	
Physical damage to semi-finished products	
Secondary direct impacts	***Secondary indirect impacts***
Costs of recovery and reconstruction	*Market disturbances (e.g. price variations of complementary and substitute products or raw materials)*
Costs of remediation and emergency measures	*Damage to the enterprise image*
	Reduced short-term competitiveness
	Increased productivity and technological development, in the medium- to long-term
	Economic growth for reconstruction
	Increased levels of poverty and inequality

Source: Andreoni and Miola (2014)

It often is difficult to clearly distinguish between direct and indirect damage. Errors in such distinctions can lead to double counting (Rose, 2004), which can be solved by referring to asset losses (i.e. reduction in the stock of assets) and output losses (i.e. reduction in an income flow) (Rose, 2007; Hallegatte, 2014).

Asset losses include impacts such as business interruptions (interrupted production during the event), production losses directly attributable to asset losses (because damaged or destroyed assets are not functional after the event), supply-chain

disruptions (when lack of input or reduced demand leads to a reduction in production from a site that is not directly affected), macro-economic feedbacks (e.g. the impact of reduced demand because consumers and businesses suffer from a reduced income, and the effect of lost tax revenue on public demand), long-term adverse consequences on economic growth (e.g. due to changes in risk perception (including over-reactions) that can drive investors and entrepreneurs out of the affected area); and increased production from a subsequent "reconstruction boom" that acts as a stimulus for the economy.

All these impacts have an effect on gross domestic product (GDP), but they are not completely captured by GDP in cases where impacts are large but localised, or when they affect household or non-market production (which are not included in GDP calculations).

With regard to output losses, the impacts on households are central.

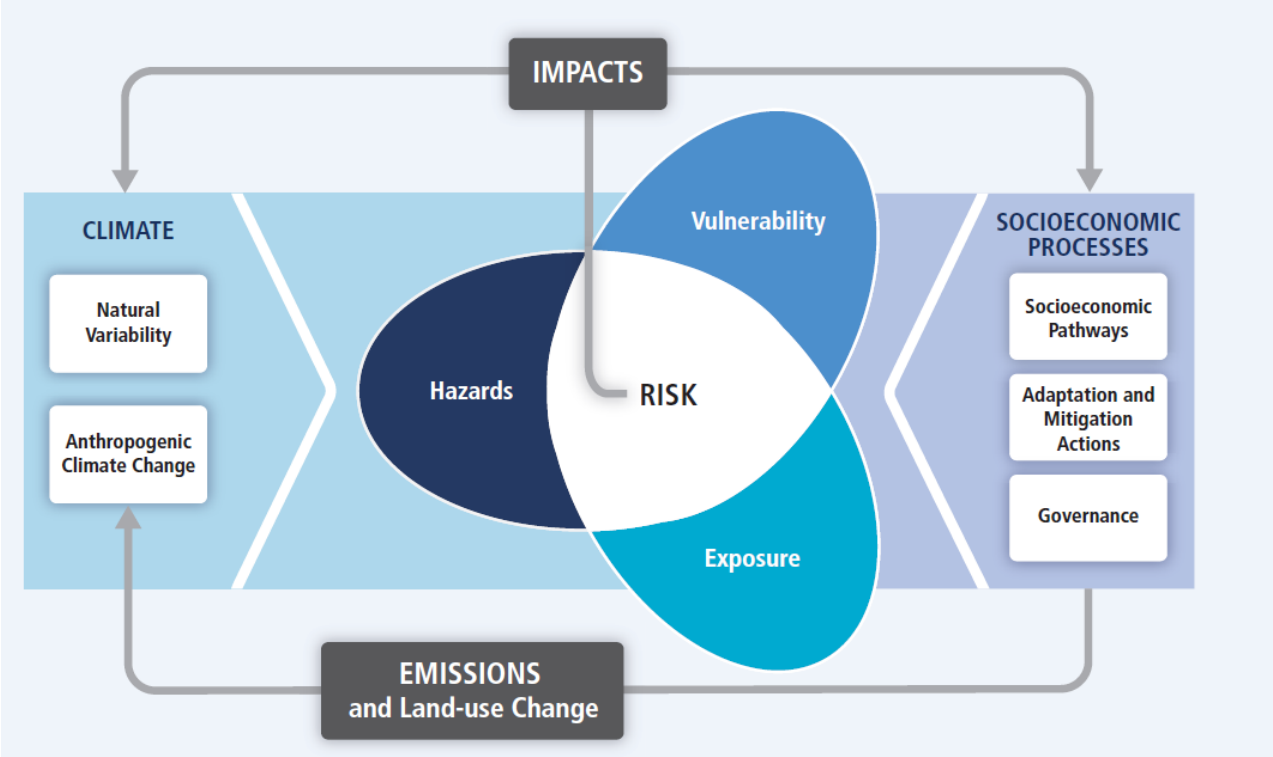
According to Hallegatte (2014) vulnerability is higher where levels of inequality are higher and GDP levels are lower. Considering the heterogeneity of direct losses to households, economic diversification decreases household vulnerability, because if households have multiple income sources, they are more likely to lose a smaller share of their income if one activity is particularly affected.

It is also argued that those households with a negative income in the year of the hazard occurrence and which do not have any smoothing option and assistance will suffer high welfare losses. Similarly, social protection and other government actions may mitigate sudden income losses and can help households to smooth income shocks over time (Hallegate, 2014).

Climate risk assessments and the identification of loss and damage risks should not only consider factors related to climate change, but also the development pathways that a country or community takes. According to the IPCC (2013, 2014), the severity of disasters depends on weather and climate events, but also on exposure (e.g. urban developments in low-lying coastal areas) and vulnerability (e.g. poverty, weak economic structures) which arise from non-climatic and multidimensional inequalities (Figure 1).
Figure 1 captures all the elements that will be considered in building our conceptual framework for identifying the indicators that should be used to assess climate resilient development, namely:

- Exposure to hazards related to climate change;
- Vulnerability to these hazards;
- Socio-economic pathways;
- Adaptation and mitigation options.

Figure 1 - Systematization of events related to climate change, vulnerability, exposure, risk and development



Source: IPCC (2014)

A general discussion on concepts and definitions is far from being the objective of this report. However, a clear definition of the terminology is useful in order to operationalise concepts that will be used to identify indicators that for assessing climate change risk components.

2.2 Vulnerability

Vulnerability is a central concept in climate change research and policy. It encompasses a variety of concepts, including sensitivity or susceptibility to harm and lack of capacity to cope and adapt (IPCC, 2014: chapter 19). It is the propensity or predisposition to be adversely affected.

The dynamic nature of the concept is often emphasised by stressing its direct and indirect relation to a range of environmental, social, economic and political factors (EEA, 2008).

For the purpose of this work, it should be noted that other authors adopt a static vision of the concept of vulnerability, consistent with what is argued by Adger et al. (2007), as a state variable, determined by the internal property of the system (i.e. the predisposition to be affected). From such a perspective the frequency and magnitude of climate change and extreme weather events are characteristics of hazards and not of vulnerability. Vulnerability is an internal risk factor, while the

hazard event is rather considered as a factor external to the exposed society or system (Birkmann, 2006). The dynamic component is captured by the resilience concept (see paragraph 2.4).

This way of conceptualising vulnerability is consistent with that defined by Brooks et al. (2005) as that "function of physically defined climate hazard and socially constructed vulnerability", which in turn is related to an outcome-based representation of risk (Adger et al., 2007)[2].

In this respect, it is important to distinguish between generic and specific determinants of vulnerability (Adger et al., 2007). Generic determinants are factors that are likely to influence vulnerability in different geographical and socio-political contexts and for different hazards. Poverty, health status, economic inequality and elements of governance are some examples (see below for a discussion of poverty and economic determinants). Specific determinants are relevant for a given context or hazard. Vulnerability to the same hazard, for example flooding, can be explained by different factors, depending on whether this hazard occurs in a least developed country or a developed one. In the former case, income diversification will be important, whilst in latter case infrastructure might be the dominant determinant (Adger et al., 2007).

2.3 Exposure

Vulnerability is often indicated as a social concept that is intrinsically interrelated with exposure, which can be considered as encompassing the spatial and temporal distribution of populations and assets.

According to the IPCC (2014), exposure is "the presence of people, livelihoods, species or ecosystems, environmental services and resources, infrastructure, or economic, social, or cultural assets in places that could be adversely affected". As noted by Hallegatte (2014), in order for an extreme event to become a hazard, a natural event should have an impact on a human system, leading to negative consequences. It is the interaction between extreme weather events or climate stressors and the vulnerable conditions that determines disaster risk (Surminski et al., 2013). Disaster loss and damage is caused by the interaction between hazard events and the characteristics of the exposed object or subject that make the latter susceptible to damage.

[2] An alternative representation of risk is the probabilistic one, which depicts risk as the probability of occurrence of hazardous events or trends multiplied by the consequences of such occurrences.

2.3 Resilience

There are several definitions of the term "resilience", stemming from the conceptualisation of the wealth of a nation in terms of natural, environmental and social capital (Bahadur et al., 2010).

The term originates in the natural sciences. Ecological resilience was first conceptualised by Holling (1973), who considered resilience to combine persistence, resistance and transformation.

Resilience in ecological terms is defined as the magnitude of disturbance that can be absorbed before the system changes its structure by changing the variables and processes that control behaviour (Gunderson, 2000). Holling (1973) argues that a certain degree of fluctuation in a system may actually improve the system's ability to persist in the face of change.

The concept of resilience has been applied in economics by considering generic shocks and extreme events that affect the economy. Generally speaking, economic resilience can be defined as the ability of the economy or society to cope, recover, and reconstruct (macroeconomic resilience) and to minimise household welfare losses (microeconomic resilience) for a disaster of a given magnitude (Hallegatte, 2014).

The factors affecting economic resilience are summarised in Table 3.

Table 3 – Main factors affecting economic resilience

Component	Factors
Exposure	- Total affected capital - Number of affected households
Vulnerability	Total asset losses
Macroeconomic resilience	- Interest rate and marginal capital productivity - Reconstruction duration in years (N), which depends on the ability of the economy to mobilise financial and technical resources to rebuild - Ripple effects that amplify (or diminish) instantaneous production losses
Microeconomic resilience	- level of income in the country - inequality level - "poverty bias" of disasters, i.e. the relative exposure of the poor, compared with the share of assets owned by the poor - heterogeneity in direct losses across households - ability of households to smooth income shocks over time - maximum loss of welfare that an household can withstand - amount of risk-sharing in the economy

Source: Adapted from Hallegatte (2014)

In its application at community level, the social resilience concept can be seen as "the ability of communities to withstand shocks to their social infrastructure" (Adger, 2000). A resilient system is one in which people are dependent upon a variety of natural resources (so that a shock to one does not upset the entire system), has a low frequency of extreme weather events (as these can lead communities to depend on particular natural resources), and where institutions are seen as being legitimate.

Resilience can also be considered as a pathway for decision-making strategies as described below:

1) The resistance of a system or of a component does not require any re-organisation since every component remains at the same point of equilibrium, and policy strategy can focus on mitigation;
2) Persistence: the system can re-organise its assets and return to a similar equilibrium level. The system is maintained in its status quo;
3) Transformation requires more significant structural changes that push the system to a different status quo.

All of these strategies conceptualise resilience as a dynamic concept (Manyena, 2006). In particular, resilience can be increased (and vulnerability reduced) by enhancing the strength of socio-economic systems, reducing the intensity of the impact, or both. Both options for increasing resilience are interlinked with humanitarian and development assistance.

2.4 Adaptive capacity

The concept of adaptive capacity has its roots in biology, where it was used to indicate the ability of species or organisms to become adapted to a certain range of environmental contingencies (Gallopin, 2006).

Determinants of adaptive capacity, understood as the main features of communities or regions that seem to determine their adaptive capacity, have been widely debated in the literature and can be grouped as follows (IPCC, 2014; EEA, 2008; Yohe and Moss, 2000):

- Economic wealth, in terms of the availability of resources and their distribution across the population. Resources include economic assets, capital resources, natural capital and financial means. It is widely recognised that poverty is directly related to vulnerability.
- Technology, i.e. the range of technological options available for adaptation. As discussed in section 2.4.1, this element is crucial to ensure that a country can implement adaptation options.
- Information and skills refer to the stocks of human capital (i.e. education and personal security) and the stocks of social capital (i.e. definition of property rights).

- Infrastructure acts both as an enhancing factor in terms of adaptive capacity (see for instance flood defences) and as a limiting factor, as it can increase the economic damage following extreme events.
- Institutions affect the ability to implement effective adaptation options, to manage information, and the credibility of the decision-makers themselves.
- Equity including the availability of resources and their access to vulnerable subsectors of a population.

2.4.1 Adaptation

According to the IPCC (2014), although natural systems have the potential to adapt through multiple autonomous processes, intervention is required for human adaptation, to promote particular adjustments or to manage adaptation deficits by minimising adverse impacts from existing climate conditions and variability.

The adoption a policy-driven adaptation strategy approach should answer some high-level questions, namely (Fankauser and Soare, 2013): (i) Where to adapt? (ii) When to adapt? (iii) How to adapt? (iv) Who should adapt?

In order to give an answer to the first question (*where*), as well as an understanding of the main areas of vulnerability (i), the urgency of action (ii), and the ease with which risk may be reduced (iii) should also be considered. Vulnerability should not be assessed by simply looking at current socio-economic structures, but also by considering different development pathways.

Regarding the timing of adaptation (*when*), although most climate change effects will materialise in the future, adaptation might be brought forward in cases where adapting now is less expensive than adapting in the future (such as retrofitting existing buildings or improving spatial planning), and when the benefits of actions do not depend on future effects of climate change (the so called "low-regret" adaptation), e.g. improving water efficiency or better environmental management.

Finally the 'who should adapt' point raises a series of additional questions, related to the allocation of responsibilities between the public and private sectors such as the role of public policy in adaptation, the economic nature of adaptation options, and how to overcome barriers to adaptation posed by private entities.

It should be noted that criteria other than economic efficiency include: effectiveness, equity, stakeholders' participation and social acceptance, sustainability, flexibility and appropriateness in terms of timeframe and scope. These criteria should be consistent with mitigation and integrated with wider social goals that are likely to avoid maladaptation traps and to prove robust against a wide range of climate and development scenarios (IPCC, 2014).

Finally, adaptation options will not eliminate all climate-change-related impacts. If one considers all actions necessary to eliminate all impacts, only a subset will be feasible due to technical and physical limitations. Moreover, there might be some implementation constraints that further restrict what can be done.

The awareness that it is impossible to eliminate all impacts of climate change (through mitigation), together with the recognition of limits to adaptation measures, have resulted in the emergence of the concept of "loss and damage" in the policy debate (Dow and Berkhout, 2014). When it is not possible to alleviate all effects of climate change, residual damage will occur. In Cancun in 2010, the Conference of the Parties (COP) of the United Nations Framework Convention on Climate Change (UNFCCC) established a work programme on loss and damage. Whilst that discussion on how to frame loss and damage is still ongoing, the different dimensions and factors that increase or reduce loss and damage are still not completely understood (Birkmann, 2006).

More investment in ex-ante risk reduction measures is needed to address climate variability, together with mechanisms to share residual risk. It should also be noted that adaptation practices should not simply deal with existing climate variability, but also help society to cope with extremes and qualitative changes in climate expected in the future (Brooks et al., 2011). Most importantly, the impossibility of having zero residual damage implies that mitigation actions are needed, together with adaptation, to deal with climate-related hazards and climate vulnerability.

2.4.2 Interface between adaptation and mitigation

Mitigation has traditionally received much greater attention than adaptation in the climate change community, both from a scientific and from a policy perspective. The main reasons for this are explained in Füssel and Klein (2006). In fact, both are essential in dealing with climate change risk as discussed above. On the one hand, as claimed by Klein et al. (2007), mitigation is crucial when a magnitude of climate change could be reached that makes adaptation impossible for some natural systems, while for most human systems such high magnitudes of change would involve very high social and economic costs. On the other hand, even if mitigation was completely effective, adaptation would be essential to deal with climate change impacts induced by past development patterns and with residual damage. In economic jargon, each policy option can compensate to some extent for deviations from the efficient outcome caused by the non-optimality of the other. De Bruin et al. (2009) concluded that the higher the current value of damage, the more important mitigation is as a policy option in comparison to adaptation.

Therefore, mitigation and adaptation are interlinked. For a start, mitigation can potentially reduce the magnitude of climate change to which human and natural systems should adapt (IPCC, 2014). In this respect, they can be considered as partial substitutes, as stringent mitigation efforts would also reduce climate damage and therefore reduce the need for adaptation investments over the long term (Agrawala, et al., 2010).

Despite several differences (Table 4), adaptation and mitigation options are often seen as being complementary, since they can deliver co-benefits, the main reasons being:

- Mitigation actions aim to prevent climate change impacts, by stabilising carbon concentrations in the atmosphere, whilst adaptation deals with the impacts of climate change once these occur, by reducing the net climate damage and the total climate costs
- Adaptation measures have immediate benefits, as opposed to mitigation actions whose effects can be only seen in future decades. Moreover, adaptation can be implemented at the local and regional scale, whilst mitigation actions require global cooperation (Füssel and Klein, 2006).

Table 4 – A comparison of adaptation and mitigation

	Mitigation of climate change	**Adaptation** to climate change
Benefited systems	All systems	Selected systems
Scale of effect	Global	Local to regional
Life time	Centuries	Years to centuries
Lead time	Decades	Immediate to decades
Effectiveness	Certain	Generally less certain
Ancillary benefits	Sometimes	Mostly
Polluter pays	Typically yes	Not necessarily
Payer benefits	Only little	Almost fully
Monitoring	Relatively easy	More difficult

Source: Füssel and Klein (2006: 3)

The most compelling argument for combining mitigation and adaptation measures is given by the World Bank (2014), where they emphasise the fact that adaptation strategies can compensate for some adverse effects of climate change below 2°C warming, but that large negative impacts cannot be avoided under 3-4°C warming, e.g. impacts on agricultural productivity and complete glacier loss in the Andes. Similarly, limiting warming to 2°C is projected to significantly reduce the risk of drought.

Although adaptation can be complementary to mitigation and to non-climate policies, an important concern is that of determining the balance between spending on adaptation versus mitigation policies, or other investments.

In terms of economic efficiency, Agrawala et al. (2010) found that the total costs of climate change are lowest when both mitigation and adaptation options are jointly undertaken. They conclude that any least-cost policy response to climate change will need to involve substantial amounts of mitigation efforts, investments in adaptation stock, and reactive adaptation measures to limit the remaining damage.

Finally, it is often difficult to distinguish between mitigation and adaptation. A well-documented example is given by agricultural management practices used in conservation agriculture. These practices involve increasing the organic matter in soils, of which carbon is a main component. This, in turn, increases fertility, water retention and the structure of soils, leading to better yields and greater resilience

(FAO, 2010). In soils lacking in carbon, the improved agricultural management practices required for mitigation are often the same as those needed to increase productivity, food security and adaptation. In other cases, adaptation options also deliver mitigation co-benefits, such as with the creation of wetlands.

3. Defining climate resilient development

3.1 Understanding the links between climate change and development

The relationship between the use of natural resources and economic development is complex, primarily because it is difficult to establish the causal links between economic growth, environmental degradation and poverty alleviation (Dasgupta, 2009). On one hand, economic growth has caused environmental degradation, with overexploitation of natural resources and the collapse of many ecosystems. On the other hand, it has brought about improvements in the quality of a number of environmental resources, such as better access to water and sanitation services.

The same difficulties apply when analysing the links between climate change (with its impacts on natural and socio-economic systems) and development. Nonetheless, it is widely accepted that *"climate change impacts can put development goals, such as increasing the rate of economic growth, reducing poverty, improving access to education, bettering child health, combating disease, and sustaining the environment, at risk*" (USAID, 2014: page 10).

The impacts of climate change effects on development have been analysed in several academic studies. A first strand of literature focuses on the impacts on economic growth. A number of studies have found that natural disasters have adverse macroeconomic impacts. Macroeconomic variables, particularly GDP, are the main focus of this strand of research. In particular, "*higher annual temperature and declining rainfall both affected economic growth. It is estimated that a 1°C warming reduces income in the long run between 0.5% and 3.8%* "(Dell et al., 2009; Horowitz, 2009). Looking at extreme events, as opposed to slow changes in temperature patterns, similar conclusions could be drawn. According to Radatz (2009), extreme climate events are associated with 2% and 4% declines in GDP in the year following the event. The difference between short- and long-term impacts may be due to adaptation measures.

The second strand of literature focuses on the effects of climate change on poverty, showing compelling evidence that the poor are most seriously affected by climate shocks. Empirical data from Munic RE (2014) support these conclusions, indicating that low-income and lower-middle-income countries account for 85% of all disaster fatalities. Moreover, many countries at highest projected future poverty risk are also those with the lowest level of risk preparedness (Shepherd et al., 2013). Therefore, climate and disaster resilient development has been indicated as central to the global goal of ending poverty and promoting shared prosperity (World Bank, 2013; 2014).

Therefore, there is an urgent need to integrate climate considerations into development policy-making. This could create a win-win outcome, if development ensures climate resilience, and improved resilience supports the achievement of development objectives.

3.2 Climate Resilient Development

Mochizuki et al. (2014) argue that the focus of academic research should shift away from analysing the links between climate change impacts and economic growth and towards a wider perspective. In their estimation, the relevant policy question becomes: "*what kind of development will foster our ability to proactively manage natural disasters risk over time and how can we make the most of pre-and post-disaster opportunities for interventions so that societies may build resilience and adaptive capacity over the long-run?*" (p. 49).

In our opinion, this research question can be addressed by referring to the concept of climate resilient development. "Climate-resilient development is about adding considerations of climate variability and climate change to development decision-making in order to ensure that progress toward development goals now includes consideration of climate impacts" (USAID, 2014). In a recent report, the World Bank (2014) notes that, in order to end global poverty, attention should be paid not just to growth, but to the type of growth that increases returns to assets held by the poor. This report also points out that equity is crucial to ensuring that poverty reduction goals are achieved, as the closer countries are to these goals the more difficult it becomes to achieve these.

The consequences of adopting this wider perspective are twofold.

First of all, from an analytical and policy perspective, the focus should be on the wider impacts of climate change, not just economic growth.

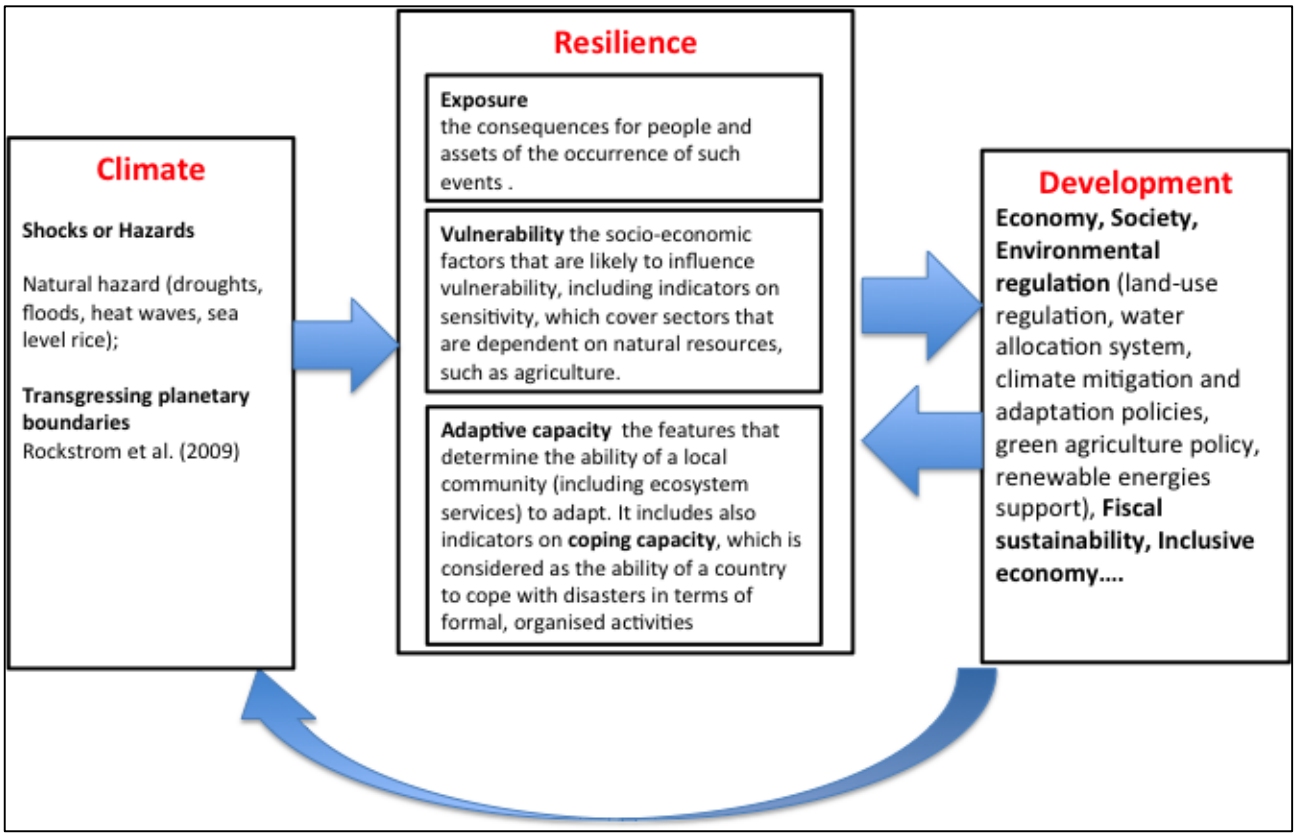
This is advocated by scholars who embrace development paradigms that focus primarily on human wellbeing and freedom.

From this perspective, climate change is seen as a possible constraint to the rights of individuals to enjoy the freedom to meet their needs including energy, food and water access, health services, education, political rights, etc. The implications are that climate change policies should be embedded in development policies, not just to ensure economic growth, but also to include land resource management, and energy and water access and affordability (Halsnæs and Verhagen, 2007). Moreover, these policies should take future climate change effects into account. From this viewpoint, climate resilient development (OECD, 2014: p. 20) occurs when societies pursue economic growth, poverty reduction and other development objectives, and systematically integrate current and future climate risks into strategies for development. Whilst vision and commitment are important, integrating climate resilience into planning processes is essential (OECD, 2014).

From an analytical perspective, more attention should be paid to risk, resilience and adaptive capacity, as opposed to disaster damage. As argued by Dow and Berkhout (2014), "serious effort should be made to reframe the problem of losses faced by vulnerable groups and regions in order to be able to move forward to address emerging losses and damages[3]". They argue that a better understanding is needed of the limits to the capacity of groups, sectors and regions to adapt to the impacts of climate variability and change.

The diagram in Figure 2 shows the building blocks of climate resilient development. This diagram will guide us in setting criteria and selecting indicators.

Figure 2 – Building blocks of climate resilient development: summarising a theoretical framework



Source: Adapted from OECD, 2014.

[3] In their definition, a loss is what is destroyed, whilst damage refers to something that can be recovered over time.

4. Use of metrics and indicators for assessing climate risk, resilience and vulnerability

As noted by Fünfgeld and McEvoy (2011), a variety of frameworks have been developed for the assessment of climate impacts, vulnerability and adaptation.

According to Surminski et al (2013) any assessment of loss and damage resulting from climate change and general climate risk needs to incorporate information about:

- the climate hazard, including current climate variability and future, long-term projections;
- vulnerability and exposure;
- how adaptation and mitigation policies can help deal with climate change impacts.

Before discussing rationale, issues and approaches to measure vulnerability and adaptation, it is worthwhile to clarify the terms used in this report. According to the IPCC (2014):

- A measure is the amount or degree of something, e.g. a value describing the current state of a variable, such as the number of fatalities following a flood event. This is synonymous with an indicator.
- The term metric refers to a group of values (measures) that taken together give an indication of the progress towards a desired state.

According to this terminology, we use metrics to understand vulnerability or adaptation, which are made up of several components, captured by indicators.

In this report we refer to "assessment" instead of "measurement". Hinkel (2011) argues that since vulnerability is not an observable phenomenon, it cannot be measured and should simply be made operational. In order to do that, it is suggested providing an operational definition, i.e. a method for linking it to observable concepts (he uses the term "methodology of a vulnerability assessment").

Box 1- Types of metrics

Indicators can measure inputs, processes, outputs, and outcomes.

Input indicators measure resources, both human and financial, devoted to a particular programme or intervention (e.g. number of workers). Input indicators can also include measures of characteristics of target populations (e.g. number of clients eligible for a programme).

Process indicators measure ways in which services and goods are provided (e.g. error rates).

Output indicators measure the quantity of goods and services produced and the efficiency of production (e.g. number of people served, speed of response to reports of abuse).

Outcome indicators measure the broader results achieved through the provision of goods and services.

Three approaches can be followed for the development of indicators, namely the deductive, inductive and normative (expert judgement) approaches (Hinkel, 2011).

Deduction uses available scientific knowledge in the form of frameworks, theories or models about the vulnerable system. These give an indication of variables that potentially determine vulnerability, but cannot be used for aggregation, as they do not explain the links between vulnerability and its causes. The only deductive argument that can be used for aggregation purposes is expert judgement (see below). An example of this approach is given by determinants of adaptive capacity to climate change determined by Yohe and Moss (2000), the IPCC (2014) and the EEA (2008), mentioned above.

"Induction uses data for building statistical models that explain observed harm through some indicating variables" (Brooks et al., 2005:152). The main limitation of this approach is that it works with few variables and insufficient data, so they are applicable to local analyses only. By showing statistical relationships, it does not explain the links between the causes and impact of vulnerability. An example of this approach is given by the application of principal component analysis (PCA) to reduce the number of causes, for example to define a Social Vulnerability Index (Cutter et al., 2003).

Finally, normative arguments use value judgement for selecting and aggregating variables. For climate risk assessment purposes, the normative approach is used to select exposure variables and for aggregating variables with equal weights. This approach is used by, for example, the Human Development Index (HDI).

4.1 Issues in Adaptation and Risk Assessment

We briefly analyse here the main issues and difficulties that analysts face when they have to assess climate risk and adaptation strategies.

As already pointed out, climate resilient development is essentially a locally driven process, which should take into account global dynamics. Climate change is a global problem that requires coordinated adaptation strategies at the local level (Ayres, 2011).

From an analytical point of view, any related analyses need to combine two different types of information: the data provided by global scenarios on climate risk, often produced by expert knowledge outside the area impacted by hazards, and on the other, evidence to inform the definition of adaptation strategies at national, regional or local level.

There are two difficulties arising from the need to combine information produced at different levels:

- the conclusions of the analyses conducted at national level do not hold once these are disaggregated to a different scale;
- local institutions often either do not have access to relevant information or do not have the tools to understand and translate it into practical actions.

Even if these difficulties can be overcome, a further complication is caused by the shifting baseline (Brooks et al., 2011), which arises due to the fact that adaptation occurs under changing climatic conditions. Any adaptation effort therefore becomes more difficult to assess, and conclusions on the evolution of key indicators over time should be treated with caution. So, for example, a stable exposure indicator (e.g. fatality rate) can be interpreted either in a positive or negative way. It will be an improvement in all cases where changing climate conditions might negatively affect the fatality rate over time, whilst it will signal ineffective practices in the case of stable climate change conditions.

Indicator-based evaluation therefore needs to be supported by monitoring climatic and other trends (such as environmental and economic conditions) so that adaptation action can be attributed correctly. This requires the normalisation of evaluation metrics with respect to changing climatic and environmental baselines.

This issue is particularly important given that development pathways can contribute to or mitigate climate change impacts.

Another important issue is that of circular arguments, which is related to the application of inductive approaches to identify resilience indicators (Béné, 2013).

The problem here lies in the fact that this method identifies variables related to social, environmental and economic characteristics as the building blocks of resilience, and assumes that these are proxies for measuring resilience.

Bené concludes that "this inductive process leads to circular analyses where resilience indices are first built from an a priori identified combination of […] indicators and then used to evaluate the impact of resilience interventions […], leading to circular (or non-independent analyses)".

In order to avoid this potential pitfall, it is suggested that metrics be identified which are independent of the system characteristics. One example is given by the total costs of extreme events (Béné, 2013; Carter et al., 2007).

We conclude that vulnerability is one of the inherent factors that should be taken into consideration when selecting climate resilience indicators, especially for aid allocation.

4.2 Vulnerability Assessment: insights from the literature

Assessments of vulnerability to climate change aim to inform the development of policies that reduce the risks associated with climate change. All studies reviewed for this analysis use an empirical approach to selecting indicators, whereby indicators are chosen subjectively by the authors on the basis of "*assumptions about the factors and processes leading to vulnerability"* (Brooks et al., 2005).

Three broad uses of vulnerability assessments have been identified (IPCC, 2014).The first is to understand the need for adaptation. In this respect, Hinkel (2011) identifies the reasons for assessing vulnerability, namely: (i) identification of mitigation targets; identification of particularly vulnerable people, regions or sectors to allocate

adaptation funds; (ii) raising awareness about climate change; (iii) monitoring the performance of adaptation policy; and (iv) scientific research. Within this context indicators can only be used to identify particularly vulnerable people, regions or sectors.

The second and third uses are both related to implementation of adaptation actions, i.e. tracking their progress or measuring effectiveness. The literature on assessing vulnerability has evolved over the past 30 years. It is thus possible to draw some useful insights, by considering the progress made and the criticism received.

Vulnerability assessments (VAs) have so far been successful in helping to understand the different social and economic groups and sectors that will be most harmed by climate-related hazards (i.e. 'who is vulnerable'), and provide evidence to support the understanding of risks to human and environmental systems posed by climate-related hazards. In other words, VAs have been very successful in identifying and describing the problem.

However, while there are agreed indicators to measure the impact of climate change, there are no agreed metrics to describe vulnerability as it is not directly observable (e.g. relating to crop yields or agricultural income) (Fellmann, 2012).

As already pointed out, vulnerability is place-based and context-specific, and consequently the significance of particular indicators can vary from region to region, especially depending on the specific socio-economic context.

This is reflected by the indicators identified in the grey and peer reviewed literature.

There are two main criticisms of current VA practices: the limited understanding of the dynamic factors that influence vulnerability and adaptive capacity (IPCC, 2014), and the fact that the results and conclusions of existing VAs depend heavily on the data and the analytical framework used.

First of all, VAs are deemed to be static, i.e. portraying a snapshot of current levels of hazards within a given context, without considering future possibilities (Preston et al., 2011; Hinkel, 2011). This is a major limitation as it is widely recognised that past trends cannot be used to predict future hazards (Royal Society, 2014).

As such, they cannot inform adaptation processes to deliver actual change, and in many cases are unable to provide policy insights.

Secondly, current VAs focus on the inherent nature of vulnerability (Kahn, 2011), and seem to neglect the dynamic and structural factors that shape the risks that people face, i.e. what makes them vulnerable. Therefore, as well as identifying vulnerable groups, VAs should make it possible to understand the factors that produce vulnerability, and shed some light on policies needed to reduce vulnerability.

More generally, many VAs lack a consistent methodology (IPCC, 2014), or fail to explain their theoretical framework in a satisfactory manner (Eriksen and Kelly, 2007).

Most importantly, VAs largely rely upon social and economic information at a range of geopolitical scales, (i.e. income, poverty and resource access). The evidence that is used as input into an assessment ultimately influences vulnerability estimates, their

relevance and how they should be interpreted (Preston, 2013). VAs are predominantly dependent upon secondary data sources for both biophysical and socio-economic dimensions of vulnerability.

Moreover, they cannot satisfactorily incorporate uncertainty. Analytical mechanisms for dealing with uncertainty are not developed, due to the often qualitative or at least semi-quantitative nature of many VAs, as well as the normative judgments they entail (Preston, 2012). Moreover, input information (such as projected climate related hazards impacts) is often highly uncertain.

Finally, their policy relevance is limited in many cases. As noted by Preston (2012: p. 47) "the tendency for vulnerability assessments to be conducted as technical, academic exercises rather than participatory, stakeholder-driven exercises means that 'success' is often defined by investigator reputation and academic publications rather than tangible benefits for stakeholders and social return on investment". It is widely recognised that stakeholders' engagement is limited and this obviously limits learning possibilities.

From the above, it is clear that the main analytical challenge is to include complex socio-ecological interactions, and to explore the use of participatory approaches and factors in developing adaptation and mitigation policies (Tschakert et al., 2013), so that VAs can support the definition of climate resilient development.

Moreover, considering the descriptive focus on the current level of impacts of VAs carried out so far, it is of critical importance to understand adaptation processes and outcomes, as many VA outcomes are used for policy decision-making or for funding decisions with regard to adaptation priorities.

5. Indicators selection

The purpose of this study is to identify and recommend a list of fit-for-purpose climate resilient development indicators. The methods used follow the approach recommended by the OECD and the JRC (2008) for building composite indicators. The guidance identifies 10 steps to define composite indicators (Box 2). The first section of this report covers the theoretical framework. This second section explores the main issue related to the definition and selection of indicators with a case on the aggregation of such indicators.

As already pointed out to select fit-for-purpose climate resilient indicators, we adopted the following objectives (OECD and JRC, 2008):

- To check the quality of the available indicators.
- To discuss the strengths and weaknesses of each selected indicator.
- To create a summary table of data characteristics, e.g. availability (across place, time), source, type (hard or soft, input or output, process).

The quality of indicators has been checked in terms of robustness against the relevant literature and criteria. This analysis also made it possible to identify the strengths and weaknesses of each indicator. The final list is dependent on data availability.

Box 2: Index (Composite indicator), definitions

In general terms, an index (composite indicator) provides an overall assessment of changes in the subject matter (be it economic, environmental or social conditions), which can be easily interpreted and communicated to the intended target audience. It is useful for indicating progress in achieving goals, and for benchmarking or policy-making purposes (JRC/OECD, 2008).

According to JRC/OECD (2008), ten main issues should be addressed to build a composite indicator:

1) The theoretical framework constitutes the basis for the selection and combination of indicators under the fit-for-purpose principle. Ideally, the composite indicator, as well as the choice of indicators, fully reflects its objectives. Key elements of this framework are: (i) definition of the concept, (ii) the subgroups related to multi-dimensional concepts; (iii) identification of selection criteria.

2) Variables selection. High-quality data is not always available, so it must be accepted that at times 'second-best' or 'proxy' indicators have to be used as component indicators. This should be done on the basis of relevance, analytical soundness, measurability, country coverage, and underlying relationships. However, the lack or the scarcity of quantitative data meeting all the above mentioned requirements can be overcome by the use of qualitative data.

3) Imputation of missing data. Consideration should be given to different approaches for imputing missing values using statistical and technical knowledge about environmental themes to be combined. Extreme values should be examined as they can become unintended benchmarks.

4) Multivariate analysis will explain the methodological choices and provide insights into the structure of the indicators and the stability of the dataset. An exploratory analysis should investigate the overall structure of the indicators, assess the suitability of the dataset and explain the methodological choices, e.g. weighting, aggregation.

5) Normalisation is carried out to make the indicators comparable. Attention needs to be paid to extreme values which can influence subsequent steps in the process of building a composite indicator. Skewed data should also be identified and accounted for.

6) Weighting and aggregation is carried out in line with the theoretical framework. Correlation and compensation among indicators need to be considered and either corrected for or treated as features of the phenomenon that needs to remain in the analysis.

7) Robustness and sensitivity tests can lead to decisions to exclude certain indicators or use another technique for completing the datasets. The robustness of the composite indicator should be analysed in terms of, for example, the mechanism for including or excluding component indicators, the normalisation scheme, the imputation of missing data, the choice of weights and the aggregation method.

8) Links to other variables. Links to other composite or aggregate indicators should be ascertained. Attempts should be made to correlate the composite indicator with other published indicators, as well as to identify links through regression analyses.

9) Back to the real data. To improve transparency, it should be possible to decompose the indicator into its underlying values.

10) Presentation and Visualisation. Composite indicators can be visualised or presented in a number of different ways, which can influence how they are interpreted and understood.

5.1 Criteria for indicators selection

To identify criteria for indicators selection, we will first present general criteria, which are valid for all indicators (table 5), and then those pertinent mainly to resilience indicators.

Table 5 – Criteria for selection of indicators

	Criterion	Explanation
Validity	Not ambiguous	Agreement on the direction of influence between the indicator and what is sought to be measured (target measure)
	Well founded	Based on a tested theoretical framework
	Well defined	So that unwitting errors are minimized (e.g. measuring a family or an household)
	Purpose is known	This helps fix problems in data collection; misunderstandings between different collecting agencies, etc
	Accurate	Measuring what it should, and responds quickly
	Precise	Statistical variation between measurements is low
	Quality checked	Ideally subject to independent checking; is there a cross checking mechanisms?
	Transparent	Information source and control of information flow is known
	Honest	There should be no rationale or opportunity for individuals to manipulate or distort the data (e.g. manipulating rain-gauges used for weather index insurance)
Value	Comprehensible	Relatively easy for user to understand
	Relevant	Applicable to a wide range of circumstances (geographic, social, economic)
	Responsive	Can measure usefully small changes in the target measure
	Actionable	The quality/quantity of what is being measured can be affected by human appropriate actions
	High information content	Usually quantitative is more useful than qualitative, than binary data; and real measurements more useful than modeled estimates or expert judgment
	Disaggregatable	Can the indicator be collected for specific groups (e.g. children, women and men)
	Participatory	Can local people be involved in the data collecting; does the data help inform and possibly empower them
Data	Available	Data is publicly and easily available; affordable
	Homogenous	Data collection is consistent across location and time, including matching season or time-of-day if necessary
	Periodic	Data is collected at a frequency that is suitable for tracking changes
	Long time-course	Data has been consistently collected for some years
	Spatial coverage	Spatial coverage must be sufficient to provide a fair representation of the measure (e.g. Density of rain gauges)

Source: IPCC (2014): chapter 14, page 885.

These general criteria are valid for any assessment study, and are useful for checking whether the screened indicators are robust.

However, to ensure consistency and theoretical robustness we first need to consider the purposes and aim of the study. Secondly, the specific criteria relevant to selected indicators for climate resilient development will be analysed.

Whilst we are not interested in monitoring the implementation of adaptation or mitigation actions, the indicators should ensure that we identify the most vulnerable sectors or social groups - we understand when action is needed, we target the most cost-effective opportunities and we minimise losses and damages from extreme events.

Methods and frameworks for assessing vulnerability should also address the determinants of adaptive capacity in order to examine the potential responses of a system to climate variability and change.

In some quantitative approaches, the indicators used are related to factors that are deemed to increase adaptive capacity (e.g. national economic capacity, human resources, and environmental capacities).

Other studies include indicators that can provide information related to the conditions, processes and structures that promote or constrain adaptive capacity (EEA, 2008).

In this respect, we will also refer to the specific criteria identified by Schneider et al. (2007) for selecting key impacts.

They recommend that the following criteria be referred to:

- magnitude of impacts (scale and intensity);
- timing of impacts;
- persistence and reversibility of impacts;
- likelihood (estimates of uncertainty) of impacts and vulnerabilities;
- potential for adaptation;
- distributional aspects of impacts and vulnerabilities across regions and population groups;
- importance of the natural systems at risk.

The main focus of this exercise will not be the selection of indicators based on determinants of vulnerability which, as discussed above, are considered as given. Instead, we will emphasise the importance of enabling people to become more resilient to climate hazards, without jeopardising development opportunities and without compromising their natural capital.

Therefore, for the purpose of this study, we will also consider these additional criteria, more focused on the processes (adaptation and mitigation strategies) and outcomes (climate resilient development and protection of natural capital):

- mitigation capacity: when adaptation is not feasible or future impacts will be excessive, then it is imperative to implement mitigation actions immediately. Some adaptation options also present mitigation benefits. Win-win opportunities exist, especially in the agricultural sector.
- environmental implications: adaptation and mitigation actions should take into account their consequences on the natural environment, and work with natural processes as much as possible.
- impacts on development opportunities: adaptation and mitigation actions could represent opportunities in term of economic growth and social development, as discussed above.
- economic efficiency: any funding decision should consider effectiveness and efficiency as key criteria for allocating scarce resources. As discussed above, no- or low-regret options and other actions yielding net benefits are already available. These should be explored and implemented sooner rather than later.

Finally, it should be noted that the analysis will be carried out on the national scale, i.e. indicators will be developed at country level. As noted by Füssel (2010), this scale is the most appropriate for assessment purposes, when funding is the main objective of the study.

That said, the indicators will be identified in such a way that they can also be applied at a smaller scale by local stakeholders, to ensure local participation and involvement. In many cases information at the national scale is not available, but can be collected for specific detailed case study analyses.

This is consistent with the goal of developing a platform that stakeholders can use for climate resilient assessment purposes.

We aim to develop climate resilient indicators, therefore these should be precise, robust, transparent and objective; they should also be simple, clear and easy to understand.

5.2 Fit-for-purpose indicators: preliminary list

A list of country-level indicators with a global coverage has been compiled by reviewing the relevant literature on climate change, development, disaster risk and the application of vulnerability and resilience indicators.

The main focus has been on peer-reviewed contributions, and on indicators used to compute global development, vulnerability and risk indices.

In particular, with respect to human development, the Human Development Index (HDI) and its indicators, the current Millennium Development Goals (MDGs) and proposed post-2015 Sustainable Development Goals (SDGs) were considered.

Other indicators used for international assessment and monitoring purposes, such as those used for the Adaptation Fund and the Hyogo Assessment Framework (both the current ones and the post-2015 proposals), have also been included.

Moreover, further indicators were identified by looking at the relevant literature on determinants of vulnerability and adaptive capacity, and on social and economic vulnerability.

Finally, the following global indices were reviewed, and relevant indicators considered:

1. The World Risk Index (**WRI**)[4] - developed by the UN University and the University of Bonn. Its objective is to measure vulnerability to extreme natural events. The Index is composed of four main indicators: exposure to natural hazards such as earthquakes, cyclones, floods, droughts and sea level rise; susceptibility depending on infrastructure, nutrition, housing conditions and economic framework conditions; coping capacities determined by governance, preparedness and early warning, healthcare, and social and material security; and adaptive capacities relating to future natural events and climate change. It covers 171 countries. The latest update was made in 2014.
2. The Index for Risk Management (**INFORM) -** developed by the JRC in partnership with DG ECHO and several international organisations. The most recent version, from 2015, considers data for 191 countries. Its objectives are to understand the drivers of humanitarian risk and to help rank countries according to the likelihood of need for international assistance in the near future.
3. The University of Notre Dame's Global Adaptation Index (**ND-GAIN**) aims to help businesses and the public sector to better prioritise investments by providing information on a country's vulnerability to climate change and other global hazards. In its 2014 version, it considers 178 countries.
4. The Environmental Vulnerability Index (**EVI**)[5] uses 50 indicators to assess environmental vulnerability. It was developed by the United Nations Environment Programme (UNEP). Unfortunately, it was last updated in 2004.
5. The Germanwatch Global Climate Risk Index (**CRI**) analyses to what extent countries have been affected by the impacts of weather-related loss events (storms, floods, heat waves, etc.), using four indicators. The 2015 version considers information from 1994 to 2013, and for 2013.

As a source of information, we reviewed the Environmental Performance Index (EPI), developed by Yale University, which analyses the environmental performance of 178 countries regarding environmental health and ecosystem vitality. Only pertinent indicators were considered.

[4] http://www.ehs.unu.edu/article/read/world-risk-report-2014
[5] http://www.vulnerabilityindex.net/EVI_Indicators.html

By also considering the relevant literature, a total of 269 indicators and 17 indexes were identified (Table I and Table II of Annex IV) and classified under the following headings:

- **Natural hazards** - the occurrence of climate-related and weather-driven hazards, such as flooding, storms, droughts, heat waves, and sea-level rise.
- **Exposure -** the consequences for people and assets of the occurrence of such events.
- **Vulnerability** - the socio-economic factors that are likely to influence vulnerability, including indicators on sensitivity, which cover sectors that are dependent on natural resources, such as agriculture.
- **Adaptive capacity** - the features that determine the ability of a local community (including ecosystem services) to adapt. It includes also indicators on **coping capacity**, which is considered as the ability of a country to cope with disasters in terms of formal, organised activities.
- **Mitigation capacity** - the factors that ease the implementation of actions taken to reduce greenhouse gases.
- **Development** - economic and social factors that make an economy more resilient to natural hazards, thereby reducing the impacts of climate related events. These indicators also describe the socio-economic conditions that should be met to ensure that development is climate resilient.

After considering all of the reviewed indicators and checking their compliance with the criteria summarised in the Tables of Annex III, a final list of indicators for a web knowledge platform for climate resilient development was compiled on the basis of the relevance of the proposed indicators as well as of data availability.

Data sources quoted in the original study were checked to ensure that the most up-to-date information is used.

74 indicators were excluded due to data availability issues, because data were not available, or were only available for some countries or only for a few years.

Ad hoc surveys or ex post project assessments would be necessary for several indicators, so they were excluded as data might become available as reporting efforts progress, especially with regard to the Hyogo Framework for Action (HFA) or the proposed Sustainable Development Goals.

Many of these indicators may be potentially useful in the future, as more information may become available or be collected at the local scale. As some indicators are redundant (i.e. they capture similar aspects), a second check was carried out to ensure that there are no duplications.

On the basis of indicator redundancy, 102 indicators were shortlisted. The criteria used to choose between similar indicators included the quality of available data and the fact that a given indicator had already been used for global climate risk assessments.

We have selected a final list of indicators which satisfy the following criteria: reliable and open-source, consistent, with global coverage and based on observed data which are in the public domain.

The next section will illustrate the application of the theoretical framework described in the first section by building a composite indicator for climate resilient development.

6. A Case Study

All the issues highlighted by the theoretical framework described in this report are extremely urgent and relevant, but integrating all of them into a single index represents a major challenge. This section proposes a case study for building an index to support climate resilient development by identifying the countries that are most vulnerable to climate change. The objective of the index will be to rank the countries based on the following issues: climate-related and weather-driven hazards, vulnerability to climate change, adaptive capacity, climate change mitigation action, disaster risk, and a (political) commitment to respond to climate change through poverty reduction.

The sample of the countries includes Least Developed Countries (LDC), Small Island Developing States (SIDS), low-income countries and lower-middle-income countries, and territories from the OECD's Development Assistance Committee (DAC) list of Official Development Assistance (ODA) Recipients (excluding Tokelau, Singapore, and Bahamas) (Table I of Annex II).

In line with the theoretical framework and the screening process described in the first section of this report, we have selected 32 fit-for-purpose country-level indicators that cover social, economic and environmental aspects of each of the components under which they have been classified (Table 6).

A specific focus on gender is proposed for the adaptive capacity component. This approach is coherent with the recognised role of the gender equality in reducing poverty and fighting against climate change (Millennium Development Goals, Post-2015 SDGs, UNFCCC COP 18 and COP19).

The tables in Annex I provide detailed information describing each indicator in terms of relevance, measuring unit, indicator creation method, data source, periodicity, trend, data type, and statistics. This information is complemented by maps showing the geographical distribution of each indicator in the sample of the countries analysed in this case study and for the latest available year.

Table 6 - Components and indicators considered to build an index

Component		N.	Indicator
Natural Hazards		1	Drought Events - the past 20 years (cumulative)
		2	Flood Events - the past 20 years (cumulative)
		3	Storm Events - the past 20 years (cumulative)
Exposure		4	Population density (people per sq. km of land area)
		5	Refugees per place of residence (% of population)
		6	Internally displaced (% of population)
		7	Proportion of Population in Low Elevation Coastal Zones (LECZ)
Vulnerability		8	Gini index
		9	Poverty headcount ratio at $1.25 a day (PPP) (% of population)
		10	Age dependency ratio (% of working-age population)
		11	Agriculture, value added (% of GDP)
		12	Forest area (% of land area)
		13	Water dependency ratio
Capacity	**Adaptive**	14	Ecosystem vitality: Agriculture
		15	Manufacturing, value added (% of GDP)
		16	ODA/DAC – Adaptive Capacity as principal
	Adaptive/ Gender	17	Access to Literacy
		18	Share of female representatives in the national parliament
		19	Access to bank accounts
	Coping	20	Improved sanitation facilities (% of population with access)
		21	Hospital beds (per 1 000 people)
		22	Physicians (per 1 000 people)
		23	Nurses and midwives (per 1 000 people)
		24	Mobile phone subscriptions (per 100 people)
	Mitigation	25	CO2 emissions (kg per PPP $ of GDP)
		26	Participation in UNFCCC fora - mitigation actions
Development		27	Life expectancy at birth, total (years)
		28	Literacy rate, adult total (% of people aged 15 and above)
		29	Income Index -Gross National Income (GNI)
		30	Net ODA received per capita (current US$)
		31	Personal remittances, received (% of GDP)
		32	Internet users (per 100 people)

The treatment of missing data is an important issue for the calculation of the index. However, for this case study we did not treat missing data but, in order to avoid the 0 value of the final index in relation to missing data, we added 0.000001 to the components presenting a null value related to missing data.

We normalised the data with the max-min formula and aggregated all the indicators of each component (hazards, vulnerability and adaptive capacity) by arithmetic average at sub component level, as reported in Table 7.

Table 7 - Normalisation of indicators and aggregation at component level.

Component	Indicator Normalisation	Aggregation at sub component level
Hazards	Max-Min	Arithmetic average
Exposure	Max-Min	Arithmetic average
Vulnerability	Max-Min	Arithmetic average
Capacity	Max-Min	Arithmetic average
Development	Max-Min	Arithmetic average

Subsequently, components were aggregated by applying geometrical (1) and linear (2) formulas of aggregation as follows:

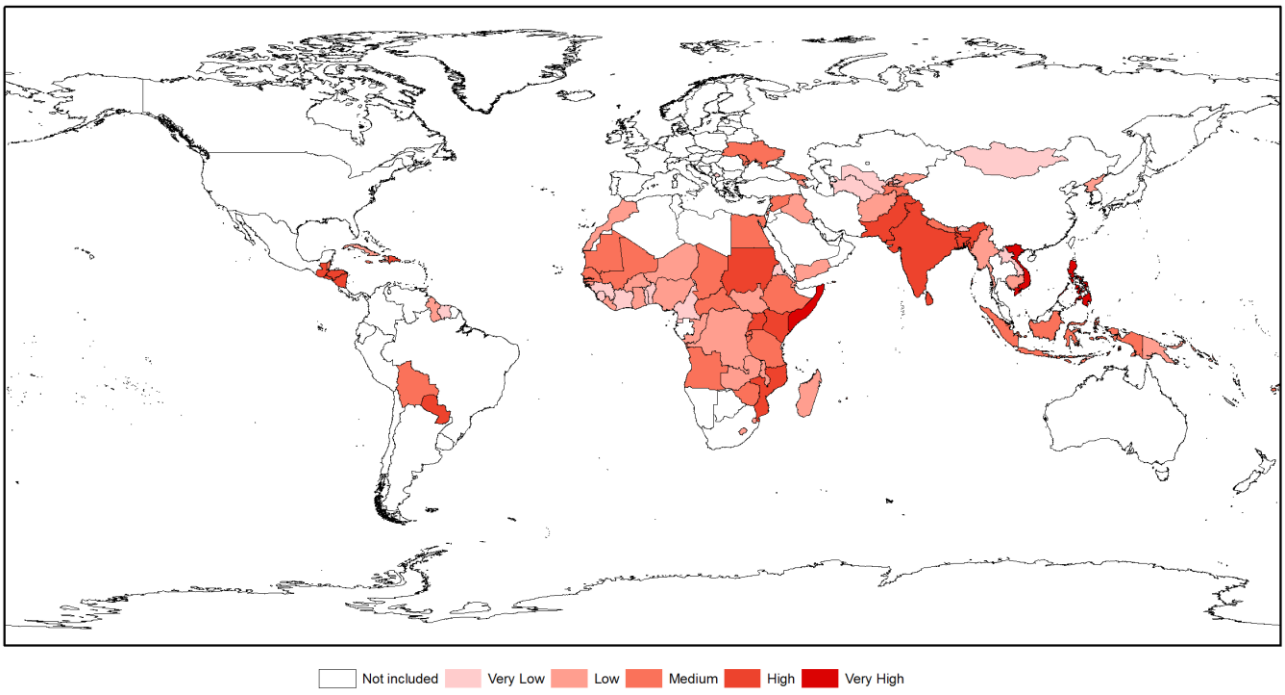
CC-Risk = Hazard * [(Exposure * Vulnerability) / (Capacity * Development)] (1)

CC-linear = (Hazard + Exposure + Vulnerability + Capacity + Development) / 5 (2)

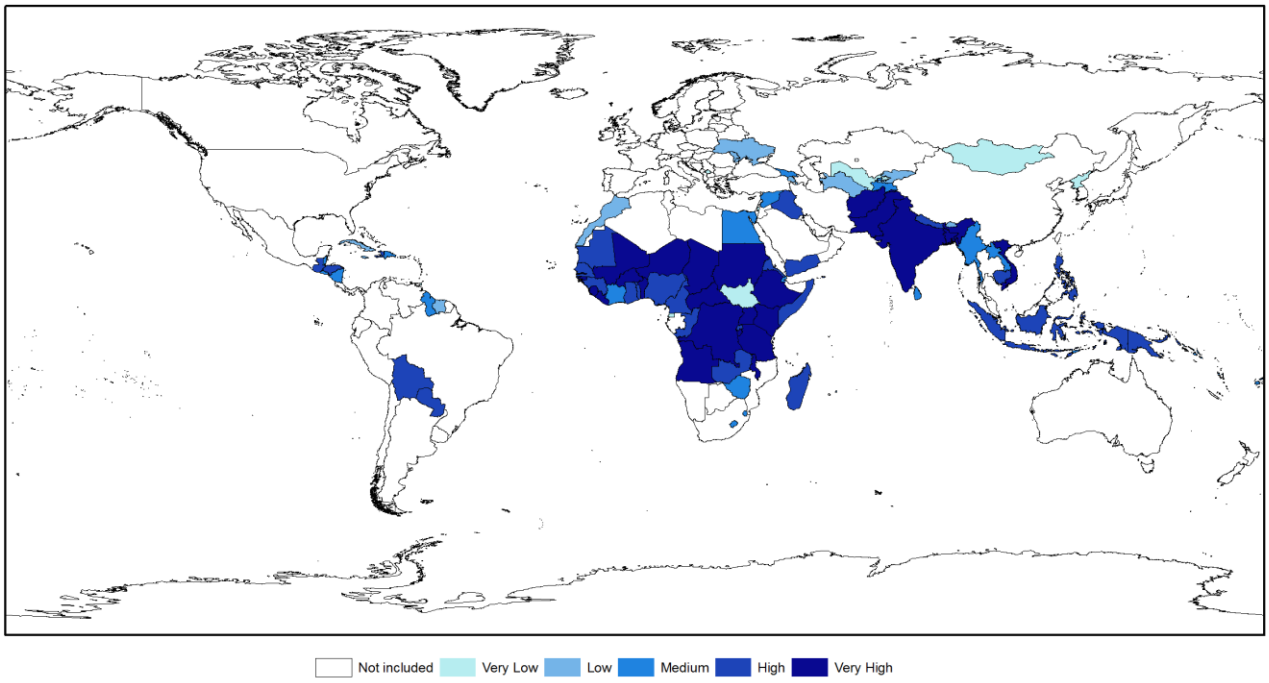
CC Mixed= [(Hazard*Exposure)+ Vulnerability+ Capacity +Development]/4 (3)

Maps 1, 2 and 3 show the results of these aggregations representing the index scores grouped into five categories (very low to very high) by means of the Jenks methodology, which consists of minimising the intra-variance group.

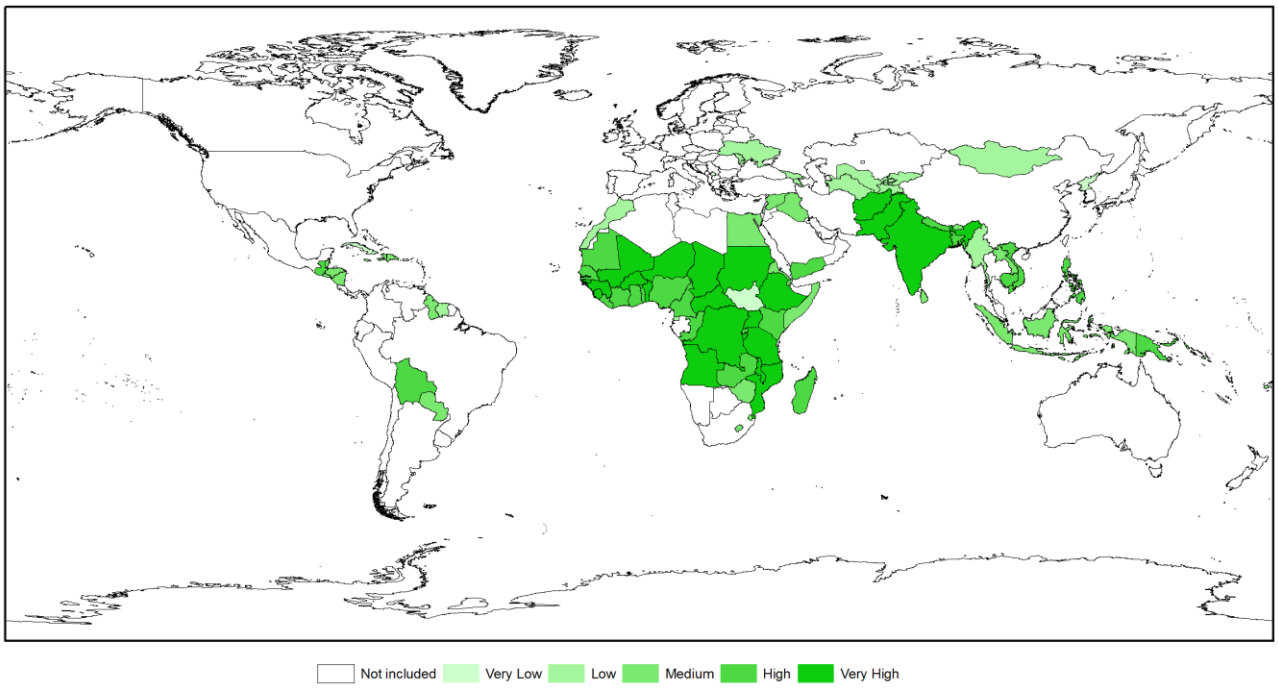
Map 1- Index calculated with geometrical formula of aggregation



Map2 - Index calculated with linear formula of aggregation



Map 3 - Index calculated with mixed formula of aggregation.



The three maps show different results. The geometrical index (Map 1) prioritises the countries that apply a climate change risk approach. Countries affected by climate and/or weather events receive the highest score ('very high').

The linear aggregation (Map 2) prioritises the countries by attributing the same weight to all the components (natural Hazards, exposure, vulnerability, capacity and development). The mixed aggregation show results very close the linear aggregation.

These results are very clear when we analyse the correlation of the scores of the each index with their components as reported in the table 8.
It shows the results of correlations between the various scores and components measured using the Pearson's Correlation Coefficient (Pearson's Product Moment Correlation Coefficient)[6]. High significant correlation is yellow marked.

[6] It shows the degree of linear dependence between two variables and is defined as the covariance of the two variables divided by the product of their standard deviations. It gives a value between +1 and −1 inclusive, where 1 is total positive correlation, 0 is no correlation, and −1 is total negative correlation.

Table 8 - Correlation between components

	Hazards	Exposure	Vulnerability	Capacity	Development
Geometric score	0,81	0,32	0,42	0,07	0,13
Linear score	0,70	0,54	0,74	0,78	0,87
Mixed score	0,62		0,80	0,85	0,91

The main component for the geometric aggregation is the hazard, highlighting a climate risk focus as already pointed out.

In the linear and mixed score confirm an over – representation of the development component.

The results of this case study show that, although there is some agreement on which indicators should be included in an index for climate resilient development, a single approach to building a global index for climate resilient development does not exist.

In our case study we used the same components and indicators for climate resilient development, but from two different policy perspectives. In the first case we adopted a climate risk approach with a geometrical formula of aggregation. In the second and third cases we applied a development policy approach.

The differences in ranking are very high, which indicates that an index should address a specific policy request with a clear objective.

This is a first step to building a fit-for-purpose index.

Figure 3 - Correlation Matrix: Plots between overall geometrical index and components

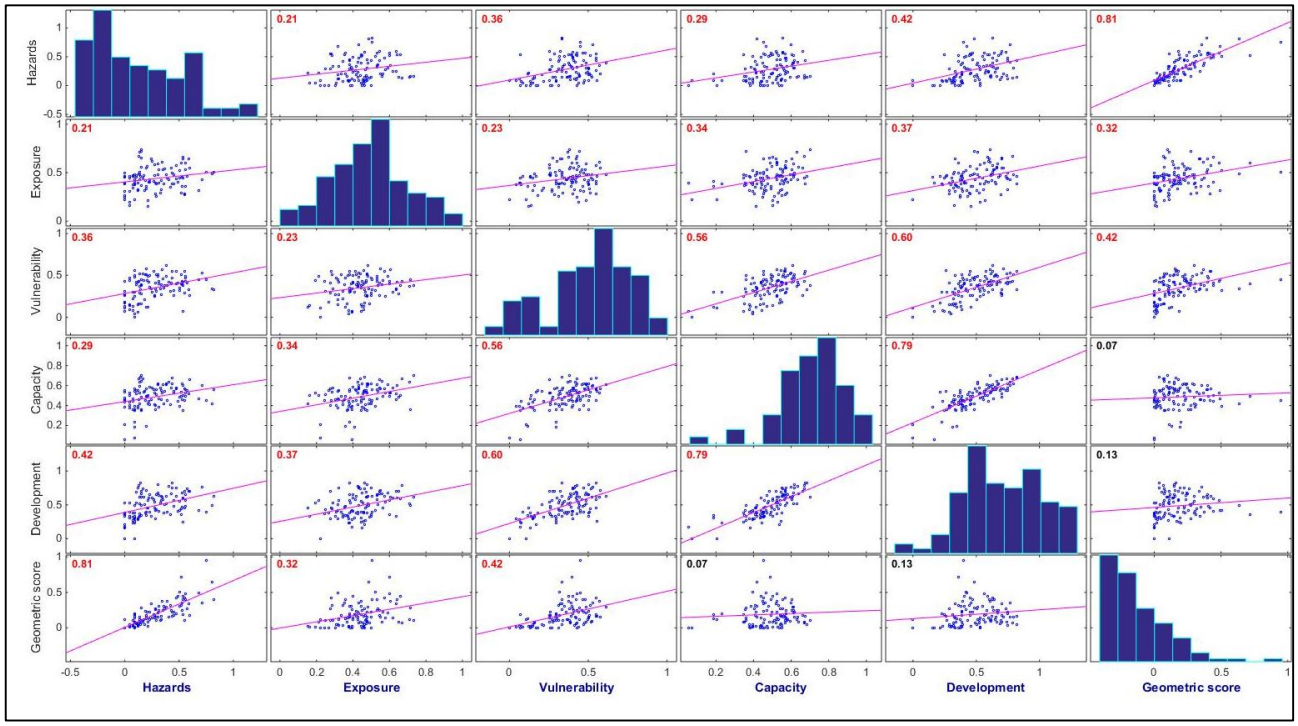


Figure 4 - Correlation Matrix: Plots between overall linear index and components

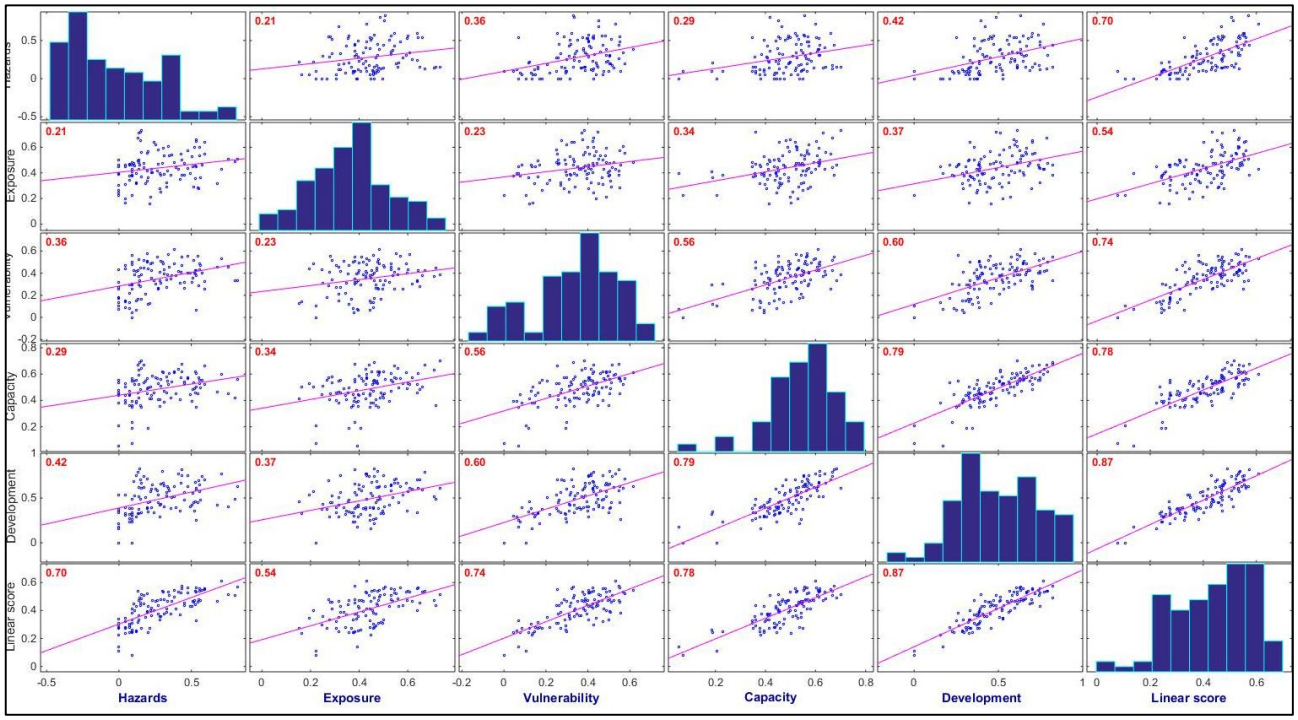
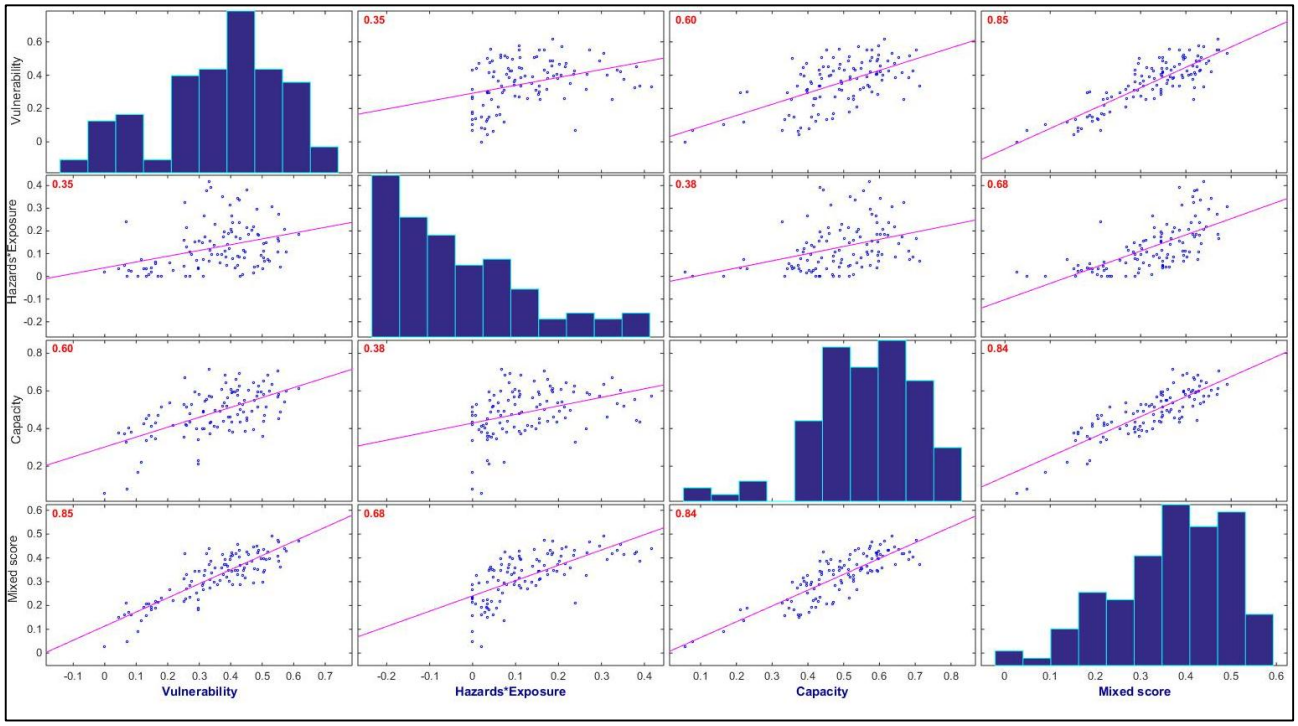


Figure 5 - Correlation Matrix: Plots between overall mixed index and components



7 Open issues

7.1 Limits of Datasets on Natural Hazards

A key issue highlighted by our analysis is the general concern about data availability, in terms of the quality, coverage and time span of data, particularly since information is least reliable in developing countries. This lack of data may lead to a fragmented picture of the key components and spatial extent of climate change risk. International efforts to compile new databases (including those on losses) should be supported, based on which the list of indicators could be updated.

7.2 Including indicators on Monitoring and Evaluation (M&E)

Two different types of indicators are used to target adaptation and mitigation funding, and to monitor and evaluate adaptation and mitigation programmes.
In the first case the evaluation is ex ante, as indicators should be able to identify priority areas and sectors for intervention on the basis of risk and vulnerability, and anticipate the types of actions that are needed to build climate resilient development.
On the other hand, M&E is an *ex post* activity, and indicators are needed mainly to capture the progress made against objectives.
Whilst indicators used for aid allocation focus on structural features of vulnerability and promote equal opportunities for more vulnerable countries and sectors, those used for M&E purposes will mainly cover the dynamic component of climate resilient development.

7.3 Indicators from Earth Observation

There is currently a wide variety of well established, operational applications for assessing and monitoring observed climate change impacts and risk factors, based on analysis of data from Earth Observation satellites. A variety of indicators of climate impacts and risk factors derived from Earth Observations has been identified (Table 8) that are suitable both for the ex ante classification of geographical areas in terms of exposure and vulnerability to climate change, as well as for assessing and monitoring the climate impacts and risk factors.

Of the indicators derived from Earth Observation listed in Table 9, the first four (i.e. Exposure to flooding; Vulnerability to flooding; Vulnerability to coastal erosion; Vulnerability to landslides) are suitable for ex ante assessment of areas in terms of climate impacts and risk. The inclusion of these indicators could be investigated further.

Table 9 - Examples of Earth-Observation-derived indicators of climate impacts and risk factors.

#	Indicator name	Thematic basis of indicator
1	Exposure to flooding	Proximity of settlements to water bodies
2	Vulnerability to flooding	Soil sealing / surface permeability of settlements
3	Vulnerability to coastal erosion	Density of mangrove plantations
4	Vulnerability to landslides	Land cover, soil type & topography
5	Loss of wetlands	Area of natural lakes & riverine swamps
6	Loss of biodiversity	Landscape fragmentation in conservation areas
7	Loss of agricultural productivity	Area of staple agricultural crops (e.g. maize)
8	Agricultural drought	Vegetation condition & surface temperature
9	Landscape degradation	Area of arable land
10	Deforestation	Area of contiguous forest cover
11	Forest fire damage	Area of burnt or fire-damaged forest
12	Forest storm damage	Area of contiguous forest cover

8. Conclusion

This study aims to contribute to the debate on climate change policies and their link to development. We adopted a climate resilient perspective to understand how climate change policy objectives can be reconciled with development goals and to explore win-win opportunities given by the integration of climate change and poverty reduction policies.

With this aim in mind, the study has been organised in two sections, namely the definition of a theoretical framework to select fit-for-purpose indicators, and a case study which involves building an index for climate resilient development.

We reviewed the main theoretical concepts that characterise the scientific literature on climate risk and vulnerability assessments, and identified climate resilient indicators accordingly.

This made it possible to build the theoretical foundations for a newly designed index to improve our understanding of the implications of aid financing on reversing unsustainable pathways, reducing vulnerability to climate change related hazards, and to obtain more equitable outcomes.

As highlighted by our analysis, climate risk indices have already been developed. The novelty of our contribution lies in its focus on the economic aspects of climate risk assessment, most notably the concepts of loss and damage, the understanding of factors that enhance economic resilience, the links between climate change policies and development (besides economic growth) and the acknowledgment of the role of natural capital in pursuing development policies.

By reviewing grey and peer-reviewed literature, we identified 102 suitable indicators, which have been grouped under six components. These were selected from a preliminary list of 286 indicators, on the basis of general criteria such as validity, data availability and their value in terms of information potential. Other specific criteria were also considered to ensure that the indicators shortlisted are theoretically robust.

Finally, although we consider all the issues highlighted in this report to be very urgent and relevant, it is extremely difficult to integrate them all into a single index. This is supported by the results of our case study, which involved building three climate resilient development indices.

The three case-study climate resilient development indices were built using the same components and indicators but from two different political perspectives. The results demonstrate that, although there is some agreement on which indicators should be included in an index for climate resilient development, a single approach to building a global index for climate resilient development does not exist. The high number of differences between the scores of the three indices indicates that a single index in the climate resilient development domain is a sort of chimera. Any index should address a specific policy request with a clear objective. This is a first step to building a fit-for-purpose index.

For this reason, we propose the construction of a scientific platform organising all the reviewed indicators and concepts. Such a platform, which is proposed as an interface between science and policy in the domain of climate change risk, and disaster risk management for humanitarian aid and development should provide transparent, objective, reliable, accurate, and open source information on the impacts of natural hazards related to climate change, vulnerability, adaptive capacity, mitigation, and resilience. The aim of such a platform is not just to provide information needed to rank countries and allocate resources, but also to provide supporting tools consistent with many frameworks such as climate resilient development, low carbon development, green growth and the green economy. The 102 indicators of the Table I Annex II will be included into this platform. It will be up to the users to select indicators and mathematical formulas for building their own composite indicators consistent with their political objectives (such as funding allocation decisions on climate resilient development policies) and their monitoring and evaluation priorities.

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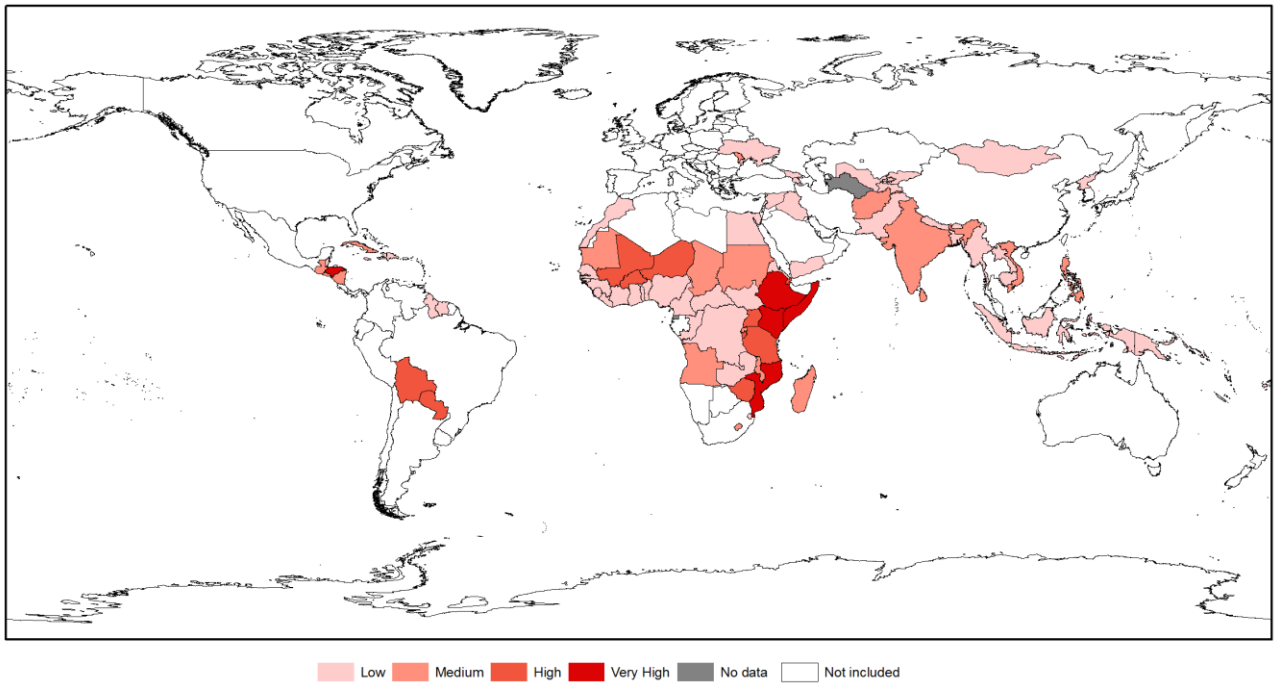
Annex I Fact sheets of the indicators included into the Case study

Natural Hazards

Indicator	**Name**	**Drought Events - the past 20 years (cumulative)**
	Description	Sum of the number of droughts reported the past 20 years (cumulative)
	Relevance	Climate-related and weather-driven hazards
Notes	Measuring Unit	Number of events
	Indicator Creation Method	For a disaster to be entered into the database at least one of the following criteria must be fulfilled: 1. Ten (10) or more people reported killed. 2. Hundred (100) or more people reported affected. 3. Declaration of a state of emergency. 4. Call for international assistance.
	References	Hahn et al 2009; Costa (2012), Kellenberg and Mobarak (2008), IPCC (2007; 2012; 2014).
Source	**Source** / Citation	EM-Data
	URL	http://www.emdat.be
	Original source - if different	
	Date of Publication	2015
	Periodicity	Annual
	Year of reference	2014 and last available
	Trend	1995-2014
	Data type	Tabular (excel)
	Missing data	36/111

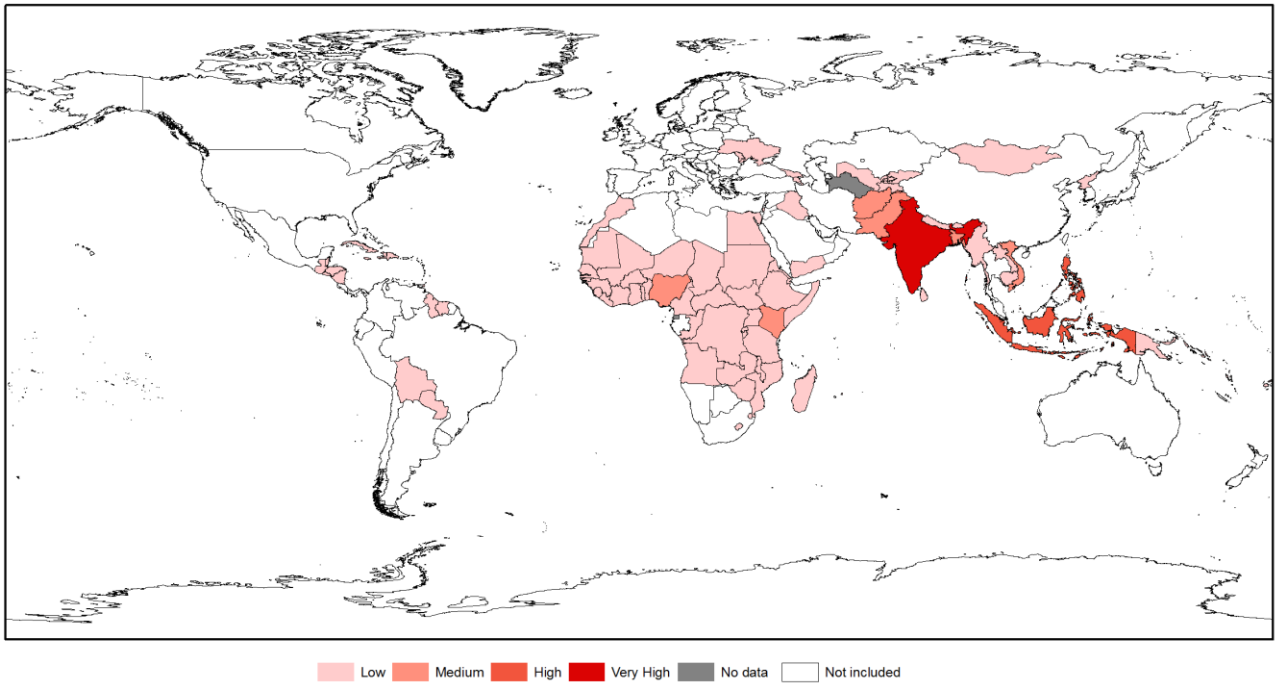
Drought Events – the past 20 years 1995-2014 (cumulative)



Source: Authors elaborations on EM – Data, 2015

Indicator	**Name**	**Flood Events - the past 20 years (cumulative)**
	Description	Number of floods reported the past 20 years (cumulative)
	Relevance	Climate-related and weather-driven hazards
Notes	Measuring Unit	Number of events
	Indicator Creation Method	For a disaster to be entered into the database at least one of the following criteria must be fulfilled: • Ten (10) or more people reported killed. • Hundred (100) or more people reported affected. • Declaration of a state of emergency. • Call for international assistance.
	References	Hahn et al 2009; Costa (2012), Kellenberg and Mobarak (2008), IPCC (2007; 2012; 2014).
Source	**Source** / Citation	EM-Data
	URL	http://www.emdat.be
	Original source - if different	
	Date of Publication	2015
	Periodicity	Annual
	Year of reference	2014 and last available
	Trend	1995-2014
	Data type	Tabular (excel)
	Missing data	14/111

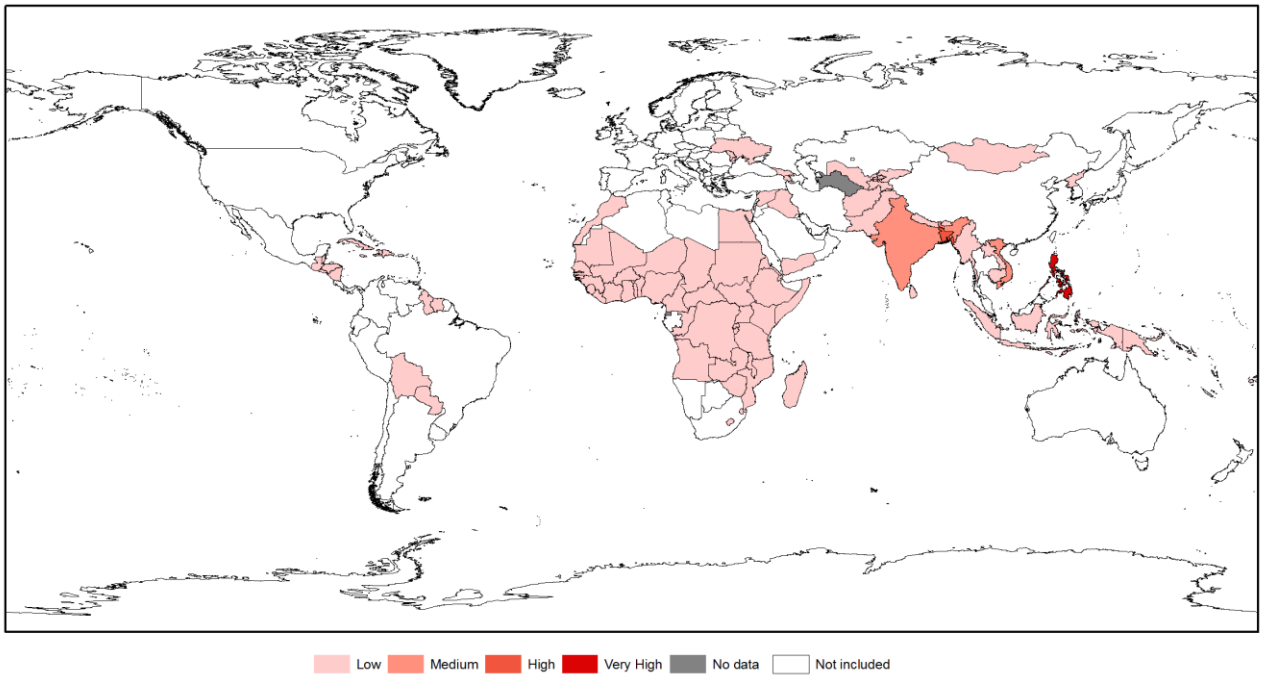
Flood Events - the past 20 years 1995-2014 (cumulative)



Source: Authors elaborations on EM – Data, 2015

Indicator	**Name**	**Storm Events - the past 20 years (cumulative)**
	Description	Number of storms reported the last 20 years (cumulative)
	Relevance	Climate-related and weather-driven hazards
Notes	Measuring Unit	Number of events
	Indicator Creation Method	For a disaster to be entered into the database at least one of the following criteria must be fulfilled: • Ten (10) or more people reported killed. • Hundred (100) or more people reported affected. • Declaration of a state of emergency. • Call for international assistance.
	References	Hahn et al 2009; Costa (2012), Kellenberg and Mobarak (2008), IPCC (2007; 2012; 2014).
Source	**Source** / Citation	EM-Data
	URL	http://www.emdat.be
	Original source - if different	
	Date of Publication	2015
	Periodicity	Annual
	Year of reference	2014 and last available
	Trend	1995-2014
	Data type	Tabular (excel)

Storm Events - the past 20 years 1995-2014 (cumulative)

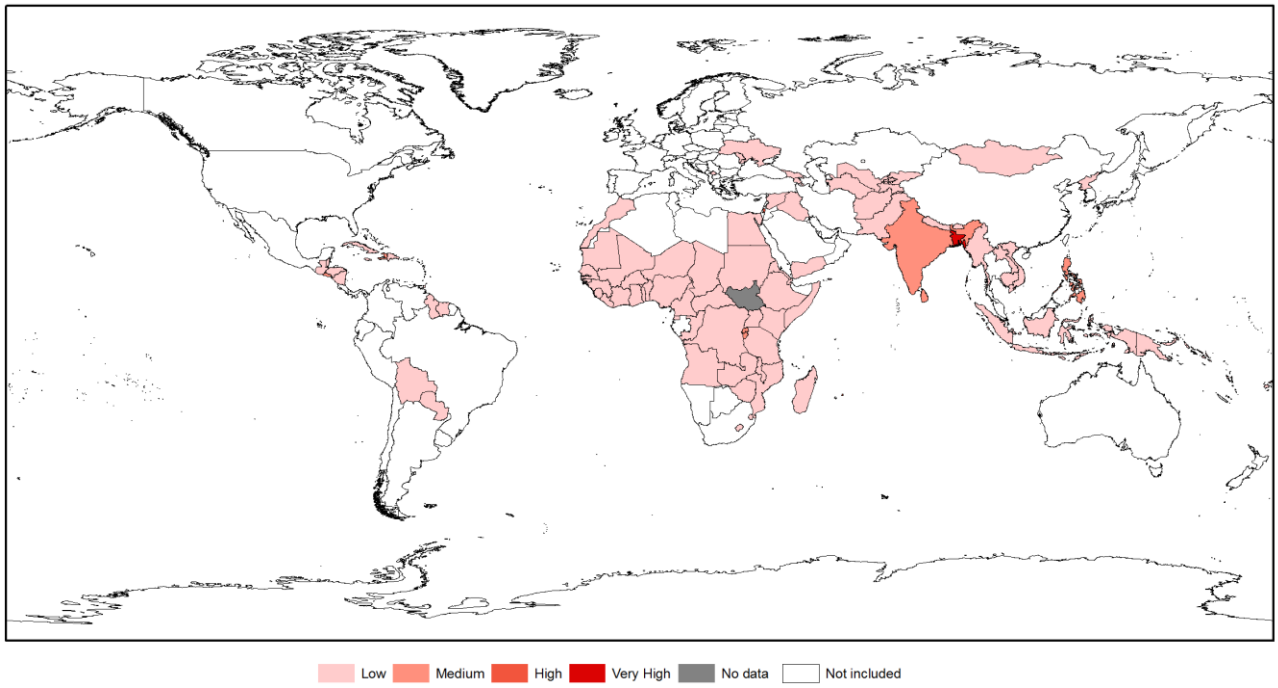


Source: Authors elaborations on EM – Data, 2015

Exposure

Indicator	**Name**	**Population density (people per sq. km of land area)**
	Description	Population/m2
	Relevance	The increasing global population increases pressure on environmental resources. Relative flood mortality is higher in less populated than in densely populated countries
Notes	Measuring Unit	people per sq. km
	Indicator Creation Method	Population density is midyear population divided by land area in square kilometers. Population is based on the current definition of population, which counts all residents regardless of legal status or citizenship - except for refugees that are not permanently settled in the country of asylum, who are generally considered part of the population of their country of origin. Land area is a country's total area, excluding area under inland water bodies, national claims to continental shelf, and exclusive economic zones. In most cases the definition of inland water bodies includes major rivers and lakes.
	References	Birkmann 2007; de Oliveira Mendes (2009), Tate et al. (2010) Khan (2012), Lee (2014), Brooks et al., 2005 Green Growth Knowledge Platform (GGKP)
Source	**Source** / Citation	World Bank Data
	URL	http://data.worldbank.org/indicator/EN.POP.DNST
	Original source - if different	Food and Agriculture Organization and World Bank population estimates.
	Date of Publication	2014
	Periodicity	Annual
	Year of reference	2013
	Trend	1995-2013 yearly
	Data type	Tabular (excel)
	Missing data	3/111 countries

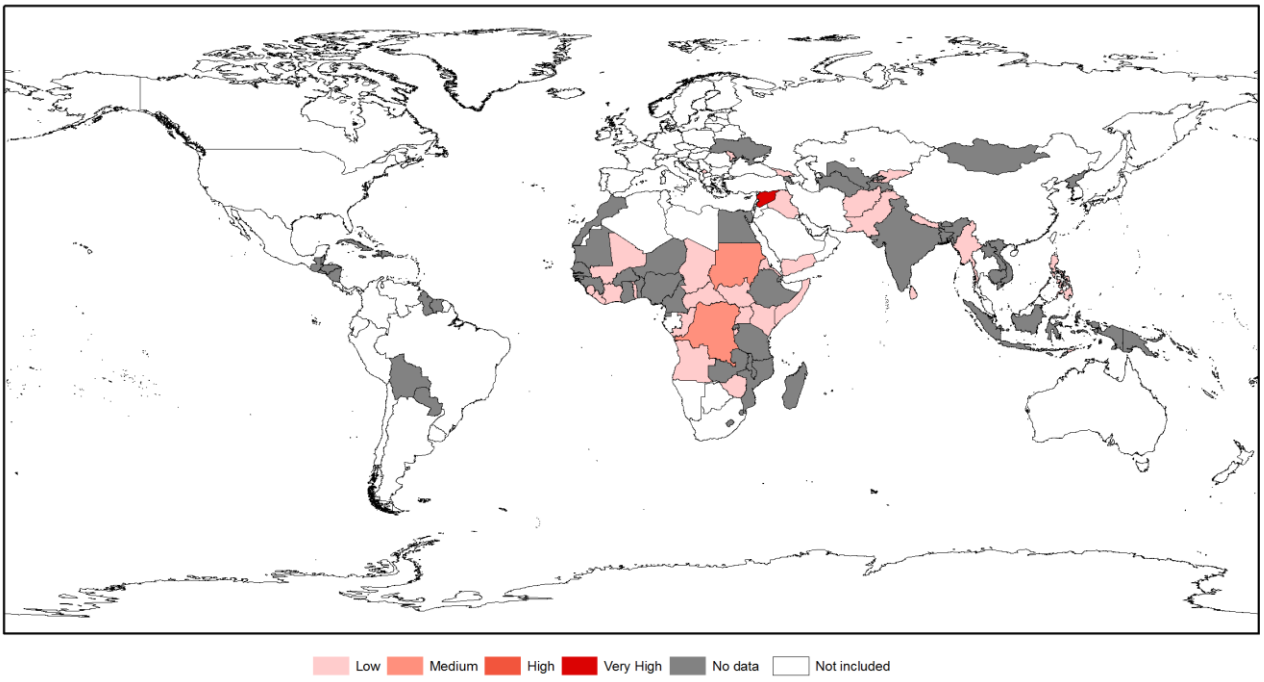
Population density (people per sq. km of land area), 2013



Source: Authors elaborations on World Bank data, 2014

Indicator	**Name**	**Internally displaced**
	Description	Internal refugees (1 000s) scale by population
	Relevance	
Notes	Measuring Unit	1 000s scale by population
	Indicator Creation Method	The data are generally provided by Governments, based on their own definitions and methods of data collection
	Additional Notes	
	Pre-Processing	
Source		
	References	Brooks et al., 2006
	Source / Citation	United Nations High Commissioner for Refugees (UNHCR) Population Statistics Reference Database,
	URL	http://popstats.unhcr.org/PSQ_TMS.aspx
	Original source - if different	
	Date of Publication	2014
	Periodicity	Annual
	Year of reference	2013 and latest available year

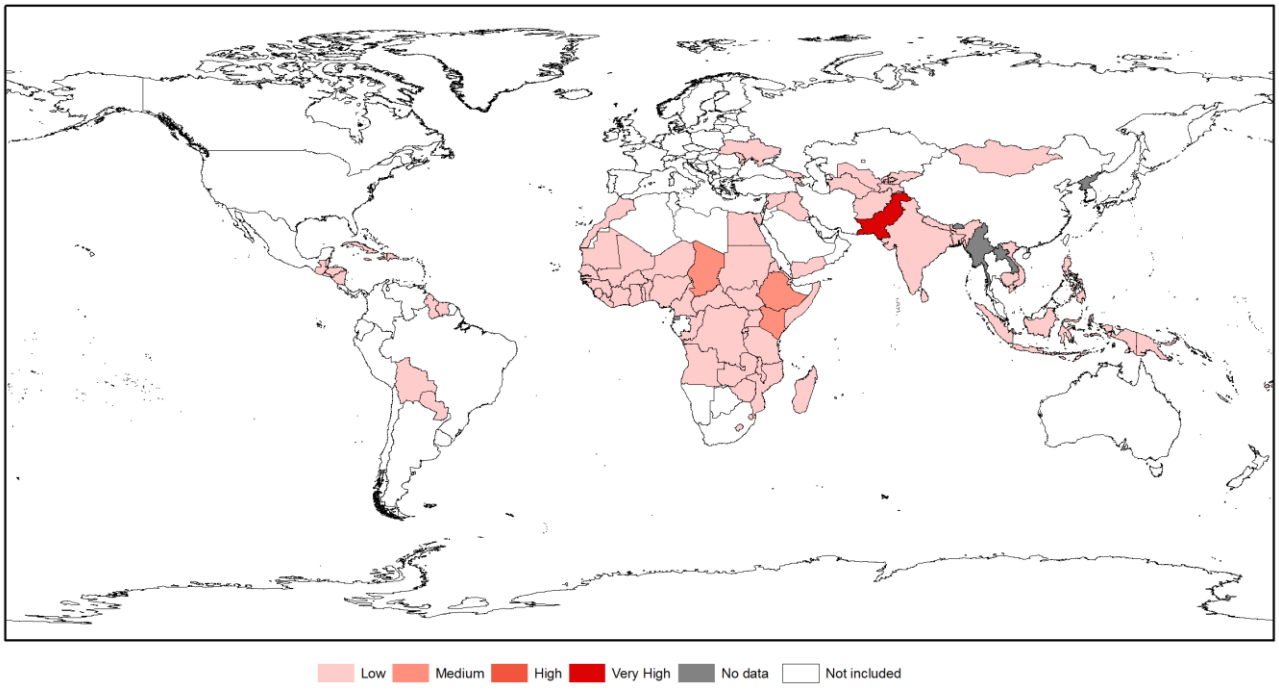
Internally displaced, 2013



Source: Authors elaborations on UNHCR data, 2014

Indicator	Name	Number of refugees per place of residence
	Description	Refugees include individuals recognised under the 1951 Convention relating to the Status of Refugees; its 1967 Protocol; the 1969 Organization of African Unity (OAU) Convention Governing the Specific Aspects of Refugee Problems in Africa; those recognised in accordance with the UNHCR Statute; individuals granted complementary forms of protection; or those enjoying temporary protection. The refugee population also includes people in a refugee-like situation.
	Relevance	Displaced people are normally a particularly at-risk group and are more likely to live in vulnerable conditions in hazard-prone areas , with less access to basic services than low-income households in general
Notes	Measuring Unit	Count
	Indicator Creation Method	
	References	Post 2015 HFA (UNISDR, 2014)
Source	**Source** / Citation	UNHCR Population Statistics Database
	URL	http://popstats.unhcr.org/PSQ_TMS.aspx
	Original source - if different	
	Date of Publication	
	Periodicity	Annual
	Year of reference	2013 and latest year available
	Trend	2000-2013
	Data type	Tabular (excel)
	Missing data	23/111

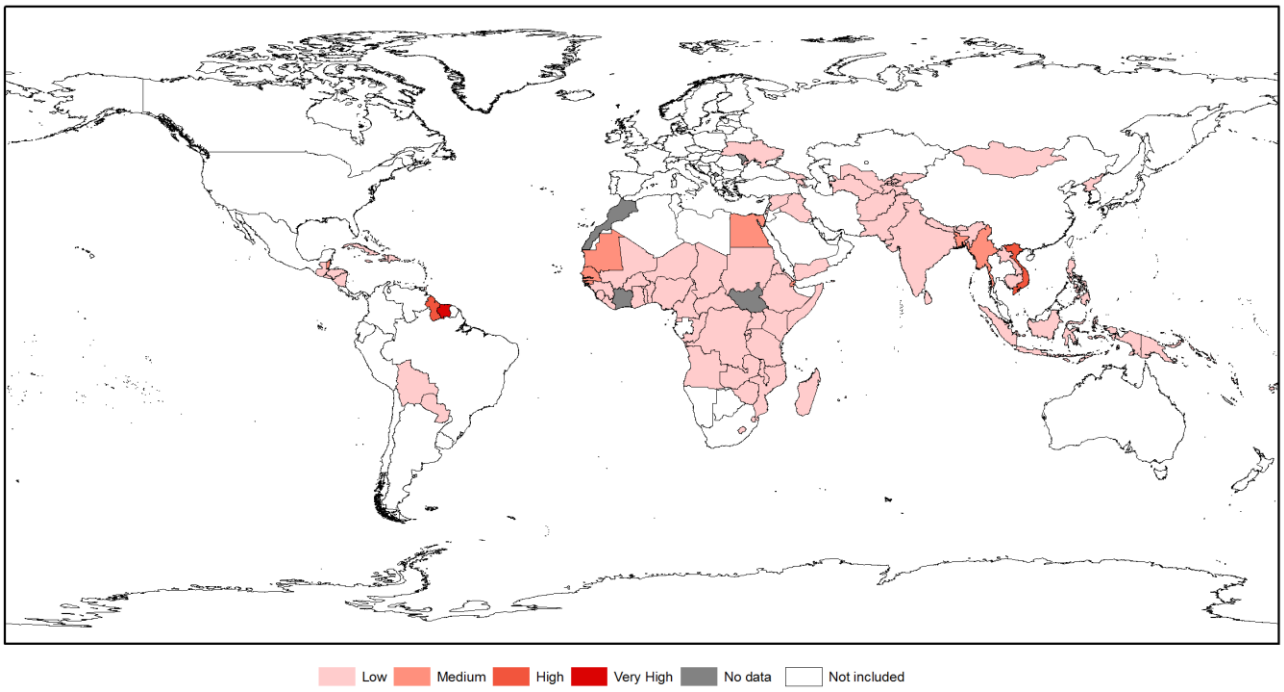
Number of refugees per place of residence, 2013



Source: Authors elaborations on UNHCR data, 2013

Indicator	**Name**	**Proportion of Population in Low Elevation Coastal Zones (LECZ)**
	Description	Proportion of Population in Coastal Zones. Low Elevation Coastal Zone (LECZ) is defined as the contiguous area along the coast that is less than 10 metres above sea level.
Notes	Measuring Unit	Percentage
	Indicator Creation Method	The proportions of populations (urban, rural and total) in low elevation coastal zones (LECZ) are calculated for each country or area by UNSD using total and LECZ population figures available from CIESIN/SEDAC. Country-level estimates of urban, rural and total population and land area in a low elevation coastal zones (LECZ) were generated globally using Global Rural-Urban Mapping Project (GRUMP) alpha population and land area data products and a Digital Elevation Model (DEM) derived from Shuttle Radar Topographic Mission (SRTM) remote sensing data. The zone was derived from the DEM by selecting all land contiguous with the coast that was 10 metres or less in elevation coastal zone . Zonal statistics were generated for urban, rural and total population and land area for the country as a whole and within the LECZ.
	References	
Source	**Source** / Citation URL	United Nations Statistics Division, Environmental Indicators: Marine and Coastal Areas http://unstats.un.org/unsd/environment/Proportion_Population_CoastalZones.htm
	Date of Publication	2009
	Periodicity	
	Year of reference	2000
	Trend	
	Data type	tabular (excel)
	Missing data	0/111

Proportion of Population in Low Elevation Coastal Zones (LECZ), 2000

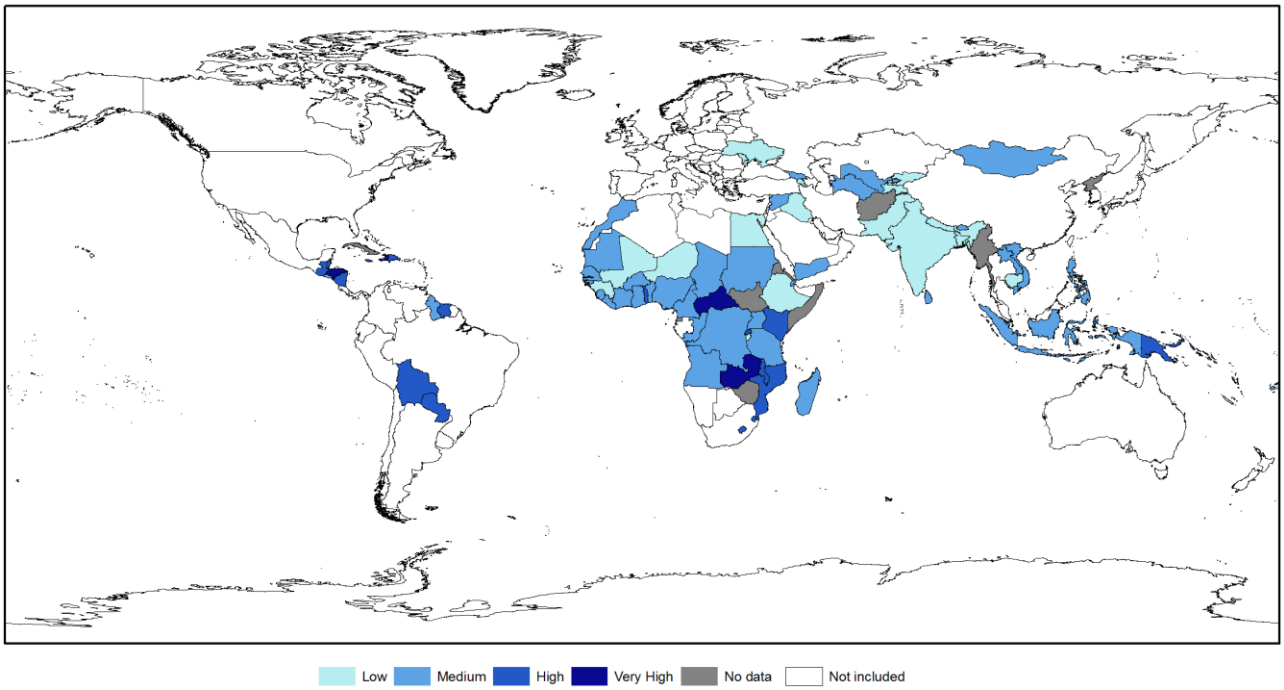


Authors elaborations on UN data, 2009

Vulnerability

Indicator	Name	Gini index
	Description	The Gini index measures the extent to which the distribution of income or consumption expenditure among individuals or households within an economy deviates from a perfectly equal distribution. A Gini index of 0 represents perfect equality, while an index of 100 implies perfect inequality.
	Relevance	The index gives an estimate of inequality as it measures the extent to which the actual income distribution differs from an equal distribution. Resilience is likely to be lower in countries with a high degree of income inequality
Notes	Measuring Unit	Index [0-100]
	Indicator Creation Method	A Lorenz curve plots the cumulative percentages of total income received against the cumulative number of recipients, starting with the poorest individual or household. The Gini index measures the area between the Lorenz curve and a hypothetical line of absolute equality, expressed as a percentage of the maximum area under the line. Thus a Gini index of 0 represents perfect equality, while an index of 100 implies perfect inequality.
	References	Inform: Gini World Risk Index: Income inequality Hallegatte 2014; Anbarci et al., 2005; Kahn, 2005;Brooks et al., 2005; post 2015 HFA (UNISDR, 2014); Green Growth Knowledge Platform (GGKP)
Source	**Source** / Citation	World Bank
	URL	http://data.worldbank.org/indicator/SI.POV.GINI
	Date of Publication	20/12/2013
	Periodicity	annual
	Year of reference	2012 and latest available year
	Trend	1995- 2012 yearly
	Data type	Tabular (excel)
	Missing data	27/111

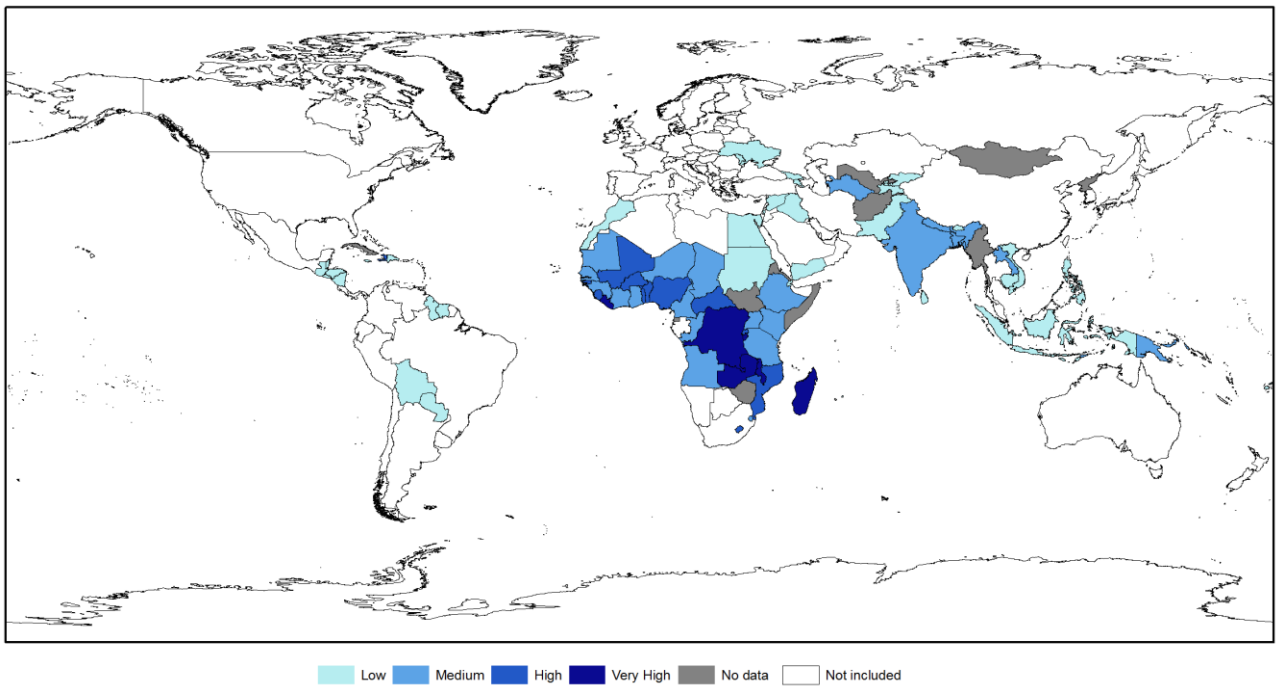
GINI index, 2013



Source: Authors elaborations on World Bank data, 2014

Indicator	Name	Poverty headcount ratio at US$1.25 a day (PPP) (% of population)
	Description	% of population living on US$ 1.25 per day or less (purchasing power parity - PPP)
	Relevance	Poor people are more susceptible to suffer from the impact of natural hazards, as they tend to live in hazard-prone areas (e.g. in unsafe buildings, on floodplains, etc.) and continuously have to cope with various shocks related to hazards, in dire conditions with limited assets
Notes	Measuring Unit	Percentage
	Indicator Creation Method	Population below US$1.25 a day is the percentage of the population living on less than US$1.25 a day at 2005 international prices. As a result of revisions in PPP exchange rates, poverty rates for individual countries cannot be compared with poverty rates reported in earlier editions (source: World Bank)
	References	Bjarnadottir er al., 2011; Sub-indicator of the World Risk Index 2014 and MDGs (UN 2005)
Source	**Source** / Citation	World Bank
	URL	http://data.worldbank.org/indicator/SI.POV.DDAY
	Original source - if different	World Bank, Development Research Group. Data are based on primary household survey data obtained from government statistical agencies and World Bank country departments. Data for high-income economies are from the Luxembourg Income Study database. For more information and methodology, please see PovcalNet (http://iresearch.worldbank.org/PovcalNet/index.htm).
	Date of Publication	2014
	Periodicity	Annual
	Year of reference	2013 and latest available year
	Trend	1995-2013
	Data type	Tabular (excel)
	Missing data	29/111 countries

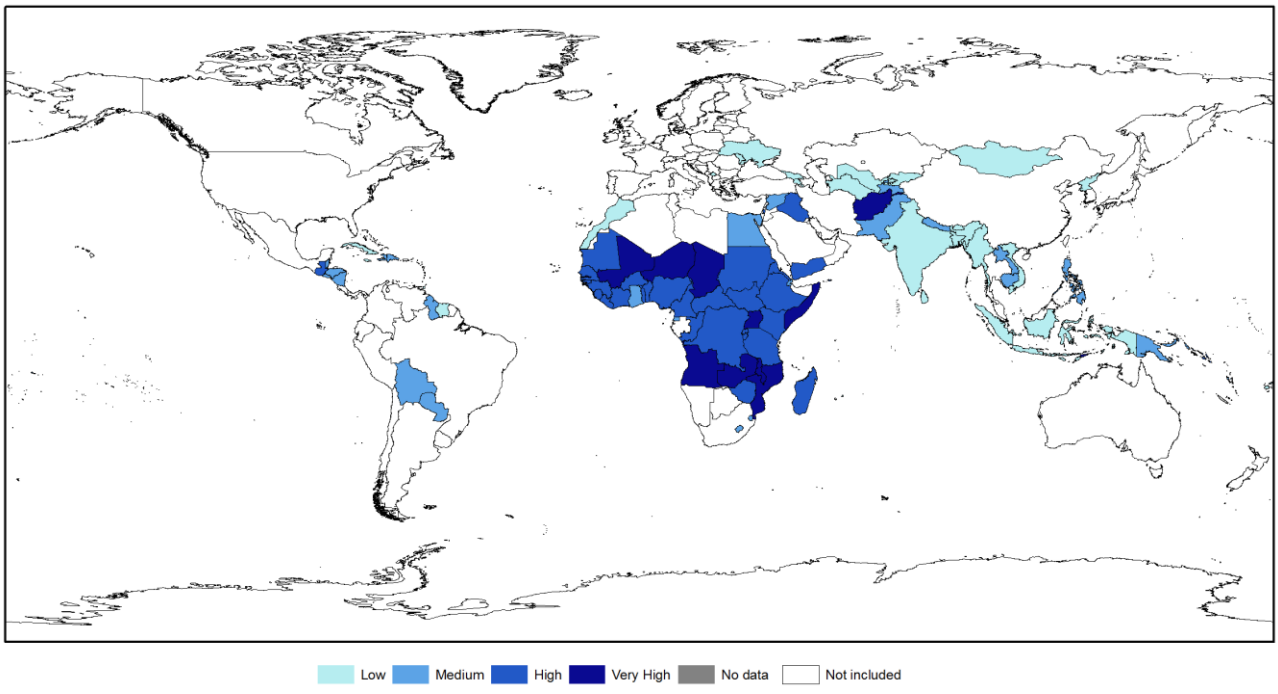
Poverty headcount ratio at US$1.25 a day (PPP) (% of population), 2013



Source: Authors elaborations on World Bank data, 2014

Indicator	Name	Age dependency ratio (% of working-age population)
	Description	Age dependency ratio (% of working-age population) is the ratio of dependents (people younger than 15 or older than 64) to the working-age population (those aged 15-64). Data are shown as the proportion of dependents per 100 working-age persons.
	Relevance	The direct effects of extreme weather may disproportionately affect the old and the young. A high age-dependency ratio means a high proportion of children and elderly people compared to working age population. This lowers resilience, particularly in the case of death or injury of a working-age adult.
Notes	Measuring Unit	Percentage
	Indicator Creation Method	World Bank estimates from various sources including census reports, the United Nations Population Division's World Population Prospects, national statistical offices, household surveys conducted by national agencies, and ICF International.
	References	World Risk Index in Susceptibility: ND-GAIN in Sensitivity: Post 2015 HFA in Resilience:
Source	**Source** / Citation	World Bank
	URL	http://data.worldbank.org/indicator/SP.POP.DPND
	Original source - if different	
	Date of Publication	2014
	Periodicity	Annual
	Year of reference	2013 and latest available year
	Trend	1995-2013 yearly
	Data type	Tabular (excel)
	Missing data	7/111 countries

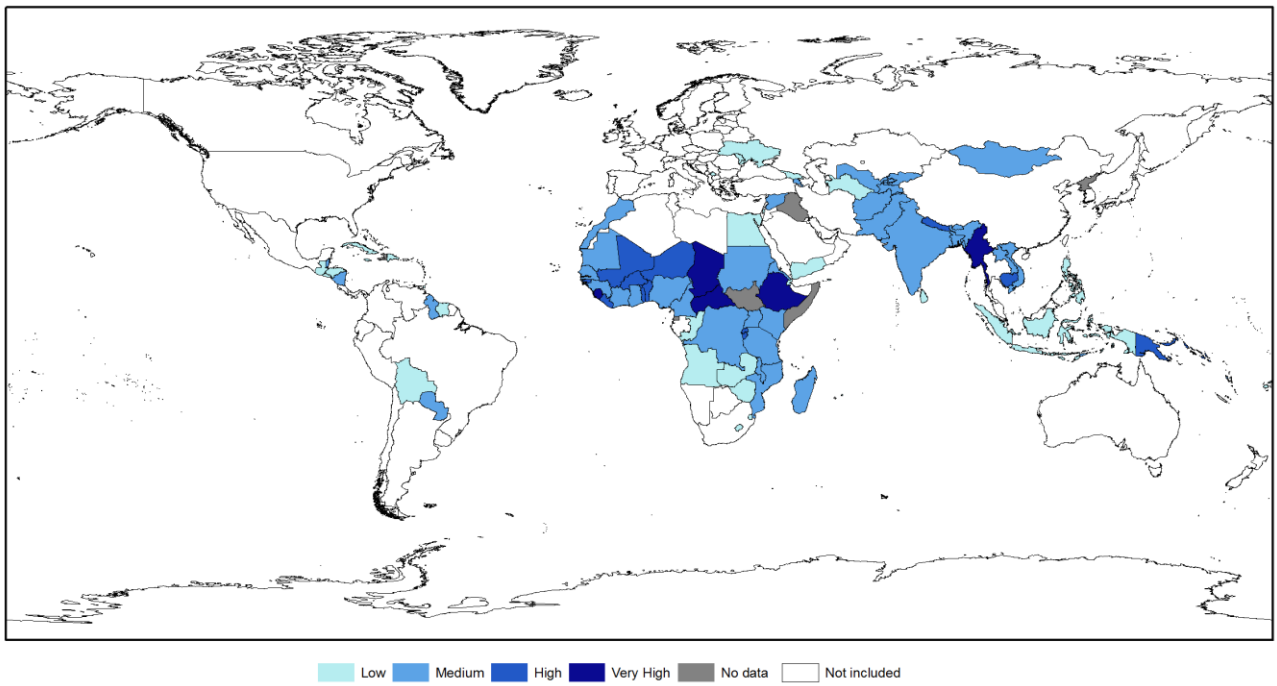
Age dependency ratio (% of working-age population), 2013



Source: Authors elaborations on World Bank data, 2014

Indicator	**Name**	**Agriculture, value added (% of GDP)**
	Description	Agriculture corresponds to ISIC divisions 1-5 and includes forestry, hunting, and fishing, as well as cultivation of crops and livestock production. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs.
	Relevance	Climate-sensitive sector
Notes	Measuring Unit	Percentage
	Indicator Creation Method	The indicator is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3. Note: For VAB countries, gross value added at factor cost is used as the denominator.
	References	Füssel, 2010 Füssel,and Klein, 2006, (IPCC, 2014a, 2014b)
Source	**Source** / Citation	World Bank
	URL	http://data.worldbank.org/indicator/NV.AGR.TOTL.ZS
	Original source - if different	World Bank national accounts data, and OECD National Accounts data files.
	Date of Publication	Last Updated: 01/30/2015 [World development indicators]
	Periodicity	Annual
	Year of reference	2013 and latest available year
	Trend	1995-2013
	Data type	Tabular (excel)
	Missing data	11/111

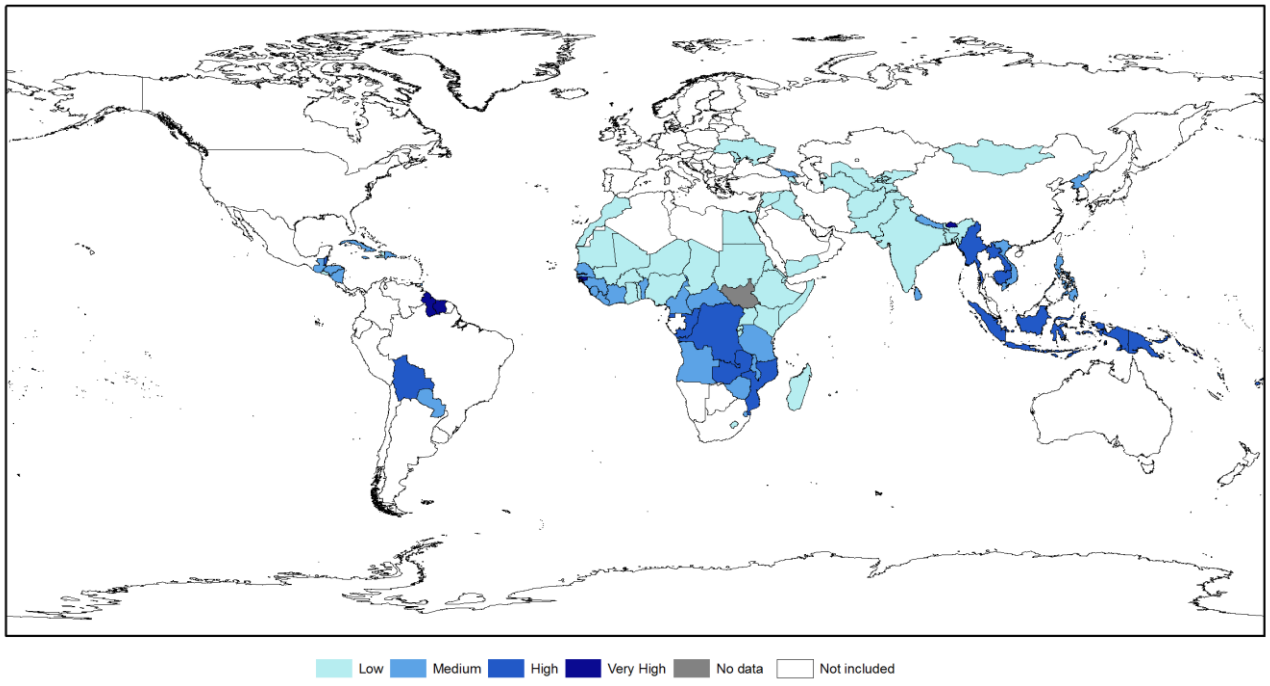
Agriculture, value added (% of GDP), 2013



Source: Authors elaborations on World Bank data, 2013

Indicator	**Name**	**Forest area (% of land area)**
	Description	Forest area as percentage of the total land area
	Relevance	
Notes	Measuring Unit	Percentage
	Indicator Creation Method	Forest area is land under natural or planted stands of trees of at least 5 metres in situ, whether productive or not, and excludes tree stands in agricultural production systems (for example, in fruit plantations and agroforestry systems) and trees in urban parks and gardens.
	References	Brooks et al., 2005; MDG 7.1 (UN 2005); WDI
Source	**Source** / Citation	World Bank
	URL	http://data.worldbank.org/indicator/AG.LND.FRST.ZS
	Original source - if different	Food and Agriculture Organization, electronic files and website.
	Date of Publication	2014
	Periodicity	Annual
	Year of reference	2012
	Trend	1995-2012 yearly
	Data type	Tabular (excel)
	Missing data	4/111 countries

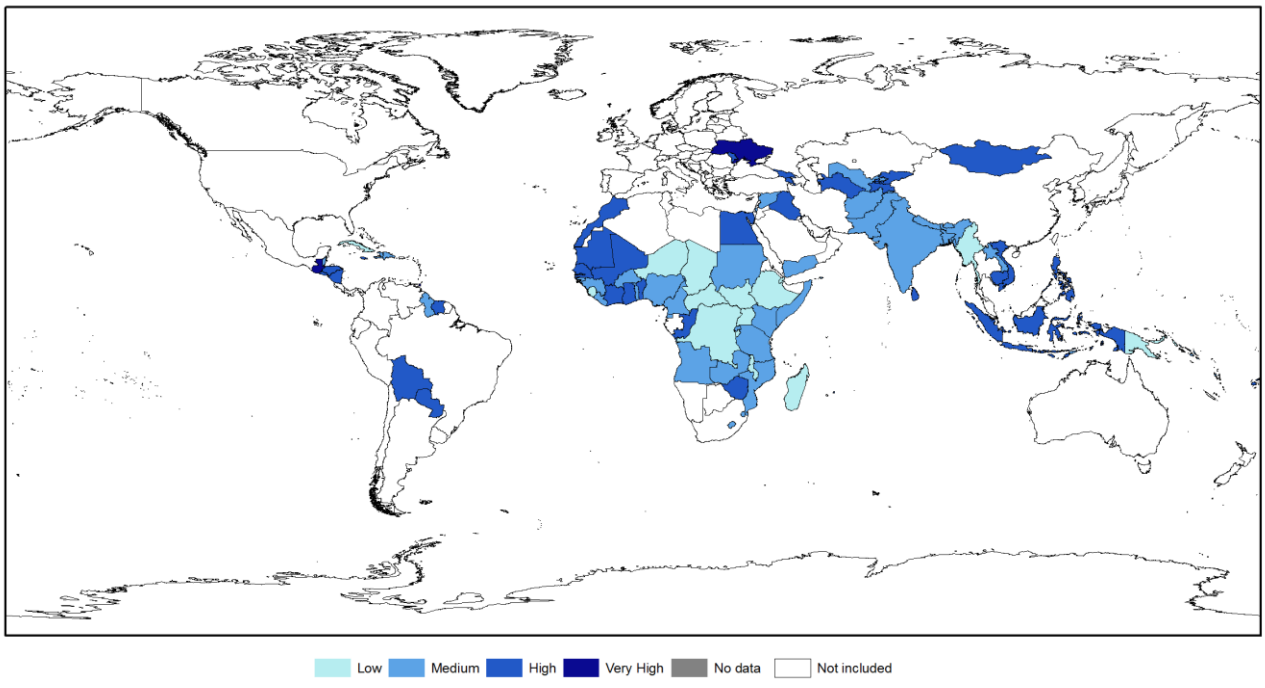
Forest area (% of land area), 2012



Source: Authors elaborations on World Bank data, 2014

Indicator	**Name**	**Water dependency ratio**
	Description	Indicator expressing the percent of total renewable water resources originating outside the country
	Relevance	High dependency on foreign water resources exacerbates water insecurity due to climate change
Notes	Measuring Unit	Percentage
	References	ND GAIN: Sensitivity
Source	**Source** / Citation	FAO- AQUASTAT
	URL	http://www.fao.org/nr/water/aquastat/data/query/index.html?lang=en
	Original source - if different	
	Date of Publication	2015
	Periodicity	5-year intervals
	Year of reference	2013-2017 and latest available
	Trend	1988 - 2013 in 5-year intervals
	Data type	Tabular (excel)

Water dependency ratio, 2014

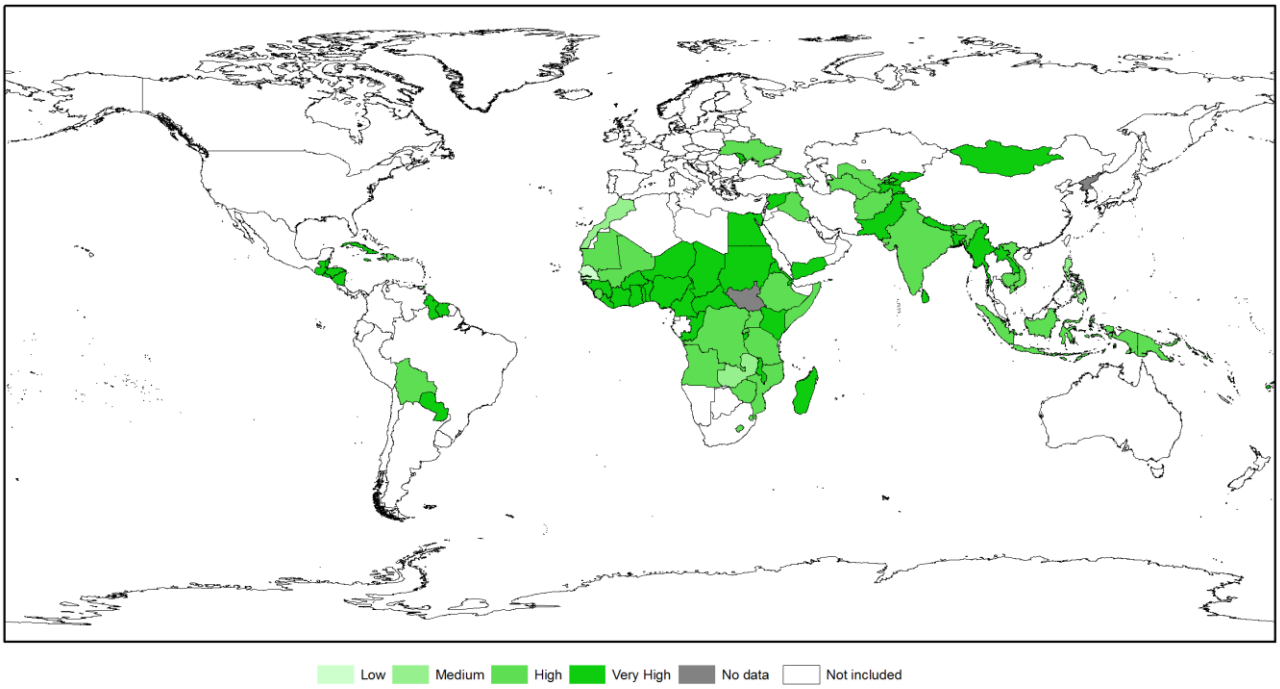


Source: Authors elaborations on FAO- AQUASTAT data, 2015

Adaptive capacity

Indicator	Name	Ecosystem vitality: Agriculture
	Description	Component of EPI. Indicator aggregated from 2 performance indicators: Agricultural Subsidies (AGSUB) and Pesticide Regulation (POPs)
	Relevance	Agriculture is one the economic activities that causes more impacts to ecosystems.
Notes	Measuring Unit	Index [0-100]
	Indicator Creation Method	Ordinal scale with a range from 0 (very poor environmental performance) to 100 (excellent environmental performance), aggregated from two performance indicators: Agricultural Subsidies (AGSUB) and Pesticide Regulation (POPs)
	References	WRI 2014: Adaptive Capacity
Source	**Source** / Citation	Yale Center for Environmental Law & Policy (YCELP) and the Center for International Earth Science Information Network (CIESIN) at Columbia University
	URL	http://epi.yale.edu/
	Original source - if different	
	Date of Publication	2015
	Periodicity	Annual
	Year of reference	2012
	Trend	2002-2012
	Data type	Tabular (excel)
	Missing data	8/111

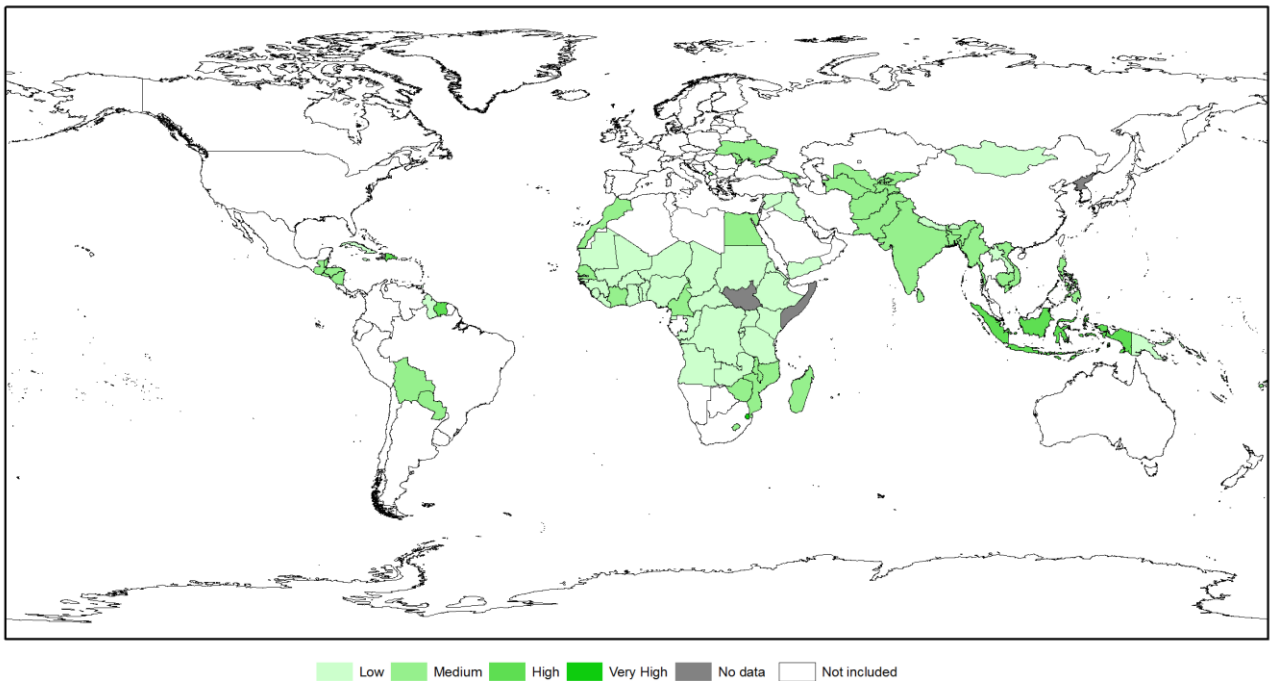
Ecosystem vitality: Agriculture, 2012



Source: Authors elaborations on EPI data, 2015

Indicator	Name	Manufacturing, value added (% of GDP)
	Description	Manufacturing refers to industries belonging to ISIC divisions 15-37. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs.
	Relevance	Economic diversification. A community with a relatively diverse local economy is better able to adjust to changes that have a significant impact on a particular sector or sectors of employment
Notes	Measuring Unit	Percentage
	Indicator Creation Method	Manufacturing refers to industries belonging to ISIC divisions 15-37. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs.
	References	Hallegatte, 2014, IPCC, 2014 a; 2014b
Source	**Source** / Citation	World Bank national accounts data, and OECD National Accounts data files.
	URL	http://data.worldbank.org/indicator/NV.IND.MANF.ZS
	Original source - if different	
	Date of Publication	2014
	Periodicity	Annual
	Year of reference	2012 and latest year available
	Trend	1995-2012
	Data type	Tabular (excel)
	Missing data	8/111

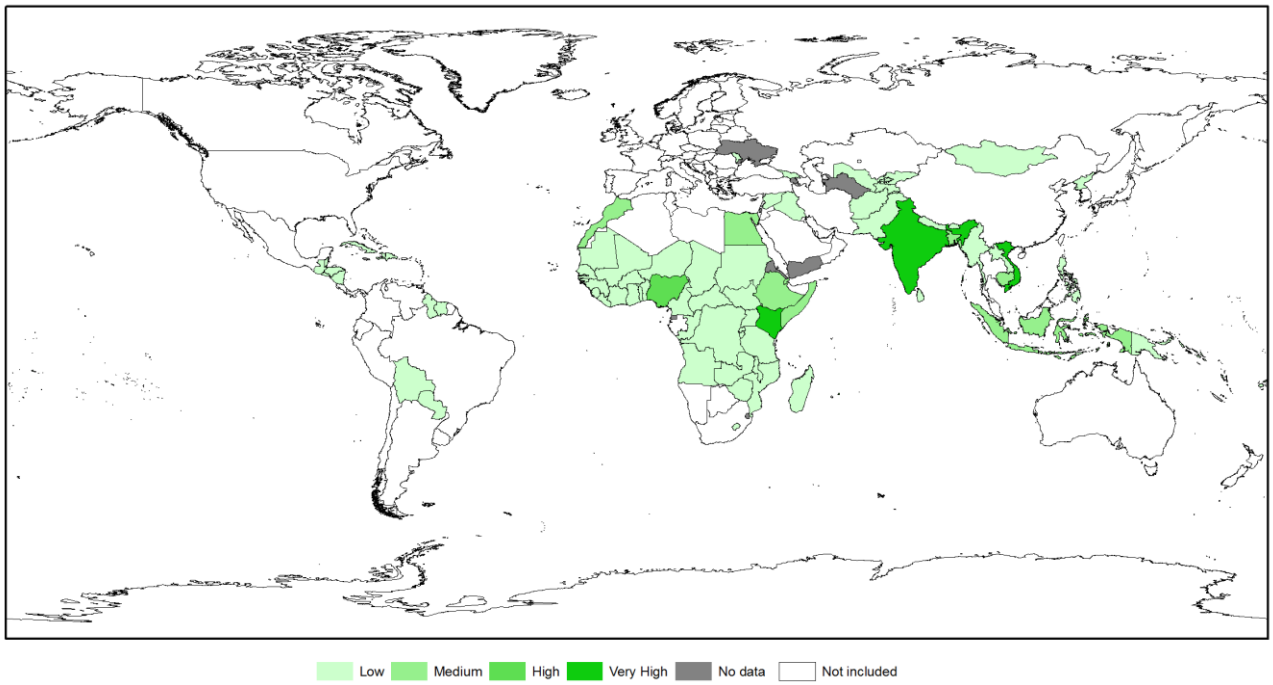
Manufacturing, value added (% of GDP), 2012



Source: Authors elaborations on World Bank data, 2014

Indicator	Name	Overall Development Assistance Committee (DAC) aid activities with adaptation as principal objective
	Description	Overall DAC aid activities with adaptation as their principal objective
	Relevance	
Notes	Measuring Unit	USD Million
	References	
Source	**Source** / Citation	OECD
	URL	http://www.oecd.org/dac/stats/
	Original source - if different	
	Date of Publication	2014
	Periodicity	
	Year of reference	2012
	Trend	
	Data type	tabular (excel)
	Missing data	17/111

Overall DAC aid activities with adaptation as principal objective 2012

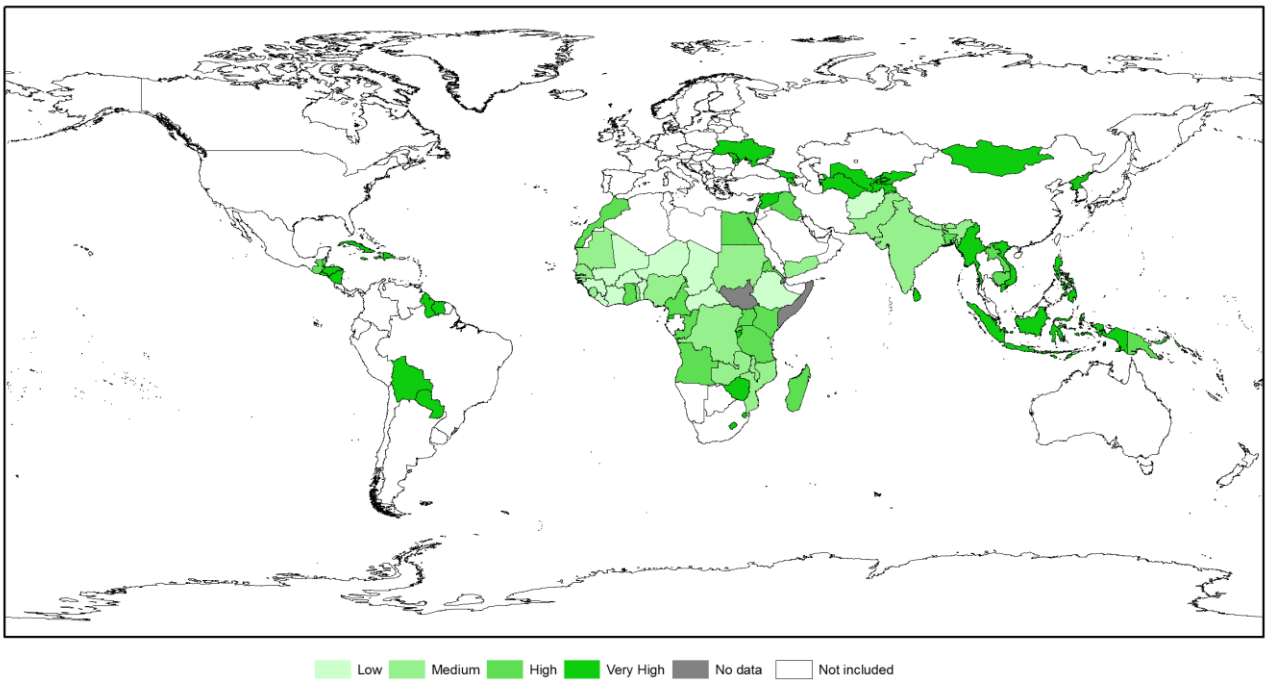


Source: Authors elaborations on OECD data, 2014

Adaptive capacity/Gender

Indicator	Name	Access to Literacy
	Description	Percentage of female population (15+ yrs) who are literate.
	Relevance	Literacy allows for increased participation and understanding. It plays a central role in increasing the ability to participate in decision-making and leadership roles
Notes	Measuring Unit	Percentage
	References	The Environment and Gender Index (EGI) 2013 Pilot (http://genderandenvironment.org/)
Source	**Source** / Citation	UNICEF/World Bank
	URL	www.unicef.org
	Original source - if different	
	Date of Publication	2014
	Periodicity	Annual
	Year of reference	2013 and latest available year
	Trend	1991- 2013
	Data type	tabular (excel)
	Missing data	18/111

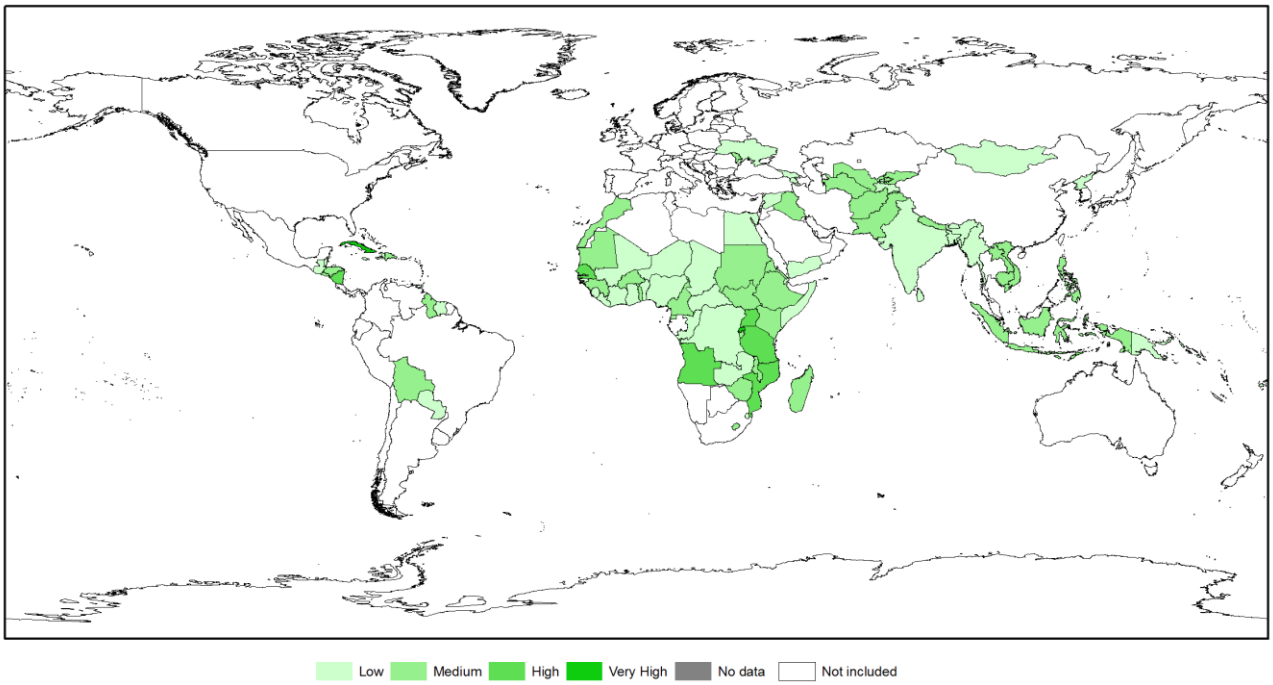
Access to Literacy, 2013



Source: Authors elaborations on UNICEF data, 2014

Indicator	Name	Share of female representatives in the National Parliament
	Description	The number of seats held by women n national parliaments expressed as a percentage of all occupied seats
	Relevance	This indicator shows the progress of female participation in the highest levels of society and their access to leadership and decision-making positions
Notes	Measuring Unit	Percentage
	Indicator Creation Method	The proportion of seats held by women in national parliament is derived by dividing the total number of seats occupied by women by the total number of seats in parliament. There is no weighting or normalising of statistics (source: UN).
	References	World Risk Index 2014: Adaptive Capacity MDG 3.3 (UN 2005) Environment and Gender Index (EGI) 2013
Source	**Source** / Citation	UN - MDG Indicators
	URL	http://mdgs.un.org/unsd/mdg/Data.aspx
	Original source - if different	http://www.ipu.org/wmn-e/world.htm
	Date of Publication	07/07/14
	Periodicity	Monthly
	Year of reference	2014
	Trend	1997-2014
	Data type	Tabular (excel)
	Missing data	5/111

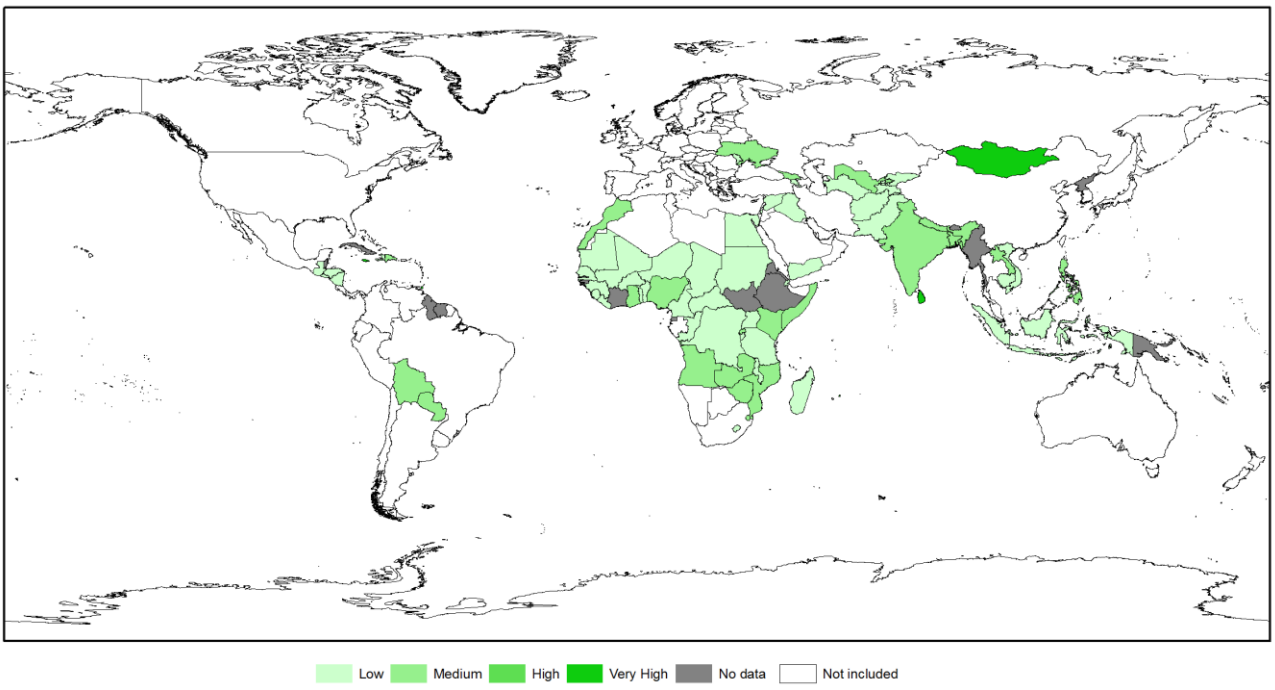
Share of female representatives in the National Parliament, 2014



Source: Authors elaborations on UN data, 2014

Indicator	Name	Access to Bank Accounts
	Description	This indicator measures the percentage of women (age 15+) with a bank account at a formal financial institution
	Relevance	Proxy for women's ability to access 'formal' institutions, be involved in the formalised economy (vs. informal) providing an indication of their abilities to participate more widely in 'formal' decision-making capacities. (EGI,2013)
Notes	Measuring Unit	Percentage
	Indicator Creation Method	Denotes the percentage of respondents with an account (alone or jointly with someone else) at a bank, credit union, another financial institution (e.g. cooperative, microfinance institution), or the post office (if applicable), including respondents who reported having a debit card (% female, age 15+).
	References	The Environment and Gender Index (EGI) 2013 Pilot (http://genderandenvironment.org/)
Source	**Source** / Citation	World Bank's Global Financial Inclusion Database (Findex), 2011 (http://econ.worldbank.org/)
	URL	http://databank.worldbank.org/Data/Views/reports/tableview.aspx
	Original source - if different	
	Date of Publication	2014
	Periodicity	Annual
	Year of reference	2011
	Trend	
	Data type	tabular (excel)
	Missing data	43/111

Access to Bank Accounts, 2011

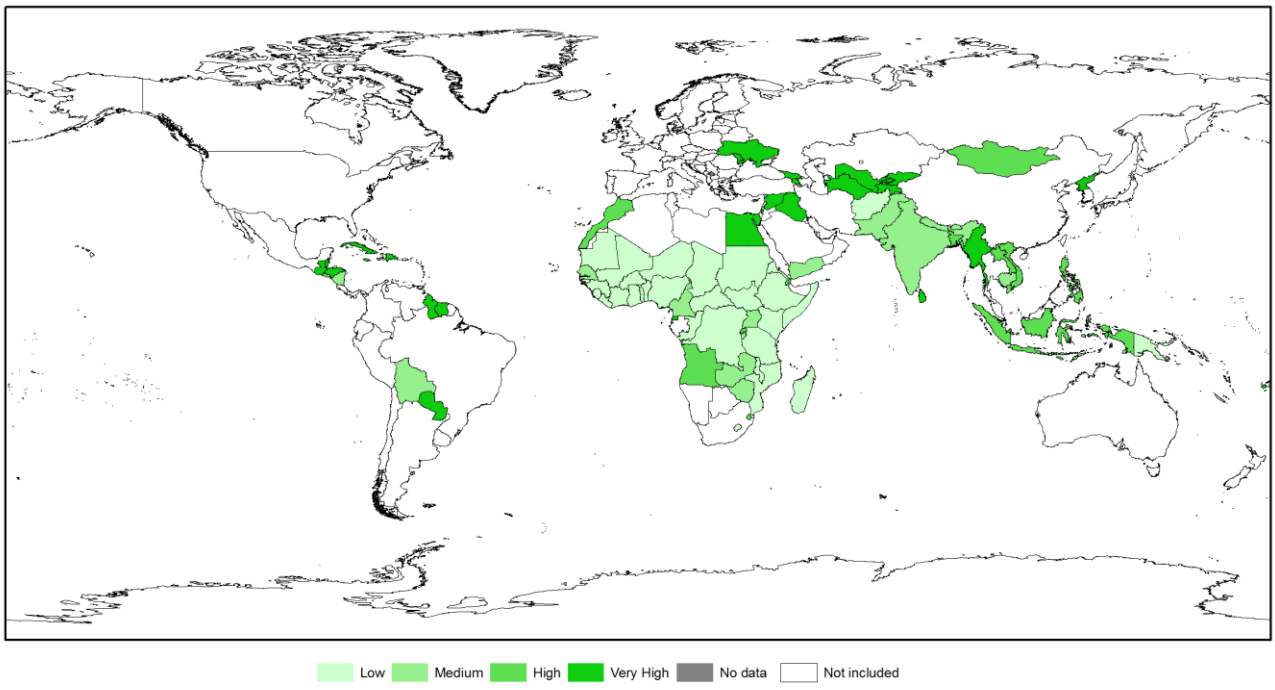


Source: Authors elaborations on World Bank data, 2014

Coping Capacity

Indicator	Name	Improved sanitation facilities (% of population with access)
	Description	Percentage of population using improved sanitation facilities. The improved sanitation facilities comprise flush toilets, piped sewer systems, septic tanks, flush/pour flush to pit latrines, ventilated improved pit latrines, pit latrines with slabs and composting toilets.
	Relevance	Access to sanitation is particularly crucial to enhance preparedness for various natural disasters that are exacerbated by climate change. People without good sanitation are susceptible to diseases and can become more vulnerable following a natural hazard event.
Notes	Measuring Unit	Percentage
	Indicator Creation Method	Coverage estimates are based on data from household surveys and censuses carried out at national level. For each country, survey and census data are plotted on a timescale from 1980 to date. A linear trend line, based on the least-squares method, is drawn through these data points to provide estimates for each year between 1990 and 2012 (wherever possible). The total estimates are population-weighted averages of the urban and rural numbers. Countries with missing data are assigned regional averages when generating regional and global estimates.
	References	World Risk Index in Susceptibility: Population with access to sanitation ND-GAIN in Adaptive capacity: Access to improved sanitation facilities INFORM in Lack of coping capacity: Access to improved sanitation facilities Green Growth Knowledge Platform (GGKP)
Source	**Source** / Citation	WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation
	URL	http://www.wssinfo.org/data-estimates/tables/
	Date of Publication	2014
	Periodicity	Annual
	Year of reference	2012 and last available year
	Trend	1995-2012 yearly
	Data type	Tabular (excel)
	Missing data	1/111

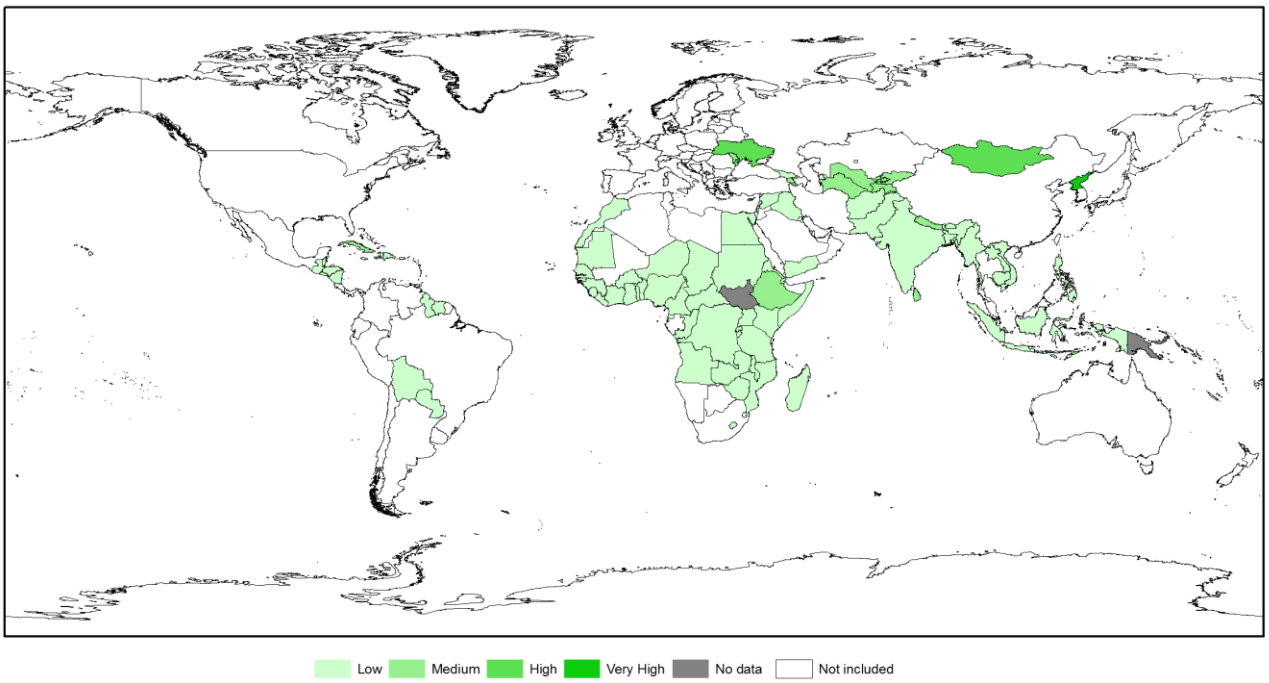
Improved sanitation facilities (% of population with access), 2012



Source: Authors elaborations on WHO/UNICEF data, 201

Indicator	Name	Hospital beds (per 1 000 people)
	Description	Hospital beds include inpatient beds available in public, private, general, and specialised hospitals and rehabilitation centres. In most cases, beds for both acute and chronic care are included.
	Relevance	Hospital beds also indicate the capacity of the medical care infrastructure to help, support or treat societies in the event of a mass emergency or disaster situation
Notes	Measuring Unit	Number of beds
	References	World Risk Index 2014: Coping Capacity
Source	**Source** / Citation	World Data Bank
	URL	http://data.worldbank.org/indicator/SH.MED.BEDS.ZS
	Original source - if different	Data are from the World Health Organization, supplemented by country data.
	Date of Publication	2014
	Periodicity	
	Year of reference	2012 and latest available year
	Trend	1995-2012
	Data type	Tabular (excel)
	Missing data	5/111

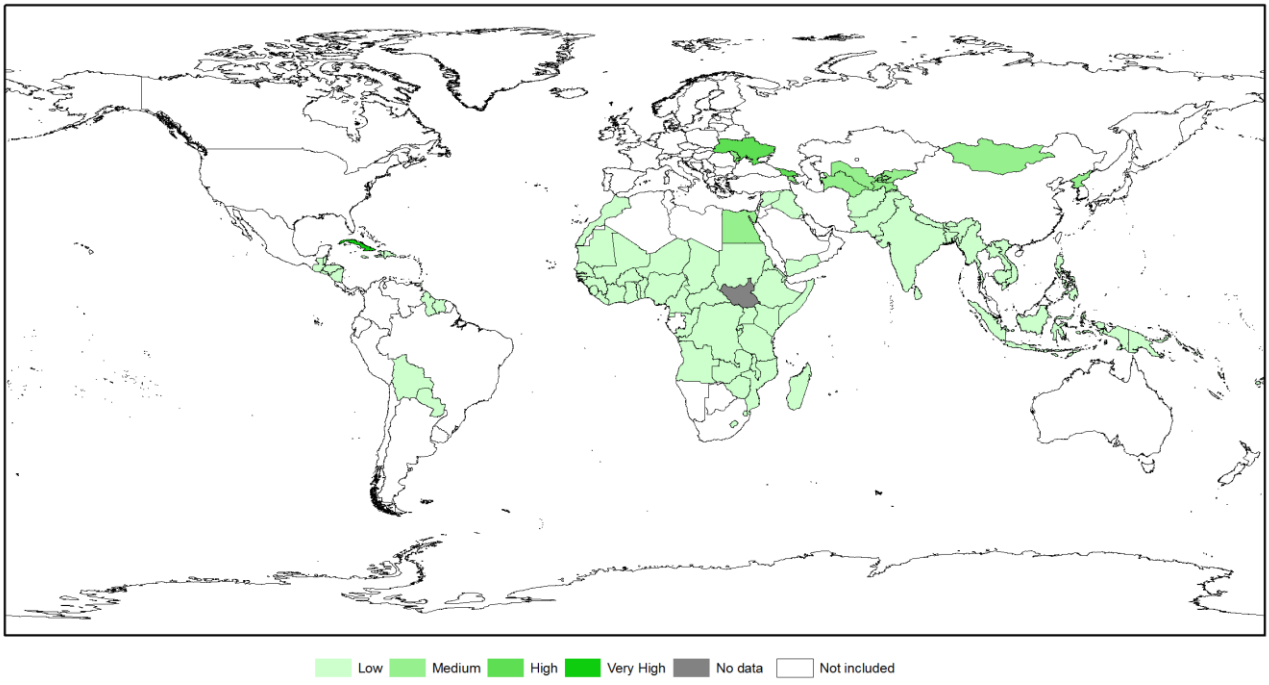
Hospital beds (per 1 000 people), 2012



Source: Authors elaborations on World Bank data, 2012

Indicator	Name	Physicians (per 1 000 people)
	Description	Physicians include general and specialist medical practitioners.
	Relevance	This indicator reflects the capacity of a country to cope with health risks caused by climate change
Notes	Measuring Unit	Number of Physicians
	References	ND GAIN: Adaptive Capacity
Source	**Source** / Citation	World Bank
	URL	http://data.worldbank.org/indicator/SH.MED.PHYS.ZS
	Original source - if different	World Health Organization, Global Atlas of the Health Workforce. For latest updates and metadata, see http://apps.who.int/globalatlas/.
	Date of Publication	2014
	Periodicity	
	Year of reference	2012 and latest available year
	Trend	1995-2012
	Data type	Tabular (excel)
	Missing data	4/111

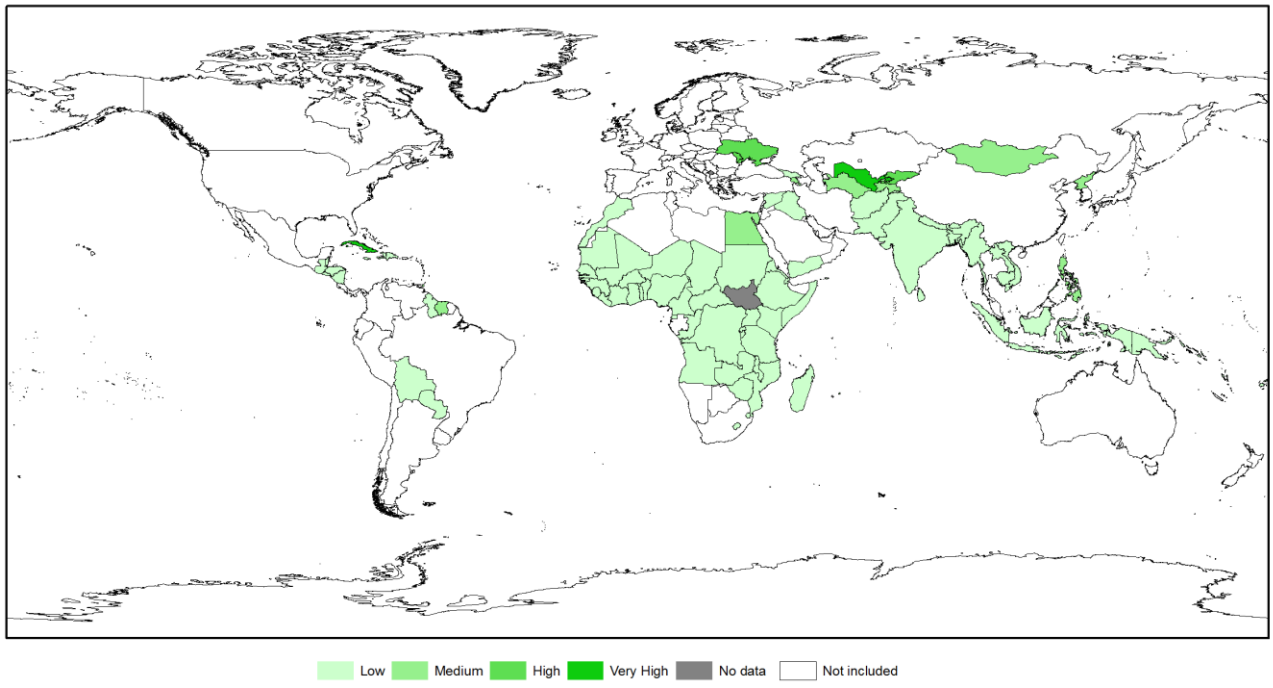
Physicians (per 1 000 people), 2012



Source: Authors elaborations on World Bank data, 2014

Indicator	Name	Nurses and midwives (per 1 000 people)
	Description	Nurses and midwives include professional nurses, professional midwives, auxiliary nurses, auxiliary midwives, enrolled nurses, enrolled midwives and other associated personnel, such as dental nurses and primary care nurses.
	Relevance	This indicator reflects the capacity of a country to cope with health risks brought about by climate change
Notes	Measuring Unit	Number of nurses and midwives
	Pre-Processing	
	References	ND GAIN: Adaptive Capacity
Source	**Source** / Citation	World Bank
	URL	http://data.worldbank.org/indicator/SH.MED.NUMW.P3 and
	Original source - if different	World Health Organization, Global Atlas of the Health Workforce. For latest updates and metadata, see http://apps.who.int/globalatlas/.
	Date of Publication	2014
	Periodicity	
	Year of reference	2012 and latest available year
	Trend	1995-2012
	Data type	Tabular (excel)
	Missing data	5/111

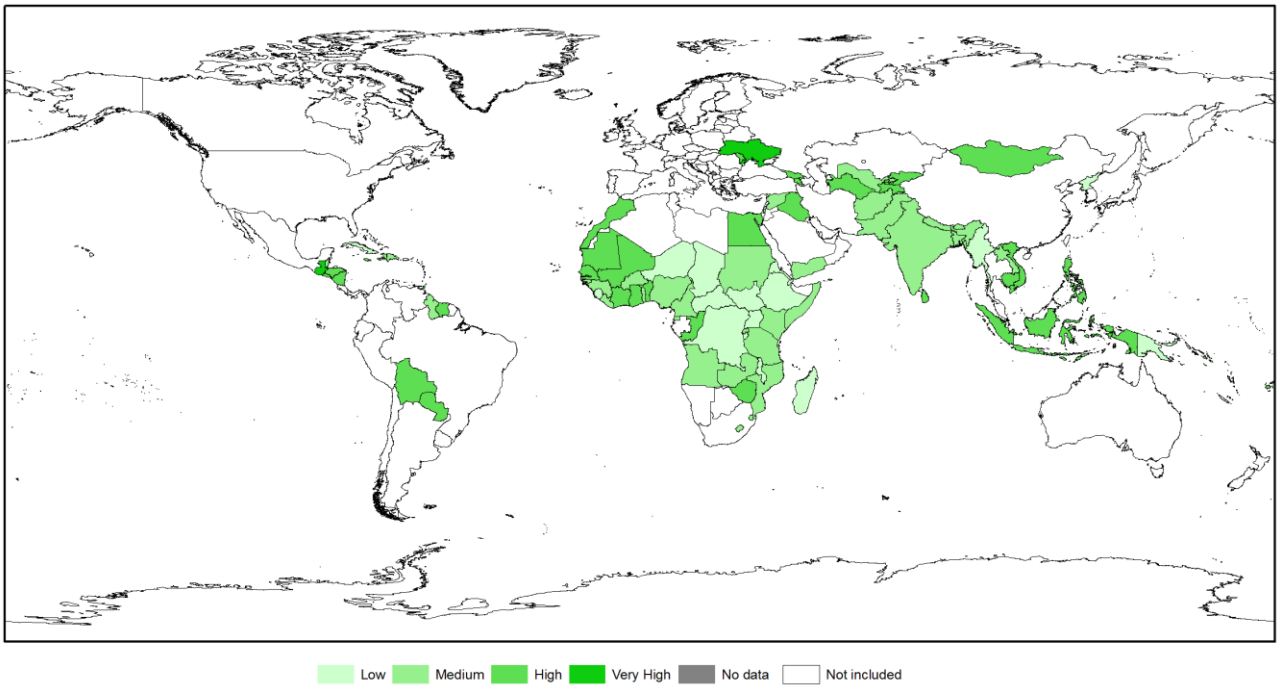
Nurses and midwives (per 1 000 people), 2012



Source: Authors elaborations on World Bank data, 2014

Indicator	Name	Mobile phone subscriptions (per 100 people)
	Description	Mobile telephone subscriptions are subscriptions to a public mobile telephone service using cellular technology, which provide access to the public telephone network. Post-paid and prepaid subscriptions are included.
	Relevance	
Notes	Measuring Unit	Number of subscriptions per 100 people
	Indicator Creation Method	
	References	INFORM: Lack of coping capacity
Source	**Source** / Citation	
	URL	http://data.worldbank.org/indicator/IT.CEL.SETS.P2/countries/1W?display=map
	Original source - if different	International Telecommunication Union, World Telecommunication/ICT Development Report and database, and World Bank estimates.
	Date of Publication	2014
	Periodicity	Annual
	Year of reference	2013 and latest available year
	Trend	1995-2013
	Data type	Tabular (excel)
	Missing data	3/111 countries

Mobile cellular subscriptions (per 100 people), 2013

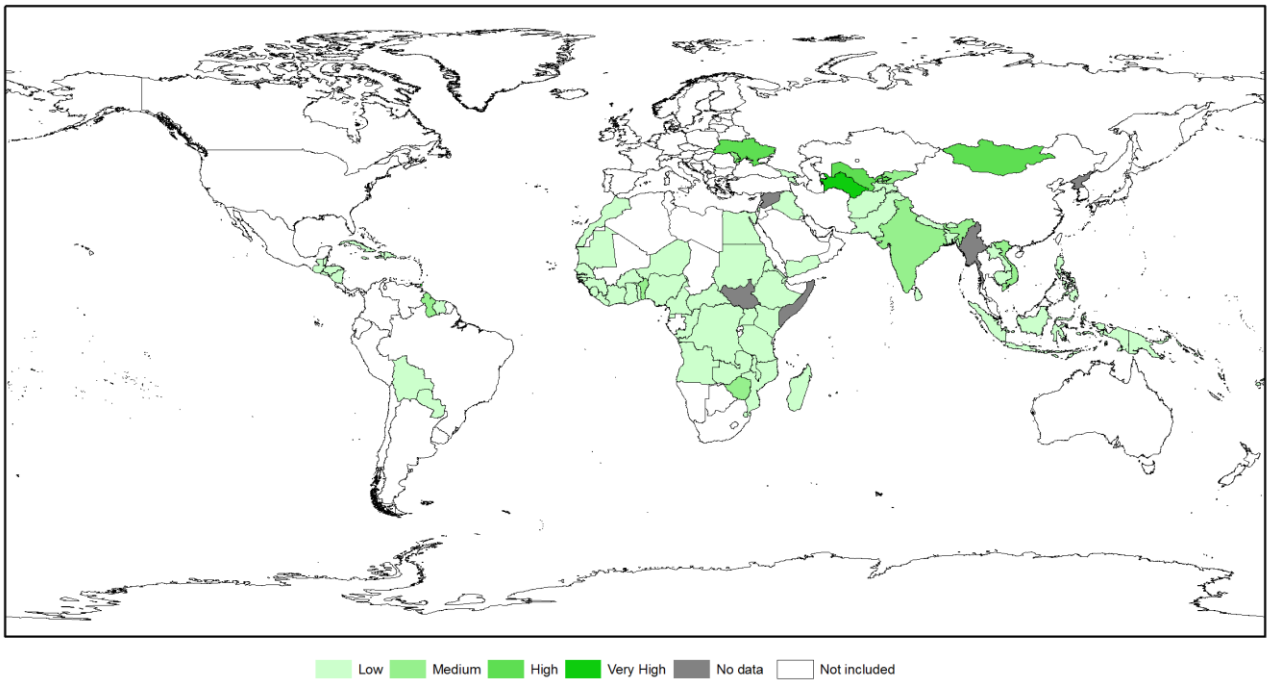


Source: Authors elaborations on Inform, 2015

Mitigation Capacity

Indicator	Name	CO2 emissions (kg per PPP US$ of GDP)
	Description	Carbon dioxide emissions are those stemming from the burning of fossil fuels and the manufacture of cement. They include carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring.
Notes	Measuring Unit	kg per PPP US$ of GDP
	Indicator Creation Method	
	Additional Notes	
	Pre-Processing	
	References	MDG 7.2 (UN 2005) Post 2015 HFA (UNISDR, 2014)
Source	**Source** / Citation	World Bank
	URL	http://data.worldbank.org/indicator/EN.ATM.CO2E.PP.GD
	Original source - if different	Carbon Dioxide Information Analysis Center, Environmental Sciences Division, Oak Ridge National Laboratory, Tennessee, United States.
	Date of Publication	2014
	Periodicity	Annual
	Year of reference	2011 and latest available year
	Trend	1995-2010 yearly
	Data type	Tabular (excel)
	Missing data	9/111 countries

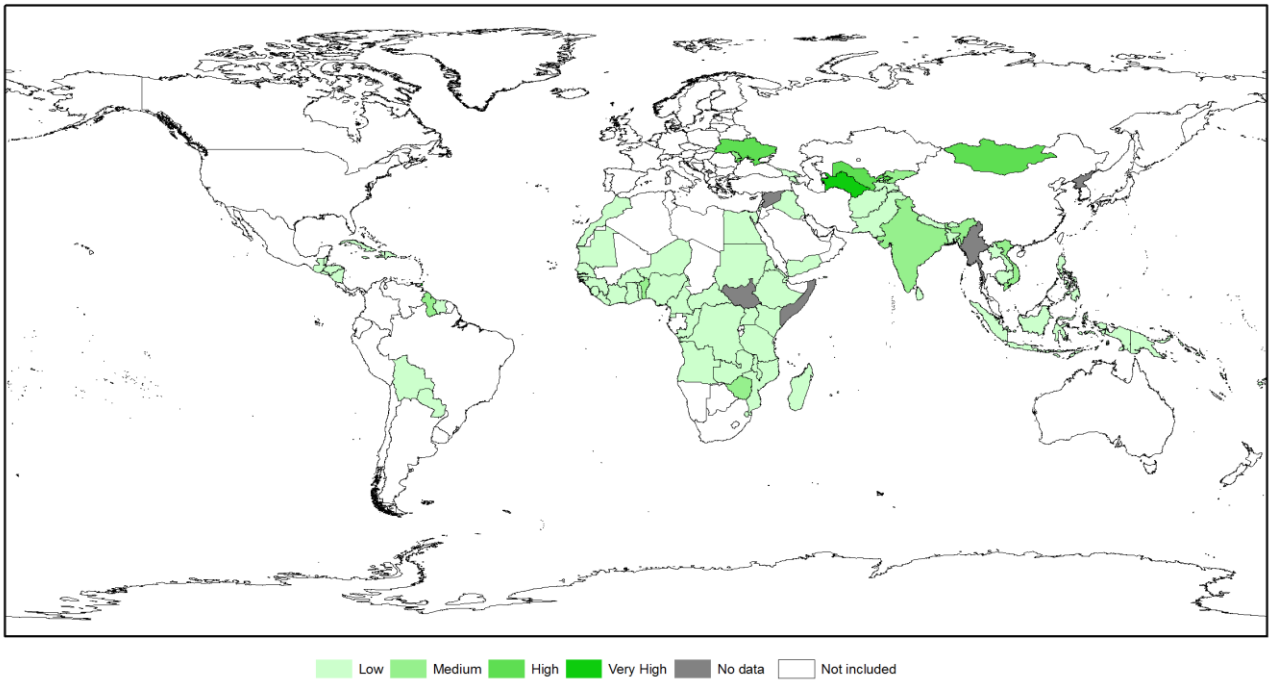
CO2 emissions (kg per PPP US$ of GDP), 2011



Source: Authors elaborations on World Bank data, 2014

Indicator	Name	Participation in UNFCCC fora - Mitigation actions
	Description	As proxy of active participation in the UNFCCC, a specific indicator has been built on Submitted National Communications from non Annex I Parties
	Relevance	
	Validity/ Limitation of Indicator	
Notes	Measuring Unit	Score [0-4]
	Indicator Creation Method	Our elaboration giving scores as follows: 0=no report 1=Initial national communication 2= Initial national communication + Second national communication 3=Initial national communication + Second national communication + Third national communication
	References	
Source	**Source** / Citation	UN Framework Convention on Climate Change
	URL	http://unfccc.int/national_reports/non-annex_i_natcom/submitted_natcom/items/653.php
	Original source - if different	
	Date of Publication	2015
	Periodicity	
	Year of reference	2015 and latest available year
	Trend	
	Data type	tabular (excel)
	Missing data	6/111

Participation in UNFCCC fora - Mitigation action, 2015

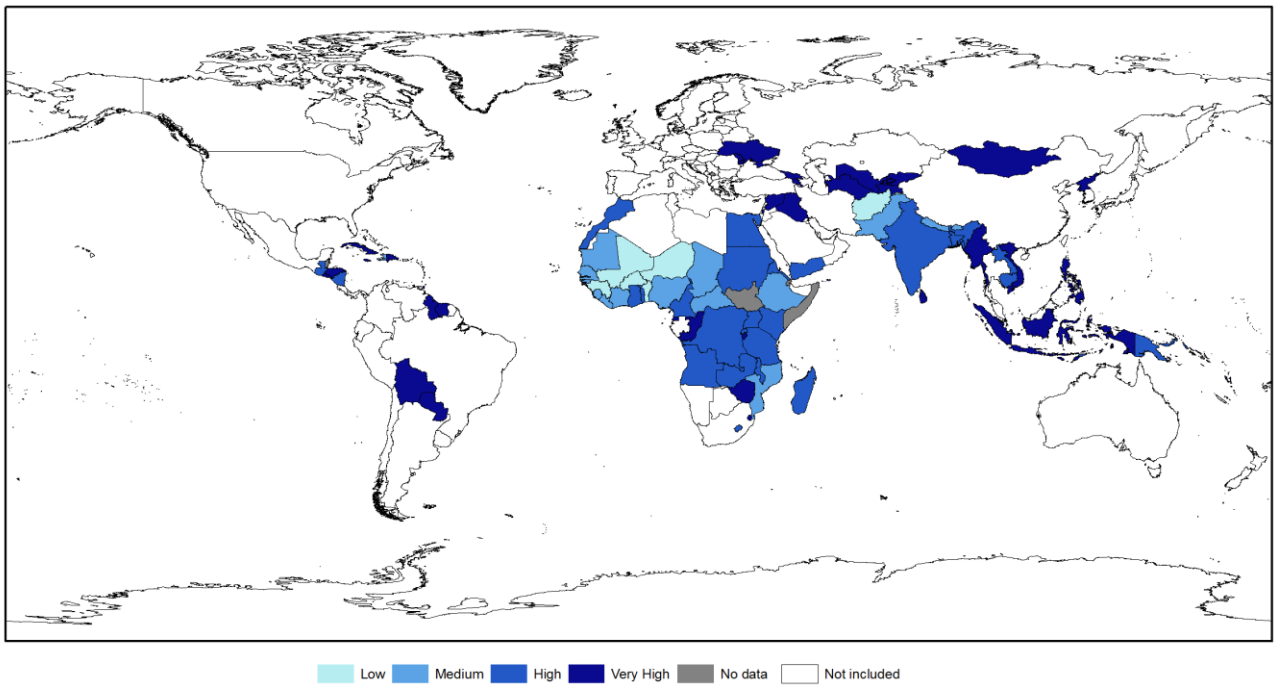


Source: Authors elaborations on UNFCCC data, 2015

Development

Indicator	Name	Literacy rate, adult total (% of people ages 15 and above)
	Description	Population aged 15 years and above who can read and write a short simple statement on their everyday life (source: World Bank)
	Relevance	Literacy could be an essential indicator, when empowering people on hazard risk reduction
Notes	Measuring Unit	Percentage
	Indicator Creation Method	Adult (15+) literacy rate (%). Total is the percentage of the population aged 15 and above who can, with understanding, read and write a short, simple statement about their everyday life. In general, 'literacy' also encompasses 'numeracy', the ability to make simple arithmetic calculations. This indicator is calculated by dividing the number of literates aged 15 years and over by the corresponding age group population and multiplying the result by 100 (source: World Bank)
	References	Brooks et al., 2005 World Risk Index 2014 MDG 2.3 (UN 2005) post 2015 HFA INFORM 2014
Source	**Source** / Citation	World Bank
	URL	http://data.worldbank.org/indicator/SE.ADT.LITR.ZS
	Original source - if different	
	Date of Publication	2014
	Periodicity	Annual
	Year of reference	2013 and latest available year
	Trend	1995-2013
	Data type	Tabular (excel)
	Missing data	18/111

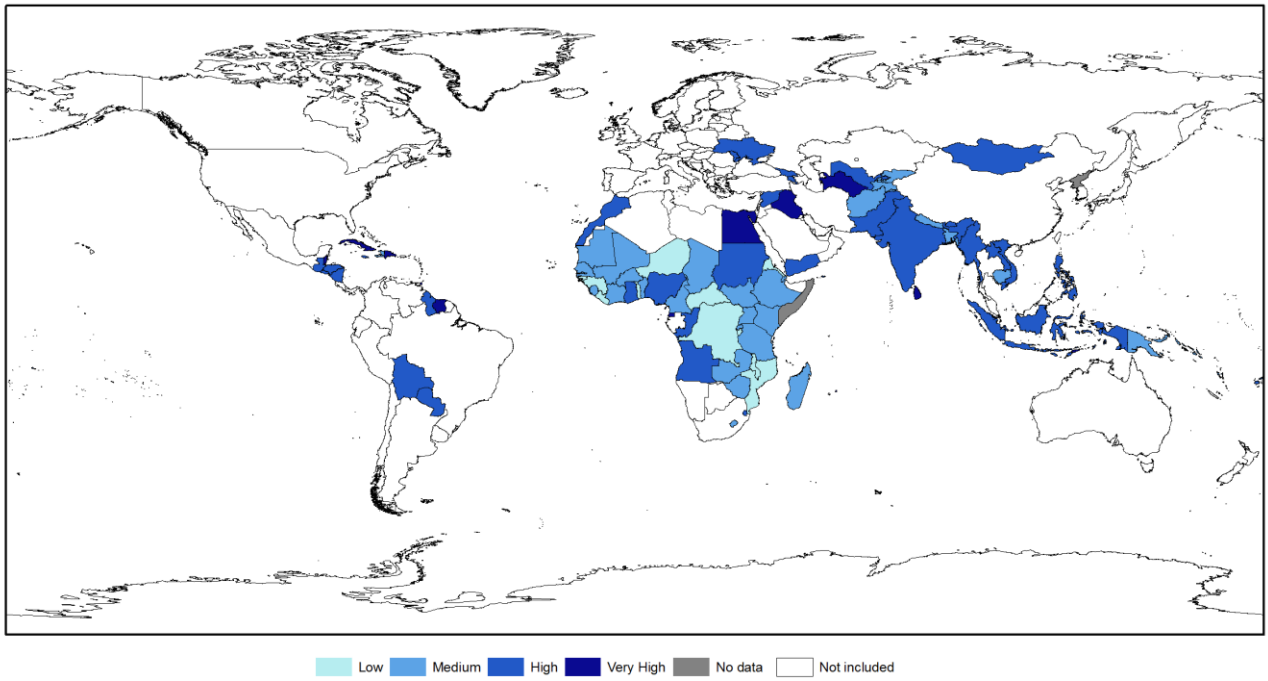
Literacy rate, adult total (% of people ages 15 and above), 2013



Source: Authors elaborations on World Bank data, 2014

Indicator	Name	Income Index - Gross National Income (GNI)
	Description	The total value of all final goods and services produced within a nation in a particular year, plus income earned by its citizens (including income of those located abroad)
	Relevance	
Notes	Measuring Unit	Index [min. value of UE$100 max. value US$60,000]
	Indicator Creation Method	GNI per capita (2005 PPP International US$, using natural logarithm) expressed as an index using a minimum value of US$100 and a maximum value US$60,000. (source UNDP)
	References	Adger (2003), Cutter et al. (2000, 2003), Dwyer et al. (2004), Brooks et al. (2005), Tunstall et al. (2007), Polsky et al. (2007), Ojerio et al. (2011), Khan (2012), Lee (2014); Sub-indicator of HDI.
Source	**Source** / Citation	UNDP - Human Development Reports
	URL	http://hdr.undp.org/en/content/income-index
	Original source - if different	
	Date of Publication	15/11/2013
	Periodicity	Annual
	Year of reference	2013
	Trend	1990,2000,2005-2013
	Data type	Tabular (excel)
	Missing data	6/111

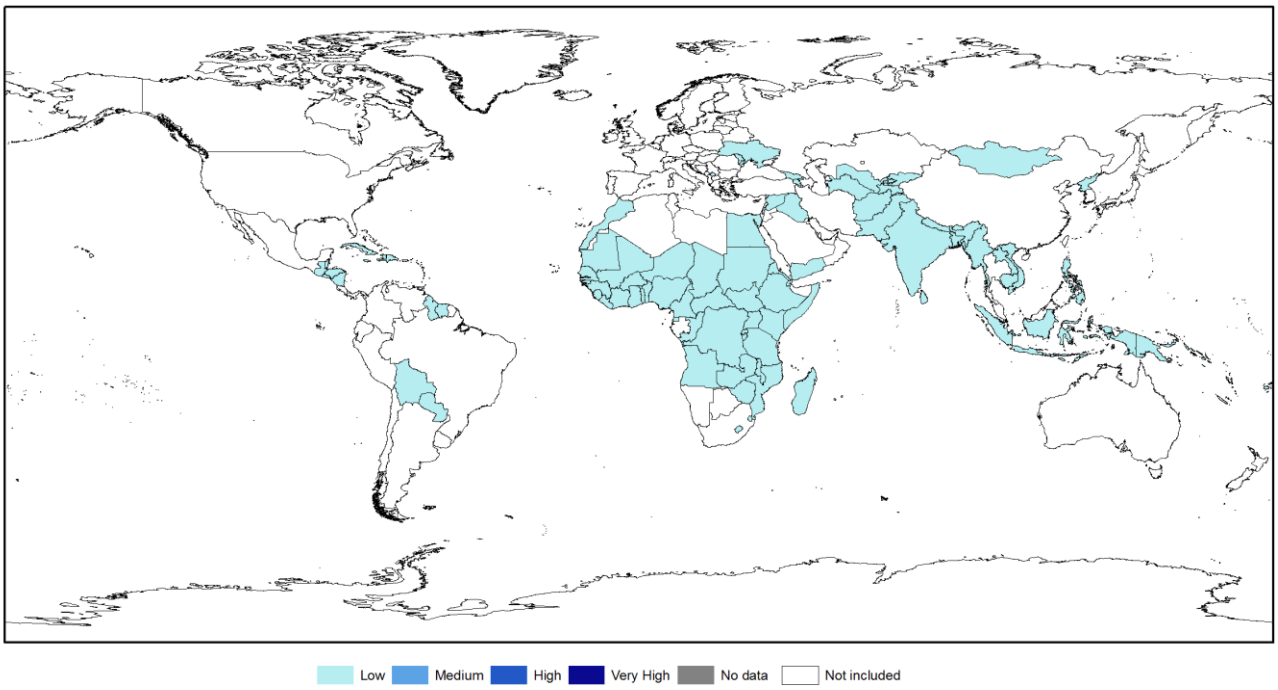
Income Index - Gross National Income (GNI), 2013



Source: Authors elaborations on UNDP data, 2013

Indicator	Name	Net ODA received per capita (current US$)
	Description	ODA received per person
	Relevance	Countries heavily dependent of ODA will be more dependent on ODA decisions to finance recovery and reconstruction
Notes	Measuring Unit	Current US$ of ODA
	Indicator Creation Method	Net official development assistance (ODA) per capita consists of disbursements of loans made on concessional terms (net of repayments of principal) and grants by official agencies of the members of the Development Assistance Committee (DAC), by multilateral institutions, and by non-DAC countries to promote economic development and welfare in countries and territories in the DAC list of ODA recipients; and is calculated by dividing net ODA received by the midyear population estimate. It includes loans with a grant element of at least 25% (calculated at a rate of discount of 10%) (source: World Bank).
	References	Costa (2012) and Raschky and Schwindt (2008); post 2015 HFA (UNISDR, 2014) and sub-indicator of INFORM 2014
Source	**Source** / Citation	World Bank
	URL	http://data.worldbank.org/indicator/DT.ODA.ODAT.PC.ZS
	Original source - if different	Development Assistance Committee of the Organisation for Economic Co-operation and Development, Geographical Distribution of Financial Flows to Developing Countries, Development Co-operation Report, and International Development Statistics database. Data are available online at: www.oecd.org/dac/stats/idsonline. World Bank population estimates are used for the denominator.
	Date of Publication	2014
	Periodicity	Annual
	Year of reference	2011 and latest available year
	Trend	1995-2011
	Data type	Tabular (excel)
	Missing data	2/111 countries

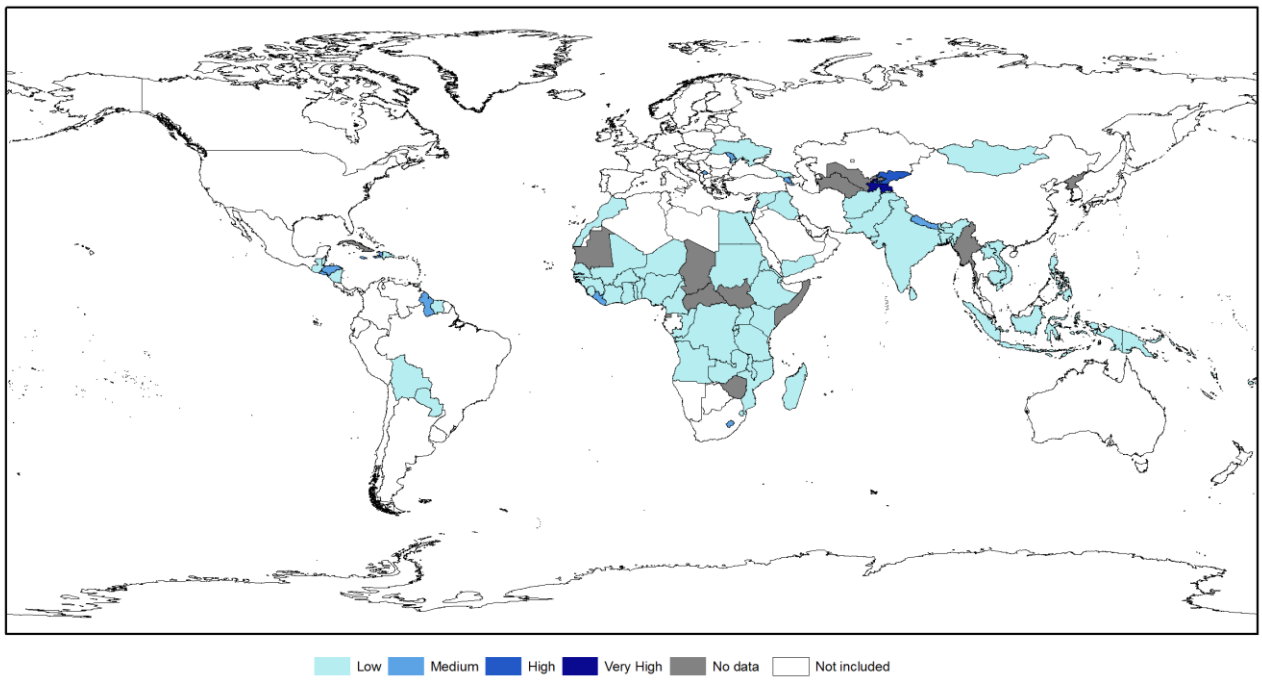
Net ODA received per capita (current US$), 2011



Source: Authors elaborations on World Bank data, 2014

Indicator	Name	Personal remittances received (% of GDP)
	Description	Personal remittances comprise personal transfers and compensation of employees. (source: World Bank)
	Relevance	Economies where remittances represent a high proportion of GDP are more resilient as risk is geographically spread and a lower proportion of household earnings will be affected.
Notes	Measuring Unit	Percentage
	Indicator Creation Method	Personal transfers consist of all current transfers in cash or in kind made or received by resident households to or from non-resident households. Personal transfers thus include all transfers between resident and non-resident individuals. Compensation of employees refers to the income of border, seasonal, and other short-term workers who are employed in an economy where they are not resident, and of residents employed by non-resident entities. Data are the sum of the two items defined in the sixth edition of the IMF's Balance of Payments Manual: personal transfers and compensation of employees (source: World Bank).
	References	Post 2015 HFA (UNISDR, 2014)
Source	**Source** / Citation	World Bank
	URL	http://data.worldbank.org/indicator/BX.TRF.PWKR.DT.GD.ZS
	Original source - if different	World Bank staff estimates based on IMF balance of payments data, and World Bank and OECD GDP estimates.
	Date of Publication	2014
	Periodicity	Annual
	Year of reference	2012 and latest available year
	Trend	1995-2012
	Data type	Tabular (excel)
	Missing data	15/111 countries

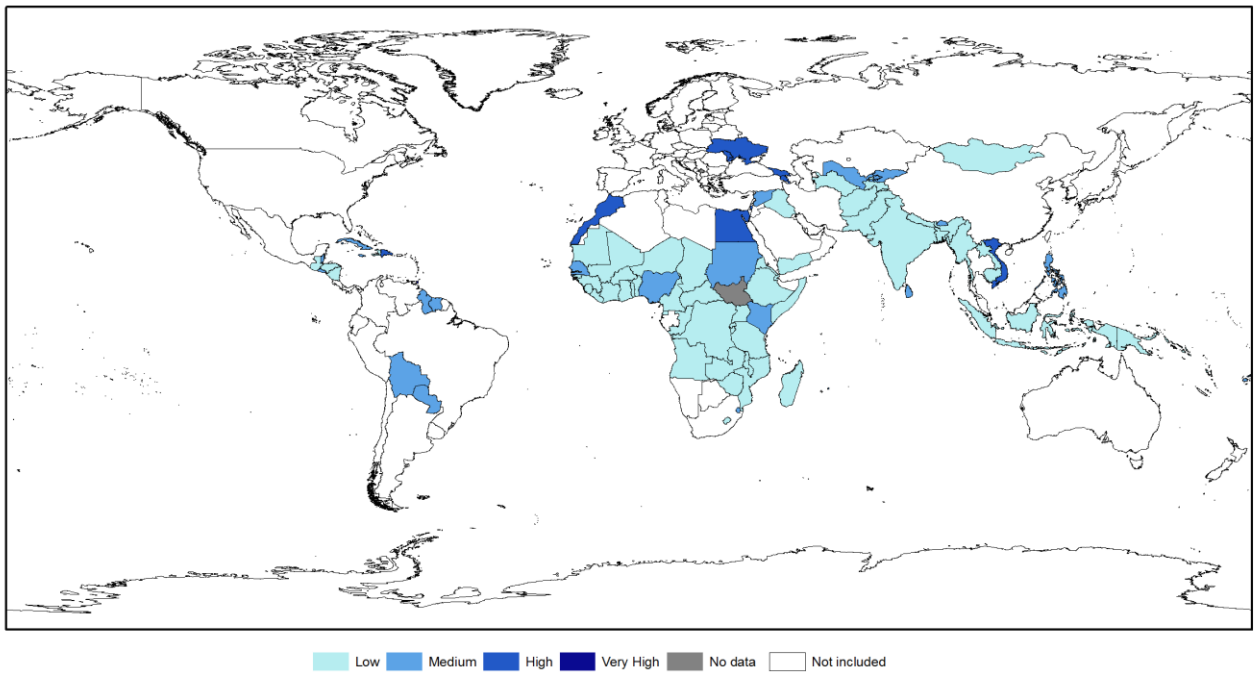
Personal remittances received (% of GDP), 2012



Source: Authors elaborations on World Bank data, 2014

Indicator	Name	Internet users (per 100 people)
	Description	Internet users are people with access to the worldwide web Internet network. (source: World Data Bank)
	Relevance	
Notes	Measuring Unit	Number of users per 100 people
	Indicator Creation Method	
	References	Perch- Nielsel 2010; Post 2015 HFA; INFORM 2014
Source	**Source** / Citation	World Bank
	URL	http://data.worldbank.org/indicator/IT.NET.USER.P2/countries/1W?display=default
	Original source - if different	International Telecommunication Union, World Telecommunication/ICT Development Report and database, and World Bank estimates.
	Date of Publication	2014
	Periodicity	Annual
	Year of reference	2013 and latest available year
	Trend	1995-2013
	Data type	Tabular (excel)
	Missing data	4/111 countries

Internet users (per 100 people), 2013



Source: Authors elaborations on World Bank data, 2014

ANNEX II

Table I – Sample of Countries for the case study

Country OECD/DAC	LDCs	other LIC-DAC	LMI-DAC	SIDs	World Bank Region	ISO3
Afghanistan	1				SAS	AFG
Angola	1				SSA	AGO
Antigua and Barbuda				1	LCR	ATG
Armenia			1		ECA	ARM
Bangladesh	1				SAS	BGD
Barbados				1	LCR	BRB
Belize			1	1	LCR	BLZ
Benin	1				SSA	BEN
Bhutan	1				SAS	BTN
Bolivia			1		LCR	BOL
Burkina Faso	1				SSA	BFA
Burundi	1				SSA	BDI
Cambodia	1				EAP	KHM
Cameroon			1		SSA	CMR
Cape Verde			1	1	SSA	CPV
Central African Rep.	1				SSA	CAF
Chad	1				SSA	TCD
Comoros	1			1	SSA	COM
Congo, Dem. Rep.	1				SSA	COD
Congo, Rep.			1		SSA	COG
Cook Islands				1	EAP	COK
Côte d'Ivoire			1		SSA	CIV
Cuba				1	LCR	CUB
Djibouti	1				SSA	DJI
Dominica				1	LCR	DMA
Dominican Republic				1	LCR	DOM
Egypt			1		MNA	EGY
El Salvador			1		LCR	SLV
Equatorial Guinea	1				SSA	GNQ
Eritrea	1				SSA	ERI
Ethiopia	1				SSA	ETH
Fiji			1	1	EAP	FJI
Gambia	1				SSA	GMB
Georgia			1		ECA	GEO
Ghana			1		SSA	GHA
Grenada				1	LCR	GRD
Guatemala			1		LCR	GTM
Guinea	1				SSA	GIN
Guinea-Bissau	1			1	SSA	GNB
Guyana			1	1	LCR	GUY
Haiti	1			1	LCR	HTI
Honduras			1		LCR	HND
India			1		SAS	IND
Indonesia			1		EAP	IDN
Iraq			1		MNA	IRQ
Jamaica				1	LCR	JAM
Kenya		1			SSA	KEN
Kiribati	1			1	EAP	KIR
Korea, Dem. Rep.		1			EAP	PRK
Kosovo			1			MNE
Kyrgyz Rep.		1			ECA	KGZ
Laos	1				EAP	LAO
Lesotho	1				SSA	LSO
Liberia	1				SSA	LBR
Madagascar	1				SSA	MDG
Malawi	1				SSA	MWI

Country OECD/DAC	LDCs	other LIC-DAC	LMI-DAC	SIDs	World Bank Region	ISO3
Maldives				1	SAS	MDV
Mali	1				SSA	MLI
Marshall Islands			1	1	EAP	MHL
Mauritania	1				SSA	MRT
Mauritius				1	SSA	MUS
Micronesia, Federated States			1	1	EAP	FSM
Moldova			1		ECA	MDA
Mongolia			1		EAP	MNG
Morocco			1		MNA	MAR
Mozambique	1				SSA	MOZ
Myanmar	1				EAP	MMR
Nauru				1	EAP	NRU
Nepal	1				SAS	NPL
Nicaragua			1		LCR	NIC
Niger	1				SSA	NER
Nigeria			1		SSA	NGA
Pakistan			1		SAS	PAK
Palau				1	EAP	PLW
Papua New Guinea			1	1	EAP	PNG
Paraguay			1		LCR	PRY
Philippines			1		EAP	PHL
Rwanda	1				SSA	RWA
Samoa	1			1	EAP	WSM
São Tomé and Príncipe	1			1	SSA	STP
Senegal	1				SSA	SEN
Seychelles				1	SSA	SYC
Sierra Leone	1				SSA	SLE
Solomon Islands	1			1	EAP	SLB
Somalia	1				SSA	SOM
South Sudan		1			SSA	SSD
Sri Lanka			1		SAS	LKA
St. Kitts-Nevis				1	LCR	KNA
St. Lucia				1	LCR	LCA
St. Vincent and Grenadines				1	LCR	VCT
Sudan	1				SSA	SDN
Suriname				1	LCR	SUR
Swaziland			1		SSA	SWZ
Syria			1		MNA	SYR
Tajikistan		1			ECA	TJK
Tanzania	1				SSA	TZA
Timor-Leste	1			1	EAP	TLS
Togo	1				SSA	TGO
Tonga			1	1	EAP	TON
Trinidad and Tobago				1	LCR	TTO
Turkmenistan			1		ECA	TKM
Tuvalu	1			1	EAP	TUV
Uganda	1				SSA	UGA
Ukraine			1		ECA	UKR
Uzbekistan			1		ECA	UZB
Vanuatu	1			1	EAP	VUT
Vietnam			1		EAP	VNM
West Bank and Gaza Strip			1		MNA	WBG
Yemen	1				MNA	YEM
Zambia	1				SSA	ZMB
Zimbabwe		1			SSA	ZWE

ANNEX III – Fit-for-purpose indicators by component

Natural Hazard Indicators (alphabetical order)

Indicator name	Definition	Relevant Hazards	Sectors affected	Rationale	References	Data Source
Average annual deviation in Sea Surface Temperatures	Average annual deviation in Sea Surface Temperatures (SST) in the past five years in relation to the 30-year monthly means (1961-1990). The indicator captures the total amount of the anomalies in SST, either as excess or deficit (using absolute values)	Fluctuations in productivity, currents, cyclones & storms,	Fisheries, blooms and coral bleaching, tourism	Frequent and severe deviations from the 30-year moving average could herald shifts in currents, upwelling, weather patterns and climate, and could negatively affect a country's resilience to other hazards	Sub-indicator of the Environmental Vulnerability Index (UNDP, 2004); http://www.vulnerabilityindex.net/; The index has not been renewed since 2004.	Original Source: 1. Climatic Research Unit, University of East Anglia, Norwich, UK. http://www.cru.uea.ac.uk/cru/data/temperature/#datdow 2. Data masked and extracted for EEZs by University of British Columbia Data NOT AVAILABLE in the EVI website.
Average annual excess heat (degrees) over the past five years	Average annual excess heat (degrees) over the past five years for all days more than 5°C (9°F) hotter than the 30-year mean monthly maximum	Waves, desertification, water resources, temperature stress, bleaching	Agriculture, society, ecosystems	This indicator captures not only the number of days with significantly higher temperatures, but also the amount of the excess	Sub-indicator of the Environmental Vulnerability Index (UNDP, 2004); http://www.vulnerabilityindex.net/; The index has not been renewed since 2004.	Original source: NOAA DATSAV3 Surface SOD 1973-2003 Data NOT AVAILABLE in the EVI website.
Average annual excess rainfall (mm) over the past five years	Average annual excess rainfall (mm) over the past five years for all months with more than 20% higher rainfall than the 30-year monthly average	Floods, cyclones, wet periods, stress on land surfaces and ecosystems subject to flooding and disturbance	Agriculture, industry, society, ecosystems	This indicator ensures that the amount of rain 'in excess' is recorded.	Sub-indicator of the Environmental Vulnerability Index (UNDP, 2004) http://www.vulnerabilityindex.net/; The index has not been renewed since 2004.	Original source: NOAA GHCN http://www.ncdc.noaa.gov/oa/pub/data/ghcn/v2/ghcnftp_zipd.html; Data NOT AVAILABLE in the EVI website.

Average annual excess wind over the past five years	Summing speeds on days during which the maximum recorded wind speed is more than 20% higher than the 30-year average maximum wind speed for that month	Cyclones, tornados, storms, erosion, habitat damage, disturbance.	Ecosystems, residential and industry	This indicator captures the likelihood of damage from frequent and severe wind that can affect forests, fan fires, create storm surges, dry soils, spread air pollution, and interact with other stressors	Sub-indicator of the Environmental Vulnerability Index (UNDP, 2004) http://www.vulnerabilityindex.net/; The index has not been renewed since 2004.	Original source: NOAA DATSAV3 Surface SOD 1973-2003 Data NOT AVAILABLE in the EVI website..
Average annual heat deficit (degrees)	Average annual heat deficit (degrees) over the past five years for all days more than 5°C (9°F) cooler than the 30-year mean monthly minimum	Cold snaps, unusual frosts, effects on water resources, temperature stress, pollution attenuation rates	Agriculture, health, households	This indicator captures not only the number of days with significantly lower temperatures, but also the amount of the "heat deficit"	Sub-indicator of the Environmental Vulnerability Index (UNDP, 2004) http://www.vulnerabilityindex.net/; The index has not been renewed since 2004.	Original source NOAA DATSAV3 Surface SOD 1973-2003 Data NOT AVAILABLE in the EVI website.
Average annual rainfall deficit (mm) over the past five years	Average annual rainfall deficit (mm) over the past five years for all months with more than 20% lower rainfall than the 30-year monthly average	Drought, dry spells, stress on surface water resources	Agriculture, industry, society, ecosystems	This indicator ensures that the amount of rain 'missed' is taken into consideration.	Sub-indicator of the Environmental Vulnerability Index (UNDP, 2004) http://www.vulnerabilityindex.net/; The index has not been renewed since 2004.	Original source : NOAA GHCN http://www.ncdc.noaa.gov/oa/pub/data/ghcn/v2/ghcnftp_zipd.html; Data NOT AVAILABLE in the EVI website.
Drought frequency	Drought Frequency	Drought, dry spells, stress on surface water resources and floods	Health and Households, agriculture		Sub-indicator of Hazard/exposure - INFORM 2014	EM DAT www.crred.org
Number of extreme events in the past years	Total number of floods, droughts, and cyclones that were reported by households over the period considered	All	All		Hahn et al 2009; Costa (2012), Kellenberg and Mobarak (2008)	EM DAT www.cred.org

Number of landslides recorded in the past five years	Number of landslides recorded in the past five years (EMDAT definitions), divided by land area	Alpine hazards	Habitat disturbance and persistence of ecosystems and species from catastrophic shifts in the land surface		Sub-indicator of the Environmental Vulnerability Index (UNDP, 2004)	Original source: 1. EMDAT OFDA/CRED International Disaster Database 2001 2. In-country Data NOT AVAILABLE in the EVI website.
Number of tsunamis or storm surges with run up greater than two metres	Number of tsunamis or storm surges with run up greater than two metres above Mean High Water Spring tide (MHWS) per 1 000 km coastline since 1900	Coastal Floods, Cyclones and Sea level rise	Severe or permanent damage to biodiversity, productivity and the ability to recover from other stressors	This indicator captures the potential loss of shorelines, coastal ecosystems and resources, and loss of species due to catastrophic run up of seawater onto coastal lands	Sub-indicator of the Environmental Vulnerability Index (UNDP, 2004)	Original sources: 1. NOAA/NESDIS/NGCC 2. In-country 3. Land area and length maritime coast from WRI 2000-2001 and CIA 2001 http://www.ngdc.noaa.gov/hazard/tsu.shtmlData NOT AVAILABLE in the EVI website.

Exposure indicators (alphabetical order)

Indicator name	Definition	Relevant Hazards	Sectors affected	Rationale	References	Data Source
ual Average Loss (AAL)	AAL represents the probable annualised loss from all hazard events occurring over different return periods.	All	All		Post 2015 HFA (UNISDR, 2014)	UN Global Risk Assessment ; http://www.preventionweb.net/english/hyogo/gar/2013/en/home/data-platform.html
Coastal vulnerable population	Population less than 5 m above sea level is the percentage of the total population living in areas where the elevation is five metres or less.	Coastal floods, cyclones and sea-level rise	Households and related economic activities, tourism		Sub-indicator of Sensitivity in ND-GAIN Index 2014	http://data.worldbank.org/indicator/EN.POP.EL5M.ZS
Disaster mortality per 100 000 population	Disaster mortality per 100 000 inhabitants (five-year moving average)	All	Health and Households	Large scale mortality is an indicator of both high levels of risk as well as limitations in disaster risk management	Post 2015 HFA (UNISDR, 2014); Sub-indicator of the Global Climate Change Index (Germanwatch 2014); Vulnerability indicator in INFORM	National disaster loss databases and EM DAT
Exposed population per 100 000 inhabitants	Sum of people exposed to extreme events/100 000 inhabitants	All	All	Countries with a high proportion of their population at risk of being affected by disasters will have high degrees of livelihood interruption and threats to human development	Post 2015 HFA (UNISDR, 2014); Sub-indicator of Sensitivity in ND-GAIN	National disaster loss databases and UN population statistics
Fiscal AAL per inhabitant	The fiscal AAL is the annual risk to publicly owned assets	All	All	The higher the fiscal AAL (the annual risk to publicly owned assets, or for which governments are responsible for replacing) per inhabitant, the higher the sovereign disaster risk, for which is	Post 2015 HFA (UNISDR, 2014)	UN Global Risk Assessment; http://www.preventionweb.net/english/hyogo/gar/2013/en/home/data-platform.html

				each citizen is responsible		
Housing damage in extensive disasters per 100 000 population	Housing damage / 100 000 population (five-year moving average)	All	Households	Housing damage affects both the lives and livelihoods of low-income urban and rural households. Most housing damage is spread over extensive disasters zones and occurs in low-income areas.	Post 2015 HFA (UNISDR, 2014)	National disaster loss databases and EM DAT
Kilometres of roads damaged as % of road network	Kilometres of roads damaged / km road network (five-year moving average)	All	Industry, Agriculture and Trade	Roads are critical to the functioning of local economies and to small and medium enterprises. This indicator can therefore provide a proxy of disaster impacts in the employment and productive sectors	Post 2015 HFA (UNISDR, 2014)	National disaster loss databases and EM DAT
Number of hectares of crops lost per total crop area	Number of hectares of crops lost / total crop area (five-year moving average)	Drought, dry spells, stress on surface water resources and floods	Agriculture	Loss of agricultural production is particularly critical for rural households and contributes to continued or worsening rural poverty	Post 2015 HFA (UNISDR, 2014)	National disaster loss databases and EM DAT
Numbers of health facilities damaged as % of total number of health facilities	% of health facilities damaged out of total number of health facilities (five-year moving average)	All	Health and Households	Damaged health facilities are a proxy for disaster impacts in the health sector. Low-income households in particular are dependent on publicly provided primary health facilities.	Post 2015 HFA (UNISDR, 2014)	National disaster loss databases and World Bank Development Indicators

Numbers of schools damaged as % of total number of schools	% of schools damaged out of total number of schools (five-year moving average)	All	Households	Damaged schools are a proxy for disaster impacts in education. The interruption of schooling negatively affects future educational and hence economic prospects	Post 2015 HFA (UNISDR, 2014)	National disaster loss databases and World Bank Development Indicators
Percentage of population below 5-m elevation	Proportion of population living in areas where the elevation is 5-m or less above sea level	Coastal Floods, Cyclones and Sea-level rise	Households and related economic activities	Indicates how many people are sensitive to risks arising from sea-level rise and storm surges	Füssel, 2010; Sub-indicator of sensitivity in ND-GAIN Index 2014	http://sedac.ciesin.columbia.edu/data/set/nagdc-population-landscape-climate-estimates-v3
Population affected by droughts	People affected by droughts 1990-2013 - average annual population affected (inhabitants)	Drought, dry spells, stress on surface water resources and floods	Health and Households		Sub-indicator of Hazard Exposure in INFORM 2014	http://www.emdat.be
Population density	Population/m2	All	Households	Higher numbers of people increase pressure on the environment for resources. Relative flood mortality is higher in less populated than in densely populated countries	Birkmann 2007; de Oliveira Mendes (2009), Tate et al. (2010) Khan (2012), Lee (2014), Brooks et al., 2005	http://data.worldbank.org/indicator/EN.POP.DNST
Population exposed to floods	Physical exposure to floods - average annual population (2010 as the year of reference) exposed (inhabitants)	Floods	Health and Households		Sub-indicator of Hazard Exposure in INFORM 2014	http://preview.grid.unep.ch/
Population exposed to hazards	Sum of people exposed to all hazards over the period considered (e.g. a year)	All	All	The knowledge of the population exposed is fundamental to raising awareness and developing protection measures (e.g. identification of suitable shelters) and evacuation strategies (e.g. development of	Sub-indicator of Exposure in the World Risk Index 2014	http://preview.grid.unep.ch/

				evacuation routes).		
Population exposed to sea-level rise (possible from 1 m to 6 m)	Percentage of population exposed to 1-m sea-level rise	Coastal floods, cyclones and sea-level rise		This indicator gives a general overview of the number of people living within the most exposed (low-lying) areas such as coastal zones	Perch- Nielsel, 2010; WRI, 2014 Perch- Nielsel 2010 (Number of people additionally inundated once a year with a sea level rise of 50 cm)	http://geodata.grid.unep.ch/mod_download/download.php and https://www.cresis.ku.edu/data/sea-level-rise-maps Data sources GRUMP Population data:Columbia University, Center for International Earth Science Information Network (CIESIN) http://geodata.grid.unep.ch/mod_download/download.php Sea level rise from 1m to 6m: University of Kansas Center for Remote Sensing of Ice Sheets (CReSIS) https://www.cresis.ku.edu/data/sea-level-rise-maps
Population exposed to tropical cyclones	Physical exposure to surges from tropical cyclone - average annual population (2010 as the year of reference) exposed (inhabitants) per country	Cyclones, tornados, storms	Health and Households		Sub-indicator of INFORM 2014 and World Risk Index 2014	http://preview.grid.unep.ch/

Population growth (Annual %)	Population growth (annual %) is the exponential rate of growth of midyear population from year t-1 to t, expressed as a percentage.	All	All	High population growth may translate into rapidly increasing exposure of people to hazards	Post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/SP.POP.GROW
Risk adjusted public debt	Indicator to be constructed from Fiscal Annual Average Loss and public debt	All	All	Fiscal AAL represents a contingent liability for governments, and is often invisible when accounting for public debt. For countries with already high or unsustainable levels of public debt, disaster risk represents another critical debt layer.	Post 2015 HFA (UNISDR, 2014)	http://www.preventionweb.net/english/hyogo/gar/2013/en/home/data-platform.html
Share of coastal area	km of coastline (scale by land area)	Coastal floods, cyclones and sea-level rise	Households and related economic activities, tourism		Füssel 2009, Brooks et al., 2005	http://preview.grid.unep.ch/
Total damages relative to GDP	Damages of past events/GDP	All	All		Birkman 2007; Sub-indicator of the Global Climate Change Index 2014	http://data.worldbank.org/data-catalog/world-development-indicators http://www.emdat.be
Total economic damages	Sum of total damages related to all hazards over the period considered	All	Possibly all, depending on hazards	Total economic damages describe the extent of economic impacts caused by climate-related hazards over the period considered	Forgette and Boening (2010); Hallegatte (2014); Akter and Mallick 2013	http://www.emdat.be

Vulnerability Indicators (alphabetical order)

Indicator name	Definition	Relevant Hazards	Sectors affected	Rationale	References	Data source
Age dependency ratio	Ratio of the population <15 and >65 years of age to the population between 19 and 65 years of age	All	Households and related economic activities	The direct effects of extreme weather may disproportionately affect the old and the young. A high age dependency ratio means a high proportion of children and elderly people compared to the working age population. This lowers resilience, particularly in the case of death or injury of a working-age adult.	Cutter et al. (2003); Shah 2013; Wolf et al, 2010; Susceptibility in World Risk Index; Resilience in post 2015 HFA; Sensitivity in ND-GAIN	http://data.worldbank.org/indicator/SP.POP.DPND
Average annual number of international tourists per km^2 land over the past five years	Average annual number of international tourists per kmq land over the past five years	All	Economic impacts on tourism		Sub-indicator of the Environmental Vulnerability Index (UNDP, 2004)	http://www.vulnerabilityindex.net/ original source- WTO http://i-tip.wto.org/services/(S(dczrer0x1sb4i3sg1l0i0m0l))/ChartResults.aspx
Average number of people per household	Average number of people per household	All	Households and related economic activities		Bjarnadottir et al., 2011	http://unstats.un.org/unsd/Demographic/sconcerns/popsize/default.htm
Average ratio of productivity: fisheries catch over the past five years	Rate of extraction / the potential for the environment to replenish those stocks (productivity)	Coastal floods, cyclones and sea-level rise	Marine ecosystems ; economic impacts on the fishing industry	This indicator captures the risk of damage to fisheries stocks by examining rates of extraction (C) in relation to the potential for the environment to replenish those stocks (productivity - P). A small P:C ratio means	Sub-indicator of the Environmental Vulnerability Index (UNDP, 2004)	http://www.vulnerabilityindex.net/ Data NOT AVAILABLE in the EVI website. The index has not been renewed since 2004

				greater vulnerability of fisheries		
Dependence on agriculture	Agricultural employees (% of total population)	Drought, dry spells, stress on surface water resources and floods	Agriculture and macro-economic impacts		Brooks et al., 2005; Sub-indicator of Sensitivity in ND-GAIN	http://data.worldbank.org/indicator/SL.AGR.EMPL.ZS
Dependency on external resources for health services	This indicator measures the proportion of total expenditure on expenditure on health or related services that are provided by entities external to the country	All	Health	A high dependency on external resources, usually on foreign aid, is an indicator of weakness in internal capacity and thus vulnerability to climate-related health shocks	Sub-indicator of Sensitivity in the ND-GAIN Index 2014	http://data.worldbank.org/indicator/SH.XPD.EXTR.ZS
Dependency on imported energy	Proportion of energy use from imports. Energy use refers to use of primary energy before transformation to other end - use fuels, according to the WDI, equal to indigenous production plus imports and stock changes, minus exports and fuels supplied to ships and aircraft engaged in international transport	All	All	A higher proportion of imported energy implies higher sensitivity to price increases or supply crises	Sub-indicator of Sensitivity in the ND-GAIN Index 2014	http://data.worldbank.org/indicator/EG.IMP.CONS.ZS sensitivity to price increases/ supply crises

Displaced people (% of population)	Displaced People	All	Health, households and related economic activities	Displaced people are normally a particularly at-risk group and are more likely to live in vulnerable conditions in hazard-prone areas , with less access to basic services than low-income households in general	Post 2015 HFA (UNISDR, 2014)	http://popstats.unhcr.org/PSQ_TMS.aspx or http://www.unhcr.org/pages/49c3646c4d6.html
Ecological footprint	Difference between the number of hectares of land and water (both within and outside the country) needed to supply the average demand of the population and the country's supply of land and water	All	Ecosystems and related economic activities	A country with a surplus (more supply than demand) has the capacity to produce more from within its boundaries and thus is likely to have more options to adapt to a changing climate	Post 2015 HFA (UNISDR, 2014), Sub-indicator of Sensitivity in the ND-GAIN Index 2014	http://www.footprintnetwork.org/en/index.php/GFN/page/footprint_data_and_results Difficulty to find data. Not clear as context National Accounts and Country Risk Rankings data are available under license for academic and commercial purposes.
Food import dependency	Imports of food/ total supply. Dependency rate is measured by the proportion of cereal consumption obtained from imports.	Drought, dry spells, stress on surface water resources and floods	All	Countries highly dependent on food imports are susceptible to shocks in food prices. Climate change will accentuate price volatility	Sub-indicator of Sensitivity in the ND-GAIN Index 2014	http://faostat3.fao.org/faostat-gateway/go/to/download/FB/BC/E
Freshwater withdrawal rate	Annual freshwater withdrawal / the total renewable water resources (excluding desalinated water)	Drought, dry spells, stress on surface water resources and floods	Ecosystems	It is a Proxy for countries' water stress	Sub-indicator of Sensitivity in the ND-GAIN Index 2014	http://www.fao.org/nr/water/aquastat/data/query/index.html?lang=en Data available in 5 year intervals.
Groundwater recharge per capita	Groundwater recharge per capita	Drought, dry spells, stress on surface water resources and floods	Households and water-dependent economic activities		Brooks et al., 2005	http://www.fao.org/nr/water/aquastat/data/query/index.html?lang=en

Industrial water consumption	Annual freshwater withdrawals refer to total water withdrawals, not counting evaporation losses from storage basins. Withdrawals also include water from desalination plants in countries where they are a significant source. Withdrawals can exceed 100% of total renewable resources where extraction from non-renewable aquifers or desalination plants is considerable or where there is significant water reuse. Withdrawals for industry are total withdrawals for direct industrial use (including withdrawals for cooling thermoelectric plants).	Drought, dry spells, stress on surface water resources	Industry		Sub-indicator of the Industrial Vulnerability Index (Hiete and Merz, 2009)	http://data.worldbank.org/indicator/ER.H2O.FWIN.ZS/countries/1W?display=graph, original source: http://www.fao.org/nr/water/aquastat/data/query/index.html?lang=en
Natural capital dependency	Ratio of natural capital to the total wealth of one country	All	Ecosystems and related economic activities		Sub-indicator of Sensitivity in the ND-GAIN Index 2014	http://index.gain.org/about/download Based on world bank data. Total wealth estimates and per capita wealth estimates for 1995, 2000, and 2005.

Population with access to improved water supply	Percentage of population with reasonable access (within one km) to an adequate amount of water (20 litres per person) through a household connection, public standpipe well or spring, or rain water system	Drought, dry spells, stress on surface water resources	Households	People without clean water sources are vulnerable to diseases caused by unclean water and could become more vulnerable in the aftermath of a hazard	Füssel, 2010; Shah et al 2013; "Susceptibility in the World Risk Index; Adaptive capacity in ND-Gain; Lack of coping capacity in INFORM-INFORM names it as ""Improved water source (% of population with access)"" and suggests as data sources: WHO; UNICEF http://www.wssinfo.org/data-estimates/table/ ND-GAIN uses WB data http://data.worldbank.org/indicator/SH.H2O.SAFE.ZS "	http://mdgs.un.org/unsd/mdg/metadata.aspx?indicatorid=30 and http://data.worldbank.org/indicator/SH.H2O.SAFE.ZS and www.wssinfo.org/data-estimates/table/
Rural population	Rural population (% of total population)	Drought, dry spells, stress on surface water resources and floods	Households and agriculture		Brooks et al., 2005; Sub indicator of Susceptibility in ND-GAIN 2014	http://data.worldbank.org/indicator/SP.RUR.TOTL.ZS
Rural population with access to safe water (%)	Access to a safe water source refers to the percentage of the population using an improved drinking water source. The improved drinking water source includes piped water on premises (piped household water connection located inside the user's dwelling, plot or yard), and other improved drinking water sources (public taps or standpipes, tube wells or	Drought, dry spells, stress on surface water resources	Health and Households	People without safe water sources are vulnerable to diseases caused by unclean water and could become more vulnerable in the aftermath of a hazard	Brooks et al., 2005	http://data.worldbank.org/indicator/SH.H2O.SAFE.RU.ZS

	boreholes, protected dug wells, protected springs, and rainwater collection).					
Value of production equipment	Machinery and transport equipment (% of value added in manufacturing). Value added in manufacturing is the sum of gross output minus the value of intermediate inputs used in production for industries classified in ISIC major division D. Machinery and transport equipment correspond to ISIC divisions 29, 30, 32, 34, and 35.	All	Industry		Sub-indicator of the Industrial Vulnerability Index (Hiete and Merz, 2009)	http://data.worldbank.org/indicator/NV.MNF.MTRN.ZS.UN
Water stress	Water stress occurs when the demand for water exceeds the available amount during a certain period or when poor quality restricts its use.	Drought, dry spells, stress on surface water resources and floods	Health, households and related economic activities, ecosystems	An unsustainable withdrawal of renewable water resources can increase land degradation and drought risk	Post 2015 HFA (UNISDR, 2014)	http://www.fao.org/nr/water/aquastat/data/query/index.html?lang=en

Adaptive capacity indicators (alphabetical order)

Indicator name	Definition	Relevant Hazards	Sectors affected	Rationale	References	Data Source
Access to electricity	Access to electricity is the percentage of population with access to electricity. Electrification data are collected from industry, national surveys and international sources.	All	All	This indicator is indicative of the capacity to delivery energy to a country's citizens and businesses	Sub-indicator of Adaptive Capacity in the ND-GAIN Index 2014 and Lack of coping capacity in INFORM 2014	http://data.worldbank.org/indicator/EG.ELC.ACCS.ZS and http://www.worldenergyoutlook.org/resources/energydevelopment/energyaccessdatabase/
Adoption of NAPAs	National Adaptation Plans s are defined and adopted (Y/N)	All	All		HFA Reporting	http://www.preventionweb.net/english/hyogo/progress/?pid:228&pil:1
Biodiversity and habitat protection	Ordinal scale with a range from 0 (very poor environmental performance) to 100 (excellent environmental performance), aggregated from three performance indicators: Terrestrial Protected Areas (National Biome Weights), Terrestrial Protected Areas (Global Biome Weights), Marine Protected Areas and Critical Habitat Protection	All	Ecosystems and species	Habitat protection is a necessary but not sufficient condition for the conservation of biodiversity and ecosystem services that are critical to sustaining human life and well-being	Sub-indicator of the World Risk Index 2014	http://epi.yale.edu/epi/issue-ranking/biodiversity-and-habitat
Control of corruption	Reflects perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well	All	All		Post 2015 HFA (UNISDR, 2014); Exposure indicator in ND-GAIN	http://info.worldbank.org/governance/wgi/index.aspx#home Found as part of the World Bank Worldwide Governance Indicators. Scale from -2.5 to 2.5

	as "capture" of the state by elites and private interests.					
Dam Capacity	Dam Capacity per capita	Drought, dry spells, stress on surface water resources and floods	Water-related economic activities, electricity production and ecosystems	Dam capacities are an appropriate measure of the capacity to cope with changes brought by climate change regarding the temporal and geographic distribution of water resources	Sub-indicator of Adaptive Capacity of the ND-GAIN Index 2014	http://atlas.gwsp.org/index.php?option=com_content&task=view&id=207&Itemid=68
Degree of economic diversification	Manufacturing, value added (% of GDP). Manufacturing refers to industries belonging to ISIC divisions 15-37. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs	All	Industry	A community with a relatively diverse local economy is better able to adjust to changes that have a significant impact on a particular sector or sectors of employment	Hallegatte, 2014	http://data.worldbank.org/indicator/NV.IND.MANF.ZS
Disaster preparedness	Monitoring from HFA	All	All		Sub-indicator of Adaptive Capacity in the ND-GAIN Index	http://www.preventionweb.net/applications/hfa/qbnhfa/home
Ecosystem vitality	Ecosystem vitality measures ecosystem protection and resource management	All	Ecosystems	Healthy ecosystems providing regulatory ecosystem services moderate many weather- and climate-related hazards	Post 2015 HFA (UNISDR, 2014);Adaptive capacity in WRI 2014	http://data.worldbank.org/indicator/NV.IND.MANF.ZS http://epi.yale.edu/
Ecosystem vitality: Agriculture	Ordinal scale with a range from 0 (very poor environmental performance) to 100 (excellent environmental	Drought, dry spells, stress on surface water resources and floods	Agriculture and ecosystems	Agriculture is one the economic activities that has the greatest impacts on ecosystems.	Sub-indicator of Adaptive capacity in the World Risk Index 2014	http://epi.yale.edu/

	performance), aggregated from two performance indicators: Agricultural Subsidies (AGSUB) and Pesticide Regulation (POPs)					
Engagement in international environmental conventions	Ratio of a country's current status of convention engagement over the maximum engagement among all countries	All	All	This indicates a country's capacity to reach agreement on appropriate actions internally and engage in multilateral negotiations on environmental issues	Sub-indicator of the ND-GAIN Index 2014 http://sedac.ciesin.columbia.edu/entri/index.jsp	http://data.worldbank.org/indicator/NV.IND.MANF.ZS
Forest cover change rate (% per year)	The Forest cover change rate indicator measures the percent change in forest cover between 2000 and 2012 in areas with greater than 50% tree cover. Ordinal scale with a range from 0 (very poor environmental performance) to 100 (excellent environmental performance), aggregated from three performance indicators: areas of deforestation (forest loss), reforestation (forest restoration or replanting) and afforestation (conversion of bare or cultivated land into forest)	Biodiversity, ecosystem resilience, the capacity of a country to attenuate pollution, prevention of soil loss and ongoing soil development, reduction of runoff, recharging of ground waters and soil formation	Ecosystems and related economic activities	Reduction in the extent of forest cover has significant negative implications for ecosystem services and habitat protection. Forests are carbon sinks to combat global climate change and in regulating the hydrological system	Sub-indicator of the World Risk Index 2014 and WDIs; post 2015 HFA (UNISDR, 2014) and Environmental Vulnerability Index	http://epi.yale.edu

Government health expenditure per capita	Per capita total expenditure on health (TEH) expressed in Purchasing Power Parities (PPP) international dollars.	All	Health and households		Sub-indicator of lack of coping capacity in INFORM 2014, Adaptive Capacity in WRI 2014	http://apps.who.int/gho data/
Hyogo Framework for Action	The indicator for a country's Disaster Risk Reduction (DRR) activity comes from its score of Hyogo Framework for Action (HFA) self-assessment progress reports. HFA progress reports assess strategic priorities in the implementation of DRR actions and establish baselines on levels of progress achieved in implementing the HFA's five priorities for action.	All	All		Sub-indicator of Lack of Coping capacity in INFORM 2014	http://preventionweb.net/applications/hfa/qbnhfa/
Insurance penetration	Insurance coverage (except life insurance)	All	All	When insurance penetration is low, asset destruction caused by natural disasters could severely hamper capital accumulation and growth potential	Baritto et al., 2009; Sub-indicator of coping capacity in the World Risk Index 2014; post 2015 HFA (UNISDR, 2014)	Data not publicly available Munich Re, Swiss Re
Measles (MCV) immunisation coverage among 1-year-olds (%)	The percentage of children under one year of age who have received at least one dose of measles-containing vaccine in a given year.	All	Health and households		Sub-indicator of lack of coping capacity in INFORM 2014	http://apps.who.int/gho data/

Paved Roads	The roads surfaced with crushed stone (macadam) and hydrocarbon binder or bituminised agents, with concrete, or with cobblestones, as a percentage of all the country's roads, measured in length	All	Industry, agriculture and Trade	Unpaved roads are more vulnerable to hazards such as floods and landslides	Brooks et al., 2005; Sub-indicator of the ND-GAIN Index; post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/IS.ROD.PAVE.ZS
Per capita net savings	Gross savings are calculated as gross national income minus total consumption, plus net transfers. Data are in current US dollars.	All	All	Low per capita savings implies a lower capacity to buffer losses and recover, therefore low resilience to disaster loss	Post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/NY.GNS.ICTR.CD
Physician density	Number of physicians per 10 000 inhabitants	All	Households and related economic activities, health	The number of medical staff, including physicians, nurses and midwives, reflects the capacity of a country to cope with exacerbated health risks brought on by climate change. Physicians, nurses, and midwives have similar weighting	Halsnæs and Verhagen, 2007; Sub-indicator of the World Risk Index 2014 and the ND-GAIN index 2014 and Lack of Coping capacity in INFORM 2014; post 2015 HFA (UNISDR, 2014)	http://www.who.int/gho/health_workforce/physicians_density/en/
Population with access to improved sanitation	Improved sanitation facilities comprise flush toilets, piped sewer systems, septic tanks, flush/pour flush to pit latrines, ventilated improved pit latrines, pit latrines with slab and composting toilets	Drought, dry spells, stress on surface water resources	Households	Access to sanitation is particularly crucial to build up preparedness to various natural disasters exacerbated by climate change. People without improved sanitation are susceptible to diseases and can become more vulnerable following a hazard	Füssel, 2010; Brooks et al., 2005; Sub-indicator of Adaptive capacity in the ND-GAIN Index 2014, Sub-indicator of Susceptibility in the World Risk Index 2014, MDG 7.9 (UN 2005) and WDIs and sub indicator of Lack of coping capacity in INFORM 2014	http://unstats.un.org/unsd/mdg/Metadata.aspx?IndicatorId=31 and http://data.worldbank.org/indicator/SH.STA.ACSN and www.wssinfo.org/data-estimates/table/

Regulation quality	Reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development	All	All	The capacity to regulate the private sector, including households, will influence the effectiveness of disaster risk management instruments such as building codes and land-use plans.	Post 2015 HFA (UNISDR, 2014)	http://info.worldbank.org/governance/wgi/index.aspx#home
Road density	Road density is the ratio of the length of the country's total road network to the country's land area. The road network includes all roads in the country: motorways, highways, main or national roads, secondary or regional roads, and other urban and rural roads.	All	Households, Industry, agriculture and Trade		Lack of Coping capacity in INFORM 2014	http://www.irfnet.ch/
Voice and accountability	Reflects perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media	All	All	The extent to which citizens are able to hold others, including government, to account for their actions is critical not only to ensure that disaster risk management plans are implemented but also to strengthen accountability in the case of actions that transfer risks from one sector to another	Keefer et al. (2011), Kahn (2005), and Raschky and Schwindt (2008); Post 2015 HFA (UNISDR, 2014)	http://info.worldbank.org/governance/wgi/index.aspx#home

Mitigation capacity indicators (alphabetical order)

Indicator name	Definition	Relevant Hazards	Sectors affected	Rationale	References	Data Source
% of electricity production from renewable sources, excluding hydroelectric	Electricity production from renewable sources, excluding hydroelectric, includes geothermal, solar, tides, wind, biomass, and biofuels (% of total)	All	All	Countries with a significant or growing proportion of electricity production from renewable sources are likely to be more committed to mitigating global climate change and its effects as well as to environmental sustainability	Development indicator in the Post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/EG.ELC.RNWX.ZS
Carbon Emissions per unit of GDP	Carbon dioxide emissions are those stemming from the burning of fossil fuels and the manufacture of cement. They include carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring. (kg per PPP US$ of GDP)	All	All		MDG 7.2 (UN 2005); Post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/EN.ATM.CO2E.PC
CO2 intensity of the power sector, and of new power generation capacity installed (gCO2 per kWh)	The amount (measured in grammes) of CO2 emissions per unit of electricity (measured in kilowatt hour) generated from the power sector as a whole (total capacities); and from new capacities	All	All	Understanding what drives the evolution of the CO2 intensity of the power sector is important to define the appropriate policies to reduce the CO2 emissions of this sector	Proposed SDG 83 (UN, 2014)	http://data.worldbank.org/indicator/EN.ATM.CO2E.EG.ZS

	installed (between two dates of measurement of the indicator)					
CO2 intensity of the transport sector (gCO2/vkm), and of new cars (gCO2/pkm) and trucks (tCO2tkm)	The proposed indicator is defined as: the amount (measured in grammes) of CO2 emissions per vehicle, kilometre travelled in aggregate; and per passenger kilometre travelled (pkm) for new cars, and per tonne kilometre travelled (tkm) for new trucks (between two dates of measurement of the indicator)	All	All	Understanding what drives the evolution of the CO2 intensity of the transport sector is important to define appropriate policies to reduce the CO2 emissions of that sector	Proposed SDG 84 (UN, 2014)	http://data.worldbank.org/indicator/EN.CO2.TRAN.ZS
Energy consumption per capita	Energy use refers to use of primary energy before transformation to other end-use fuels, which is equal to indigenous production plus imports and stock changes, minus exports and fuels supplied to ships and aircraft engaged in international transport. (kg of oil equivalent per capita)	All	All		Proposed SDG 85 (UN, 2014)	http://data.worldbank.org/indicator/EG.USE.PCAP.KG.OE
Net GHG emissions in the Agriculture, Forest and Other Land Use (AFOLU) sector (tCO2e)	GHG net emissions/removals by AFOLU refers to changes in atmospheric levels of all greenhouse gases attributable to agriculture, forest and	All	All		Proposed SDG 85 (UN, 2014)	http://data.worldbank.org/indicator/EN.CLC.GHGR.MT.CE

	land-use change activities, including but not limited to (1) emissions and removals of CO2 from decreases or increases in biomass stocks due to forest management, logging, fuel wood collection, etc.; (2) conversion of existing forests and natural grasslands to other land uses; (3) removal of CO2 from the abandonment of formerly managed lands (e.g. croplands and pastures); and (4) emissions and removals of CO2 in soil associated with land-use change and management.					

Development indicators (alphabetical order)

Indicator name	Definition	Relevant Hazards	Sectors affected	Rationale	References	Data sources
Adult literacy rate	Population aged 15 years and above who can read and write a short simple statement on their everyday life	All	Households and related economic activities	Literacy could be an essential indicator, when empowering people on hazard risk reduction	Brooks et al., 2005; Sub-indicator of Adaptive Capacity in the World Risk Index 2014; MDG 2.3 (UN 2005); post 2015 HFA; and Lack of Coping capacity in INFORM 2014	http://hdr.undp.org/en/content/adult-literacy-rate-both-sexes-ages-15-and-older and http://data.worldbank.org/indicator/SE.ADT.LITR.ZS
AIDS/HIV infection (% of adults)	An HIV/AIDS epidemic is defined by the HIV prevalence in the general population. HIV prevalence is the percentage of the population living with HIV	All	Health and households	Removal of economically active population	Brooks et al., 2005; Vulnerability in INFORM 2014	http://apps.who.int/gho/indicatorregistry/App_Main/view_indicator.aspx?iid=334; http://www.unaids.org/en/dataanalysis/datatools/aidsinfo
Balance of payments (net current account % of GDP)	Current account balance is the sum of net exports of goods and services, net primary income, and net secondary income	All	All	The economies of countries with a positive balance of payments to GDP ratio are likely to be more resilient to reductions in domestic demand following disasters, but could be less resilient to disasters in key export markets	Post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/BN.CAB.XOKA.GD.ZS
Central government debt, total (% of GDP)	Debt is the entire stock of direct government fixed-term contractual obligations to others outstanding on a particular date. It includes domestic and foreign liabilities such as currency and money deposits, securities	All	All	High existing debt limits the capacity of a government to recover	Post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/GC.DOD.TOTL.GD.ZS

	other than shares, and loans. It is the gross amount of government liabilities reduced by the amount of equity and financial derivatives held by the government. Because debt is a stock rather than a flow, it is measured as of a given date, usually the last day of the fiscal year					
Child Malnutrition	The proportion of children under five whose weight for height is more than two standard deviations below the median for the international reference population aged 0-59	All	Households and health	Malnutrition can be a product of different circumstances relating to development policies and strategies, such as agricultural measures for food availability	ND-GAIN	http://data.worldbank.org/indicator/SH.STA.WAST.ZS
Educational commitment 1	Education expenditure as % of GNP	All	Health and households		Brooks et al., 2005	http://data.worldbank.org/indicator/NY.ADJ.AEDU.GN.ZS
Energy source diversification	Clean energy is non-carbohydrate energy that does not produce carbon dioxide when generated. It includes hydropower and nuclear, geothermal, and solar power, among others.	All	All	The more diversified the energy sources, the less likelihood of power interruption if a given source is affected by disaster	Post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/EG.USE.COMM.CL.ZS
Extreme poverty	% of population living on US$ 1.25 per day or less (purchasing power parity)	All	Households and related economic activities	Poor people are more susceptible to the impacts of natural hazards, as they tend to live in hazard-prone areas (e.g. in unsafe buildings, on floodplains, etc.) and continuously	Bjarnadottir et al., 2011; Sub-indicator of Susceptibility in the World Risk Index 2014 and MDGs (UN 2005)	http://data.worldbank.org/indicator/SI.POV.DDAY

				have to cope with various shocks related to hazards, in dire conditions with limited assets		
GDP per capita at purchasing power parity (current US$)	Gross domestic product (GDP) is the gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. GDP per capita is GDP divided by the mid-year population converted to US$ using purchasing power parity rates	All	All	The GDP per capita PPP can serve as an overall measure of economic development and has often been used as an indicator of economic development and vulnerability. Useful to estimate a population's susceptibility to harm, as limited monetary resources are seen as being an important factor of vulnerability	UNDP, 2014; Füssel 2010; Ferreira et al. (2013), Anbarci et al. (2005), Escaleras et al. (2007), Keefer et al. (2011), Kahn (2005), and Raschky (2008) Schooling ; X Skidmore and Toya (2002), Padli et al. (2010), and Padli and Habibullah (2009) Skidmore and Toya (2002), Raschky and Schwindt (2008), Kellenberg and Mobarak (2008), and Padli et al. (2010), Padli and Habibullah (2009), Brooks et al. 2005; Bjarnadottir er al., 2011; Sub-indicator of Susceptibility in the World Risk Index 2014; post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/NY.GDP.PCAP.CD
General food availability	Food production index	All	Health, households		Brooks et al., 2005; Coping capacity in WRI 2014	http://data.worldbank.org/indicator/AG.PRD.FOOD.XD
Government effectiveness	Reflects perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and	All	All	Ineffective government undermines implementation, for example when policies and strategies for disaster risk management are not evidence based, clearly formulated, integrated	Post 2015 HFA (UNISDR, 2014);Lack of Coping capacity in INFORM 2014	

	implementation, and the credibility of the government's commitment to such policies			into broader policy and backed by political commitment.		
Gross fixed capital formation	Gross capital formation (formerly gross domestic investment) consists of outlays in addition to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements (fences, ditches, drains, etc.); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales, and "work in progress"	All	All	High rates of Gross Fixed Capital Formation are likely to be associated with rapidly increasing hazard exposure of economic assets	Post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/NE.GDI.TOTL.KD
Income distribution	Gini Index	All	All	The Gini index gives an estimate of inequality as it measures the extent to which the actual income distribution differs from an equitable distribution.	Hallegatte, 2014; Anbarci et al. (2005) and Kahn 2005, Brooks et al., 2005; Sub-indicator of the World Risk Index 2014; post 2015 HFA	http://data.worldbank.org/indicator/SI.POV.GINI

				Resilience is likely to be lower in countries with a high degree of income inequality	(UNISDR, 2014); INFORM 2014	
Internet users	Internet users are people with access to the worldwide web network. Internet users per 100 inhabitants	All	All		Perch- Nielsel, 2010; Post 2015 HFA; INFORM 2014	http://data.worldbank.org/indicator/IT.NET.USER.P2
Life expectancy at birth	Years of individual life expectancy (procedure: 0.25*Log(log(85/Years of individual life expectancy)))	All	Households and related economic activities	This indicator also reveals the general health standards of a country	Briguglio et al., 2008. Brooks et al., 2005; Sub-indicator of HDI and World Risk Index 2014 and post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/SP.DYN.LE00.IN
Malaria mortality rate	The number of deaths caused by malaria per 100 000 people per year	All	Health and households	Removal of economically active population	Sub-indicator of INFORM 2014; WHO Global Health Observatory	http://apps.who.int/gho data/
Maternal mortality per 100 000	Maternal mortality ratio is the number of women who die during pregnancy and childbirth, per 100 000 live births.	All	Health and households		Brooks et al., 2005; MDG5.1 (UN 2005)	http://data.worldbank.org/indicator/SH.STA.MMRT
Microeconomic market efficiency - regulation of credit, labour and business index	A component of the Fraser Index of Economic Freedom	All	Macroeconomic impacts		Briguglio et al., 2008	http://www.fraserinstitute.org/research-news/display.aspx?id=20395

ODA received per person	Net official development assistance (ODA) per capita consists of disbursements of loans made on concessional terms (net of repayments of principal) and grants by official agencies of the members of the OECD's Development Assistance Committee (DAC), by multilateral institutions, and by non-DAC countries to promote economic development and welfare in countries and territories in the DAC list of ODA recipients. It is calculated by dividing net ODA received by the midyear population estimate. It includes loans with a grant element of at least 25% (calculated at a rate of discount of 10%).	All	All	Countries heavily dependent on ODA will also be more dependent on ODA decisions to finance recovery and reconstruction	Costa (2012) and Raschky and Schwindt (2008); post 2015 HFA (UNISDR, 2014) and sub-indicator of INFORM 2014	http://www.oecd.org/dac/stats/
Personal remittances (% of GDP)	Personal remittances comprise personal transfers and compensation of employees. Personal transfers consist of all current transfers in cash or in kind made or received by resident households to or from non-resident households. Personal	All	All	Economies where remittances represent a high proportion of GDP are more resilient as risk is geographically spread, and a lower proportion of household earnings will be affected.	Post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/BX.TRF.PWKR.DT.GD.ZS

	transfers thus include all current transfers between resident and non-resident individuals. Compensation of employees refers to the income of border, seasonal, and other short-term workers who are employed in an economy where they are not resident and of residents employed by non-resident entities. Data are the sum of two items defined in the sixth edition of the IMF's Balance of Payments Manual: personal transfers and compensation of employees.					
Quality of energy supply	Number of supply interruptions	All	All	The quality of utilities infrastructure affects the impact severity of natural hazards. A significant proportion of business interruption is associated with power outages. A reliable electricity network is therefore a key resilience factor for business	Swanson et al. 2007; Post 2015 HFA (UNISDR, 2014)	file:///D:/Dev1/WEF_GlobalEnergyArchitecturePerformance_Index_2015.pdf

Share (%) of population undernourished	Population below minimum level of dietary energy consumption (also referred to as prevalence of undernourishment) shows the percentage of the population whose food intake is insufficient to meet dietary energy requirements continuously	All	Households and related economic activities, health	Malnutrition situation can be also a product of different circumstances having relationship with development policies and strategies, such as agricultural measures for food availability	Sub-indicator of the World Risk Index 2014 and ND-GAIN Index 2014 and INFORM; MDG1.9 (UN 2005)	http://data.worldbank.org/indicator/SN.ITK.DEFC.ZS
Tourism as % of GDP	International tourism receipts are expenditures by international inbound visitors, including payments to national carriers for international transport. These receipts include any other prepayment made for goods or services received in the destination country. They also may include receipts from same-day visitors, except when these are important enough to justify separate classification. For some countries, they do not include receipts for passenger transport items (current US$)	All	Tourism and macro-economic effects	Economies which are significantly concentrated in the tourism sector may have lower resilience when that sector is affected	Perch- Nielsel, 2010	http://data.worldbank.org/indicator/ST.INT.RCPT.CD

Tuberculosis prevalence	The number of cases of tuberculosis (all forms) in a population at a given point in time (the middle of the calendar year), expressed as the rate per 100 000 population. Estimates include cases of TB in people with HIV.	All	Health and households	Removal of economically active population	Sub-indicator of INFORM 2014; WHO Global Health Observatory	http://apps.who.int/gho data/

ANNEX IV

Table I - Indicators identified by reviewing the relevant literature on climate change, development and disaster risk. (alphabetical order)

Indicator name	Definition	Rationale	Strengths and Weaknesses	References	Data source
% forest cover	Land under natural or planted stands of trees of at least 5 metres, whether productive or not, excluding tree stands in agricultural production systems (% of land area)			Brooks et al., 2005; MDG 7.1 (UN 2005); WDI	http://data.worldbank.org/indicator/AG.LND.FRST.ZS
~~%~~ of households dependent solely on agriculture as a source of income	Percentage of households dependent solely on agriculture as a source of income			Hahn et al., 2009; Shah et al., 2013; de Oliveira Mendes (2009), Schmidtlein et al. (2011), Khan (2012)	Not Available/ Data to be collected locally
% of households primarily dependent on self-farmed food	Percentage of households that get their food primarily from their own farms			Hahn et al., 2009; Shah et al., 2013	Data can be collected locally
% of the national budget allocated to risk reduction	% of the national budget allocated to risk reduction			Post 2015 HFA (UNISDR, 2014)	Available in future
Access to education	Number of students enrolled in primary, secondary and tertiary levels of education, regardless of age, as a			Halsnæs and Verhagen, 2007; Briguglio et al., 2008	http://data.uis.unesco.org/

	percentage of the school-age population for each level				
Access to electricity	The percentage of population with access to electricity. Electrification data are collected from industry, national surveys and international sources	Indicative of the capacity to delivery energy to a country's citizens and businesses		Sub-indicator of the ND-GAIN Index 2014 and INFORM 2014	http://data.worldbank.org/indicator/EG.ELC.ACCS.ZS and http://www.worldenergyoutlook.org/resources/energydevelopment/energyaccessdatabase/
Adoption of NAPAs	National Adaptation Plans are defined and adopted (Y/N)				http://www.preventionweb.net/english/hyogo/progress/?pid:228&pil:1
Adult literacy rate	Population aged 15 years and over who can read and write a short simple statement on their everyday life	Literacy could be an essential indicator, which helps to empower people with regard to hazard risk reduction		Brooks et al., 2005; Sub-indicator of the World Risk Index 2014; MDG 2.3 (UN 2005); post 2015 HFA; and INFORM 2014	http://hdr.undp.org/en/content/adult-literacy-rate-both-sexes-ages-15-and-older and http://data.worldbank.org/indicator/SE.ADT.LITR.ZS
Age and condition of utilities				Swanson et al., 2007	Data not available
Age dependency ratio	Ratio of the population <15 and >65 years of age to the population between 19 and 65 years of age	The direct effects of extreme weather may disproportionately affect the old and the young. A high age dependency ratio means a high proportion of children and elderly people compared to the working age population. This lowers resilience, particularly in the case of the death or injury of a		Cutter et al. (2003); Shah 2013; Wolf et al., 2010; Sub-indicator of the World Risk Index 2014; post 2015 HFA (UNISDR, 2014), ND-GAIN 2014	http://data.worldbank.org/indicator/SP.POP.65UP.TO.ZS/

		working-age adult			
Agricultural capacity	This comprises of four indicators: % of agricultural area/land area equipped for irrigation, Fertiliser use on arable and permanent crop areas; Tractor use per 100 kmq of arable land; and % of agricultural area/land area equipped for irrigation			Sub-indicator of ND-GAIN	
Agricultural self-sufficiency	Agricultural production index			Brooks et al., 2005	
AIDS/HIV infection (% of adults)	An HIV/AIDS epidemic is defined by the HIV prevalence in the general population. HIV prevalence is the percentage of the population living with HIV	Removal of economically active population		Brooks et al., 2005; INFORM 2014	http://apps.who.int/ghodata/
Annual Average Loss (AAL)	The probable annualised loss from all hazard events occurring over different return periods.			Post 2015 HFA (UNISDR, 2014)	http://www.preventionweb.net/english/hyogo/gar/2013/en/home/data-platform.html
Annual Average Loss (AAL) as % of Gross Fixed Capital Formation	Annual average losses	Countries that risk losing a significant proportion of their annual capital investment in disasters run a high risk to their economies		Post-2015 HFA (UNISDR, 2014)	http://www.preventionweb.net/english/hyogo/gar/2013/en/home/data-platform.html
Annual change in GDP	Annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 2005 US dollars	Rapidly increasing GDP indicates decreasing vulnerability and mortality for a given level of		Post-2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG

		hazard exposure, and increasing hazard exposure of economic assets			
Annual maximum five-day precipitation	Where RR_{kj} is the amount of precipitation for the five-day interval ending $_k$, period *j*, the maximum five-day values for period *j* are: Rx5dayj = max (RRkj)			Perch- Nielsel, 2010; World Bank, 2014	Data can be collected locally
Availability and implementation of a transparent and detailed deep decarbonisation strategy	A decarbonisation strategy is in place and implemented	Keeping global warming within 2°C or less requires that countries prepare national deep decarbonisation strategies to 2050, covering all sources of greenhouse gas (GHG) emissions including from the energy, industry, agriculture, forest, transport, and building sectors		Proposed SDG 82 (UN, 2014)	http://unsdsn.org/wp-content/uploads/2014/07/140724-Indicator-working-draft1.pdf
Average agricultural Livelihood Diversification Index	The inverse of (the number of agricultural activities + 1) reported by a household			Hahn et al., 2009; Shah et al., 2013	Data to be collected locally
Average annual deviation in Sea-Surface Temperatures	Average annual deviation in Sea-Surface Temperatures (SST) in the past five years in relation to the 30-year monthly means (1961-1990). The indicator captures the total amount of the anomalies in SST, either as excess or	Frequent and severe deviations from the 30-year moving average could herald shifts in currents, upwelling, weather patterns and		Sub-indicator of the Environmental Vulnerability Index (UNDP, 2004)	http://www.vulnerabilityindex.net/ and Climatic Research Unit, University of East Anglia, Norwich, UK. http://www.cru.uea.ac.uk/cru/data/temperature/#datdow

	deficit (using absolute values)	climate, and could negatively a country's resilience to other hazards			
Average annual excess heat (degrees) over the past five years	Average annual excess heat (degrees) over the past five years for all days more than 5°C (9°F) hotter than the 30 year mean monthly maximum	This indicator captures not only the number of days with significantly higher temperatures, but also the amount of the excess		Sub-indicator of the Environmental Vulnerability Index (UNDP, 2004)	http://www.vulnerabilityindex.net/ NOAA DATSAV3 Surface SOD 1973-2003 http://gcmd.gsfc.nasa.gov/records/GCMD_gov.noaa.ncdc.C00442.html
Average annual excess rainfall (mm) over the past five years	Average annual excess rainfall (mm) over the past five years for all months with more than 20% higher rainfall than the 30-year monthly average	This indicator ensures that the amount of rain 'in excess' is considered		Sub-indicator of the Environmental Vulnerability Index (UNDP, 2004)	http://www.vulnerabilityindex.net/ and NOAA GHCN http://www.ncdc.noaa.gov/oa/pub/data/ghcn/v2/ghcnftp_zipd.html
Average annual excess wind over the past five years	Summing wind speeds on days during which the maximum recorded wind speed is more than 20% higher than the 30-year average maximum wind speed for that month	This indicator captures the likelihood of damage from frequent and severe wind that can affect forests, fan fires, create storm surges, dry soils, spread air pollution, and interact with other stressors		Sub-indicator of the Environmental Vulnerability Index (UNDP, 2004)	http://www.vulnerabilityindex.net/ NOAA DATSAV3 Surface SOD 1973-2003 http://gcmd.gsfc.nasa.gov/records/GCMD_gov.noaa.ncdc.C00442.html

Average annual heat deficit (degrees)	Average annual heat deficit (degrees) over the past five years for all days more than 5°C (9°F) cooler than the 30-year mean monthly minimum	This indicator records not only the number of days with significantly lower temperatures, but also the amount of the "heat deficit"		Sub-indicator of the Environmental Vulnerability Index (UNDP, 2004)	http://www.vulnerabilityindex.net/ and NOAA DATSAV3 Surface SOD 1973-2003 http://gcmd.gsfc.nasa.gov/records/GCMD_gov.noaa.ncdc.C00442.html
Average annual number of international tourists per km² land over the past five years	Average annual number of international tourists per km² land over the past five years			Sub-indicator of the Environmental Vulnerability Index (UNDP, 2004)	http://www.vulnerabilityindex.net/ WTO http://i-tip.wto.org/services/(S(dczrer0x1sb4i3sg1l0i0m0l))/ChartResults.aspx
Average annual rainfall deficit (mm) over the past five years	Average annual rainfall deficit (mm) over the past five years for all months with more than 20% lower rainfall than the 30-year monthly average	This indicator ensures that the amount of rain 'missed' is considered		Sub-indicator of the Environmental Vulnerability Index (UNDP, 2004)	http://www.vulnerabilityindex.net/ NOAA GHCN http://www.ncdc.noaa.gov/oa/pub/data/ghcn/v2/ghcnftp_zipd.html;
Average annual water usage as a percentage of renewable water resources over the past five years	Average annual number of international tourists per km² land over the past five years			Sub-indicator of the Environmental Vulnerability Index (UNDP, 2004)	http://www.vulnerabilityindex.net/ NOAA GHCN http://www.ncdc.noaa.gov/oa/pub/data/ghcn/v2/ghcnftp_zipd.html;
Average crop diversity index	The inverse of (the number of crops grown by a household + 1)			Shah, 2013	Data can be collected locally
Average days water supply stored per household	Average water supply security per household			Shah et al., 2013	Data can be collected locally
Average days without regular water supply per month	Percentage of households reporting that water is not available from their primary water supply			Shah et al., 2013	Data can be collected locally

Average dietary supply adequacy	Average dietary energy supply as a percentage of the average dietary energy requirement			Sub-indicator of INFORM 2014	http://www.fao.org/economic/ess/ess-fs/ess-fadata/en/
Average help received: given ratio	Ratio of (the number of types of help received by a household in the past month +1) to (number of types of help given by a household to another household in the past month +1)			Hahn et al., 2009; Shah et al., 2013	Data can be collected locally
Average number of people per household	Average number of people per household			Bjarnadottir et al., 2011	http://unstats.un.org/unsd/Demographic/sconcerns/popsize/default.htm
Average ratio of borrowing to lending	Ratio of a household's financial borrowings in the past month to a household's financial lending in the past month			Hahn et al., 2009; Shah et al 2013	Data can be collected locally
Average ratio of productivity: fisheries catch over the past five years	Rate of extraction/ the potential for the environment to replenish those stocks (productivity)	This indicator captures the risk of damage to fisheries stocks by examining rates of extraction in relation to the potential for the environment to replenish those stocks (productivity). A small productivity ratio means greater vulnerability of fisheries		Sub-indicator of the Environmental Vulnerability Index (UNDP, 2004)	http://www.vulnerabilityindex.net/

Average time to health facility	Average time taken to travel to the nearest health facility			Shah 2013	Data can be collected locally
Average time to water source (minutes)	Average time it takes households to travel to their primary water source			Hahn et al., 2009	Data can be collected locally
Balance of payments (current account net % of GDP)	Current account balance is the sum of net exports of goods and services, net primary income, and net secondary income	The economies of countries with a positive balance of payments to GDP ratio are likely to be more resilient to reductions in domestic demand following disasters, but could be less resilient to disasters in key export markets		Post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/BN.CAB.XOKA.GD.ZS
Beach length to be maintained in order to maintain important tourist resort areas	Beach length to be maintained (km) in order to maintain important tourist resort areas	This highlights the dependence of the tourism sector on the maintenance of natural capital		Perch- Nielsel, 2010	
Benefit/cost ratios of adaptation options identified/implemented	BCR based on the ratio of the value of assets and productivity made less vulnerable to climate hazards, to adaptation expenditure			Brooks et al., 2011	Data to be collected by reviewing local projects
Better vulnerability Assessments	Number of projects/interventions that conduct and update risk and vulnerability assessments	This indicator assumes that higher numbers of projects and interventions within different sectors conducting and updating risk and vulnerability	This indicator cannot measure quality of generated or updated risk and vulnerability assessments	Adaptation Fund indicator 1.1 (AF, 2014)	Data to be collected by reviewing national policies

		assessments would provide more information on specific risk and vulnerability assessments. This information would form the basis to develop relevant and sector-specific adaptation measures			
Biodiversity and habitat protection	Ordinal scale with a range from 0 (very poor environmental performance) to 100 (excellent environmental performance), aggregated from three performance indicators: Terrestrial Protected Areas (National Biome Weights), Terrestrial Protected Areas (Global Biome Weights), Marine Protected Areas and Critical Habitat Protection	Habitat protection is a necessary but not sufficient condition for the conservation of biodiversity and ecosystem services that are critical to sustain human life and well-being	Controversial in terms of development opportunities	Sub-indicator of the World Risk Index 2014	http://epi.yale.edu/
Birth rate	Crude birth rate indicates the number of live births occurring during the year, per 1 000 population estimated at mid-year			de Oliveira Mendes (2009), Lee (2014)	http://data.worldbank.org/indicator/SP.DYN.CBRT.IN
Capacity to undertake research and understand issues	Scientists and engineers in R&D per million population			Brooks et al., 2007	
Carbon Emissions per capita	Carbon dioxide emissions stemming from the burning of fossil fuels and the manufacture of cement. They include carbon			MDG 7.2 (UN 2005); Post-2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/EN.ATM.CO2E.PC

	dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring (metric tonnes per capita)				
Carbon Emissions per unit of GDP	Carbon dioxide emissions stemming from the burning of fossil fuels and the manufacture of cement. They include carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring (kg per PPP US$ of GDP)			MDG 7.2 (UN 2005); Post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/EN.ATM.CO2E.PP.GD
Central government debt, total (%of GDP)	Debt is the entire stock of direct government fixed-term contractual obligations to others that are outstanding on a particular date. It includes domestic and foreign liabilities such as currency and money deposits, securities other than shares, and loans. It is the gross amount of government liabilities reduced by the amount of equity and financial derivatives held by the government. Because debt is a stock rather than a flow, it is measured as of a given date, usually the last day of the fiscal year	High existing debt limits the capacity of a government to recovery		Post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/GC.DOD.TOTL.GD.ZS

Child Malnutrition	The proportion of children under five whose weight for their height is more than two standard deviations below the median for the international reference population aged 0-59	Malnutrition can be a product of different circumstances related to development policies and strategies, such as agricultural measures for food availability		ND-GAIN	http://data.worldbank.org/indicator/SH.STA.WAST.ZS
Child Mortality Rate	The under-five mortality rate is the probability per 1 000 that a new born child will die before reaching the age of five			Füssel, 2010; de Oliveira Mendes (2009), Lee (2014) MDG4.2 (UN 2005); INFORM 2014	http://data.worldbank.org/indicator/SH.DYN.MORT
Children Under Weight	Children aged <5 years Under Weight	Malnutrition can be a product of different circumstances related to development policies and strategies, such as agricultural measures for food availability		INFORM 2014	http://apps.who.int/gho data/; http://www.unicef.org/publications/index_pubs_statistics.html
Climate change priorities are integrated into national development strategy	This is a measure of the existence of a document to achieve goals and objectives at national and/or local levels and a group of potential and agreed adaptation options to be implemented. Climate change "adaptation priorities" depend on: • Targeted geographic area covered (local, regional, national, etc.). For	Understanding the integration of climate change priorities into development strategies can help determine the level of commitment at local/municipality, regional, and national scales, as well as the effectiveness of adaptation	Integrating climate change priorities into development strategies does not necessarily address their actual implementation	Adaptation Fund indicator 7 (AF, 2014)	Data to be collected by reviewing national policies

	example, at the national level NAPAs include climate change adaptation priorities. • Sectors targeted: agriculture, health, energy, waste, forestry, etc. • Socioeconomic aspects covered by policy: physical capital; improve livelihoods; social, natural or human capital	responses			
Clustering tendency	Industrial clusters are groups of firms on the same location composing a production system with spill-overs that can be vertical and/or horizontal			Sub-indicator of the Industrial Vulnerability Index (Hiete and Merz, 2009)	http://www.iscramlive.org/ISCRAM2009/papers/Contributions/131_An%20Indicator%20Framework%20to%20Assess%20the%20Vulnerability_Merz2009.pdf
CO2 intensity of the power sector, and of new power generation capacity installed (gCO2 per kWh)	This indicator is defined as the amount (measured in grammes) of CO2 emissions per unit of electricity (measured in kilowatt hour) generated from the power sector as a whole (total capacities); and from new capacities installed (between two dates of measurement of the indicator)	Understanding what drives the evolution of the CO2 intensity of the power sector is also important to define the appropriate policies to reduce the CO2 emissions of this sector		Proposed SDG 83 (UN, 2014)	http://data.worldbank.org/indicator/EN.ATM.CO2E.EG.ZS
CO2 intensity of the transport sector (gCO2/vkm), and of new cars (gCO2/pkm) and trucks (tCO2tkm)	The amount (measured in grammes) of CO2 emissions per vehicle, kilometre travelled in aggregate; and per passenger kilometre travelled (pkm) for new cars, and per tonne kilometre travelled (tkm) for new trucks (between	Understanding what drives the evolution of the CO2 intensity of the transport sector is important to define appropriate policies to reduce the CO2 emissions of that		Proposed SDG 84 (UN, 2014)	http://data.worldbank.org/indicator/EN.CO2.TRAN.ZS

	two dates of measurement of the indicator)	sector			
Coastal vulnerable population	Population below 5m is the percentage of the total population living in areas where the elevation is 5 metres or less above sea level			Sub indicator of ND-GAIN	http://data.worldbank.org/indicator/EN.POP.EL5M.ZS
Combined gross school enrolment	The number of students enrolled in primary, secondary and tertiary levels of education, regardless of age, as a percentage of the population of theoretical school age for the three levels	A good level of education is important to recover sooner from shocks related to natural hazards		Sub-indicator of the World Risk Index 2014 and HDI	http://hdr.undp.org/en/content/combined-gross-enrolment-education-both-sexes and http://www.uis.unesco.org/Datacentre/Pages/instructions.aspx?SPSLanguage=EN
Commitment to and resources for research	R&D investment (% GNP)			Brooks et al., 2008	Data not available
Community health and services measure				Swanson et al., 2007	Data not available
Conflict	Internal refugees (1 000s) scale by population			Brooks et al., 2006	
Control of corruption	Reflects perceptions of the extent to which public power is exercised for private gain, including both petty and large forms of corruption, as well as "capture" of the state by elites and private interests			Post 2015 HFA (UNISDR, 2014)	http://info.worldbank.org/governance/wgi/index.aspx#home

Corruption Perception Index	This indicator measures the perceived level of corruption of national governments using 13 different sources	People living in countries with higher levels of corruption are thought to have greater difficulty in recovering from natural hazard impacts, due to limited governmental support reaching affected population compared to states with lower levels of corruption		Escaleras et al. (2007); Sub-indicator of the World Risk Index 2014 and INFORM 2014 and Proposed SDG 100 (UN, 2014)	http://cpi.transparency.org/cpi2013/results/
Coverage of Climate Change interventions	Proportion of portfolio that includes measures to address climate change			Brooks et al., 2011	Data to be collected by reviewing local projects
Customer proximity	The level of proximity of customers			Sub-indicator of the Industrial Vulnerability Index (Hiete and Merz, 2009)	http://www.iscramlive.org/ISCRAM2009/papers/Contributions/131_An%20Indicator%20Framework%20to%20Assess%20the%20Vulnerability_Merz2009.pdf
Dam Capacity	Dam Capacity per capita	Dam capacities are an appropriate measure of the capacity to cope with changes brought about by climate change regarding the temporal and geographic distribution of water resources		Sub-indicator of the ND- GAIN Index 2014	http://www.fao.org/nr/water/aquastat/data/query/index.html?lang=en

Debt repayments	Actual amounts of principal (amortization) paid by the borrower in currency, goods, or services in the year specified			Brooks et al., 2005	http://data.worldbank.org/indicator/DT.AMT.DLTF.CD
Degree of economic diversification	Manufacturing, value added (% of GDP). Manufacturing refers to industries belonging to ISIC divisions 15-37. Value added is the net output of a sector, calculated by adding up all outputs and subtracting intermediate inputs.	A community with a relatively diverse local economy is better able to adjust to changes that have a significant impact on a particular sector or sectors of employment		Hallegatte, 2014 Füssel and Klein, 2006	http://data.worldbank.org/indicator/NV.IND.MANF.ZS
Degree of power self supply	Degree of power self supply			Sub-indicator of the Industrial Vulnerability Index (Hiete and Merz, 2009)	http://www.iscramlive.org/ISCRAM2009/papers/Contributions/131_An%20Indicator%20Framework%20to%20Assess%20the%20Vulnerability_Merz2009.pdf
Degree of water self supply (industry)	Degree of water self supply (industry)			Sub-indicator of the Industrial Vulnerability Index (Hiete and Merz, 2009)	http://www.iscramlive.org/ISCRAM2009/papers/Contributions/131_An%20Indicator%20Framework%20to%20Assess%20the%20Vulnerability_Merz2009.pdf
Democracy				Keefer et al. (2011), Kahn (2005), and Raschky and Schwindt (2008)	Data not available
Density of people living in coastal settlements	Density of people living in coastal settlements (within 100 km of the coast)	Countries with heavy densities of human populations living in coastal areas are likely to damage some of their most		UNDP, 2004 ; Perch-Nielsel 2010	http://www.vulnerabilityindex.net/ Center for International Earth Science Information Network - CIESIN - Columbia University

		productive and diverse areas and negatively affect the country 's resilience to natural disasters such as cyclones, tsunamis etc.			http://sedac.ciesin.columbia.edu/data/sets/browse
Dependence on agriculture	Agricultural employees (% of total population)			Brooks et al., 2005	http://data.worldbank.org/indicator/SL.AGR.EMPL.ZS
Dependency on external resource for health services	This indicator measures the proportion of total expenditures to health or related services that are provided by entities external to the country	A high dependency, usually on foreign aid, is an indicator of weakness in internal capacity and thus vulnerability to climate-related health shocks		Sub-indicator of the ND-GAIN Index 2014	http://data.worldbank.org/indicator/SH.XPD.EXTR.ZS
Dependency on imported energy	Proportion of energy use from imports. Energy use refers to the use of primary energy before transformation to other end-use fuels, according to WDI, equal to indigenous production plus imports and stock changes, minus exports and fuels supplied to ships and aircraft engaged in international transport	A higher proportion of imported energy implies higher sensitivity to price increases or supply crises		Sub-indicator of the ND-GAIN Index 2014	http://index.gain.org/about/download http://data.worldbank.org/indicator/EG.IMP.CONS.ZS
Direct benefits	Value of assets and economic activities protected or made less vulnerable as a result of adaptation interventions compared with a business-as-usual scenario, turnover			Brooks et al., 2011	Data to be collected by reviewing local projects/surveys

	of businesses incorporating adaptation measures resulting from projects, etc.				
Disaster mortality per 100 000 population	Disaster mortality per 100 000 inhabitants (five-year moving average)	Large scale mortality is an indicator of both high levels of risk as well as limitations in disaster risk management		Post 2015 HFA (UNISDR, 2014); Sub-indicator of the Global Climate Change Index (Germanwatch 2014)	http://germanwatch.org/en/cri
Disaster preparedness	Monitoring from Hyogo Framework Action			Sub-indicator of the ND-GAIN Index	http://www.preventionweb.net/applications/hfa/qbnhfa/home
Displaced people (% of population)	Displaced People	Displaced people are normally a particularly at-risk group and are more likely to live in vulnerable conditions in hazard-prone areas, with less access to basic services than low-income households in general		Post 2015 HFA (UNISDR, 2014)	http://www.unhcr.org/pages/49c3646c4d6.html
Drought frequency	Drought Frequency			Sub-indicator of INFORM 2014	http://www.emdat.be
Ecological footprint	Difference between the number of hectares of land and water (both within and outside the country), needed to supply the average demand of the population and the country's supply of land	A country with a surplus (more supply than demand) has the capacity to produce more from within its boundaries and thus is likely to		Post 2015 HFA (UNISDR, 2014), Sub-indicator of ND-GAIN Index	http://www.footprintnetwork.org/en/index.php/GFN/page/footprint_data_and_results

	and water	have more options to adapt to a changing climate			
Economic loss as proportion of Gross Fixed Capital Formation (GFCF)	Economic loss / Gross Fixed Capital Formation (GFCF) (five-year moving average)	When a significant proportion of public and private capital investment is lost in disasters, social and economic development is eroded		Post-2015 HFA (UNISDR, 2014)	
Ecosystem vitality	Ecosystem vitality measures ecosystem protection and resource management	Healthy ecosystems providing regulatory ecosystem services moderate many weather and climate related hazards		Post 2015 HFA (UNISDR, 2014); WRI 2014	http://epi.yale.edu/epi/data-explorer
Ecosystem vitality: Agriculture	Ordinal scale with a range from 0 (very poor environmental performance) to 100 (excellent environmental performance), aggregated from two performance indicators: Agricultural Subsidies (AGSUB) and Pesticide Regulation (POPs)	Agriculture is one the economic activities that has most impacts on ecosystems	It is not is a direct measurement of agricultural environmental performance	Sub-indicator of the World Risk Index 2014	http://epi.yale.edu/
Educational commitment 1	Education expenditure as % of GNP			Brooks et al., 2005	
Educational commitment 2	Education expenditure as % of government expenditure	Poverty is closely associated with low levels of education, which in turn limits capacities for disaster risk management		Brooks et al., 2005; Post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/SE.XPD.TOTL.GB.ZS/countries

Emergency plans in place	Emergency plans are in place (0-1)			Hallegatte, 2014	Data available for some countries
Energy access	Proportion of population with access to electricity			Sub-indicator of the ND-GAIN Index	Halsnæs and Verhagen, 2007
Energy source diversification	Clean energy is non-carbohydrate energy that does not produce carbon dioxide when generated. It includes hydropower and nuclear, geothermal, and solar power, among others	The more diversified the energy sources, the less likelihood of power interruption if a given source is affected by disaster		Post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/EG.USE.COMM.CL.ZS
Engagement in international environmental conventions	Ratio of a country's current status of convention engagement to the maximum engagement among all countries	Indicates a country's capacity to reach agreement on appropriate actions internally and thereby engage in multilateral negotiations on environmental issues		Sub-indicator of the ND-GAIN Index 2014 http://sedac.ciesin.columbia.edu/entri/index.jsp	http://sedac.ciesin.columbia.edu/entri/index.jsp
Expected years of schooling (years)	Number of years of schooling that a child of school-entrance age can expect to receive if prevailing patterns of age-specific enrolment rates persist throughout the child's life			Sub-indicator of HDI	http://hdr.undp.org/en/content/expected-years-schooling-children-years
Exposed cropland to drought				Sub-indicator of INFORM 2014	
Exposed population per 100 000 inhabitants	Sum of people exposed to extreme events/100 000 inhabitants	Countries with a high proportion of their population at risk of being affected by disasters will have		Post 2015 HFA (UNISDR, 2014)	

		high degrees of livelihood interruption and threats to human development			
External debt-to-GNI ratio	Total external debt stocks to gross national income (GNI). Total external debt is debt owed to non-residents that is repayable in currency, goods, or services. It is the sum of public, publicly guaranteed, and private non-guaranteed long-term debt, use of IMF credit, and short-term debt. Short-term debt includes all debt having an original maturity of one year or less and interest in arrears on long-term debt. GNI (formerly GNP) is the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output, plus net receipts of primary income (compensation of employees and property income) from abroad	A country with a high level of external debt may find it more difficult to mobilise resources in order to offset the effects of external shocks		Briguglio et al., 2008	http://data.worldbank.org/indicator/DT.DOD.DECT.GN.ZS

Extreme poverty	Percentage of the population living on US$ 1.25 per day or less (purchasing power parity)	Poor people are more susceptible to the impact of natural hazards, as they tend to live in hazard-prone areas (e.g. in unsafe buildings, on floodplains, etc.) and continuously have to cope with various shocks related to hazards, in dire conditions and with limited assets		Bjarnadottir er al., 2011; Sub-indicator of the World Risk Index 2014 and MDGs (UN 2005)	http://data.worldbank.org/indicator/SI.POV.DDAY
Facilitated access to credit in post-disaster situation	Credit is available in post-disaster situations (0-1)			Hallegatte, 2014; Forgette and Boening (2010); Akter and Mallick, 2013	Data can be collected locally
Financial sector				Skidmore and Toya (2002), and Padli et al. (2010)	Data not available
Fiscal AAL per inhabitant	The annual risk to publicly owned assets	The higher the fiscal AAL (the annual risk to publicly owned assets, or for which governments are responsible for replacing) per inhabitant, the higher the sovereign disaster risk, for which is each citizen is responsible		Post 2015 HFA (UNISDR, 2014)	http://www.preventionweb.net/english/hyogo/gar/2013/en/home/data-platform.html
Fiscal Deficit	Government's total expenditure surpasses the revenue generated. Cash	A healthy fiscal position would allow adjustments		Briguglio et al., 2008; Skidmore and Toya (2002), and Padli et al.	http://data.worldbank.org/indicator/GC.BAL.CASH.GD.ZS

	surplus or deficit is revenue (including grants) minus expense, minus net acquisition of nonfinancial assets	to taxation and expenditure policies in the face of adverse shocks		(2010)	
Food import dependency	Imports of food/ total supply. Dependency rate is measured by proportion of cereal consumption obtained from imports	Countries highly dependent on food imports are susceptible to shocks in food prices. Climate change will accentuate price volatility		Sub-indicator of the ND-GAIN Index 2014	http://faostat3.fao.org/faostat-gateway/go/to/download/FB/BC/E
Food imports (% of merchandise imports)	Food comprises the commodities in SITC sections 0 (food and live animals), 1 (beverages and tobacco), and 4 (animal and vegetable oils and fats) and SITC division 22 (oil seeds, oil nuts, and oil kernels)	Countries with a high food import ratio would be more resilient to the effects of disasters in the agricultural sector in the country, but more at risk of the impact of food price spikes on the international market		Post-HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/TM.VAL.FOOD.ZS.UN
Foreign aid				Costa (2012) and Raschky and Schwindt (2008)	Data not available
Foreign direct investment (net inflows as % of Gross Fixed Capital Formation (GFCF)	Foreign direct investment are the net inflows of investment to acquire a management interest (10 % or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings,	Economies with a high proportion of capital investment from overseas may be more resilient given that parent companies of damaged facilities can quickly invest to repair and		Post-2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/BX.KLT.DINV.CD.WD

	other long-term capital, and short-term capital as shown in the balance of payments	rehabilitate damaged facilities			
Forest cover change rate (% per year)	The Forest cover change rate indicator measures the percent change in forest cover between 2000 and 2012 in areas with greater than 50% tree cover. Ordinal scale with a range from 0 (very poor environmental performance) to 100 (excellent environmental performance), aggregated from three performance indicators: areas of deforestation (forest loss), reforestation (forest restoration or replanting) and afforestation (conversion of bare or cultivated land into forest)	Reduction in the extent of forest cover has significant negative implications for ecosystem services and habitat protection. Forests are carbon sinks that help combat global climate change and regulate the hydrological system		Sub-indicator of the World Risk Index 2014 and WDIs; post 2015 HFA (UNISDR, 2014) and Environmental Vulnerability Index	http://epi.yale.edu
Fraction of the population covered by an early warning system and with ability to prepare and evacuate	Percentage of households that received a warning about the most severe flood, drought, and cyclone event in the past 10 years			Füssel and Klein, 2006; Hahn et al., 2009; Hallegatte, 2014, Akter and Mallick 2013; Forgette and Boening (2010); Adaptation Fund indicator 2.2.1 (AF, 2014); post 2015 HFA (UNISDR, 2014)	Data available for some countries
Frequency of water contamination	Frequency of water contamination (over a defined period)			Swanson et al., 2007	Data can be collected locally

Freshwater withdrawal rate	Annual freshwater withdrawal / the total renewable water resources (excluding desalinated water)	A proxy for countries' water stress		Sub-indicator of the ND-GAIN Index 2014	http://www.fao.org/nr/water/aquastat/data/query/index.html?lang=en
GDP per capita at purchasing power parity (current US$)	GDP is gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. The GDP per capita is the gross domestic product divided by mid-year population converted to international (US) dollars, using purchasing power parity rates	The GDP per capita PPP can serve as an overall measure of economic development and has often been used as an indicator for economic development and vulnerability. It can be used to estimate a population's susceptibility to negative impacts, as limited monetary resources are seen as an important factor of vulnerability		UNDP, 2014; Füssel 2010; Ferreira et al. (2013), Anbarci et al. (2005), Escaleras et al. (2007), Keefer et al. (2011), Kahn (2005), and Raschky (2008) Schooling ; X Skidmore and Toya (2002), Padli et al. (2010), and Padli and Habibullah (2009) Skidmore and Toya (2002), Raschky and Schwindt (2008), Kellenberg and Mobarak (2008), and Padli et al. (2010), Padli and Habibullah (2009), Brooks et al. 2005; Bjarnadottir er al., 2011; Sub-indicator of the World Risk Index 2014; post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/NY.GDP.PCAP.CD
Gender parity in primary, secondary and tertiary education	Ratio of girls to boys, based on UNESCO data on school enrolment Values: 1 = parity > 0 < 1 = disparity in favour of males >1 = disparity in favour of females	In the disaster risk context, education is an important resource for adaptation as it prepares a community to understand natural hazards and disaster consequences		Brooks et al., 2005; Sub-indicator of the World Risk Index 2014; MDG 3.1 (UN 2005)	http://unstats.un.org/unsd/mdg/Metadata.aspx?IndicatorId=9 and http://www.uis.unesco.org/Datacentre/Pages/instructions.aspx?SPSLanguage=EN

Government effectiveness	Reflects perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies	Ineffective government undermines implementation, for example when policies and strategies for disaster risk management are not evidence based, clearly formulated, integrated into broader policy and backed by political commitment.		Post 2015 HFA (UNISDR, 2014); INFORM 2014	http://info.worldbank.org/governance/wgi/index.aspx#home
Government health expenditure per capita	Per capita total expenditure on health (TEH) expressed in international dollar Purchasing Power Parities (PPP)			Sub-indicator of INFORM 2014, WRI 2014	http://apps.who.int/ghodata/
Government stability				Raschky (2008)	Data not available
Gross fixed capital formation	Gross capital formation (formerly gross domestic investment) consists of outlays in addition to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements (fences, ditches, drains, etc.); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and	High rates of Gross Fixed Capital Formation are likely to be associated with rapidly increasing hazard exposure of economic assets		Post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/NE.GDI.TOTL.KD

	commercial and industrial buildings. Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales, and "work in progress"				
Gross National Product/Income	The total value of all final goods and services produced within a nation in a particular year, plus income earned by its citizens (including income of those located abroad)			Adger (2003), Cutter et al. (2000, 2003), Dwyer et al. (2004), Brooks et al. (2005), Tunstall et al. (2007), Polsky et al. (2007), Ojerio et al. (2011), Khan (2012), Lee (2014); Sub-indicator of HDI.	http://hdr.undp.org/en/content/income-index
Groundwater recharge per capita	Groundwater recharge per capita			Brooks et al., 2005	http://preview.grid.unep.ch/
Hospital beds	Number of hospital beds per 10 000 persons. Hospital beds in private, general and specialised hospitals, including medical and rehabilitation centres	Hospital beds indicate the capacity of the medical care infrastructure to help or support societies in the case of a mass emergency or disaster with respective treatment	"hospital beds" is rather weak, since it only provides information on the health care capacity	Sub-indicator of the World Risk Index 2014	http://data.worldbank.org/indicator/SH.MED.BEDS.ZS
Houses with weak storm-resistant construction materials (wood, mud)	Percentage of houses that will be unable to withstand a severe climatic event (e.g. hurricane winds) due to the quality of the materials			Shah et al., 2013; de Oliveira Mendes (2009), Lee (2014); Cutter et al. (2000), Adger et al. (2004)	Data can be collected locally

	used in their construction				
Housing damage in extensive disasters per 100 000 population	Housing damage / 100 000 population (five-year moving average)	Housing damage affects both the lives and livelihoods of low income urban and rural households. Most housing damage is spread over extensive disaster zones and occurs in low-income areas		Post 2015 HFA (UNISDR, 2014)	
Human rights				Costa (2012)	Data not available
Hyogo Framework for Action	The indicator for the Disaster Risk Reduction (DRR) activity in the country comes from its score of Hyogo Framework for Action (HFA) self-assessment progress reports. HFA progress reports assess strategic priorities in the implementation of DRR actions and establish baselines on levels of progress achieved in implementing the HFA's five priorities for action			Sub-indicator of INFORM 2014	http://preventionweb.net/applications/hfa/qbnhfa/
Implemented NAMA	Nationally Appropriate Mitigation Actions (NAMAs) are policies, programmes and projects that developing countries undertake to contribute to				http://www.nama-database.org/index.php/NAMAs

	the global effort to reduce greenhouse gas emissions				
Income distribution	Gini Index	The Gini index gives an estimate of inequality as it measures the extent to which the actual income distribution differs from an equitable distribution. Resilience is likely to be lower in countries with a high degree of income inequality		Hallegatte 2014; Anbarci et al. (2005) and Kahn (2005), Brooks et al., 2005; Sub-indicator of the World Risk Index 2014; post 2015 HFA (UNISDR, 2014); INFORM 2014	http://data.worldbank.org/indicator/SI.POV.GINI
Increased income, or avoided decrease in income in Adaptation Projects	Income sources for households generated under climate change scenario is a measure of how individual livelihoods (specifically income sources and income in general) are strengthened in relation to climate change impacts and variability	Household livelihoods (including income sources), which include how people obtain their income and have access to and use assets to make a living, are a key part of understanding project beneficiary characteristics		Adaptation Fund indicator 6.1.2 (AF, 2014)	Data to be collected by reviewing local projects/surveys
Industrial water consumption	Annual freshwater withdrawals refer to total water withdrawals, not counting evaporation losses from storage basins. Withdrawals also include water from desalination plants in countries where they are a significant source. Withdrawals can			Sub-indicator of the Industrial Vulnerability Index (Hiete and Merz, 2009)	http://data.worldbank.org/indicator/ER.H2O.FWIN.ZS/countries/1W?display=graph

	exceed 100% of total renewable resources where extraction from non-renewable aquifers or desalination plants is considerable or where there is significant water reuse. Withdrawals for industry are total withdrawals for direct industrial use (including withdrawals for cooling thermoelectric plants).				
Insurance penetration	Insurance coverage (except life insurance)	When insurance penetration is low, asset destruction caused by natural disasters could severely hamper capital accumulation and growth potential		Baritto et al., 2009; Sub-indicator of the World Risk Index 2014; post 2015 HFA (UNISDR, 2014)	Data not publicly available
Internet users	Internet users are those with access to the worldwide network. Internet users per 100 inhabitants			Perch- Nielsel 2010; Post 2015 HFA; INFORM 2014	http://data.worldbank.org/indicator/IT.NET.USER.P2/countries?display=graph
Inverse of the average number of litres of water stored per household (range: >0–1)	The inverse of the average number of litres of water stored by each household, + 1			Hahn et al., 2009	Data can be collected locally
Investment climate				Raschky (2008)	Data not available
Investment in low - arbon energy	% of investment in low carbon energy as % of GDP	Hydropower tends to compete very favourably with carbon-fuel energy sources in much of Asia and Africa, even at current		Dercon, 2014	Data not available at National scale - see http://www.worldenergyoutlook.org/investment/

		prices, provided it is available			
Kilometres of roads damaged as % of road network	Kilometres of roads damaged / km road network (five-year moving average)	Roads are critical to the functioning of local economies and to small and medium enterprises. This indicator therefore can provide a proxy of disaster impacts in the employment and productive sectors		Post 2015 HFA (UNISDR, 2014)	
Length of low-lying coastal zone with more than 10 persons per km2				Perch- Nielsel, 2010	Data not available
Life expectancy at birth	Years of individual life expectancy (procedure: 0.25*Log(log(85/Years of individual life expectancy)))	This indicator also reveals the general health standards of a country		Briguglio et al., 2008. Brooks et al., 2005; Sub-indicator of HDI and World Risk Index 2014 and post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/SP.DYN.LE00.IN
Malaria mortality rate	The death rate associated with malaria is the number of deaths caused by malaria per 100 000 people per year	Removal of economically active population		Sub-indicator of INFORM 2014	http://apps.who.int/gho data/
Maternal mortality per 100 000	Maternal mortality ratio is the number of women who die during pregnancy and childbirth, per 100 000 live births			Brooks et al., 2005; MDG5.1 (UN 2005)	http://data.worldbank.org/indicator/SH.STA.MMRT
Mean standard deviation of average precipitation by month	Standard deviation of average monthly precipitation			Hahn et al., 2009; Shah et al., 2013	http://www.worldclim.org/bioclim

Mean standard deviation of the daily average maximum temperature by month	Standard deviation of the average daily maximum temperature by month			Hahn et al., 2009; Shah et al., 2013	http://www.worldclim.org/bioclim
Mean standard deviation of the daily average minimum temperature by month	Standard deviation of the average daily minimum temperature by month			Hahn et al., 2009; Shah et al., 2013	http://www.worldclim.org/bioclim
Mean years of schooling	Average number of years of education received by people aged 25 and older, converted from education attainment levels using official durations of each level			Briguglio et al., 2008; Sub-indicator of HDI	http://hdr.undp.org/en/content/mean-years-schooling-adults-years
Measles (MCV) immunisation coverage among 1-year-olds (%)	The percentage of children under one year of age who have received at least one dose of measles-containing vaccine in a given year			Sub-indicator of INFORM 2014	http://apps.who.int/gho data/
Medical staff	Sum of medical staff, including physicians, nurses and midwifes per 1 000 inhabitants	This reflects the capacity of a country to cope with health risks brought about by climate change		Sub-indicator of ND-GAIN	http://data.worldbank.org/indicator/SH.MED.NUMW.P3 and http://data.worldbank.org/indicator/SH.MED.PHYS.ZS
Microeconomic market efficiency - regulation of credit, labour and business index	This is a component of the Fraser Index of Economic Freedom			Briguglio et al., 2008	http://www.fraserinstitute.org/research-news/display.aspx?id=20395
Mobile Telephone Subscriptions	Mobile telephone subscriptions are subscriptions to a public mobile telephone service using cellular technology, which provide access to the public switched			INFORM 2014	http://data.worldbank.org/indicator/IT.CEL.SETS.P2/countries/1W?display=map

	telephone network. Post-paid and pre-paid subscriptions are included.				
Natural capital dependency	Ratio of natural capital over the total wealth of the country			Sub-indicator of the ND-GAIN Index 2014	http://index.gain.org/about/download
Natural habitats protected or rehabilitated due to Adaptation Projects	The extent to which project initiatives aimed at maintaining or improving natural resources (land, water, soil, forests, etc.) have reached their intended objectives	Effectively established, improved, or created ecosystem services and/or natural assets would give information on the availability of resources for human access and sustainable use, as well as overall ecosystem health		Adaptation Fund indicator 5 (AF, 2014)	Data to be collected by reviewing local projects/surveys
Net GHG emissions in the Agriculture, Forest and other Land Use (AFOLU) sector (tCO2e)	GHG net emissions/removals by LUCF refers to changes in atmospheric levels of all greenhouse gases attributable to forest and land-use change activities, including but not limited to (1) emissions and removals of CO2 from decreases or increases in biomass stocks due to forest management, logging, fuelwood collection, etc.; (2) conversion of existing forests and natural grasslands to other land			Proposed SDG 85 (UN, 2014)	http://data.worldbank.org/indicator/EN.CLC.GHGR.MT.CE

	uses; (3) removal of CO2 from the abandonment of formerly managed lands (e.g. croplands and pastures); and (4) emissions and removals of CO2 in soil associated with land-use change and management				
Net ODA received (% of GNI)	Net official development assistance (ODA) consists of disbursements of loans made on concessional terms (net of repayments of principal) and grants by official agencies of the members of the OECD's Development Assistance Committee (DAC), by multilateral institutions, and by non-DAC countries to promote economic development and welfare in countries and territories in the DAC list of ODA recipients. It includes loans with a grant element of at least 25% (calculated at a rate of discount of 10%)	Countries heavily dependent on ODA will also be more dependent on ODA decisions to finance recovery and reconstruction		Sub-indicator of INFORM 2014	http://data.worldbank.org/indicator/DT.ODA.ODAT.GN.ZS
Number and type of materials	Number of materials used for production			Sub-indicator of the Industrial Vulnerability Index (Hiete and Merz, 2009)	http://www.iscramlive.org/ISCRAM2009/papers/Contributions/131_An%20Indicator%20Framework%20to%20Assess%20the%20Vulnerability_Merz2009.pdf
Number of deaths per 100 000 inhabitants				Sub-indicator of the Global Climate Change Index	Germanwatch

Number of early warnings	Number of early warnings	Development of early warning systems is a measure of long-term knowledge generated and disseminated in the area of intervention. This indicator assumes higher numbers of early warning systems would provide more information on specific risk and vulnerability assessments	This indicator does not provide information on the effectiveness or operational capacity of EWS	Adaptation Fund indicator 1.2 (AF, 2014)	Data to be collected by reviewing local projects/surveys
Number of extreme events in the past 10 years	Total number of floods, droughts, and cyclones that were reported by households over the period considered			Hahn et al., 2009; Costa (2012), Kellenberg and Mobarak (2008)	http://www.emdat.be
Number of fatalities due to extreme events	Sum of fatalities over the period considered			Sub-indicator of the Global Climate Change Index (Germanwatch 2014)	http://www.emdat.be
Number of health or social infrastructures developed or modified to respond to new conditions resulting from climate change variability and change	Health and social development projects support the reform of secondary education, control the spread of infectious diseases, increase the capacity of health services, provide national-level health policy assistance; provide expanded and improved reproductive health services, and improve conditions for vulnerable	Number of development services addressed by the intervention provides information on availability of adapted services available for human use in response to climate change impacts	Number of development-sector services addressed during the project does not inform on the sustainability or effectiveness of these services against the impacts of climate variability	Adaptation Fund indicator 4.1.1 (AF, 2014)	Data to be collected by reviewing local projects/surveys

	children and youth				
Number of hectares of crops lost per total crop area	Number of hectares of crops lost / total crop area (five-year moving average)	Loss of agricultural production is particularly critical for rural households and contributes to continued or worsening rural poverty		Post 2015 HFA (UNISDR, 2014)	
Number of landslides recorded in the past five years	Number of landslides recorded in the past five years (EMDAT definitions), divided by land area			Sub-indicator of the Environmental Vulnerability Index (UNDP, 2004)	http://www.vulnerabilityindex.net/
Number of risk reduction actions or strategies introduced at local level	Risk reduction actions or strategies include: Monitoring/Forecasting capacity (EWS, vulnerability mapping system); Policy/regulatory reform; Capacity development; Sustainable forest management; Strengthening infrastructure; Supporting livelihoods; Mangrove reforestation; Coastal drainage and infrastructure; Irrigation system; Community-based adaptation; Erosion control; Soil water conservation; Microfinancing; Special programmes for women; Livelihoods; Water	This assesses the extent to which the intervention/project or programme helped improve risk reduction at the local level	Number of introduced risk reduction actions and strategies does not necessarily equate to their effective application at local level	Adaptation Fund indicator 3.1.1 (AF, 2014)	Data to be collected by reviewing local projects/surveys

	storage; ICT and information dissemination, among others				
Number of targeted development strategies that incorporate climate change priorities	This assesses the extent to which project interventions have effectively helped enforce strategies to address/incorporate climate change risks in the different sectors	Understanding the number of elements of development strategy enforced to effectively address/incorporate climate change risks (increase adaptive capacity or achieve an enhanced level of protection) makes it possible to determine and ensure that specific regulations support the policy(ies) and are being successfully implemented		Adaptation Fund indicator 7.2 (AF, 2014)	Data to be collected by reviewing local projects/surveys
Number of tsunamis or storms surges with runup greater than two metres	Number of tsunamis or storms surges with runup greater than two metres above Mean High Water Spring tide (MHWS) per 1 000 km coastline since 1900	This indicator captures the potential loss of shorelines, coastal ecosystems and resources, and loss of species due to catastrophic run up of seawater onto coastal lands		Sub-indicator of the Environmental Vulnerability Index (UNDP, 2004)	http://www.vulnerabilityindex.net/

Number, type, and sector of policies introduced or adjusted to address climate change risks	Policies that introduce or adjust climate change risks is a measure of how countries/sectors can adapt to climate change	Developed or adjusted policies do not guarantee adoption or implementation. Consider other aspects like regulation and enforcement to fully understand impact of policies.		Adaptation Fund indicator 7.1 (AF, 2014)	Data to be collected by reviewing national policies
Numbers of beneficiaries of Climate Change interventions	Number of people benefiting from projects or project components that address climate change issues, e.g. by integrating measures to promote resilience or reduce climate-change-related risks			Brooks et al., 2011	Data to be collected by reviewing local projects/surveys
Numbers of health facilities damaged as % of total number of health facilities	% of health facilities damaged out of total number of health facilities (five-year moving average)	Damaged health facilities are a proxy for disaster impacts in the health sector. Low-income households in particular are dependent on publicly provided primary health facilities		Post 2015 HFA (UNISDR, 2014)	
Numbers of people experiencing reductions in vulnerability	People who become less vulnerable to extreme events			Brooks et al., 2011; Adaptation Fund Indicator 2.2 (AF, 2014)	Data to be collected by reviewing local projects/surveys
Numbers of schools damaged as % of total number of schools	% of schools damaged out of total number of schools (five-year moving average)	Damaged schools are a proxy for disaster impacts in education. The interruption of		Post 2015 HFA (UNISDR, 2014)	

		schooling negatively affects future educational and hence economic prospects			
Nutritional status	Calorie intake per capita			Brooks et al., 2005	
Official climate financing from developed countries that is incremental to ODA (in US$)	Official climate financing from developed countries that is incremental to ODA (in US$)	Under the Conference of Parties of the UNFCCC, developed countries have pledged to provide some US$100 billion per year in climate finance by 2020. This indicator will track official (i.e. public) climate finance provided by each developed country as a contribution towards the overall target of at least US$100 billion per year		Proposed SDG 86 (UN, 2014)	http://www.climatefundsupdate.org/data
Paved Roads	This is quantified by the proportion of roads surfaced with crushed stone (macadam) and hydrocarbon binder or bituminised agents, with concrete, or with cobblestones, as a percentage of all the country's roads, measured in length	Unpaved roads are more vulnerable to hazards such as floods and landslides		Brooks et al., 2005; Sub-indicator of the ND-GAIN Index; post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/IS.ROD.PAVE.ZS

Per capita net savings	Gross savings are calculated as gross national income minus total consumption, plus net transfers. Data are in current US dollars	Low per capita savings implies a lower capacity to buffer losses and recover, therefore low resilience to disaster loss		Post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/NY.GNS.ICTR.CD
Percentage households utilising a natural water system	Percentage of households obtaining water from wells, rainwater, springs and other means apart from the public system			Hahn et al., 2009; Shah et al., 2013	Data can be collected locally
Percentage households with dependent members needing care	% of households with at least one member requiring daily care because of age, physical or mental condition, illness or disability	Households with disabled people increase the total cost to government of responding to, and recovering from, a disaster		Shah, 2013; Cutter et al. (2003), Dwyer et al. (2004)	Data to be collected locally
Percentage households with members suffering from chronic illness	Percentage of households reporting at least one member with a chronic illness			Shah, 2013	Data can be collected locally
Percentage households without non-agricultural income contribution	Percentage of households reporting livelihoods other than agriculture/fishing/hunting as their main source of income			Shah, 2013	Data to be collected locally
Percentage households without ownership of the lands on which they live	Percentage of households that can be removed from the lands on which they presently reside			Shah et al., 2013	Data can be collected locally

Percentage of electricity production from renewable sources, excluding hydroelectric	Electricity production from renewable sources, excluding hydroelectric; includes geothermal, solar, tides, wind, biomass, and biofuels (% of total)	Countries with a significant or growing proportion of electricity production from renewable sources are likely to be more committed to mitigating global climate change and its effects, as well as to environmental sustainability		Post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/EG.ELC.RNWX.ZS
Percentage of female-headed households	Percentage of households where the head of the household is female			Hahn et al., 2009; Shah et al., 2013	Data to be collected locally
Percentage of heads of households that did not attend school	Percentage of households where the head reports not finishing primary school			Hahn et al., 2009; Shah et al., 2013	Data to be collected locally
Percentage of households dependent on family farm/hunting/fishing for food	Percentage of households that get their food primarily from their personal farms, hunting/fishing activity food			Hahn et al., 2009; Shah et al., 2013	Data can be collected locally
Percentage of households from which a member missed work/school in past two weeks due to illness	Percentage of households reporting at least one member who missed school or work due to illness in the past two weeks			Shah, 2013	Data can be collected locally
Percentage of households reporting water conflicts	Percentage of households that report having heard about conflicts over water in their community			Hahn et al., 2009	Data can be collected locally

Percentage of households that do not save crops	Percentage of households that do not keep reserves of crops from each harvest			Hahn et al., 2009	Data can be collected locally
Percentage of households that do not save seeds	Percentage of households that do not have seeds from year to year			Hahn et al., 2009	Data can be collected locally
Percentage of households that have applied for government assistance in the past 12 months	Percentage of households that reported that they have asked their local government for assistance in the past 12 months			Hahn et al., 2009; Shah et al., 2013	Data can be collected locally
Percentage of households with family member working in a different community	Percentage of households with family member working in a different community			Hahn et al., 2009; Shah et al., 2013	Data to be collected locally
Percentage of households with orphans	Percentage of households with orphans			Hahn et al., 2009	Data to be collected locally
Percentage of households without pipe-borne water	Percentage of households not receiving water through the public water system			Shah et al., 2013	Data not available
Percentage of houses not elevated by posts/high ground to avoid floods	Percentage of houses that will be unable to withstand storm surges and floods			Shah et al., 2013; de Oliveira Mendes (2009), Lee (2014); Cutter et al. (2000), Adger et al. (2004)	Data can be collected locally
Percentage of land area below 5-m elevation	Area where the elevation is 5 m or less above sea level			Füssel, 2010	http://sedac.ciesin.columbia.edu/data/set/nagdc-population-landscape-climate-estimates-v3
Percentage of land area less than or equal to 50m above sea level	Percentage of land area below or at 50m above sea level	A country's resilience to future hazards is related to risks on lowland areas		Sub-indicator of the Environmental Vulnerability Index (UNDP, 2004)	http://www.vulnerabilityindex.net/

Percentage of old house				de Oliveira Mendes (2009), Lee (2014)	Data not available
Percentage of population 65 years old and over	Percentage of population 65 years old and over	Those at either extreme of the age spectrum have a relatively poor capacity for self-protection during a disaster		Bjarnadottir er al., 2011; Khan 2012	http://data.worldbank.org/indicator/SP.POP.65UP.TO.ZS
Percentage of population below 5-m elevation	Proportion of population living in areas where the elevation is 5 m or less	This indicates how many people are sensitive to risks arising from sea level rise and storm surges		Füssel, 2010; Sub-indicator of the ND-GAIN Index 2014	http://sedac.ciesin.columbia.edu/data/set/nagdc-population-landscape-climate-estimates-v3
Percentage of population under 5 years of age	Percentage of population under 5 years of age	Those at either extreme of the age spectrum have a relatively poor capacity for self-protection during a disaster		Bjarnadottir er al., 2011; Khan 2012	http://data.worldbank.org/indicator/SP.POP.0014.TO.ZS
Percentage of population with an injury or death as a result of the most severe natural disaster in the past 10 years	Percentage of population that reported either an injury to or death of one of their family members as a result of the most severe flood, drought, or cyclone events in the past 10 years			Hahn et al., 2009	http://www.emdat.be/database
Percentage of targeted population aware of predicted adverse impacts of climate change and of appropriate responses	% of targeted population aware of predicted adverse impacts of climate change and of appropriate responses	Measures the level of knowledge and capacity of the targeted population to respond to adverse effects	Population aware of climate change and appropriate response measures does not necessarily translate to the application of response measures at the household level. Population perceptions are difficult parameters to assess	Adaptation Fund indicator 3.1 (AF, 2014)	Data to be collected by reviewing local projects/surveys

Personal remittances (% of GDP)	Personal remittances comprise personal transfers and compensation of employees. Personal transfers consist of all current transfers in cash or in kind made or received by resident households to or from non-resident households. Personal transfers thus include all current transfers between resident and non-resident individuals. Compensation of employees refers to the income of border, seasonal, and other short-term workers who are employed in an economy where they are not resident and of residents employed by non-resident entities. Data are the sum of two items defined in the sixth edition of the IMF's Balance of Payments Manual: personal transfers and compensation of employees	Economies where remittances represent a high proportion of GDP are more resilient as risk is geographically spread and a lower proportion of household earnings will be affected		Post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/BX.TRF.PWKR.DT.GD.ZS
Physical exposure	Number of people located in the area in which the disaster occurred * frequency of the hazard			UNDP, 2004	http://www.vulnerabilityindex.net/
Physical infrastructure improved to withstand climate change and variability-induced stress	Physical infrastructure includes: Roads, Government Buildings, Causeways, Airports, Schools, Training Centres, Hospitals, other	This assesses the extent to which project/programme interventions of improvement and adaptation of physical assets		Adaptation Fund indicator 4.2 (AF, 2014)	Data to be collected by reviewing local projects/surveys

		achieved their intended results/objectives			
Physician density	Number of physicians per 10 000 inhabitants	The number of medical staff, including physicians, nurses and midwives, reflects the capacity that a country has to cope with exacerbated health risks brought on by climate change. Physicians, nurses, and midwives are weighted the same		Halsnæs and Verhagen, 2007; Sub-indicator of the World Risk Index 2014 and the ND-GAIN index 2014 and INFORM 2014; post 2015 HFA (UNISDR, 2014)	http://www.who.int/gho/health_workforce/physicians_density/en/
Policies for preventing future risk	Index built from the checklist included in HFA post-2015 (every item 0-1, then simple average) - Y/N questions			Derived from proposed post-2015 HFA Indicator (UNISDR, 2014)	Available in future
Policies for reducing existing risk	Index built from the checklist included in HFA post 2015 (every item 0-1, then simple average) - Y/N questions			Derived from proposed post-2015 HFA Indicator (UNISDR, 2014)	Available in future
Policies for risk governance	Index built from the checklist included on HFA post 2015 (every item 0-1, then simple average) - Y/N questions			Derived from proposed post-2015 HFA Indicator (UNISDR, 2014)	Available in future
Policies for risk knowledge	Index built from the checklist included on HFA post 2015 (every item 0-1, then simple average) - Y/N questions			Derived from proposed post-2015 HFA Indicator (UNISDR, 2014)	Available in future

Policies for strengthening resilience	Index built from the checklist included in the HFA post 2015 (every item 0-1, then simple average) - Y/N questions			Derived from proposed post 2015 HFA Indicator (UNISDR, 2014)	Available in future
Poor population living in hazards plains	The percentage of poor living in areas subject to significant risk of death or damage caused by prominent hazards: cyclones, drought, floods, and landslides. The indicator maybe calculated separately for each relevant prominent hazard.	Smallholder farming is dependent on land, water and climate. But also the urban poor tend to depend on environmental capital for their livelihoods and living conditions, being more affected by pollution of air and water, and often living in floodplains in cities, with huge consequences for health and wellbeing.		Dercon 2014; Cutter et al. (2003), Schmidtlein et al. (2011), Khan (2012), Lee (2014)	Data are not available
Population affected by droughts	People affected by droughts 1990-2013 - average annual population affected (inhabitants)			Sub-indicator of INFORM 2014	http://www.emdat.be
Population affected by natural disasters	Relative number of affected population by natural disasters in the past three years			Sub-indicator of INFORM 2014	http://www.emdat.be
Population density	Population/m2	Greater numbers of people increase pressure on the environment for resources. Relative flood mortality is higher in less		Birkmann, 2007; de Oliveira Mendes, 2009; Tate et al., 2010; Khan, 2012; Lee. 2014; Brooks et al., 2005	http://data.worldbank.org/indicator/EN.POP.DNST

		populated than in densely populated countries			
Population exposed to floods	Physical exposure to flood - average annual population (2010 as the year of reference) exposed (inhabitants)			Sub-indicator of INFORM 2014	http://preview.grid.unep.ch/
Population exposed to hazards	Sum of people exposed to all hazards over the period considered (e.g. a year)	The knowledge of the population exposed is fundamental for raising awareness and the development of protection measures (e.g. identification of suitable shelters) and evacuation strategies (e.g. development of evacuation routes)		Sub-indicator of the World Risk Index 2014	http://preview.grid.unep.ch/
Population exposed to sea level rise (possible from 1m to 6m)	Percentage of population exposed to 1-m sea level rise	This indicator gives a general overview of the number of people living within exposed (low - lying) areas such as coastal zones		Perch- Nielsel, 2010; WRI, 2014	http://geodata.grid.unep.ch/mod_download/download.php and https://www.cresis.ku.edu/data/sea-level-rise-maps
Population exposed to storm surges	Inundated area based on historical records from 1975-2009			Sub-indicator of INFORM 2014	
Population exposed to tropical cyclones	Physical exposure to tropical cyclone surges - average annual population (2010 as the year of reference) exposed			Sub-indicator of INFORM 2014 and World Risk Index 2014	http://preview.grid.unep.ch/

	(inhabitants) per country				
Population exposed to tsunamis	Average annual population (2010 as the year of reference) physically exposed to tsunamis (inhabitants)			Sub-indicator of INFORM 2014	http://preview.grid.unep.ch/
Population growth (Annual %)	The exponential rate of growth of mid-year population from year t-1 to t, expressed as a percentage.	High population growth may translate into rapidly increasing hazard exposure of people		Post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/SP.POP.GROW
Population with access to improved sanitation	Improved sanitation facilities comprise flush toilets, piped sewage systems, septic tanks, flush/pour flush to pit latrines, ventilated improved pit latrines, pit latrines with slabs and composting toilets	Access to sanitation is particularly crucial to build up preparedness to various natural disasters that are exacerbated by climate change. People without access to improved sanitation facilities are susceptible to diseases and can become more vulnerable following a hazard event		Füssel, 2010; Brooks et al., 2005; Sub-indicator of the ND-GAIN Index 2014, the World Risk Index 2014, MDG 7.9 (UN 2005) and WDIs and INFORM 2014	http://unstats.un.org/unsd/mdg/Metadata.aspx?IndicatorId=31 and http://data.worldbank.org/indicator/SH.STA.ACSN and www.wssinfo.org/data-estimates/table/
Population with access to improved water supply	Percentage of the population with reasonable access (within one km) to an adequate amount of water (20 litres per person) through a household connection, public standpipe well or	People without improved water supply sources are vulnerable to diseases caused by unclean water and could become more vulnerable in the		Füssel, 2010; Shah et al 2013; Sub-indicator of the World Risk Index 2014, MDG 7.8 (UN 2005) and WDIs and INFORM 2014; Sub-indicator of the ND-GAIN Index 2014	http://mdgs.un.org/unsd/mdg/metadata.aspx?indicatorid=30 and http://data.worldbank.org/indicator/SH.H2O.SAFE.ZS and www.wssinfo.org/data-estimates/table/

	spring, or rain water system	aftermath of a hazard event			
Poverty bias	The relative exposure of the poor, compared with the share of assets owned by the poor			Hallegatte, 2014	
Poverty gap	Poverty gap is the mean shortfall from the poverty line (counting the non-poor as having zero shortfall), expressed as a percentage of the poverty line. This measure reflects the depth of poverty as well as its incidence	Households in extreme poverty have greater difficulty to access the assets required to buffer disaster losses and are therefore likely to be less resilient		Post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/SI.POV.GAPS
Power consumption	Electricity consumption for industrial uses			Sub-indicator of the Industrial Vulnerability Index (Hiete and Merz, 2009)	http://www.iea.org/Sankey/index.html or http://www.iea.org/stats/prodresult.asp?PRODUCT=Electricity/Heat
Power essentiality	Essentiality of energy availability for industry			Sub-indicator of the Industrial Vulnerability Index (Hiete and Merz, 2009)	http://www.iscramlive.org/ISCRAM2009/papers/Contributions/131_An%20Indicator%20Framework%20to%20Assess%20the%20Vulnerability_Merz2009.pdf
Private per capita expenditure on health	Private per capita expenditure on health (as a percentage of total health expenditure)			Sub-indicator of the World Risk Index 2014	World Health Statistics, Health Expenditure Ratios: http://apps.who.int/gho data/
Public expenditure as % of GDP	General government final consumption expenditure (formerly general government consumption) includes all current expenditures by government for purchasing goods and services	Low levels of public expenditure are reflected in deficiencies in public services and social welfare systems. Low-income households		Post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/NE.CON.GOVT.ZS

	(including compensation of employees). It also includes most expenditures on national defence and security, but excludes government military expenditures that form part of government capital	are particularly dependent on public expenditure to manage their risks			
Public infrastructure and resources that belong to inhabitants	Number of hospital beds per 1 000 inhabitants			Polsky et al. (2007), de Oliveira Mendes (2009), Menoni et al. (2012), Lee (2014)	Data can be collected locally
Pure Prime Risk	Pure Prime Risk represents the proportion of the value of exposed assets that is at risk each year	The higher the Pure Prime Risk, the higher the risk to the country's economy		Post 2015 HFA (UNISDR, 2014)	http://www.preventionweb.net/english/hyogo/gar/2013/en/home/data-platform.html
Quality and price of house				Cutter et al. (2000), Adger et al. (2004), Lee (2014)	Data not available
Quality of energy supply	Number of supply interruptions	The quality of utilities infrastructure affects severity of impact. A significant proportion of business interruption is associated with power outages. A reliable electricity network is therefore a key resilience factor for business		Swanson et al., 2007; Post 2015 HFA (UNISDR, 2014)	file:///D:/Dev1/WEF_GlobalEnergyArchitecturePerformance_Index_2015.pdf

Quality of port infrastructure	The Quality of port infrastructure measures business executives' perception of their country's port facilities	Poor quality infrastructure is likely to be more vulnerable to hazards. Damaged and destroyed infrastructure is responsible for business and livelihood interruption and is therefore a major risk driver		Post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/IQ.WEF.PORT.XQ
Quality of trade and transport infrastructure	Data are from Logistics Performance Index surveys conducted by the World Bank in partnership with academic and international institutions and private companies and individuals engaged in international logistics. (1=low to 5=high)	Quality of trade and transport infrastructure shows the capacity to effectively supply and manage essential infrastructure by the public and private sectors, and is indicative of capacity to sustain that infrastructure in the face of future changes, including climate change		ND-GAIN Index 2014	http://data.worldbank.org/indicator/LP.LPI.INFR.XQ?display=graph
Rate of unemployment	Unemployment refers to the share of the labour force that is without work but available for and seeking employment (% of total labour force)	Diverse employment opportunities. As with poverty, the level of unemployment will have a direct influence on the capacity of households to buffer disaster		Dwyer et al. (2004), de Oliveira Mendes (2009), Khan (2012), Lee 2014 Post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/SL.UEM.TOTL.ZS

		losses and recover or provide more options if climate affects a particular type of occupation			
Ratio of length of borders (land and maritime) to total land area	Ratio of length of borders (land and maritime) to total land area	This indicator captures the degree to which a country's land area is fragmented and 'thin'		Sub-indicator of the Environmental Vulnerability Index (UNDP, 2004)	http://www.vulnerabilityindex.net/
Regulation quality	Reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development	The capacity to regulate the private sector, including households, will influence the effectiveness of disaster risk management instruments such as building codes and land-use plans		Post 2015 HFA (UNISDR, 2014)	http://info.worldbank.org/governance/wgi/index.aspx#home
Relative vulnerability	Number of people killed/the number of people exposed	A higher relative mortality, expressed as the average annual deaths as a proportion of the average population exposed, indicates a higher vulnerability for a particular country		UNDP, 2004	http://www.vulnerabilityindex.net/

Renewable water resources per person	m^3capita = (internal river flows + groundwater from rainfall)/population	The greater the resource availability per person, the greater the resilience of society to droughts and heat waves		Füssel, 2010	http://data.worldbank.org/indicator/ER.H2O.INTR.PC
Required adaptation of corals to increased thermal stress	Frequency of coral bleaching	This highlights the dependence of the tourism sector on the maintenance of natural capital		Perch- Nielsel, 2010	Data can be collected locally
Risk-adjusted public debt	Indicator to be constructed from Fiscal AAL and public debt	Fiscal AAL represents a contingent liability of governments, and is often invisible when accounting for public debt. For countries with already high or unsustainable levels of public debt, disaster risk represents another critical debt layer		Post 2015 HFA (UNISDR, 2014)	http://www.preventionweb.net/english/hyogo/gar/2013/en/home/data-platform.html
Road density	Road density is the ratio of the length of the country's total road network to the country's land area. The road network includes all roads in the country: motorways, highways, main or national roads, secondary or regional roads, and other urban and rural roads			INFORM 2014	http://www.irfnet.ch/

Rule of law	Reflects the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence	Plans related to disaster risk management, including land use plans, building codes and environmental regulations, are unlikely to be implemented in countries where there is only weak compliance with laws and regulations		Costa (2012); Post 2015 HFA (UNISDR, 2014)	http://info.worldbank.org/governance/wgi/index.aspx#home
Rural population	Rural population (% of total population)			Brooks et al., 2005; ND-GAIN 2014	http://data.worldbank.org/indicator/SP.RUR.TOTL.ZS
Rural population with access to safe water (%)	Access to a safe water source refers to the percentage of the population using an improved drinking water source. The improved drinking water source includes piped water on premises (piped household water connection located inside the user's dwelling, plot or yard), and other improved drinking water sources (public taps or standpipes, tube wells or boreholes, protected dug wells, protected springs, and rainwater collection).	People without improved water sources are vulnerable to diseases caused by unclean water and could become more vulnerable in the aftermath of a hazard		Brooks et al., 2005	http://data.worldbank.org/indicator/SH.H2O.SAFE.RU.ZS

Sector - specific greenhouse gas emission intensity	CO2 emissions from manufacturing industries and construction include emissions from the combustion of fuels in industry			Sub-indicator of the ND-GAIN Index 2014	http://data.worldbank.org/indicator/EN.CO2.MANF.ZS
Share (%) of population undernourished	Population below minimum level of dietary energy consumption (also referred to as prevalence of undernourishment) shows the percentage of the population whose food intake is insufficient to meet dietary energy requirements continuously	Malnutrition can be a product of different circumstances related to development policies and strategies, such as agricultural measures for food availability		Sub-indicator of the World Risk Index 2014 and ND-GAIN Index 2014 and INFORM; MDG1.9 (UN 2005)	http://data.worldbank.org/indicator/SN.ITK.DEFC.ZS
Share of agricultural value added in GDP	Agriculture corresponds to ISIC divisions 1-5 and includes forestry, hunting, and fishing, as well as cultivation of crops and livestock production. Value added is the net output of a sector calculated by adding up all outputs and subtracting intermediate inputs.			Füssel, 2010; Füssel and Klein, 2006	http://data.worldbank.org/indicator/NV.AGR.TOTL.ZS
Share of arrivals for leisure, recreation and holidays				Perch- Nielsel, 2010	Data not available
Share of coastal area	km of coastline (scale by land area)			Füssel 2009, Brooks et al., 2005	http://preview.grid.unep.ch/
Share of female representatives in the National Parliament	The number of seats held by women in national parliament expressed as a percentage of all occupied seats	This indicator gives an idea of the progress of female participation in the highest levels of society	Low relevance to adaptive capacity	Sub-indicator of the World Risk Index 2014; MDG 3.3 (UN 2005)	http://data.worldbank.org/indicator/SG.GEN.PARL.ZS and http://mdgs.un.org/unsd/mdg/Data.aspx

Slum populations	The proportion of urban population living in slum households, defined by the Millennium Development Goals as a group of individuals living under the same roof lacking one or more life-supporting facilities, namely access to safe water, access to good sanitation, sufficient living area and durability of housing	Urban populations living in slum-like conditions are vulnerable to climate change and poor health		Sub-indicator of the World Risk Index 2014 and ND-GAIN Index 2014; MDG 7.10 (UN 2005); post 2015 HFA (UNISDR, 2014)	http://mdgs.un.org/unsd/mdg/SeriesDetail.aspx?srid=710
Strength of social networks				Füssel and Klein, 2006;	Data not available
Subsidised insurance for the poor	Availability of Subsidised insurance for the poor (0-1)			Hallegatte, 2014	Data can be collected locally
Sum of losses in US$ purchasing power parity (PPP)	Sum of total damages over the period considered in US$ purchasing power parity (PPP)			Sub-indicator of the Global Climate Change Index (Germanwatch 2014)	http://germanwatch.org/en/cri
Total affected capital	Capital losses due to extreme events	This describes the extent of loss of the productive capacity of a country following an extreme event		Hallegatte, 2014	
Total damages relative to GDP	Damages of past events/GDP			Birkman, 2007; Sub-indicator of the Global Climate Change Index 2014	http://data.worldbank.org/data-catalog/world-development-indicators http://www.emdat.be
Total economic damages	Sum of total damages related to all hazards over the period considered	Total economic damages describe the extent of economic impacts caused by climate-		Forgette and Boening (2010); Hallegatte (2014); Akter and Mallick 2013	http://www.emdat.be

		related hazards over a certain period			
Total health expenditure	Total health expenditure is the sum of public and private health expenditure as a ratio of the total population. It covers the provision of health services (preventive and curative), family planning activities, nutrition activities, and emergency aid designated for health, but does not include the provision of water and sanitation	High levels of government expenditure on health are understood to be an indicator for the quality of the health system, which is an important factor of adaptive capacity because medical services represent important sources of post-disaster relief.		Brooks et al., 2005; Cutter et al. 2003; Sub-indicator of the World Risk Index 2014	http://data.worldbank.org/indicator/SH.XPD.PCAP
Total refugees and people in refugee-like situations	Total refugees and people in refugee-like situations	Displaced people are normally a particularly at-risk group and are more likely to live in vulnerable conditions in hazard-prone areas, with less access to basic services than low-income households in general		Sub-indicator of INFORM 2014 and Proposed SDG 94 (UN, 2014)	http://www.unhcr.org/pages/49c3646c4d6.html

Tourism as % of exports	International tourism receipts are expenditures by international inbound visitors, including payments to national carriers for international transport. These receipts include any other prepayment made for goods or services received in the destination country. They may also include receipts from same-day visitors, except when these are important enough to justify separate classification. For some countries they do not include receipts for passenger transport items. Their share in exports is calculated as a ratio to exports of goods and services, which comprise all transactions between residents of a country and the rest of the world involving a change of ownership from residents to non-residents of general merchandise, goods sent for processing and repairs, non-monetary gold, and services.	Economies which are significantly concentrated in the tourism sector may have lower resilience when that sector is affected		Perch- Nielsel 2010; post 2015 HFA (UNISDR, 2014)	http://data.worldbank.org/indicator/ST.INT.RCPT.XP.ZS
Tourism as % of GDP	International tourism receipts are expenditures by international inbound visitors, including payments to national carriers for international transport. These receipts	Economies which are significantly concentrated in the tourism sector may have lower resilience when that sector is		Perch- Nielsel, 2010	http://data.worldbank.org/indicator/ST.INT.RCPT.CD

	include any other prepayment made for goods or services received in the destination country. They also may include receipts from same-day visitors, except when these are important enough to justify separate classification. For some countries they do not include receipts for passenger transport items (current US$).	affected			
Tractor use per 100 sq. km of arable land	The number of wheel and crawler tractors (excluding garden tractors) in use in agriculture at the end of the calendar year or during the first quarter of the following year. Arable land includes land defined by the FAO as land under temporary crops (double-cropped areas are counted once), temporary meadows for mowing or for pasture, land under market or kitchen gardens, and temporarily fallow land. Land abandoned as a result of shifting cultivation is excluded.			Sub-indicator of the ND-GAIN Index 2014	http://data.worldbank.org/indicator/AG.LND.TRAC.ZS
Trade openness	This indicator is calculated for each country as the simple average (i.e. the mean) of total trade (i.e. the sum of exports and imports of goods and services) relative to GDP	The more open an economy the more resilient it is to disasters affecting any one sector		Skidmore and Toya (2002) and Raschky and Schwindt (2008)	http://data.worldbank.org/indicator/BX.GSR.GNFS.CD and http://data.worldbank.org/indicator/BM.GSR.GNFS.CD

Transport volume		Industry		Sub-indicator of the Industrial Vulnerability Index (Hiete and Merz, 2009)	Data not available
Tuberculosis prevalence	The number of cases of tuberculosis (all forms) in a population at a given point in time (the middle of the calendar year), expressed as the rate per 100 000 population. Estimates include cases of TB in people with HIV	Removal of economically active population		Sub-indicator of INFORM 2014	http://apps.who.int/ghodata/
Type of materials		Industry		Sub-indicator of the Industrial Vulnerability Index (Hiete and Merz, 2009)	Data not available
Unpopulated land area	Unpopulated land area			Brooks et al., 2005	http://preview.grid.unep.ch/
Urban Concentration	% of total population. Urban population refers to people living in urban areas as defined by national statistical offices	Countries in which urban populations are concentrated in a single or a small number of urban areas are considered to be more sensitive to climate change		Kellenberg and Mobarak (2008); Sub-indicator of the ND-GAIN Index 2014 and WDIs and post HFA (UNISDR, 2014)	http://index.gain.org/about/download
Vaccination against climate-sensitive vector-borne diseases	The percentage of people who have received a vaccine in a given year			Füssel and Klein, 2006	Data are not available for vaccination against climate sensitive vector borne disease
Value of production equipment	Machinery and transport equipment (% of value added in manufacturing). Value added in manufacturing is the sum of gross output minus the			Sub-indicator of the Industrial Vulnerability Index (Hiete and Merz, 2009)	http://data.worldbank.org/indicator/NV.MNF.MTRN.ZS.UN

	value of intermediate inputs used in production for industries classified in ISIC major division D. Machinery and transport equipment correspond to ISIC divisions 29, 30, 32, 34, and 35				
Vertical integration	Degree of vertical integration			Sub-indicator of the Industrial Vulnerability Index (Hiete and Merz, 2009)	http://www.iscramlive.org/ISCRAM2009/papers/Contributions/131_An%20Indicator%20Framework%20to%20Assess%20the%20Vulnerability_Merz2009.pdf
Voice and accountability	Reflects perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media	The extent to which citizens are able to hold others, including government, to account for their actions is critical not only to ensure that disaster risk management plans are implemented but also to strengthen accountability in the case of actions that transfer risks from one sector to another		Keefer et al. (2011), Kahn (2005), and Raschky and Schwindt (2008); Post 2015 HFA (UNISDR, 2014)	http://info.worldbank.org/governance/wgi/index.aspx#home

Wastewater treatment	This tracks the performance of basic wastewater management on an ordinal scale with a range from 0 (very poor environmental performance) to 100 (excellent environmental performance)	Untreated sewage can disrupt the functioning of downstream ecosystems. Good wastewater management is especially relevant for areas facing more significant impacts of climate change and rapid population growth, since such areas may face more constrained water resources in the future		Sub-indicator of the World Risk Index 2014	http://epi.yale.edu/
Water dependency ratio	Indicator expressing the percentage of total renewable water resources originating outside the country.	High dependency on foreign water resources exacerbates water insecurity due to climate change		Sub-indicator of the ND-GAIN Index 2014	http://www.fao.org/nr/water/aquastat/data/query/index.html?lang=en
Water essentiality	Extent to which water is essential to industrial processes			Sub-indicator of the Industrial Vulnerability Index (Hiete and Merz, 2009)	http://www.iscramlive.org/ISCRAM2009/papers/Contributions/131_An%20Indicator%20Framework%20to%20Assess%20the%20Vulnerability_Merz2009.pdf
Water stress	Water stress occurs when the demand for water exceeds the available amount during a certain period or when poor quality restricts its use	An unsustainable withdrawal of renewable water resources can increase land degradation and drought risk		Post 2015 HFA (UNISDR, 2014)	http://www.fao.org/climatechange/asis/en/

Water use ratio	Litres /capita/day	A country's ability to maintain high-level access to improved drinking water indicates its capacity to adapt to water shortage in general		Halsnæs and Verhagen, 2007; Füssel, 2010; Brooks et al., 2005	http://www.grida.no/graphicslib/detail/water-availability-in-africa_3368
Wealth of Nations	This provides country-level data on comprehensive wealth, adjusted net savings, and non-renewable resource indicators			Füssel, 2010	http://data.worldbank.org/sites/default/files/total_and_per_capita_wealth_of_nations.xls

Table II – Indexes identified by reviewing the relevant literature on climate change, development and disaster risk. (alphabetical order)

Index name	Definition	Rational	Reference	Data source
Agriculture Stress Index	ASI is based on 10-day satellite data of vegetation and land surface temperature from the METOP-AVHRR sensor at 1-km resolution. Agricultural drought: 30% of cropland under stress for more than 10 days		Sub-indicator of INFORM 2014	http://www.fao.org/giews/earthobservation/asis/index_1.jsp?lang=en
Disaster Deficit Index 100	The DDI captures the relationship between the demand for contingent resources to cover the losses caused by the Maximum Considered Event (MCE) and the public sector's economic resilience (that is, the availability of internal and external funds for restoring affected inventories). Probable max. loss in 100 years	Countries with a high DDI and a low capacity to mobilise financial resources (through insurance, credits, taxation, debt, etc.) will have a low resilience to intensive disasters	Adapted from post 2015 HFA (UNISDR, 2014)	http://www.iadb.org/exr/disaster/ddi.cfm?language=EN&parid=2
Disaster Deficit Index 50	The DDI captures the relationship between the demand for contingent resources to cover the losses caused by the Maximum Considered Event (MCE) and the public sector's economic resilience (that is, the availability of internal and external funds for restoring affected inventories). Probable max. loss in 50 years	Countries with a high DDI and a low capacity to mobilise financial resources (through insurance, credits, taxation, debt, etc.) will have a low resilience to intensive disasters	Adapted from post 2015 HFA (UNISDR, 2014)	http://www.iadb.org/exr/disaster/ddi.cfm?language=EN&parid=2

Disaster Deficit Index 500	The DDI captures the relationship between the demand for contingent resources to cover the losses caused by the Maximum Considered Event (MCE) and the public sector's economic resilience (that is, the availability of internal and external funds for restoring affected inventories). Probable max. loss in 500 years	Countries with a high DDI and a low capacity to mobilise financial resources (through insurance, credits, taxation, debt, etc.) will have a low resilience to intensive disasters	Adapted from post 2015 HFA (UNISDR, 2014)	http://www.iadb.org/exr/disaster/ddi.cfm?language=EN&parid=2
Domestic Food Price Volatility Index	This compares the variations of monthly change in international prices of a basket of food commodities across countries and time		Sub-indicator of INFORM 2014	http://www.fao.org/economic/ess/ess-fs/ess-fadata/en/
Economic discomfort index	The sum of unemployment and inflation rates	If an economy already has high levels of unemployment and inflation, it is likely that adverse shocks would impose significant costs on it	Briguglio et al., 2008	http://data.worldbank.org/indicator/SL.UEM.TOTL.NE.ZS and http://data.worldbank.org/indicator/SL.UEM.TOTL.NE.ZS
Failed States Ind	This captures a state's vulnerability based on 12 variables that can be divided into social, economic and political indicators	Vulnerable states may have difficulties recovering from the impacts of natural hazard, owing to their critical inherent characteristics	Füssel, 2010; Sub-indicator of the World Risk Index 2014	http://ffp.statesindex.org/rankings-2013-sortable
Gender Inequality Index	The GII measures gender inequalities in three important aspects of human development—reproductive health measured by maternal mortality ratio and adolescent birth rates; empowerment, measured by proportion of parliamentary seats occupied by females and proportion of adult females and males aged 25 years and above with at least some secondary education; and economic status expressed as labour market participation and measured by labour force participation rate of female and	Disadvantaged women, in terms of reproductive health, empowerment and the labour market, are likely to be less resilient to disaster loss	Post 2015 HFA (UNISDR, 2014); INFORM 2014	http://hdr.undp.org/en/content/gender-inequality-index-gii

	male populations aged 15 years and above			
General food availability	Food production index		Brooks et al., 2005	http://data.worldbank.org/indicator/AG.PRD.FOOD.XD
Gini index	The Gini index gives an estimate of inequality as it measures the extent to which	Income distribution All	the actual income distribution differs from an equitable distribution. Resilience is likely to be lower in countries with a high degree of income inequality	Hallegatte, 2014; Anbarci et al. (2005) and Kahn 2005, Brooks et al., 2005; Sub-indicator of the World Risk Index 2014; post 2015 HFA (UNISDR, 2014); INFORM 2014 http://data.worldbank.org/indicator/SI.POV.GINI
Global Aridity Index	The ratio of the annual precipitation sum in mm to the annual mean temperature in °C +10		World Bank, 2014	http://www.cgiar-csi.org/data/global-aridity-and-pet-database
Global Hunger Index	The GHI combines three equally weighted indicators in one index number: 1) Undernourishment - the proportion of undernourished as a percentage of the population (reflecting the share of the population with insufficient calorie intake); 2) Child underweight - the proportion of children under the age of five who are underweight (low weight for age reflecting wasting, stunted growth, or	Households and communities with high levels of malnutrition are likely to have a very low capacity to buffer disaster losses, such as failed harvests	Füssel, 2010; Post 2015 HFA (UNISDR, 2014)	http://www.ifpri.org/book-8018/ourwork/researcharea/global-hunger-index

	both), which is one indicator of child malnutrition; and 3) Child mortality - the mortality rate of children under the age of five (partially reflecting the fatal synergy of inadequate dietary intake and unhealthy environments).			
HDI	The Human Development Index measures development by combining indicators of life expectancy, educational attainment and income into a composite index		UNDP, 2014; Füssel, 2010; and INFORM	http://hdr.undp.org/en/content/table-1-human-development-index-and-its-components
Human Asset Index	Based on indicators of: (a) nutrition: percentage of population undernourished; (b) health: mortality rate of children aged five years or under; (c) education: the gross secondary school enrolment ratio; and (d) adult literacy rate		Füssel, 2010	http://www.ferdi.fr/en/indicator/human-assets-index
Multidimensional poverty index	The Multidimensional Poverty Index (MPI) identifies overlapping deprivations at the household level across the same three dimensions as the Human Development Index (living standards, health, and education) and shows the average number of poor people and deprivations with which poor households contend		Sub-indicator of INFORM 2014	http://hdr.undp.org/en/content/table-6-multidimensional-poverty-index-mpi
Trade concentration Index	Calculated using the shares of all three-digit products in a country's exports: Hj = sqrt [sum (xi / Xt)2] where xi is country j's exports of product i (at the three-digit SITC classification) and Xt is country j's total exports	The more diversified an economy, the more it is resilient to disasters affecting any one sector. Export diversification is deemed to be important for developing countries because many developing countries are often highly dependent on relatively few primary commodities for their export earnings	Post 2015 HFA (UNISDR, 2014)	

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